Groundwater Withdrawal and Land Subsidence in Harris and Galveston Counties for the 2024 Calendar Year

by
Ashley Greuter, P.G.

Harris-Galveston Subsidence District Report 2025-01

Harris – Galveston Subsidence District
Friendswood, TX
2025

MICHAEL J. TURCO
GENERAL MANAGER

The Harris-Galveston Subsidence District (District) has monitored water use, groundwater levels, and subsidence in Harris, Galveston, and adjacent counties since 1975. In the greater Houston area, subsidence, the lowering of land-surface elevation, is caused by the depressurization of our aquifers due to the use of groundwater as a primary water source. The mission of the District is to cease ongoing subsidence and prevent the occurrence of future subsidence. As part of this effort, it is important for the District to provide consistent, high-quality information to the public regarding groundwater use, aquifer water levels, and subsidence.

The information contained within this report is the compilation of the largest multi-agency effort in the State of Texas that leverages the resources of both the Harris-Galveston and Fort Bend Subsidence Districts with the City of Houston, the U.S. Geological Survey, the Brazoria County Groundwater Conservation District, and the Lone Star Groundwater Conservation District. This year, this multi-agency partnership will publish the 49th volume of this important data compilation. This report is intended to exceed the requirements of section 8801.117 of the District's enabling legislation.

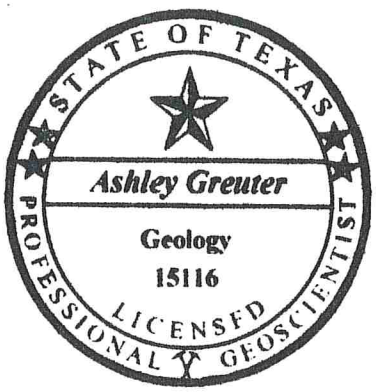
On behalf of the Harris-Galveston Subsidence District Board of Directors, I would like to thank you for your interest in this year's Annual Groundwater Report. We look forward to continuing to provide timely, accurate, high-quality data and research to inform the District's regulatory planning efforts to prevent subsidence and improve water planning throughout this region.

Sincerely,

Michael J. Turco
General Manager

Professional Geoscientist Seal

The contents of this report (including figures and tables) document the work of the following Licensed Professional Geoscientist:



Ashley Greuter, P.G. No. 15116

Ashley Greuter was responsible for working on all aspects of the climate, water use, and subsidence sections of the report, including the preparation of report figures, tables, and written text. The groundwater level data collection and interpretations were performed by the USGS and are included in the report for informational purposes. The subsidence data were processed and analyzed by Dr. Guoquan Wang at the University of Houston.

Ashley Greuter

Signature

May 14, 2025

Date

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Acknowledgments

The compilation of the data and analysis contained within this report would not be possible without the concerted effort of many who contributed to the 2024 Annual Groundwater Report. The author would like to thank the staff of the Harris-Galveston Subsidence District for their diligent field work in collecting GPS data, as well as Veronica Osegueda, Ronald Geesing, Vanson Truong, Karimah Hasan, Ana Scheffler, Stephanie Lafranca, Denise Lizama, and Denise Ma (Harris-Galveston Subsidence District) for their processing of water use data; Dr. Guoquan Wang (University of Houston) for processing and archiving raw GPS data; and the engineers, staff, and permittees/owners of actively permitted wells in the District that submitted detailed water use on over 7,600 pumpage reports contained in this report.

Public hearing notice was posted on:	March 27, 2025
Draft presentation posted on District website on:	April 28, 2025
Public hearing held on:	April 29, 2025
Hearing Examiner:	Helen Truscott
Hearing record held open for public comment until:	May 7, 2025
Approved by the Board of Directors:	May 14, 2025

Conversions Factors and Datums

Multiply	By	To obtain
inch (in)	2.54	centimeter (cm)
foot (ft)	0.305	meter (m)
mile (mi)	1.61	kilometer (km)
square mile (mi^2)	2.59	square kilometer (km^2)
gallon (gal)	3.785	liter (L)
million gallons per day (MGD)	3785.41	cubic meter (m^3)
million gallons per day (MGD)	3.0688	acre-feet (acre-ft)

List of Acronyms

BCGCD	Brazoria County Groundwater Conservation District
CORS	Continuously Operating Reference Station
FBSD	Fort Bend Subsidence District
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRP	Groundwater Reduction Plan
HGSD	Harris-Galveston Subsidence District
InSAR	Interferometric Synthetic Aperture Radar
LOWESS	locally weighted scatterplot smoothing
LSGCD	Lone Star Groundwater Conservation District
MGD	Million Gallons per Day
NGS	National Geodetic Survey
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PAM	Periodically Measured Station
POR	Period of Record
TxDOT	Texas Department of Transportation
UH	University of Houston
USGS	United States Geological Survey

Executive Summary

In the greater Houston region, groundwater was the primary source of water for municipal, agricultural, and industrial users over the last century. The rapid and large population growth in the 1950s led to a dramatic increase in water demand and groundwater withdrawal. The reliance on groundwater and significant subsidence that resulted from this abundant groundwater withdrawal led to the creation of the Harris-Galveston Subsidence District (District) in 1975 by the Texas Legislature. The District's mission is to regulate groundwater use in Harris and Galveston counties to prevent further subsidence.

This report comprises the 49th Annual Groundwater Report for the District. Pursuant to District Resolution No. 2025-1126 passed on February 12, 2025, the Board of Directors held a public hearing at 9:00 a.m. on April 29, 2025, to present climatic conditions, groundwater use, groundwater levels and measured subsidence within the District for the 2024 calendar year. This report provides an overview of the information presented during the public hearing.

Climate

Annual variations in precipitation can significantly impact the amount of water used (i.e., total water demand) in the District. Groundwater use patterns fluctuate based on total rainfall received, which results in changes in aquifer water levels and, potentially, in land subsidence. During periods of excessive rainfall, total water demand can decline; conversely, during periods of drought, groundwater use can increase, resulting in declining groundwater levels. The 2024 calendar year began with above normal rainfall for all of the eight National Weather Service (NWS) climate stations analyzed for the region. The year progressed with seven stations recording above the 1991-2020 average normal precipitation and increased in summer through fall. The year ended with six stations above normal and two stations, Katy and Hobby Airport, below normal rainfall. The most cumulative rainfall was measured at Scholes Field with almost 63 inches, placing it over 15.5 inches above normal. The lowest total rainfall measured in 2024 was recorded at Katy with only 26 inches, placing it almost 23 inches below normal.

Water Use

Since 1976, water users in the District have been working to change their primary source of water from groundwater to alternative water as required by the District's Regulatory Plan to prevent subsidence. The percentage of total water demand sourced from groundwater has decreased from about 61 percent in 1976 to about 22 percent in 2024. The majority of groundwater use, approximately 82 percent, occurs in Regulatory Area Three, where the regulatory compliance timeline will not be completed until 2035. The three primary water uses in the District are public supply, industrial, and irrigation. The overall groundwater use within the District in 2024 is 237.6 million gallons per day (MGD), which is an eight percent decrease from 2023. Groundwater used for public supply remains the largest use category at about 208.6 MGD, a twelve percent decrease from the previous year, and accounts for approximately 88 percent of all groundwater used in the District.

The District's Regulatory Plan requires permittees to convert to alternative water sources in order to reduce their reliance on groundwater. The primary alternative water supply used in the District is treated surface water sourced from three river basins: the Trinity River Basin, the San Jacinto River Basin and the Brazos River Basin. In 2024, the total alternative water used was 855.9 MGD,

with the Trinity River remaining the single largest source of alternative water at 69 percent of the total and provided about 591.4 MGD in surface water supply. Groundwater remains the second largest source of water supply representing approximately 22 percent of the total water demand. The total water demand for the District was 1,093.5 MGD in 2024, which is over one percent higher than the reported water use in the previous year.

Groundwater Levels

Annually, since 1975, the United States Geological Survey (USGS) has measured the aquifer potentiometric water level (water-level) in hundreds of wells throughout southeast Texas in cooperation with the District through a joint funding agreement along with additional cities, subsidence districts and groundwater conservation districts. These data are used to monitor the water-level altitude for the Chicot/Evangeline and Jasper aquifers and evaluate the temporal change in water level. Since aquifer water-level is the best measure of pressure in the aquifer, this information is also of vital importance to understanding how groundwater pumping may stress the aquifer and its resulting impacts on land subsidence.

The change in water-level in the Chicot-Evangeline (undifferentiated) aquifer from 1977 to 2025 highlights the impact of District regulation on the aquifer. Generally, Regulatory Areas One and Two have seen a substantial rise in the water-level of over 200 feet (60 meters) in the Chicot-Evangeline (undifferentiated) aquifer measured in areas like the Houston Ship Channel. The area of rise is a result of the reduction of groundwater use required by the District's Regulatory Plan. Conversely, in Regulatory Area Three, water-levels measured in 2024 were consistently lower than the 1977 benchmark water-levels, with some declines over 300 feet (91 meters) in the Chicot-Evangeline (undifferentiated) aquifer in northern Harris County. These areas are growing rapidly and the conversion to alternative sources of water will not be completed until 2035. The highest historical water-level declines were measured in south-central Montgomery County, with over 400 feet (122 meters) around The Woodlands.

Subsidence

Since the 1990s, the District has developed a subsidence monitoring network utilizing global positioning system (GPS) technology to monitor land surface deformation within and surrounding the District. This network involves collaboration amongst GPS station operators such as the Fort Bend Subsidence District (FBSD), the University of Houston (UH), the Lone Star Groundwater Conservation District (LSGCD), the Brazoria County Groundwater Conservation District (BCGCD), Texas Department of Transportation (TxDOT), and other local entities. The subsidence monitoring network includes over 190 active GPS stations throughout southeast Texas in 2024.

The District estimates the average annual subsidence rate as the linear regression of the change in ellipsoidal height, which represents the vertical movement in the GPS data collected from the GPS stations, from the five most current years (i.e., 2020 through 2024). The subsidence rates observed in Regulatory Areas One are stable, since it has reached the full regulatory conversion level, and Chicot-Evangeline (undifferentiated) water-levels have risen. Subsidence rates are generally above half a centimeter per year throughout Regulatory Area Three, as groundwater is still the primary water source in this area, and Chicot-Evangeline (undifferentiated) water-levels have significantly declined. The highest subsidence rate was measured at GPS station in the Katy and Fulshear area at over three centimeters per year.

Introduction

The greater Houston area has relied on groundwater as a primary source of water since the early 1900s. During and following the economic boom of the 1940s, rapid population expansion and increased water use resulted in water-level declines in the Chicot and Evangeline aquifers of 250 and 300 feet (76 and 91 meters), respectively from 1943 to 1977 (Gabrysch, 1982). The reliance on groundwater and subsequent subsidence, which was the outcome of this abundant groundwater withdrawal, resulted in the creation of the Harris-Galveston Subsidence District (District) in 1975. The District's mission is to regulate groundwater withdrawal in Harris and Galveston counties to prevent future subsidence that can contribute to flooding and infrastructure damage.

Purpose of Report

This document comprises the 49th Annual Groundwater Report for the District. Pursuant to District Resolution No. 2025-1126 passed on February 12, 2025, the Board of Directors held a public hearing for the Annual Groundwater Report beginning at 9:00 a.m. on April 29, 2025. The public hearing was held at the District office and offered virtually for viewing purposes only. The public hearing fulfills the requirements of Section 8801.117, Texas Special Districts Local Laws Code, which states that each year, the Board of Directors shall hold a public hearing for the purpose of taking testimony concerning the effects of groundwater withdrawals on the subsidence of land within the District during the preceding year.

The hearing was attended by 28 people, including both in-person and virtual participants, members of the USGS staff, members of the District's staff, HGSD Board Directors, representatives from regional water authorities and cities, and the public. Those giving testimony were Ashley Greuter, P.G., HGSD's Director of Research and Water Conservation, and Jason Ramage, Hydrologist, USGS Texas-Oklahoma Water Science Center, Gulf Coast Programs Office. Ms. Greuter submitted 13 exhibits, including topics of precipitation, groundwater withdrawal, alternative water use, and subsidence data. Mr. Ramage presented 13 exhibits, including information on water-level altitudes, water-level changes, and aquifer compaction. The record for testimony and public comment was open from April 29, 2025, through May 7, 2025. All testimony, public comments, and questions are provided in **Appendix C**.

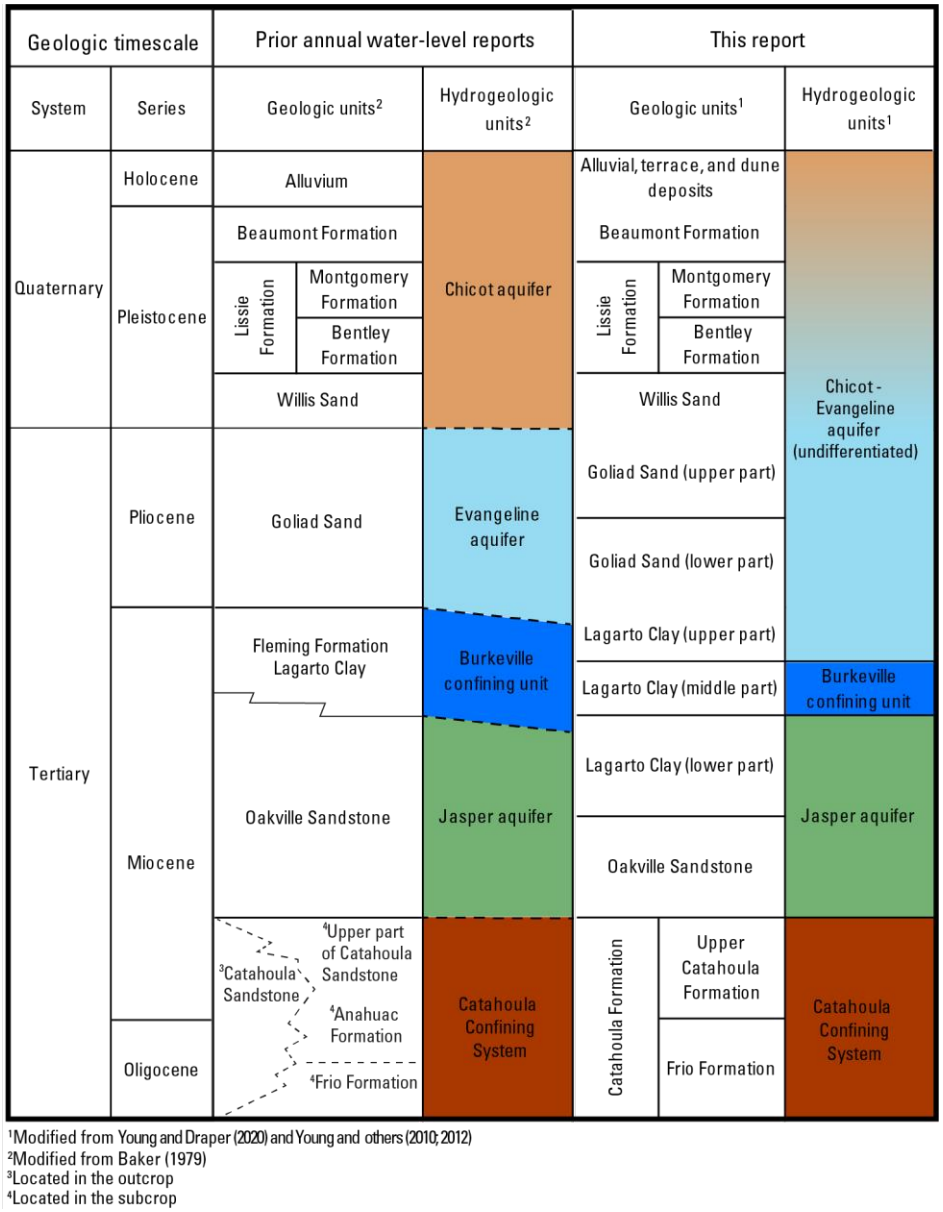
This report provides a general description of the District, which includes hydrogeology, alternative water sources, and regulatory planning, as well as an overview of the information presented during the public hearing, including precipitation, water use, groundwater levels and subsidence within the District from January 1, 2024, through December 31, 2024. **Appendix A** of this report includes the exhibits presented at the public hearing held on April 29, 2025.

Description of Study Area

The following section provides an overview of the conditions within the jurisdiction of the District, including hydrogeology, hydrology and an overview of the District's regulatory planning areas.

Hydrogeology

The Gulf Coast Aquifer exists as an accretionary wedge of unconsolidated sediments composed primarily of sand, silt, and clay. The interbedded sands and clays are indicative of a transgressive-regressive shoreline such that the units are horizontally and vertically discontinuous at large scales and thicken down-dip southeast towards the Gulf of Mexico. From youngest to oldest, these hydrogeologic units include the Chicot-Evangeline (undifferentiated), Burkeville Confining Unit, Jasper, and Catahoula Confining System Aquifers (**Figure 1**).



[1]Modified from Young and Draper (2020) and Young and others (2010; 2012)
[2]Modified from Baker (1979)
[3]Located in the outcrop
[4]Located in the subcrop

Figure 1: Updated stratigraphic column of the Gulf Coast Aquifer System in Harris and adjacent counties, Texas (Source: Ramage et al., 2022).

The two primary water-bearing units located within the District include the Chicot-Evangeline (undifferentiated) aquifer and the Jasper aquifer. The Chicot-Evangeline (undifferentiated) aquifer comprises the shallow portion of the Gulf Coast Aquifer system and is hydrologically connected, allowing for the free flow of water between the Chicot and Evangeline units. Historically in the District, nearly all groundwater production in the Gulf Coast Aquifer system occurred in the Chicot-Evangeline (undifferentiated) aquifer. This aquifer was heavily used because it contains freshwater (i.e., total dissolved solids under 1,000 milligrams per liter) at depths ranging from a few hundred feet to over a thousand feet below the land surface for the majority of the District, with some exceptions of slightly saline (i.e., total dissolved solids ranging from 1,000 to 3,000 milligrams per liter) groundwater in areas within Galveston County in close proximity to the Gulf of Mexico (Anaya, et al., 2016).

The Jasper aquifer is the deepest of the primary water-bearing units and is isolated by the regionally persistent Burkeville confining unit. The Catahoula Sandstone, the deepest water-bearing unit in the Gulf Coast Aquifer System, and the Burkeville confining unit are utilized as a groundwater supply in areas to the north and west of the District, where these units may produce appreciable amounts of freshwater.

Most of the subsidence that has occurred in the District can be sourced to clay compaction in the Chicot-Evangeline (undifferentiated) aquifer associated with long-term water use and the decline in the aquifer's water-level. Because of the significant amount of clay material in the primary water-bearing units of the aquifer, the risk of compaction is high in areas where the developed portions of the aquifers are within about 2,000 feet of land surface under high stress from groundwater development and have had sustained potentiometric water level declines (Yu, et al., 2014).

Surficial Hydrology

The District's Regulatory Plan requires permittees to reduce their reliance on groundwater by converting to alternative water supplies to meet their water needs. The primary alternative water supplies used in the District are surface water sourced from three main river basins: the Brazos River Basin, the San Jacinto River Basin and the Trinity River Basin (**Figure 2**)**.**

The Brazos River Basin is the second largest river basin in Texas, covering over 45,000 square miles (116,550 sq km) (Texas Water Development Board, 2025). The headwaters of the Brazos River are located near the Texas-New Mexico border and the river travels over 800 miles (1,287 km) to discharge into the Gulf of Mexico near Freeport, Texas. The Brazos River Authority manages the 11 reservoirs within this basin, eight of which are owned by the Brazos River Authority and three are owned by the U.S. Army Corps of Engineers (Region H Water Planning Group, 2016).

The San Jacinto River Basin is the smallest river basin in Texas, covering almost 4,000 square miles (10,360 sq. km) (Texas Water Development Board, 2025). Lake Conroe and Lake Houston are the two water supply reservoirs located within the San Jacinto River Basin. Lake Conroe is jointly owned by the City of Houston and the San Jacinto River Authority. The San Jacinto River Authority operates Lake Conroe and provides water supply to Harris and Montgomery counties. Lake Houston is owned by the City of Houston and operated by the Coastal Water Authority.

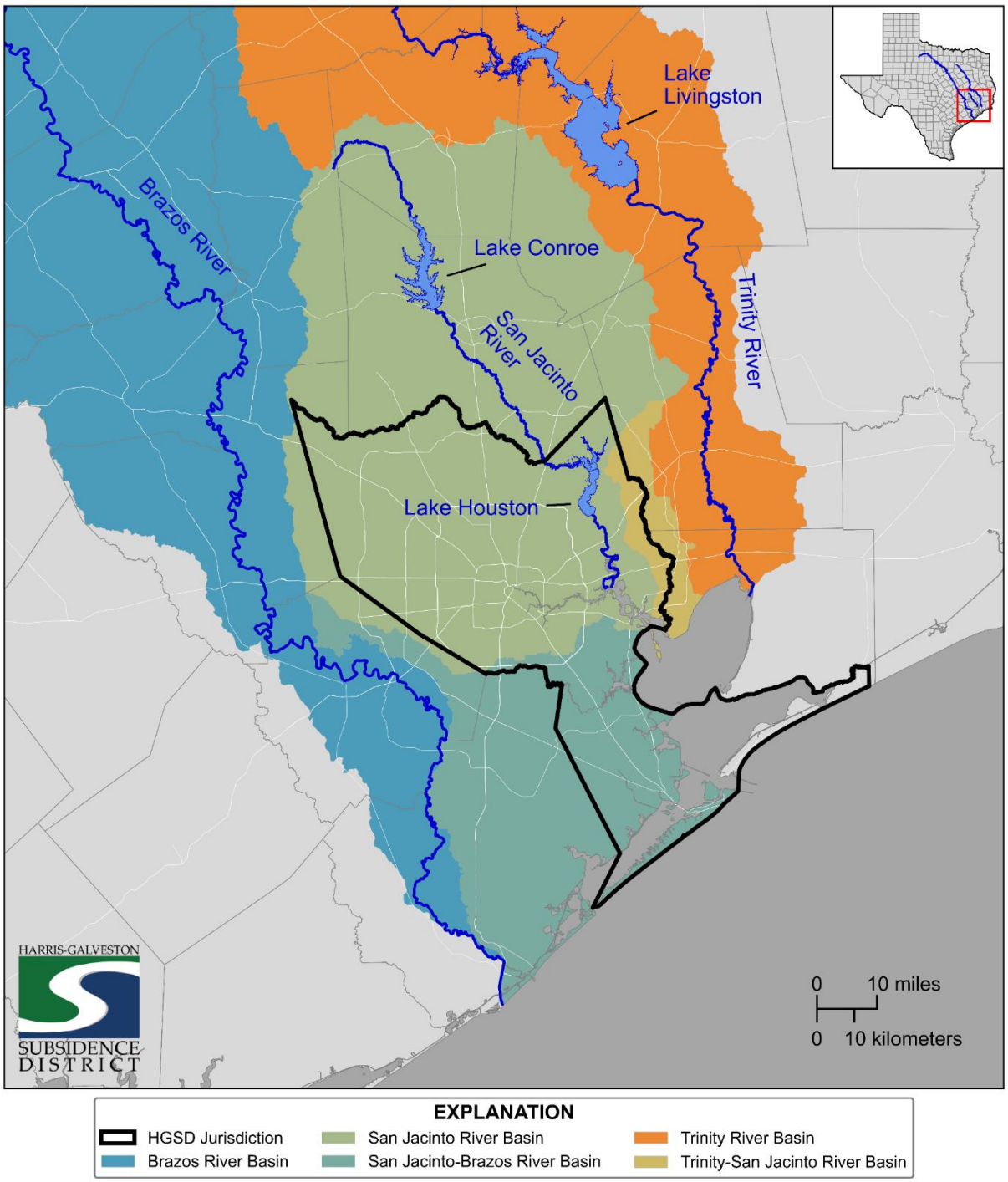


Figure 2: Location and extent of river basins and reservoirs that supply alternative water to Harris and Galveston counties.

The Trinity River Basin covers almost 18,000 square miles (46,619 sq. km), with headwaters of the basin located in north central Texas (Texas Water Development Board, 2025). The Trinity River flows through the Dallas-Fort Worth metroplex, traversing 550 miles (885 km) until the river discharges into Trinity Bay near Anahuac, Texas. The Trinity River Basin includes many

reservoirs that are owned and operated by several different agencies, such as Lake Livingston, which is owned and operated by the Trinity River Authority.

Alternative Source Waters

In the 1950s, the City of Houston along with other entities in the region began the development of several water supply reservoirs within the San Jacinto and Trinity River Basins to provide water for the rapidly growing region. Today, water treatment plants served by these surface water sources and the Brazos River Basin are operated by the City of Houston, the City of Sugar Land, the City of Richmond, the Gulf Coast Water Authority, the Brazosport Water Authority, and others.

To meet the Harris-Galveston Subsidence District's regulatory requirements to convert from groundwater to an alternative water supply, the City of Houston and four regional water authorities—the Central Harris County Regional Water Authority, North Fort Bend Water Authority, North Harris County Regional Water Authority, West Harris County Regional Water Authority, and Coastal Water Authority (collectively, the Water Authorities) – began working together to plan, design, finance, and construct several major infrastructure projects.

Four projects were developed to support the necessary alternative water supply and distribution infrastructure to facilitate the District's future conversion requirements (**Figure 3**):

- Luce Bayou Interbasin Transfer Project: pumps untreated surface water from the Trinity River through a series of canals and water pipelines along Luce Bayou to Lake Houston. This project was completed in 2024 (Coastal Water Authority, 2025).
- Northeast Water Purification Plant Expansion: provides 400 MGD of treated surface water conveyed by the Luce Bayou Interbasin Transfer Project (Greater Houston Water, 2025).
- Northeast Transmission Line Project: provides for the conveyance of the additional treated surface water from Lake Houston into central and northern Harris County (Musku, et al., 2025).
- The Surface Water Supply Project: will convey treated water from the expanded Northeast Water Purification Plant into western Harris County and northeastern Fort Bend County (Surface Water Supply Project, 2025).

In addition to the four projects described above, the City of Houston and the water authorities are each designing and constructing their own distribution systems to convey the treated surface water to their customers. These interrelated regional projects are planned to be completed by 2026 for the northern portion of Fort Bend County.

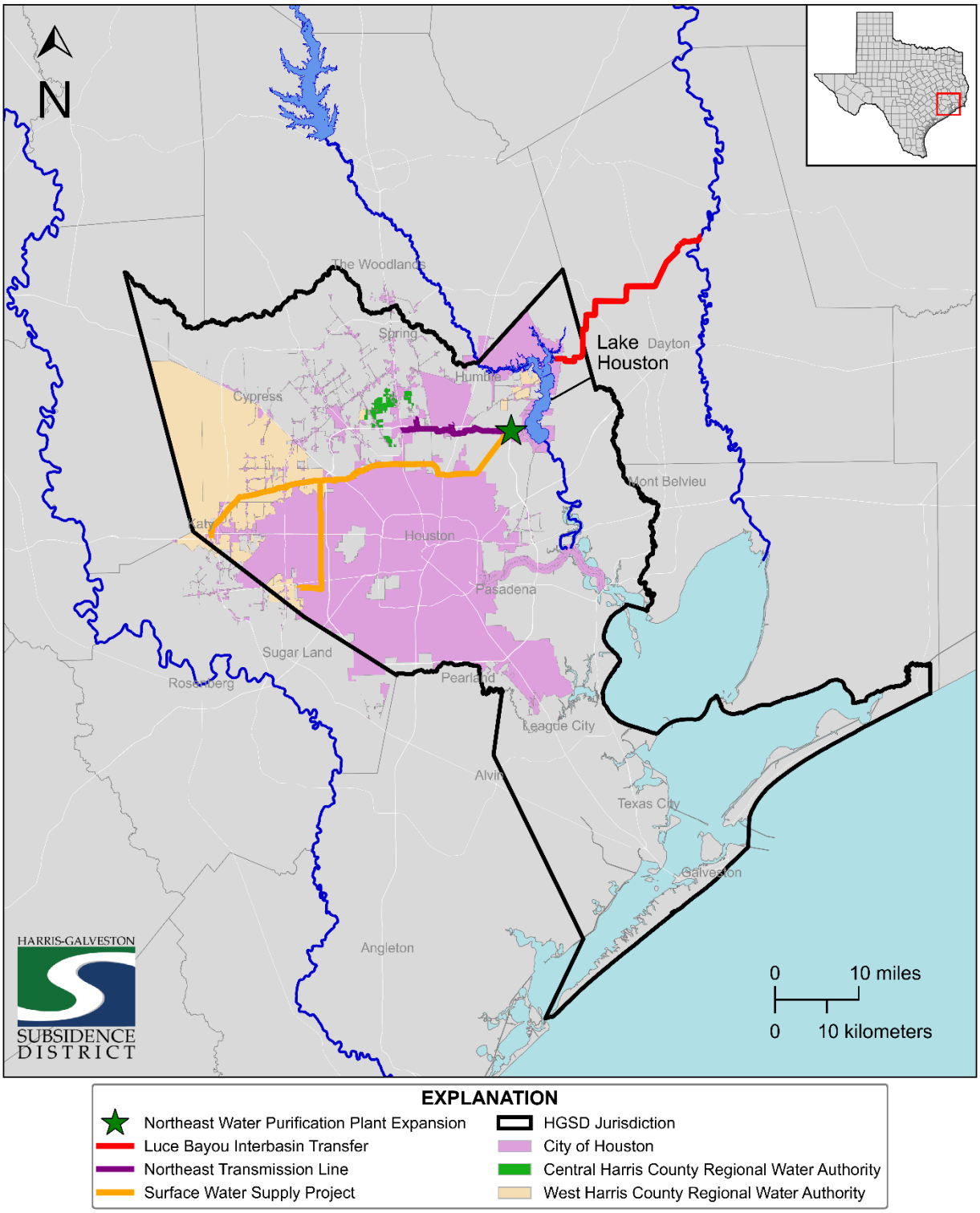


Figure 3: Alternative water supply and infrastructure distribution projects occurring within the District.

Regulatory Planning

The District's Regulatory Plan was developed to reduce groundwater withdrawal to a level that ceases ongoing subsidence and prevents future subsidence within the District. The District utilizes a novel approach to regulate groundwater withdrawal in order to prevent subsidence by allowing a portion of the total water demand of a water user to be sourced from groundwater. Total water demand is defined as the total amount of water used by an entity from all sources including groundwater, treated surface water, reclaimed water, etc. The District adopted the most recent Regulatory Plan on January 9, 2013, and it was subsequently amended on May 8, 2013, and April 14, 2021 (Harris-Galveston Subsidence District, Amended 2021).

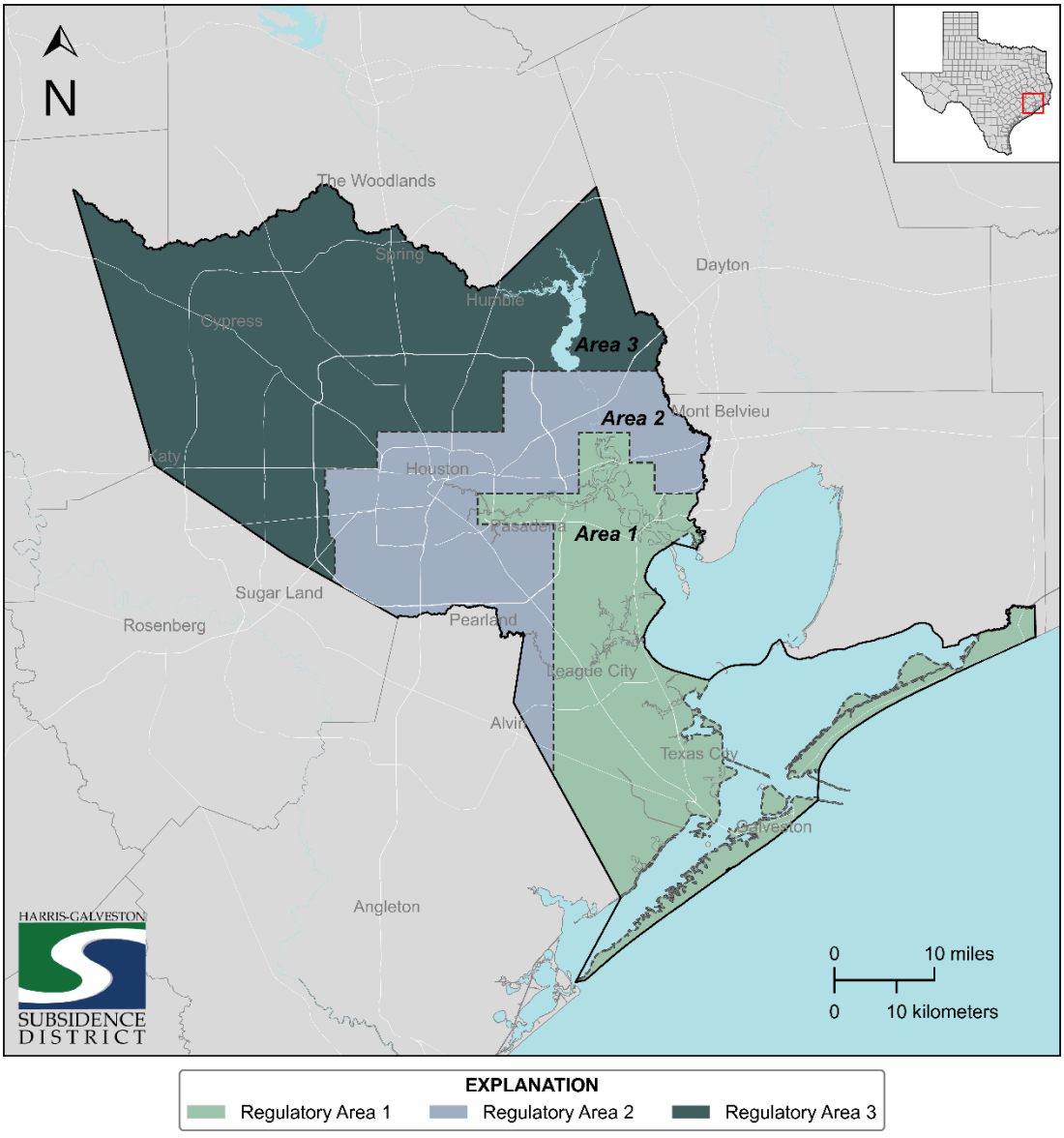


Figure 4: Geographic designation of the Harris-Galveston Subsidence District's Regulatory Areas.

The District has historically used regulatory areas to guide groundwater conversion deadlines and regulations. The 2013 Regulatory Plan has subdivided Harris and Galveston counties into three regulatory areas (**Figure 4**). Regulatory Area One includes the Houston Ship Channel, Industrial Corridor, and coastal areas of Galveston and Harris Counties. Regulatory Area Two is primarily an urban intermediate area that includes downtown, the Texas Medical Center, and parts of eastern Harris County. Regulatory Area Three covers the remaining areas of the District in northern and western Harris County.

Permittees in Regulatory Area One are required to have no more than 10 percent of their total water demand come from groundwater sources. Permittees in Regulatory Area Two must have no more than 20 percent of their total water demand sourced from groundwater. Reduction in groundwater use for both Regulatory Area One and Two began once the District was created in 1975, and by 2000 most of those areas had been fully converted to using alternative sources of water. Regulatory Area Three is still undergoing conversion from groundwater to alternative water sources. This area completed its first conversion in 2010, reducing groundwater use from 100 percent to 70 percent of total water demand.

The District's Regulatory Plan allows permittees with more than ten million gallons per year of total water demand the option to establish groundwater reduction plans (GRPs) that provide a phased approach to conversion in Area Three with additional conditions in Area Two.

For those permittees operating under a GRP in Area Three, permittees are required to adhere to the following future conversion deadlines:

- In 2025, groundwater withdrawals must not comprise more than 40 percent of the permittee's total water demand.
- In 2035, groundwater withdrawals must not comprise more than 20 percent of the permittee's total water demand.

All other permittees, specifically those without GRPs, in Regulatory Area Three are required to reduce their groundwater withdrawals so that no more than 20 percent of their total water demand is sourced from groundwater.

2024 Climate Summary

The District reviews local climatic data provided by the National Oceanic and Atmospheric Administration (NOAA) – National Weather Service (NWS) climate stations within and adjacent to the District's jurisdiction (**Figure 5**). Variation in local precipitation, specifically deviation from historical normal, is important to analyze because it directly impacts the magnitude of the total water demand from water users in the region and can affect the availability of alternative water supplies, such as surface water.

During periods of above normal precipitation in the region, total water demand remains typically near normal or below normal due to reduced municipal and agricultural water uses. Conversely, during times with below normal precipitation, the total water demand of the region will typically increase due to increased need for water mainly used for outdoor irrigation and agricultural needs. Additionally, during prolonged periods of below normal precipitation, natural limitations on alternative supplies may require additional groundwater use and subsequently result in additional lowering of aquifer water-levels, compaction of the aquifer materials, and resulting land subsidence.

The cumulative precipitation departure from 1991-2020 normal precipitation is referenced against each NWS climate station displayed in **Figure 6**. The 1991 to 2020 normals represent the average precipitation over that 30-year interval from NWS climate stations. The normals provide the basis for comparing daily, seasonal, to annual climate conditions. When necessary, NOAA compiles data from NWS climate stations to produce normals for the next 30-year period. For example, the last update was performed in 2021 and the 1991-2020 climate normals were officially released (National Centers for Environmental Information, 2025).

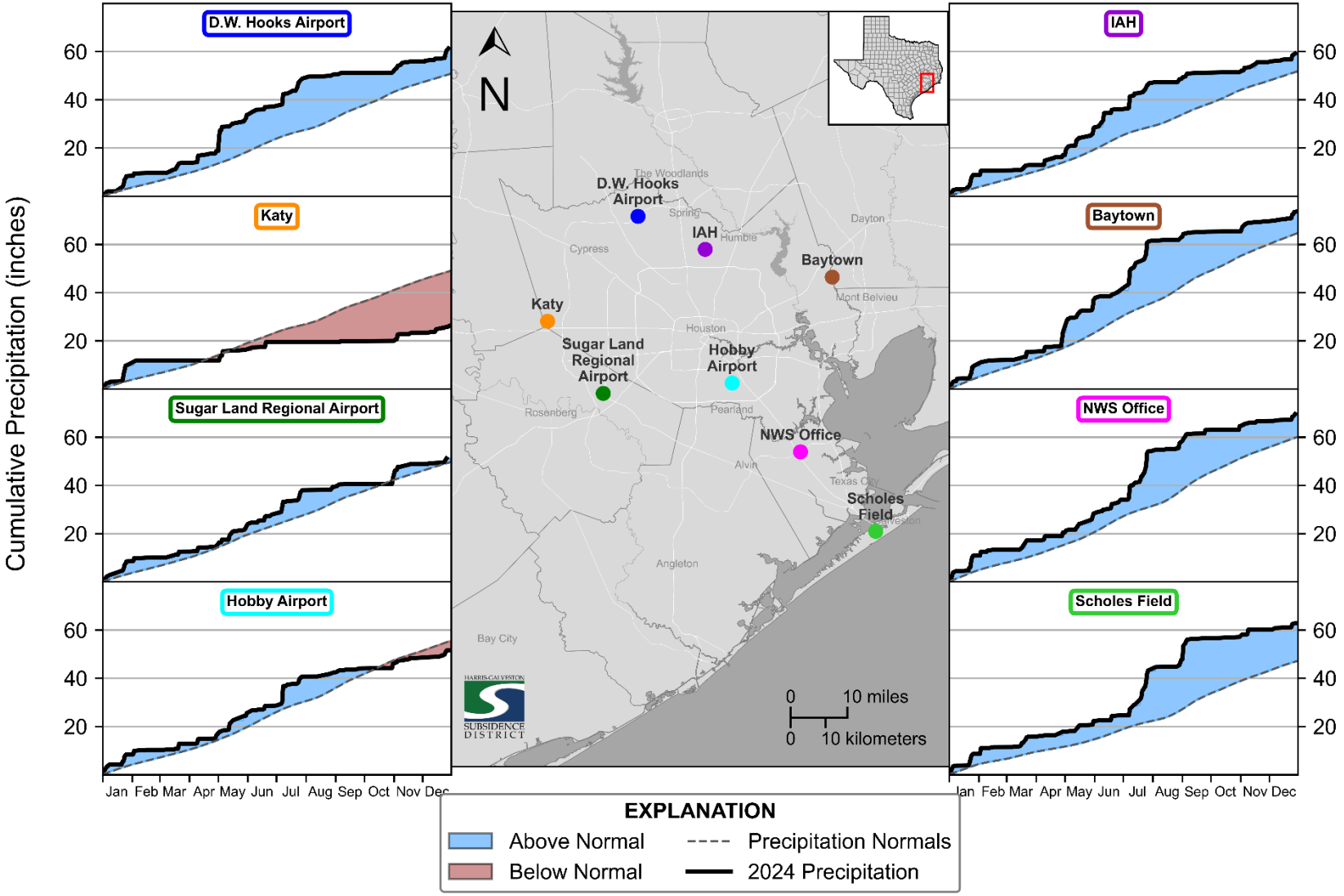


Figure 5: Location of National Weather Service (NWS) climate stations analyzed for the 2024 calendar year. Graphs contain individual station cumulative precipitation, in inches, as the solid black line compared to the 1991-2020 Precipitation Normals shown in the dashed line.

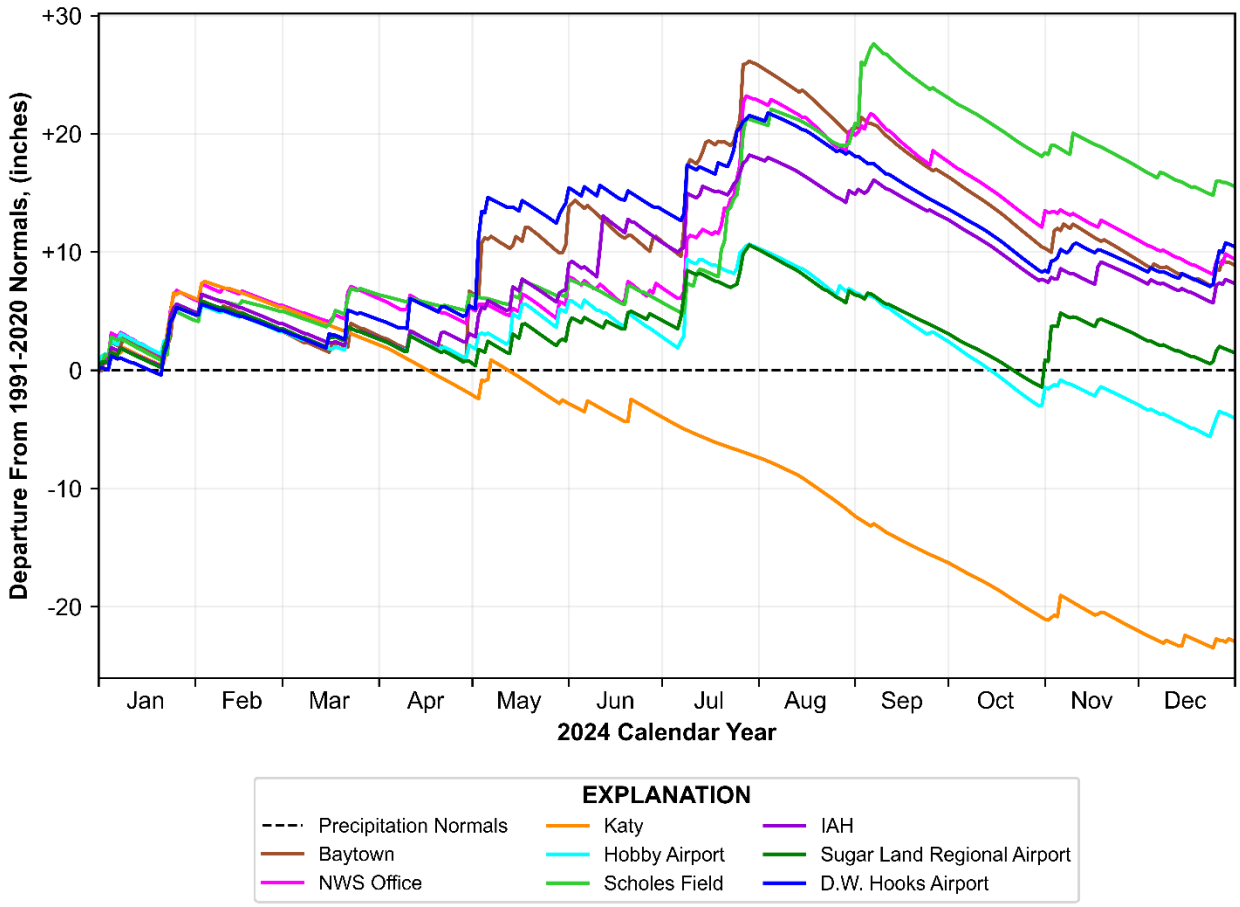


Figure 6: Cumulative 2024 precipitation departure from 1991-2020 normals precipitation, in inches, at select NWS climate stations within and surrounding the District. Source: https://www.ncei.noaa.gov/access.

The 2024 calendar year began with above normal rainfall for all of the eight National Weather Service (NWS) climate stations analyzed for the region. The year progressed with seven stations recording above the 1991-2020 average normal precipitation and increased in summer through fall. The year ended with six stations above normal and two stations, Katy and Hobby Airport, below normal rainfall. The most cumulative rainfall was measured at Scholes Field with almost 63 inches, placing it over 15.5 inches above normal (**Figure 6**). The lowest total rainfall measured in 2024 was recorded at Katy with only 26 inches, placing it almost 23 inches below normal as represented by the orange line in **Figure 6**.

2024 Water Use Summary

The District collects groundwater and alternative water supply use annually from permittees. These datasets provide an understanding of the location and quantity of groundwater use, intended use of groundwater withdrawal, as well as perspective on the conversion from groundwater to surface water since the volume and source of alternative water use is obtained.

As of April 2024, the permittees submitted their annual water use data from over 7,600 active water wells in 2024 for the District to compile and use in this report. Estimations for groundwater withdrawals associated with missing reports were based on permitted allocations for operational wells in 2024 and amount to approximately 10.1 MGD, which equates to about four percent of the total groundwater withdrawal.

In addition to providing water use data for 2024, this report also provides updated groundwater withdrawal totals for the previously reported year of 2023. These changes are made during the normal permitting and reporting process as part of the exchange between the District and its permittees. The changes include updating estimated amounts with actual amounts, correction of data entry errors, and errors in the submitted data. The reported 2023 groundwater withdrawal total increased by 0.45 MGD to a new total of 259.05 MGD.

The following sections provide a summary of the information presented at the Public Hearing held on April 29, 2025. The exhibits used to provide testimony during the hearing are included in **Appendix A – Exhibits Presented at Public Hearing held on April 29, 2025.**

Groundwater Use for the Entire District

The three primary water use types in the District are public supply, industrial, and irrigation. Trends in the intended use of groundwater withdrawals have changed over time as evident in the reduced use for industrial and agricultural supply when compared from the late 1970s to mid-2000s.

The total amount of groundwater used in 2024 was reported to be 237.6 MGD, which is an eight percent decrease from the previous year. Public supply continues to be the dominant use type in the District at 208 MGD, which comprises 88 percent of the total groundwater used (**Figure 7**).

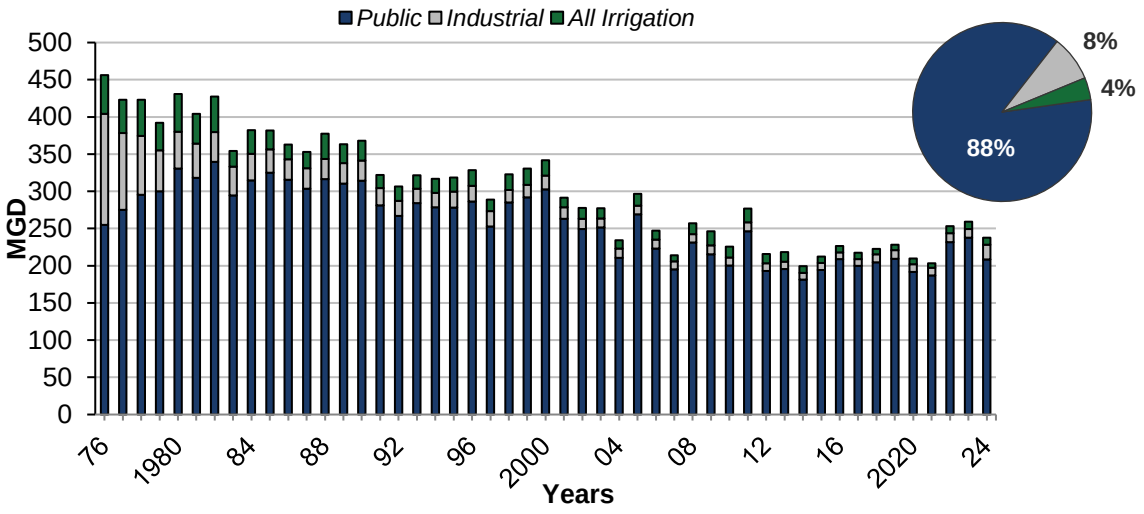


Figure 7: Groundwater withdrawals, in million gallons per day (MGD), by well use from 1976 to 2024. The total groundwater used in the District was 237.6 MGD in 2024, with 88 percent as public supply as shown in the pie chart.

The District is divided into three regulatory areas that define how much groundwater may be utilized as a percentage of the total water demand. The total amount of groundwater withdrawal for 2024 is 237.6 MGD, about an eight percent decrease from the previous year (**Table 1**).

Table 1. Summary of Reported Groundwater Use (in MGD) Grouped by Regulatory Area.

Regulatory Area	Year	Water Use Category			Total
		Public	Industrial	All Irrigation	
Area 1	2023	2.67	5.91	0.23	8.8
	2024	2.78	14.17	0.18	17.1
	1-Year Change	*4%*	*140%*	*-22%*	*94%*
Area 2	2023	26.84	3.14	1.19	31.2
	2024	21.94	2.89	1.03	25.9
	1-Year Change	*-18%*	*-8%*	*-13%*	*-17%*
Area 3	2023	208.38	2.25	8.45	219.1
	2024	183.85	2.53	8.27	194.7
	1-Year Change	*-12%*	*12%*	*-2%*	*-11%*

The total groundwater withdrawals are grouped by regulatory area over the history of the District as shown in **Figure 8** and highlight the impact of the District's Regulatory Plan through the conversion to alternative water sources through the decrease in groundwater use. Regulatory Areas One and Two, which have been fully converted according to the Regulatory Plan, use significantly less groundwater than Regulatory Area Three, which is still undergoing conversion.

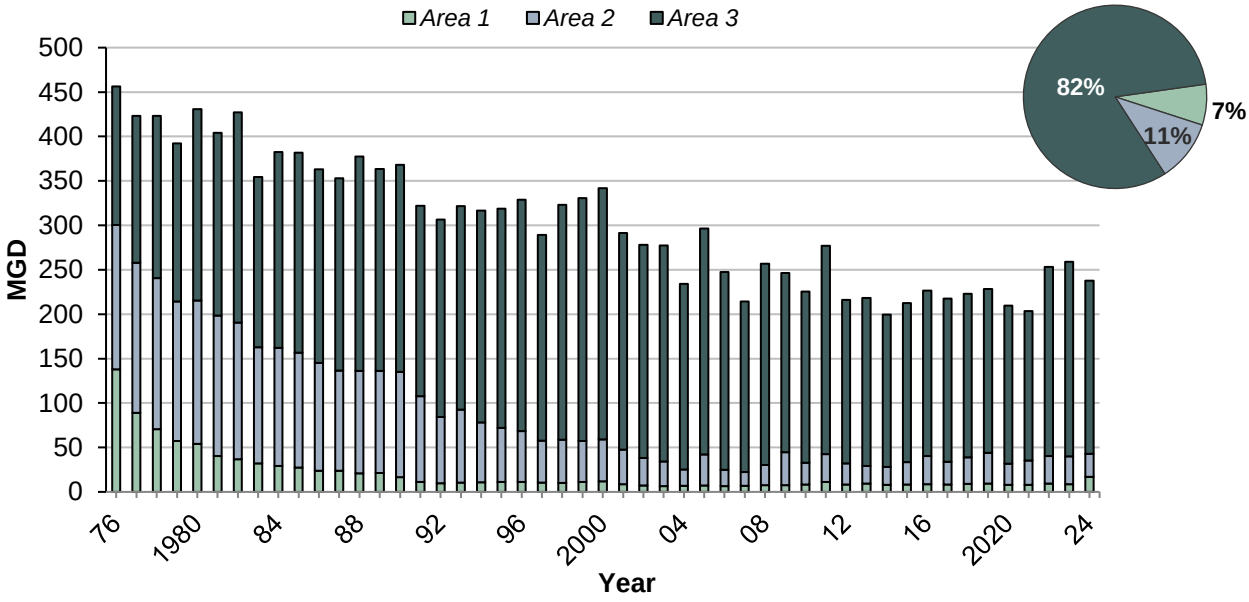


Figure 8: Groundwater withdrawals, in million gallons per day (MGD), by regulatory area from 1976 to 2024. Total groundwater used in the District was 237.6 MGD in 2024 with the majority from Area Three, as represented by the pie chart.

The following sections provide additional information regarding groundwater withdrawals in each Regulatory Area.

Regulatory Area One

Regulatory Area One covers most of Galveston County and the southeastern portion of Harris County. Cities and villages included are Bacliff, Baytown, Bayou Vista, Channelview, Clear Lake Shores, Deer Park, Dickinson, El Lago, Galena Park, Galveston, Highlands, Hitchcock, Kemah, La Marque, La Porte, League City, Morgan's Point, Nassau Bay, Pasadena, San Leon, Santa Fe, Texas City, Seabrook, Shoreacres, Taylor Lake Village, Tiki Island, and Webster. Also included are Clear Lake, Johnson Space Center, and Bolivar Peninsula Areas. This area was converted to alternate water sources back in the 1980s and early 1990s.

In 2024, total groundwater withdrawal in Regulatory Area One was 17.1 MGD, a 94 percent increase from the previous year (**Table 1**). The majority of groundwater use in Regulatory Area One is associated with industrial needs, which comprises 83 percent of the use in this area. Industrial use has been relatively stable since 1990, and groundwater use for public supply has remained generally stable since 2001 (**Figure 9**). In fact, 2024 had a 140 percent increase in industrial use, making it the largest increase observed in the District. Irrigation decreased by 22 percent from the previous year; however, it comprises about one percent of the total groundwater used in Area One. Public supply increased by 4 percent from the previous year and is about 93 percent less than used in 1976.

Historically, groundwater withdrawals have declined in Regulatory Area One from a maximum of 138.1 MGD in 1976 to 17.1 MGD in 2024, which represents approximately 88 percent decrease (**Figure 9**).

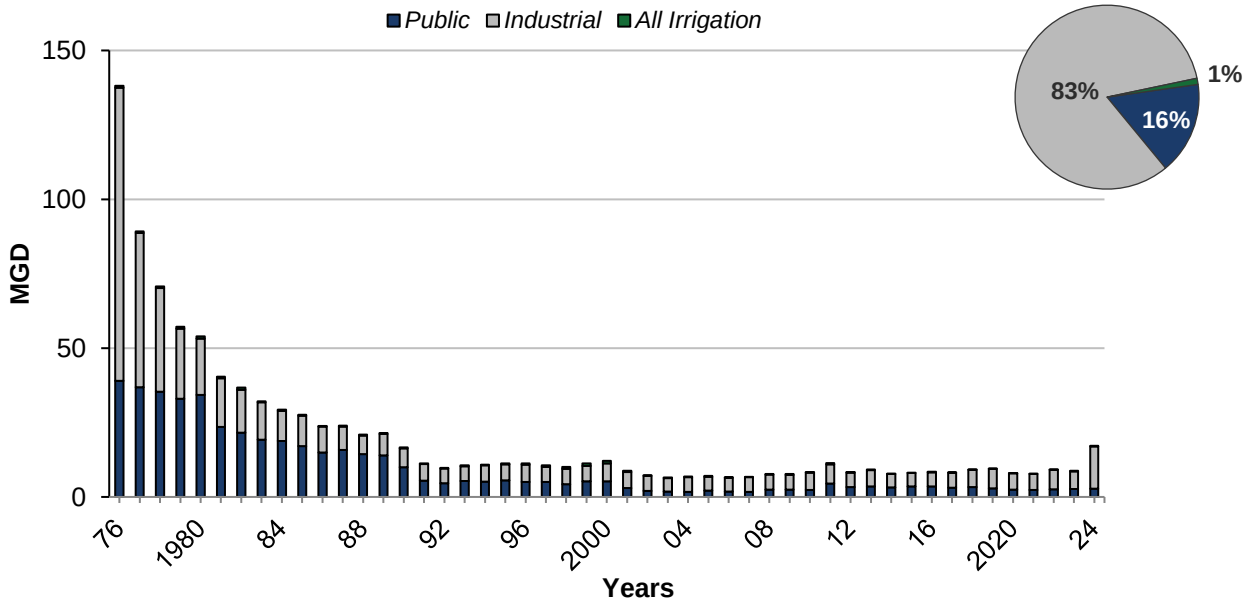


Figure 9: Groundwater withdrawals for Regulatory Area One, in million gallons per day (MGD), by water use category from 1976 to 2024. A total of 17.1 MGD of groundwater was used in Regulatory Area One in 2024, with 83% of the withdrawals being used for industrial purposes as shown in the pie chart.

Regulatory Area Two

Regulatory Area Two covers a small northwestern slice of Galveston County and southern and eastern Harris County. Cities, entities, and areas included are Bellaire, Cloverleaf, Crosby, Friendswood, Highlands, Hobby Airport, Pasadena, Sheldon, South Houston, the Villages, West University, and large portions of the City of Houston. Regulatory Area Two has been converted to alternate water sources since 2002, where possible.

In 2024, total groundwater withdrawal in Regulatory Area Two was 25.9 MGD, a 17 percent decrease from the previous year (**Table 1**). Public supply remains the dominant use type at 85 percent of the total and has decreased by 84 percent from the maximum of 143.8 MGD in 1980 to 21.9 MGD in 2024 (**Figure 10**). Overall, groundwater use in Regulatory Area Two has declined from 169.8 MGD in 1978 to below 40 MGD since 2001.

All use categories experienced a decrease in groundwater use in 2024. Public supply had the largest decrease of 18 percent, followed by irrigation at a decrease of 13 percent, when compared to the previous year.

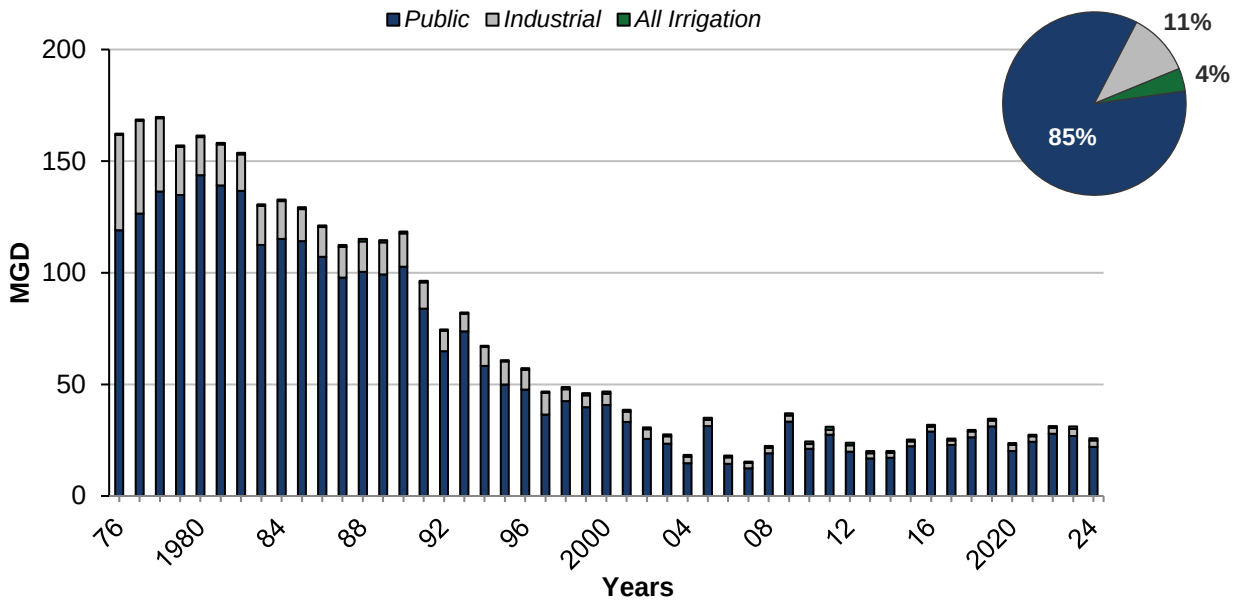


Figure 10: Groundwater withdrawals for Regulatory Area Two, in million gallons per day (MGD), by water use category from 1976 to 2024. A total of 25.9 MGD of groundwater was used in Regulatory Area Two in 2024, with 85% of the withdrawals being used for public supply as shown in the pie chart.

Regulatory Area Three

Regulatory Area Three covers north and west Harris County. Cities, entities and areas included are the Jersey Village, Humble, Kingwood, Huffman, Tomball, Cypress, Hockley, Spring, and parts of Katy. Entities in this regulatory area were required to convert to alternate water beginning in 2010, with this conversion facilitated by the City of Houston and the Regional Water Authorities. Two subsequent conversion deadlines in 2025 and 2035 remain for permittees with groundwater reduction plans.

In 2024, total groundwater withdrawal in Regulatory Area Three was 194.7 MGD, an eleven percent decrease from the previous year (**Table 1**). Similar to Regulatory Area Two, the largest category of water use is public supply, which was reported at 183.8 MGD and accounts for 95 percent of the total groundwater use in this area (**Figure 11**). This also marks an increase of 90 percent since 1976 as the population has grown northward and westward into Area Three during this time. Industrial water use has been below 3 MGD since 2012. While all irrigation use has remained below 10 MGD since 2014.

Groundwater use in Area Three was less in 2024 than in the previous two years. This decline in groundwater use could be attributed to a combination of increased availability to alternative water supply as significant projects became operational in 2024 as well as the increased rainfall measured in this region when compared to the exceptional droughts in 2022 and 2023.

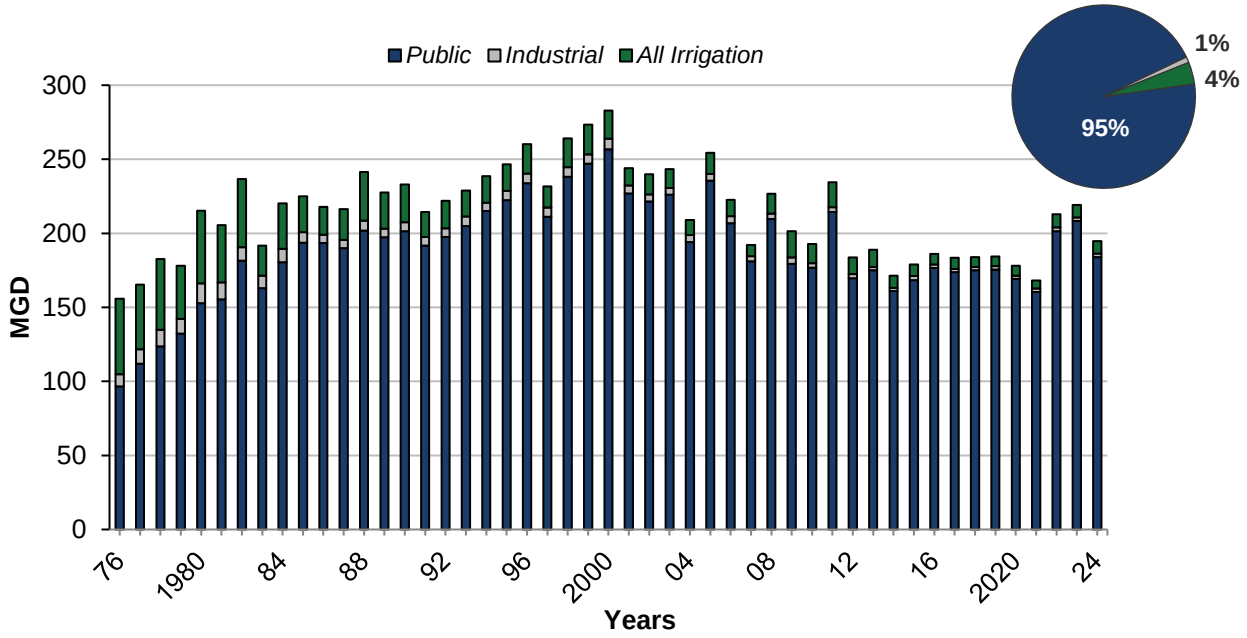


Figure 11: Groundwater withdrawals for Regulatory Area Three, in million gallons per day (MGD), by water use category from 1976 to 2024. A total of 194.7 MGD of groundwater was used in Regulatory Area Three in 2024, with 95% of the withdrawals being used for public supply as shown in the pie chart.

Alternative Water Supply and Total Water Use

The District's Regulatory Plan requires permittees to convert to alternative water supplies in order to reduce their reliance on groundwater sources. The primary alternative water supply used in the region is surface water sourced from three primary river basins from east to west are the Trinity River Basin, the San Jacinto River Basin and the Brazos River Basin (**Figure 2**). Reclaimed water is another alternative supply that began providing a consistent supply to the District since 1997. Reclaimed water includes metered water from the effluent from treatment plants, captured stormwater runoff, and reuse water from industrial processes.

In 2024, the total alternative water used in the District was 855.9 MGD, which is over four percent more than used in the previous year (**Figure 12**). The Trinity River Basin accounts for the majority of alternative water supply and brought about 591 MGD to the District followed by the San Jacinto

with approximately 181 MGD. Reclaimed water has increased by over 1,300 percent from less 0.4 MGD in 2001 to almost 5.5 MGD in 2024; however, it still accounts for less than one percent of the total alternative water used in the District.

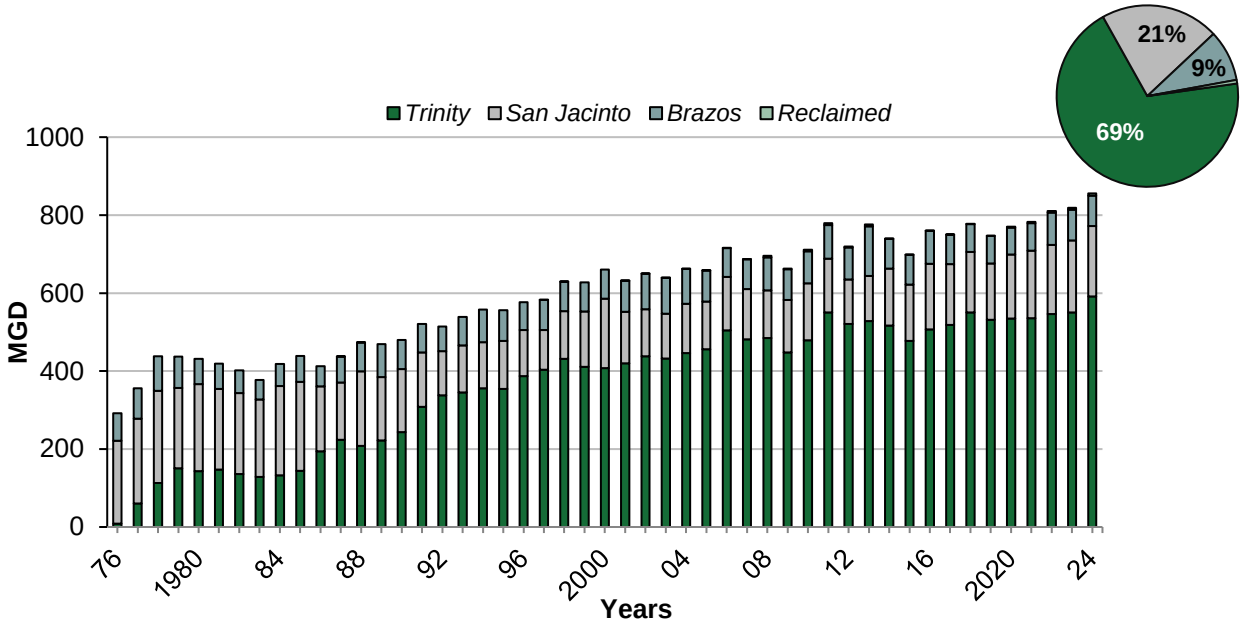


Figure 12: Total alternative water use for the District, in million gallons per day (MGD), by source water, from 1976 to 2024. The reported total alternative water used in the District in 2024 was 855.9 MGD, with the majority supplied from the Trinity River Basin as shown in green in the pie chart.

Since 1992, the Trinity River Basin continues to be the largest water source used within the District. Groundwater remains the second largest source of water supply within the District as a whole. Compared with 2022, the largest increase, coming in at 13 percent, for alternative supply in 2023 was reclaimed water (**Error! Not a valid bookmark self-reference.**). The other sources of alternative supply received relatively small increases, and the Brazos River Basin was the only one to receive a decrease of four percent from the previous year.

Table 2. Summary of Reported Alternative Water, Groundwater and Total Water Use (in MGD) for the entire District.

Water Source		2023	2024	1-Year Change
Alternative Supplies	Brazos River Basin	79.31	78.27	-1%
	San Jacinto River Basin	184.35	180.73	-2%
	Trinity River Basin	550.44	591.40	7%
	Reclaimed Water	5.02	5.45	9%
	Alternative Subtotal	819.12	855.85	4%
Groundwater		259.05	237.64	-8%
Total Water Use		**1078.2**	**1093.5**	**1.4%**

The total water use for the District was determined to be 1,093.5 MGD in 2024, which is slightly over one percent increase from the previous year (**Figure 13** and

Since 1992, the Trinity River Basin continues to be the largest water source used within the District. Groundwater remains the second largest source of water supply within the District as a whole. Compared with 2022, the largest increase, coming in at 13 percent, for alternative supply in 2023 was reclaimed water (**Error! Not a valid bookmark self-reference.**). The other sources of alternative supply received relatively small increases, and the Brazos River Basin was the only one to receive a decrease of four percent from the previous year.

Table 2).

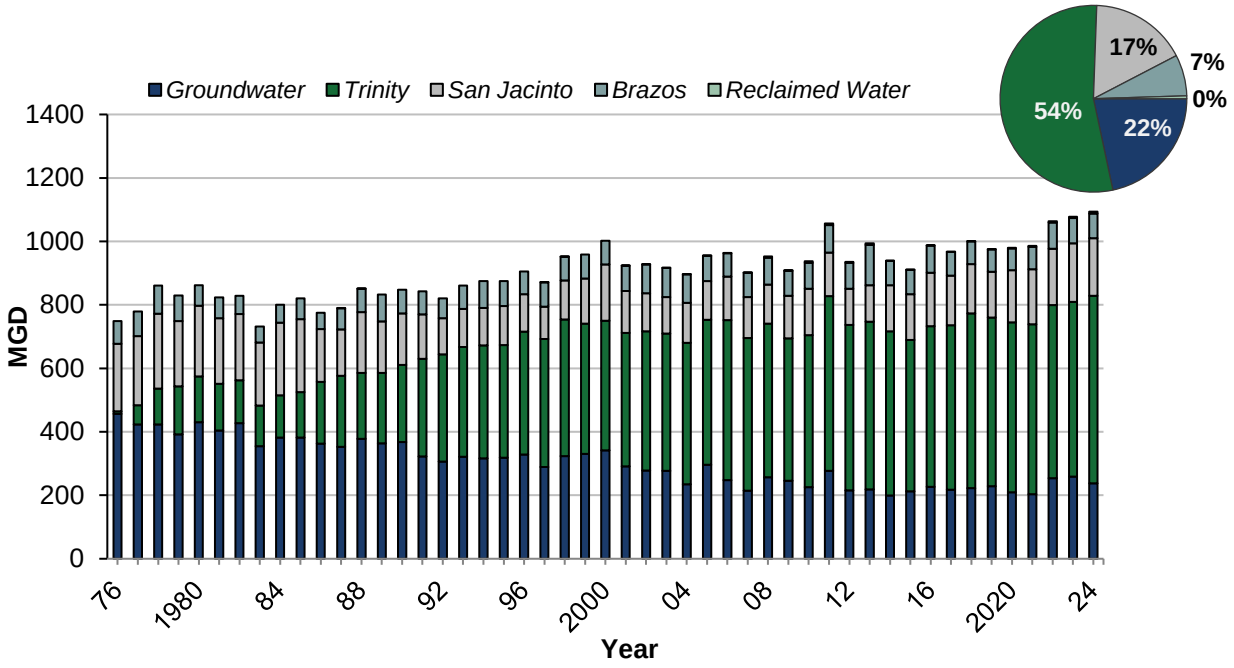


Figure 13: Total water use for the District, in million gallons per day (MGD), by source water, from 1976 to 2024. The reported total water used in the District in 2024 was 1,093.5 MGD with the majority sourced from the Trinity River Basin as shown in the pie chart.

2024 Groundwater Levels Summary

All groundwater used in the District is sourced from the Gulf Coast Aquifer System, which is composed of two primary water-bearing units. The unit most widely used in the District is the Chicot-Evangeline (undifferentiated) aquifer. The Chicot is the shallowest aquifer in the District which is directly connected to the Evangeline Aquifer immediately beneath it. Additionally, the analysis of new hydrogeologic datasets and advancements in modeling led to modifications of the base of the Chicot aquifer (Young & Draper, 2020). Due to the interconnectedness of these units and recent changes to the hydrostratigraphy, the Chicot and Evangeline aquifers were grouped together and reclassified as the Chicot-Evangeline (undifferentiated) by the USGS (Ramage, et al., 2022). The Burkeville confining unit lies beneath the Evangeline portion of the Chicot-Evangeline (undifferentiated) and isolates the last primary aquifer, the Jasper aquifer. The Jasper aquifer is not widely used in the District but is a primary source of water for counties north of the District such as Montgomery County.

Annually, since 1975, the USGS has measured the potentiometric surface in hundreds of wells throughout the Houston region in cooperation with the District through a joint funding agreement along with additional cities, subsidence districts, and groundwater conservation districts to monitor and provide reports on groundwater level altitude data for the Chicot-Evangeline (undifferentiated) and Jasper aquifers. The potentiometric surface is defined as the level to which water rises in a well (Fetter, 2001). For confined aquifers like the Gulf Coast Aquifer System, the potentiometric surface can be above the top of the aquifer unit in tightly cased wells. Changes in the potentiometric surface (water-level) are primarily caused by external forces, such as pumping groundwater out of wells.

Annual measurements of aquifer water-level, also referred to as the water-level altitude, are essential to understanding the impact that groundwater use has on the aquifer which in turn may impact land subsidence. The USGS staff measures the water-level in various wells (e.g., public supply, industrial, irrigation, and observation) from December through March on an annual basis. The collected data and associated analyses, such as generating the water-level altitude map, are performed by USGS staff and provided to the District through the joint funding agreement for the purposes of the annual groundwater report.

The water-level altitude for the Chicot/Evangeline (undifferentiated) aquifer shows the areas of primary stresses, which are the greatest declines in the water-level, occur in western and northern Harris County as well as southern Montgomery County and northeastern Fort Bend County (**Figure 14**). The 2024 water-level map was created using measurements collected from 525 wells across 11 counties in the greater Houston-Galveston region from December 2024 through March 2025. The black circles in **Figure 14** designate the location of the wells that were measured.

The USGS also uses the annual water-level measurements to compare against past datasets to determine changes in the aquifer over different time periods. The change in water-level in the Chicot/Evangeline (undifferentiated) aquifer since 1977 clearly demonstrates the impact of District regulation on the aquifers (**Figure 15**). Generally, Regulatory Areas One and Two have seen a substantial rise in water-levels with over 200 feet (about 61 meters) in the Chicot-Evangeline (undifferentiated) aquifer in locations like the Houston Ship Channel. The areas of rise are a result of the reduction of groundwater use as required by the District's Regulatory Plan.

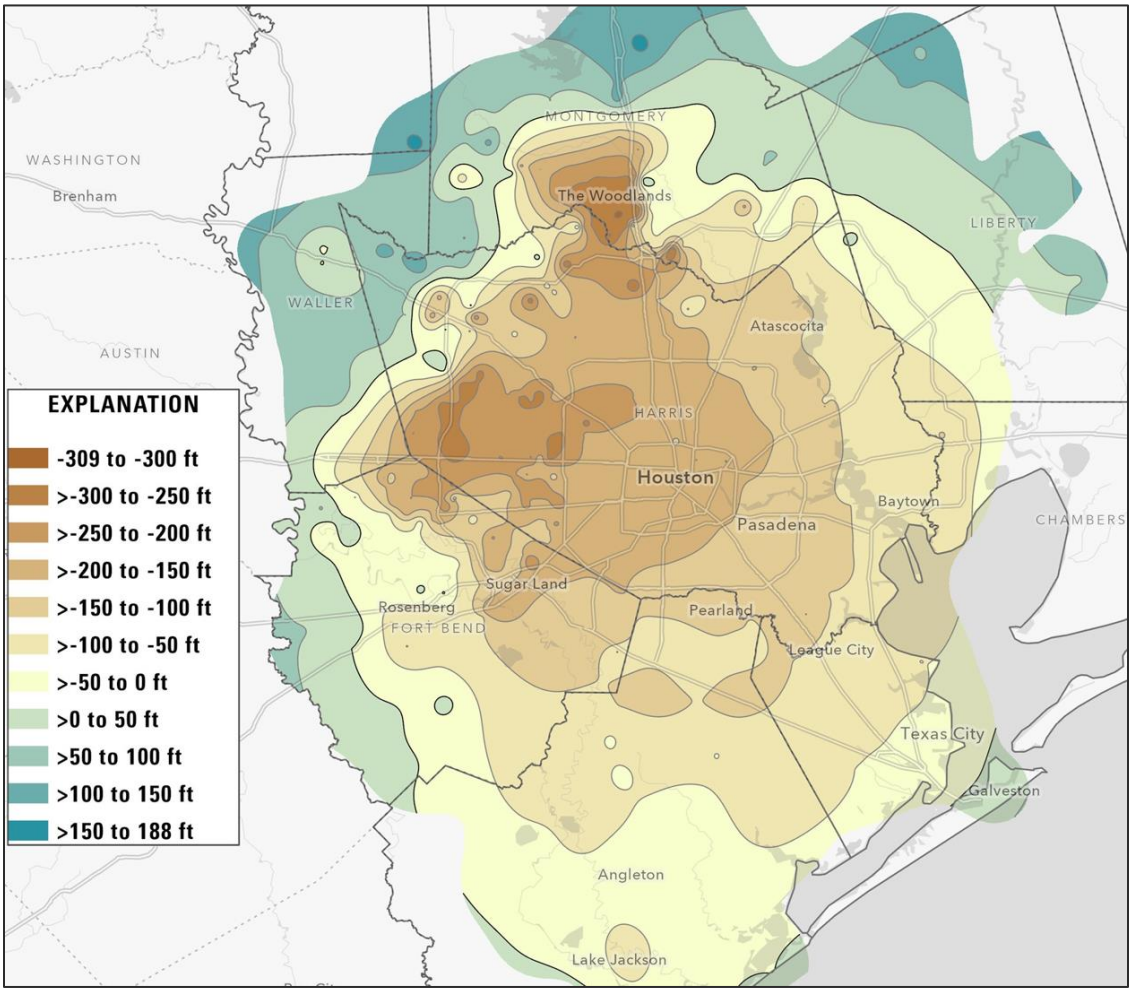


Figure 14: Altitude of the potentiometric surface determined from water-levels measured in tightly cased wells (black circles) screened in the Chicot-Evangeline (undifferentiated) aquifer, Houston region, Texas, 2025 (Source: USGS provisional data – preliminary and subject to change).

Conversely, in Regulatory Area Three, water-levels of the Chicot-Evangeline (undifferentiated) aquifer continue to be significantly lower than the historical benchmark as the population is growing rapidly, and the conversion to alternative sources of water will not be completed in this area until 2035. The maximum decline for the Chicot-Evangeline (undifferentiated) aquifer occurs in The Woodlands within south-central Montgomery County, with over 400 feet (about 122 meters) below datum from 1977 to 2025 (**Figure 15**).

Groundwater levels in southern Montgomery County are of particular concern as the greatest water-level declines in the Chicot-Evangeline (undifferentiated) aquifer exists in southern Montgomery County near The Woodlands in both 2025 water-level measurements as shown in **Figure 14** as well as the comparison of changes in the water-level from 1977 to 2025 as displayed in **Figure 15**. The deregulation of groundwater withdrawal in Montgomery County by the LSGCD may impact the groundwater use in this area as the aquifer water-level continues to decline. This

area is also an important area of interest as continued population growth and expanded groundwater use may result in an expansion of the area of decline into northern Harris County.

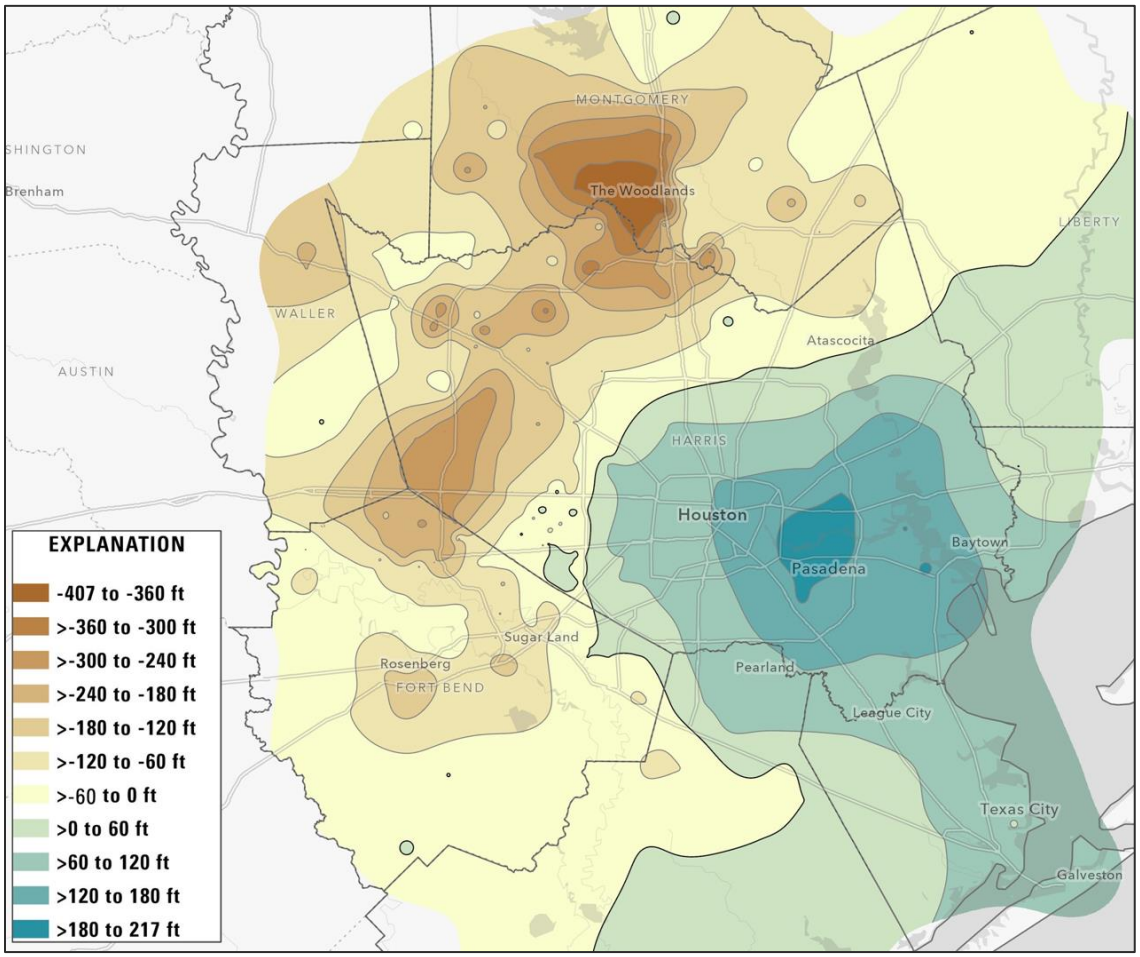


Figure 15: Potentiometric water-level change at wells screened in the Chicot-Evangeline (undifferentiated) aquifer, Houston region, Texas, from 1977 to 2025 (Source: USGS provisional data – preliminary and subject to change).

Water-level altitudes in the Jasper aquifer also indicate a decline with as much as 250 feet (76.2 meters) measured in wells near the central border between Harris County and Montgomery County in 2025 (**Appendix A**). Additionally, the Jasper water-level altitude in 2025 shows declines over 250 feet (76.2 meters) in south central Montgomery County near The Woodlands. The majority of the groundwater withdrawal from the Jasper aquifer occurs in Montgomery County where the hydrogeologic conditions are more favorable for drinking water.

The information presented for the groundwater levels section is a summary of the provisional data presented at the public hearing held on April 29, 2025, by the USGS. Such exhibits used to provide testimony during the hearing are included in **Appendix A**. A USGS Scientific Investigation Report should be released later in 2025, documenting the status of groundwater level altitudes and the long-term changes in the Chicot-Evangeline (undifferentiated) and the Jasper aquifers. Once released, this report will be available through the USGS website.

2024 Subsidence Summary

Subsidence is the lowering of land surface elevation. In the Houston-Galveston region, subsidence primarily occurs from the compaction of clays due to groundwater withdrawal for municipal, industrial, and irrigation water supply. As the water level of the aquifer declines, fine-grained sediments, such as silt and clay, in the aquifer release water thereby depressurizing and can cause compaction through the reorientation of minerals within these fine-grained sediments. This compaction of the aquifer results in the lowering of overlying stratigraphic units and is observed at the land surface as subsidence.

The District has installed and maintained global positioning system (GPS) stations throughout Harris, Galveston, and surrounding counties to monitor the land surface on a routine basis since the mid-1990s. The collection of GPS stations is referred to as the subsidence monitoring network. The subsidence monitoring network consists of a collaboration between the District, FBSD, UH, LSGCD, Brazoria County Groundwater Conservation District (BCGCD), the National Geodetic Survey (NGS), the USGS, the City of Houston, and the Texas Department of Transportation (TxDOT). The monitoring network has grown to over 190 stations throughout the region. As of 2025, the District operates and maintains 74 GPS stations with approximately 66 stations located in Harris and Galveston counties and the remaining eight stations within Brazoria, Waller, Montgomery, and Chambers counties.

GPS Station Overview

The GPS stations are constructed in different ways based on when they were installed and operator preferences. The District designed a permanent GPS station in the mid-1990s to apply a consistent measurement method across multiple counties. This design is known as PAM and is named after the original port-a-measure method utilized by the District in the early 1990s when the GPS station was a survey benchmark disk and each location collected data periodically. The design consists of a two-inch galvanized pipe drilled approximately 34 feet below ground surface and extends eight feet above the ground surface. The pipe is anchored in a concrete plug at the base and enclosed by centering bands and PVC pipe near the surface to reduce movement. The exposed pipe (i.e., the section of pipe that extends eight feet above the ground surface) is mounted with an antenna adapter to secure the global navigation satellite system (GNSS) antenna. A separate two-inch pipe is installed within a few feet from the antenna pipe to hold an enclosure box, which stores a battery and GNSS receiver, and a mounted solar panel. Both pipes are surrounded by four bollards and encased in a concrete slab for protection. **Figure 16** depicts a schematic of the District's GPS station design.

The building mount is another design for a GPS station. Building mounts have a GNSS antenna mounted on or near the roof. Buildings with deep foundations and clear sky views are optimal locations to measure land-surface elevation change and limit interference. This building mount design is used by UH throughout the greater Houston area.

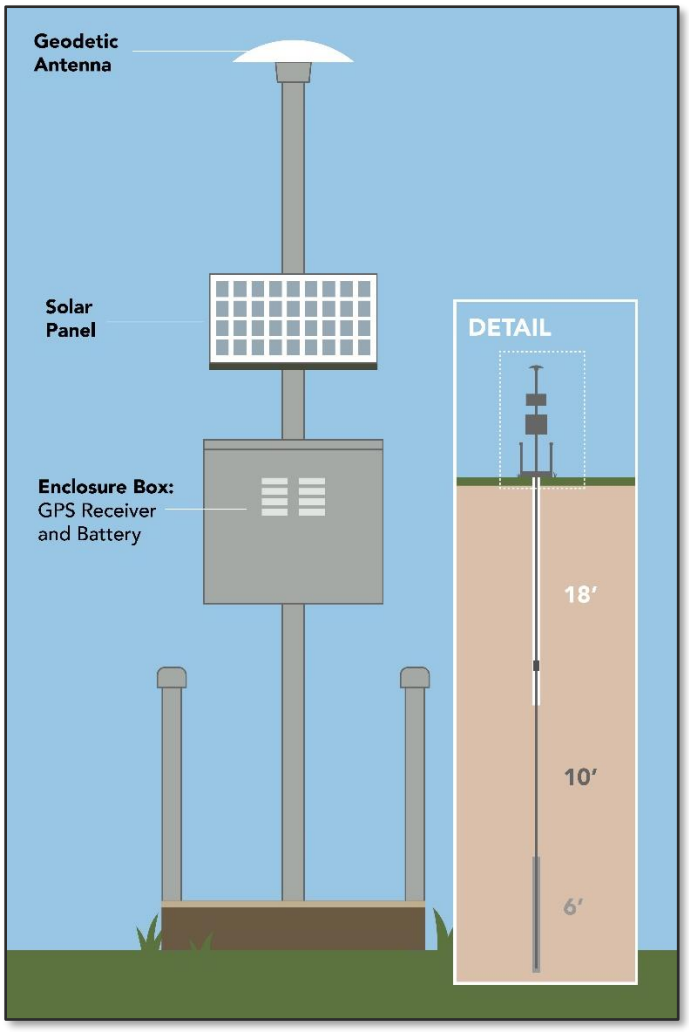


Figure 16: Schematic of the District's GPS station design for a permanent GPS station. Note schematic is not drawn to scale and is intended for visual purposes only. All numbers are provided in US standard measurement.

GPS data are collected at each GPS station on specific monitoring schedules. The District operates both periodic and continuous monitoring GPS stations. Periodic monitoring stations collect GPS data for approximately seven days every two months at the GPS station. These stations are constructed in the District's PAM design and use a Trimble GNSS antenna and receiver to gather land-surface data. Continuous monitoring stations collect GPS data every day of the year and some are designated as continuously operating reference stations (CORS). Operators, such as UH and TxDOT, operate continuous monitoring stations.

GPS Data Processing

Satellite signals are collected every 30 seconds and averaged over 24 hours by global navigation satellite system (GNSS) antenna and receiver into one raw daily data file. The GPS data collected measure the land surface as a three-component displacement time series involving the horizontal (East-West), vertical (North-South), and ellipsoidal height (up-down) components. GPS data are processed and converted to a stable reference frame called Houston20 to remove natural movements such as plate tectonics (Agudelo, et al., 2020). Additional methods of GPS data processing include the identification of outliers and estimations of site velocities and associated uncertainties.

Outliers are identified through a series of steps that include applying a locally weighted scatterplot smoothing (LOWESS) algorithm to obtain a time-series trend with two iterations, removing the residual time-series trend, and estimating the median of absolute deviations (MAD) of the residual time-series (Wang, et al., 2022). The subsidence rate of a GPS station is estimated using the linear regression of the most recent five-year ellipsoidal height data (i.e., 2020-2024), for active stations that have a minimum of three years of data. The root mean square (RMS) accuracy of the GPS data provided in this report is approximately five to eight millimeters for the vertical direction or ellipsoidal height (Wang, et al., 2022).

The entire GPS dataset from all contributors is reprocessed every few years as improvements in positioning software, updates to global to regional reference frames, and other data processing analysis tools, such as orbital clock updates, are disseminated to users. Caution should be applied when attempting to mix or compare old GPS datasets with newer versions as GPS data processing is both a complex and a dynamic procedure.

The vertical displacement is determined by the change in ellipsoidal height, which is the distance from a point on the earth's surface to the reference ellipsoid. The reference ellipsoid is a mathematical representation of the earth's surface as a smoothed ellipsoid. Although the ellipsoid height is not the same as elevation, or the orthometric height, research has shown that linear trends of vertical displacement at GPS stations over the same time interval were the same for both ellipsoidal and orthometric heights (Wang & Soler, 2014). Therefore, ellipsoidal heights are used to estimate vertical displacement of the land surface.

The period of record includes GPS measurements of the ellipsoidal height that are collected over the lifespan of each GPS station. It is used to track the full history of land-surface deformation and is represented as a vertical displacement time series. Period of record plots give a historical context to understand local to regional subsidence trends. Period of record plots for each GPS station in the subsidence monitoring network that were actively collecting data in 2024 are provided in **Appendix B**.

Average Annual Subsidence Rate

The average annual subsidence rate helps show the recent change in land surface deformation at each GPS station and is calculated by using the linear regression (i.e., the statistically determined best-fit straight line through a scatter plot of data points) of the most recent five (5) years of data for active GPS stations with at least three years of GPS data. **Figure 17** depicts the average annual subsidence rate from 2020 to 2024 for over 180 GPS stations in southeast Texas.

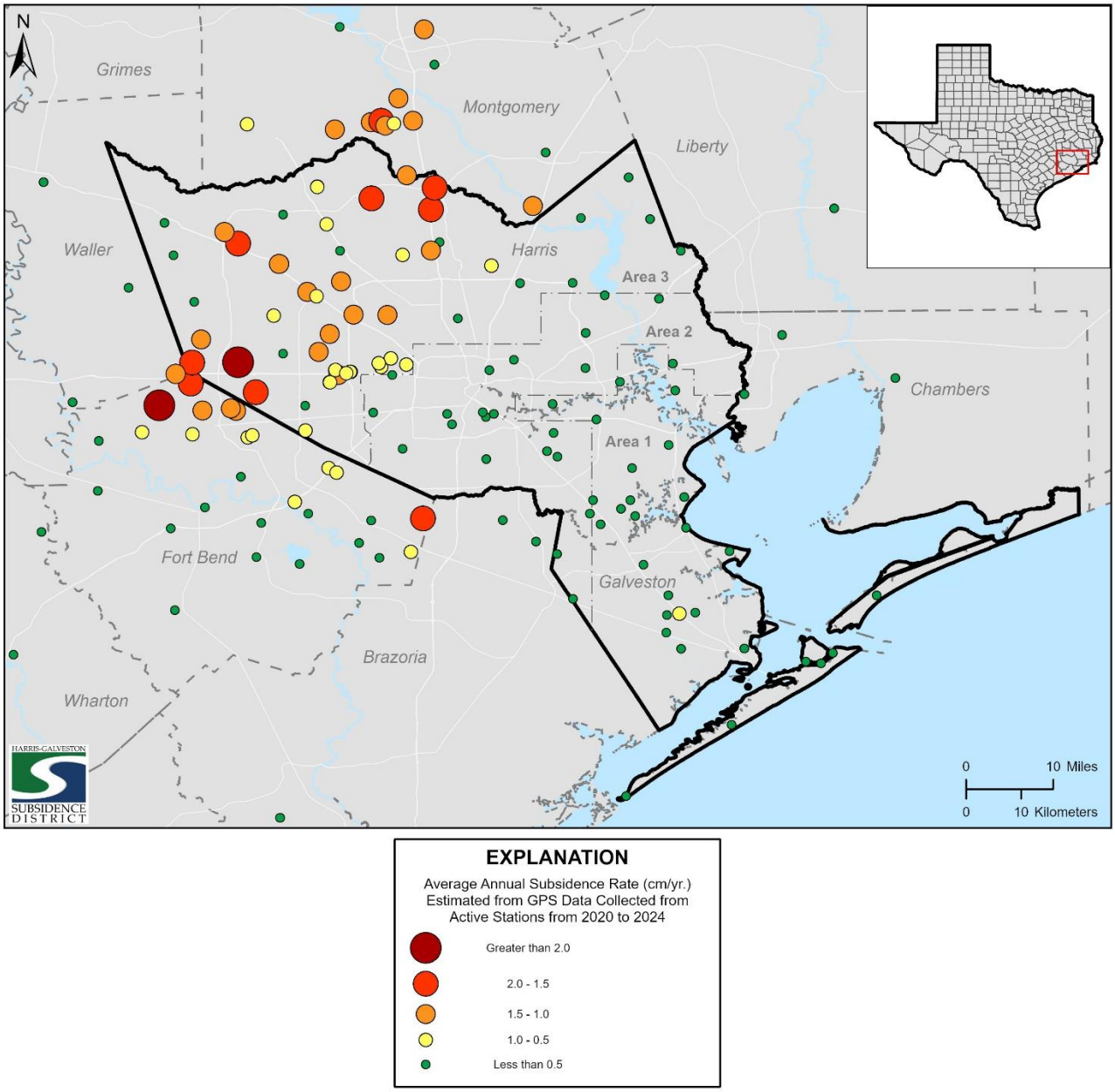


Figure 17: Annual subsidence rate, measured in centimeters per year, from 2020 to 2024, referenced to Houston20 and estimated from three or more years of GPS data collected from active GPS stations in Harris, Galveston, and surrounding counties, Texas.

Regulatory Areas One and Two show stable subsidence rates at less than half a centimeter per year as noted by the small green circle in **Figure 17** since both areas have been fully converted and USGS groundwater level data show that water-levels have risen. Nearly all GPS stations in Regulatory Areas One and Two show little to no subsidence (**Figure 17**).

The highest subsidence rates (i.e., greater than 2 centimeters per year) occur in Regulatory Area Three within western Harris County as well as southeastern Waller County and northeastern Fort Bend County. GPS station P111, located near Fulshear within Fort Bend County, has the highest subsidence rate estimated at 3.31 centimeters per year. Other GPS stations near P111 in the Katy area also show high subsidence rates greater than 2.0 centimeters per year, such as GPS station MRHK, located in Katy within Harris County (**Figure 18**).

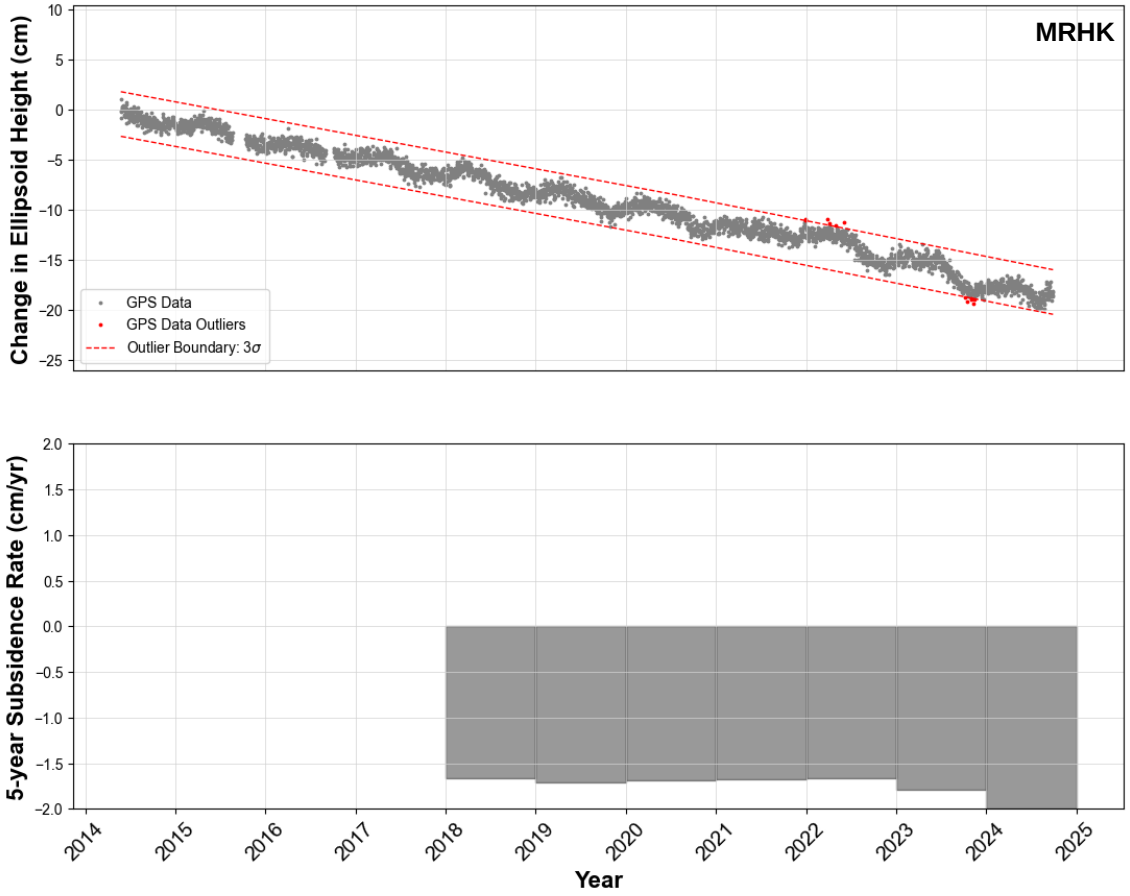


Figure 18: Period of record data from GPS station MRHK located in Katy, Texas, 2014-2024. MRHK has recorded approximately 18.2 cm of subsidence since 2014. The 2020-2024 subsidence rate is 2.07 cm/yr. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

Other areas in Regulatory Area Three, such as Cypress and Tomball, as well as areas in southern Montgomery County like The Woodlands and in southeastern Fort Bend County like Fresno have subsidence rates greater than one centimeter per year. Based on the GPS data collected and analyzed in the subsidence monitoring network, subsidence is occurring in Regulatory Area Three, as this area is still undergoing conversion to alternative water supplies.

Interferometric Synthetic Aperture Radar

Since 2019, the District has sponsored research conducted by Southern Methodist University that utilizes a novel remote sensing methodology to evaluate land-surface changes in the Houston-Galveston region. This project involves multi-temporal interferometric synthetic aperture radar (InSAR) to estimate changes in the land surface from a regional scale and complements the District's subsidence monitoring network by providing data in between the GPS stations. Synthetic aperture radar (SAR) scenes are created through the transmission of electromagnetic radiation (i.e., radio waves) that are sent from the sensor to the ground surface and bounce back up to the sensor. The sensor circles the earth in precise orbit and time called passes. It takes about 12 days for the sensor to revisit an area previously captured. Experts use information gleamed from these different passes to detect small changes in the distances between them. This processed pair of SAR images is called an interferogram and shows if the land is moving up or down (Helz, 2005). This process was applied to the Houston-Galveston region and using state-of-the-art processing techniques achieved accuracy in millimeters.

This report marks the first year that InSAR-derived subsidence rates were analyzed and presented at the Public Hearing. The District worked with technical experts from SkyGeo, Inc. to estimate the annual subsidence rate averaged from 2020 through 2024 across Harris, Galveston, and surrounding counties. Approximately 202 SAR scenes were analyzed from January 5, 2020 through December 21, 2024 from the descending track of Sentinel-1 and processed using the persistent scatterers technique to create an interferogram of the velocities in the vertical direction.

Results from InSAR-derived subsidence rates are shown in **Figure 19** and these rates closely resemble rates calculated from the GPS stations. For example, green colors indicate very minor subsidence to uplift and warmer colors, ranging from yellow to red, indicate higher subsidence. As presented in **Figure 19,** Regulatory Area One shows predominately green color from InSAR-derived data indicating little subsidence to uplift. Conversely, Regulatory Area Three contains darker red InSAR-derived data, which represents subsidence rates greater than 2.0 centimeters per year, in **Figure 19** and these higher subsidence rates extend into northeastern Fort Bend County and southcentral Montgomery County. Some isolated areas of higher subsidence rates, which are represented by red colors, were also detected in northwestern Brazoria County and western Chambers County.

The combination of different remote sensing technologies, such as InSAR and GPS, allow the District to monitor changes in the land surface with increased accuracy. The agreement between these different datasets enhances the District's ability to track subsidence from a regional to local scale.

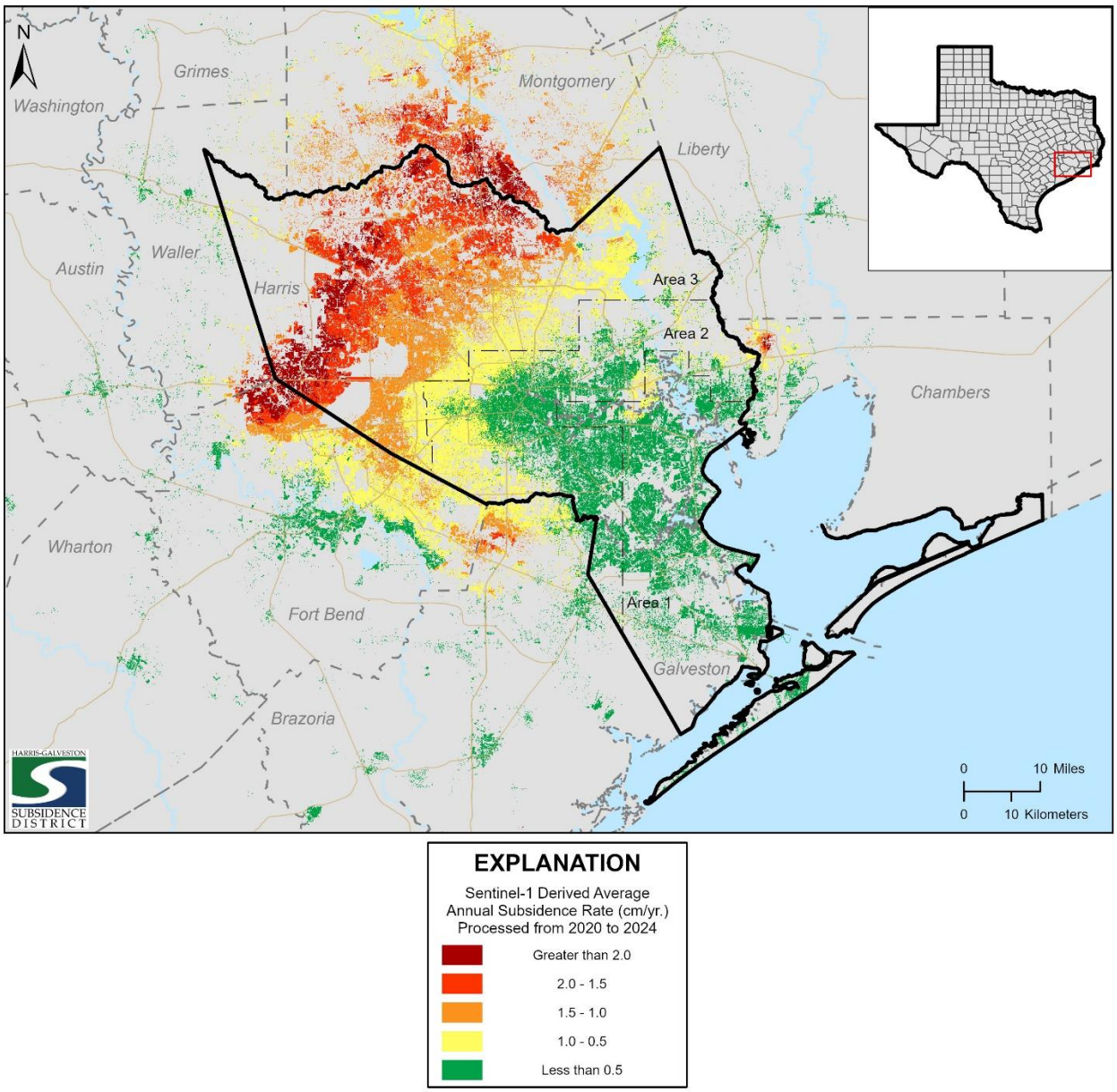


Figure 19: Interferometric Synthetic Aperture Radar (InSAR)-derived annual subsidence rate, calculated in centimeters per year, estimated from Sentinel-1 data and averaged from 2020 through 2024. Processed SAR scenes were analyzed using persistent scatterers methodology from 202 scenes on the descending track. Source: SkyGeo.

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Appendix A – Exhibits Presented at Public Hearing held on April 29, 2025

Welcome to the 2024 Annual Groundwater Report Public Hearing

IN-PERSON ATTENDEES

- Check to make sure your mobile devices are muted.
- This board room is equipped with microphones that will be recording throughout the entirety of the hearing. Please be mindful of this to not disturb the audio for our virtual attendees.
- Public testimony and Q&As will be available at the end of this hearing.

VIRTUAL ATTENDEES

- Virtual attendees will be muted for the entirety of the hearing.
- The webinar will be recorded, including all chat between participants.
- For audio/visual issues, please chat with the organizer.

HARRIS-GALVESTON SUBSIDENCE DISTRICT

2024 Annual Groundwater Report

Public Hearing - April 29, 2025

Harris-Galveston Subsidence District

The Harris-Galveston Subsidence District (HGSD) is a special-purpose district created by the Texas Legislature in 1975 to prevent further land subsidence in Harris and Galveston counties.

HARRIS-GALVESTON SUBSIDENCE DISTRICT
1975 - 2025

GROUNDWATER REGULATION

- Collaborating with local groundwater conservation districts, regional water providers, and other water agencies to manage groundwater use through water planning and well permitting.

SCIENCE & RESEARCH

- Utilizing the highest quality data and research to monitor groundwater usage, aquifer characteristics, and land surface changes as well as analyzing the best-available predictive models.

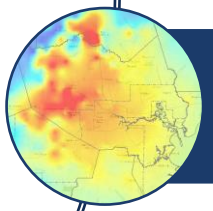
WATER CONSERVATION

- Equipping permittees, residents, businesses, and educators with water conservation tools and resources to reduce water usage and empower the community to value water.

Agenda

Climate

Water Use



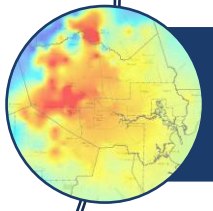
Groundwater Levels

Subsidence

Agenda


Climate


Water Use


Groundwater Levels


Subsidence

Exhibit 1

Location of National Weather Service (NWS) climate stations used for rainfall data for the 2024 calendar year.

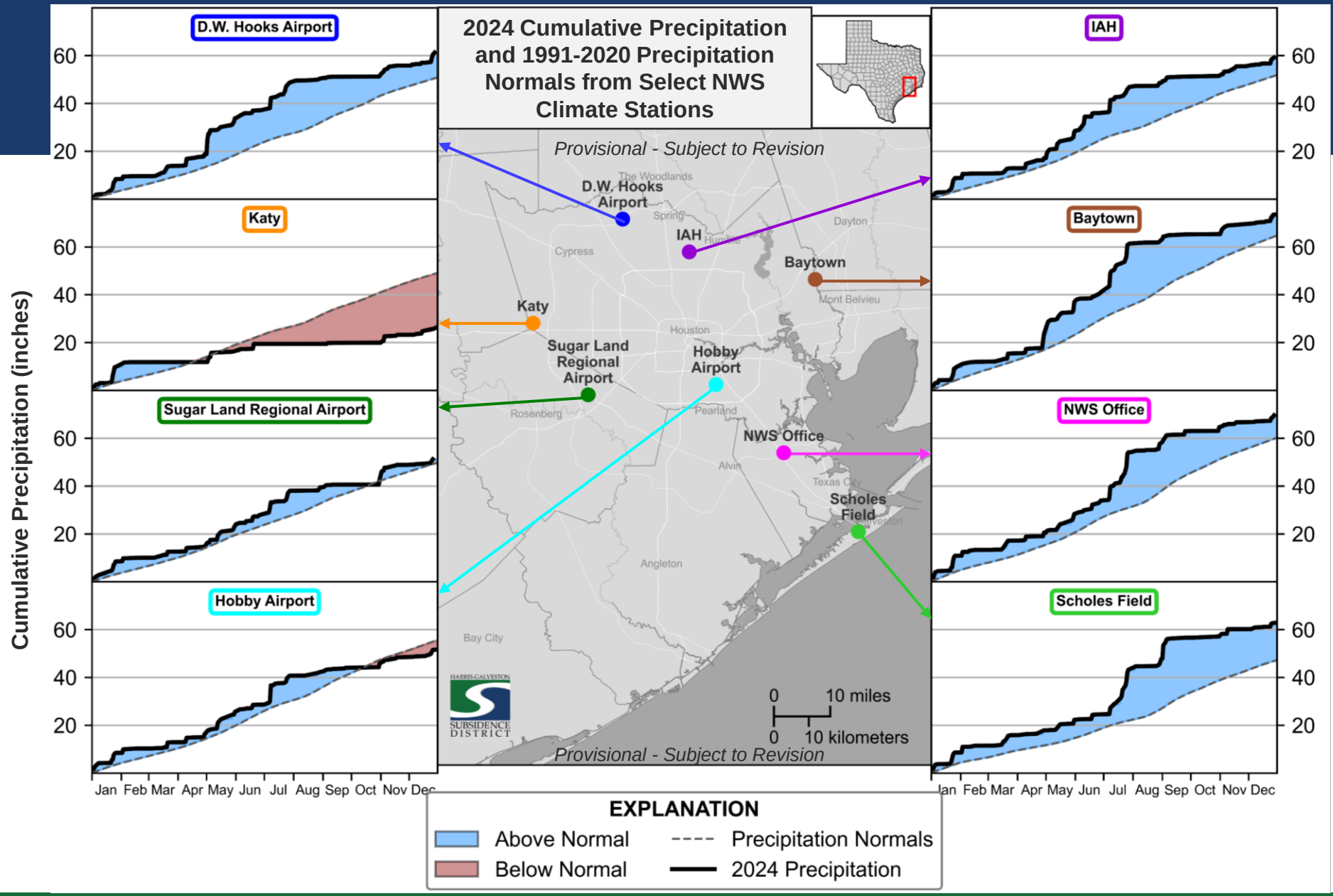
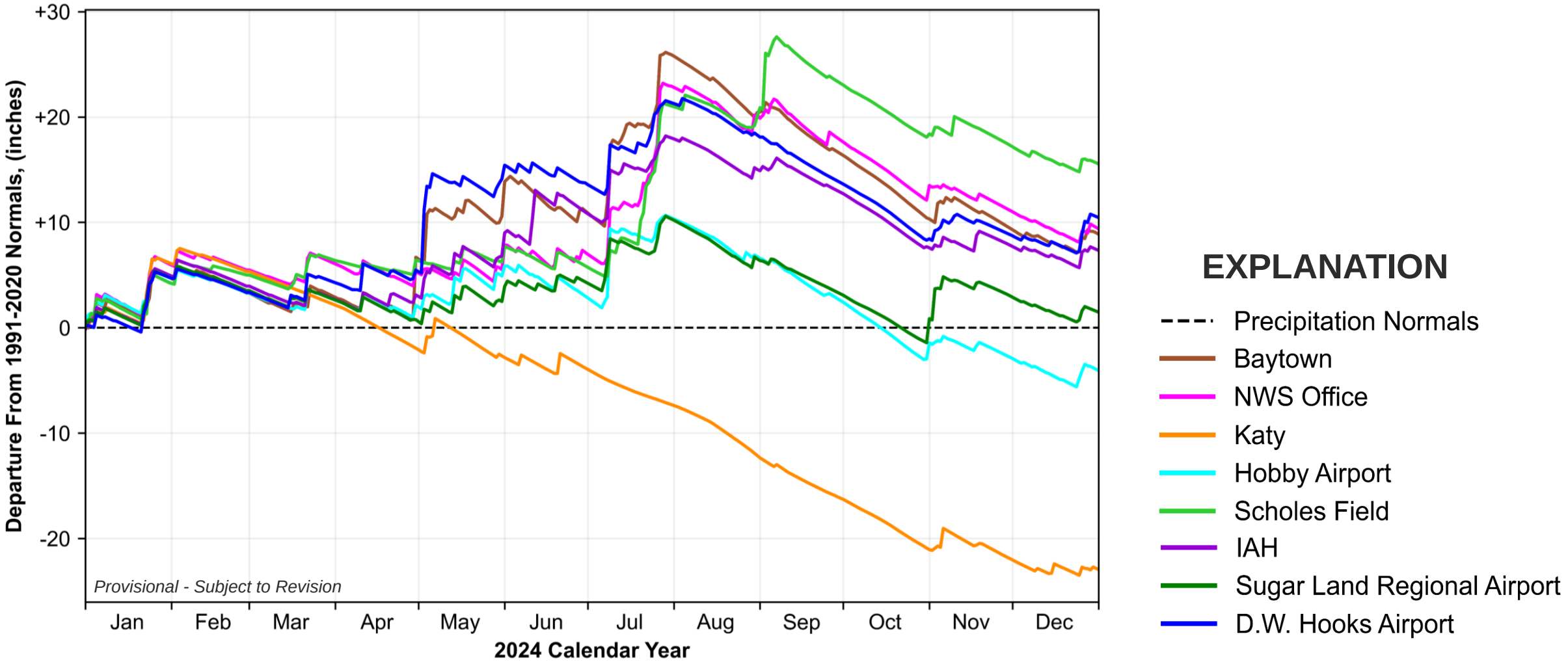


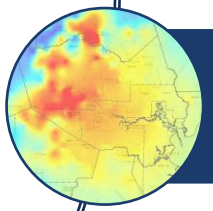
Exhibit 2 | 2024 Precipitation Data



Agenda

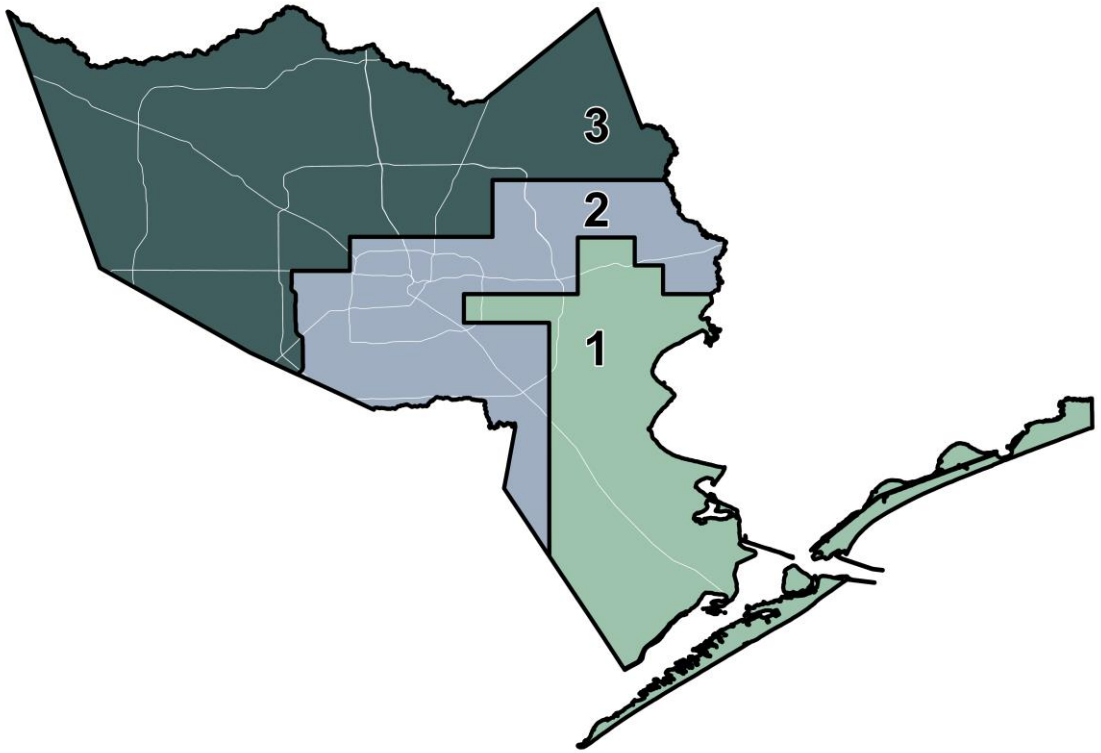

Climate


Water Use


Groundwater Levels

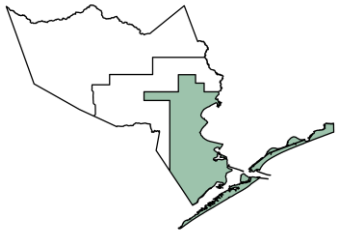

Subsidence

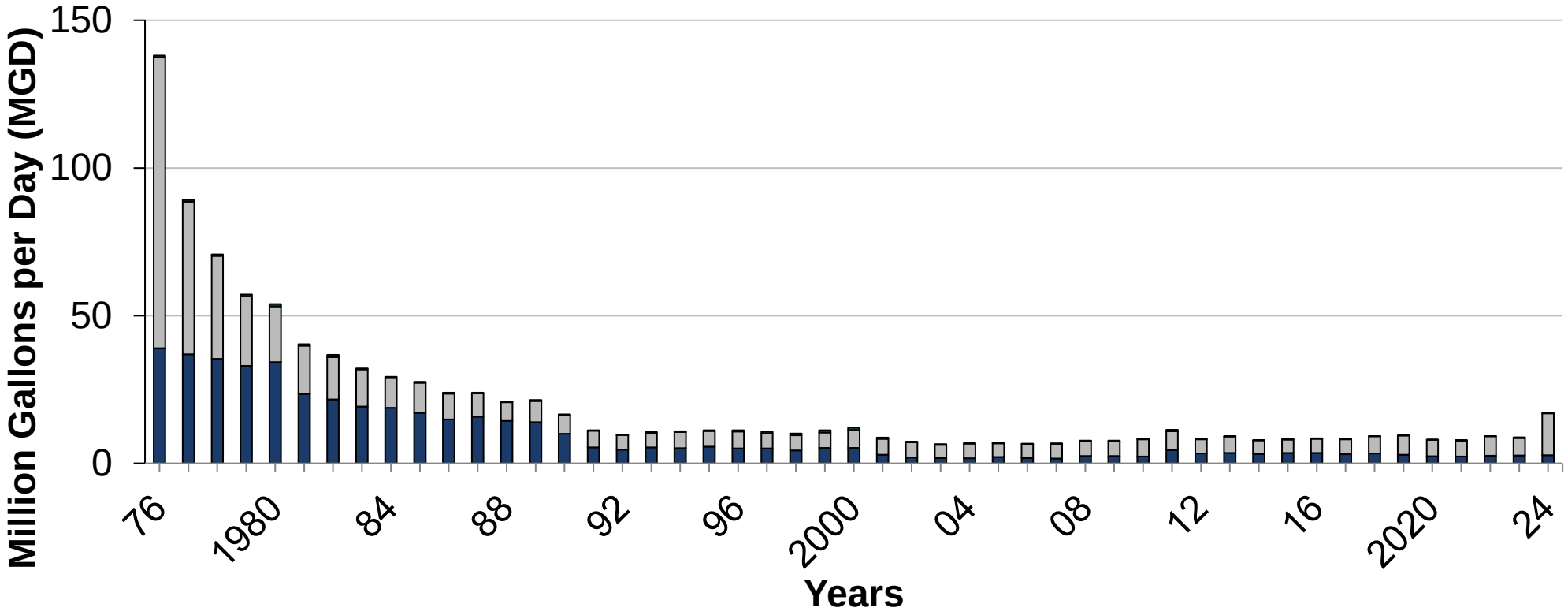
HGSD's Regulatory Areas



- **Area 1:** No more than 10% of Total Water Demand (TWD) may be sourced from groundwater.
- **Area 2:** No more than 20% of TWD may be sourced from groundwater.
  - Groundwater Reduction Plan (GRP) may be approved with conditions.
- **Area 3:** No more than 20% of TWD may be sourced from groundwater.
  - Permittees operating within an approved GRP have the following requirements:
    - 2025 – reduce groundwater use to no more than 40% of TWD
    - 2035 – reduce groundwater use to no more than 20% of TWD

Exhibit 3 | Regulatory Area 1 Groundwater Use





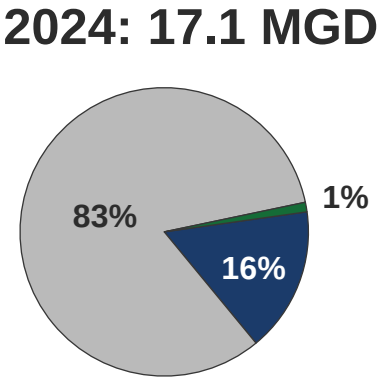
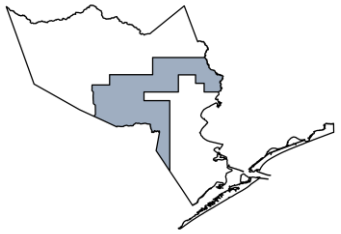
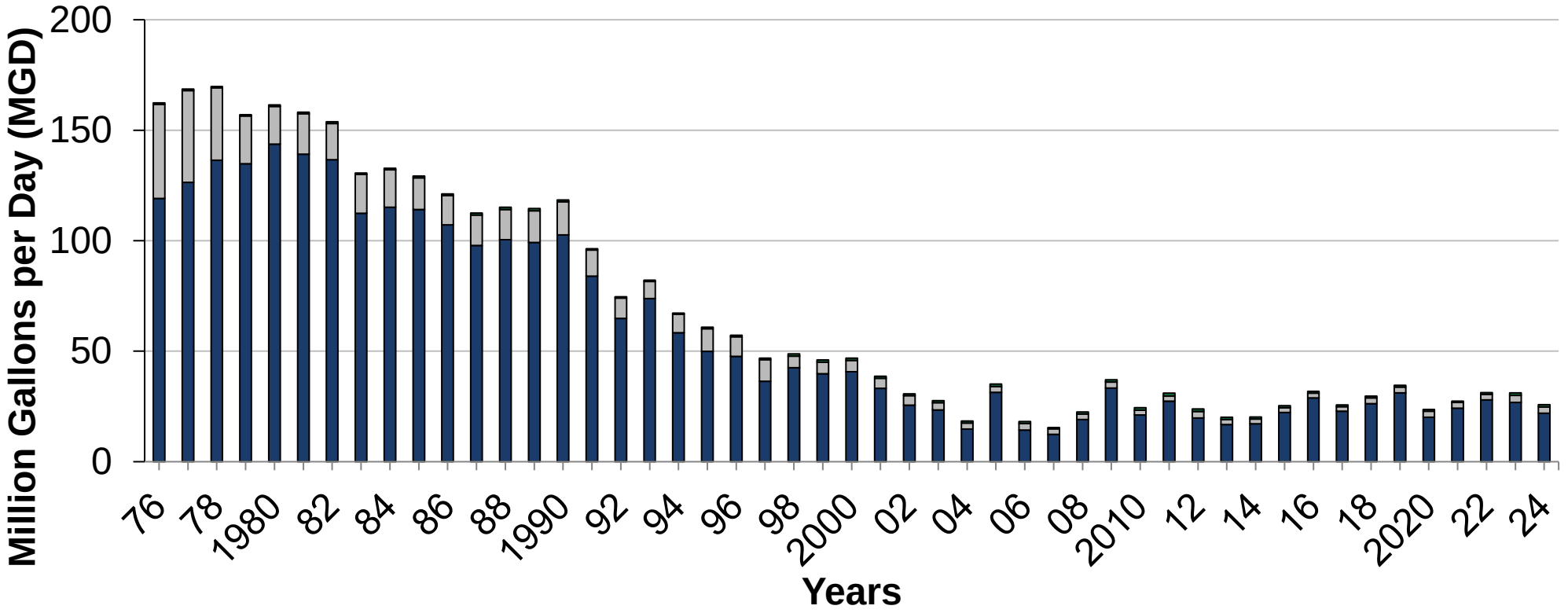


Exhibit 4 | Regulatory Area 2 Groundwater Use





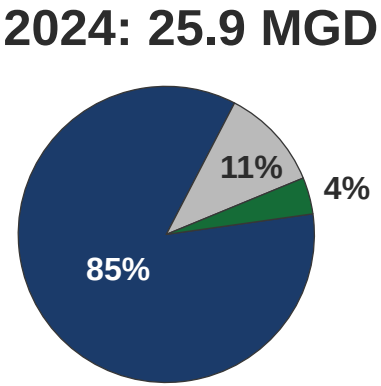
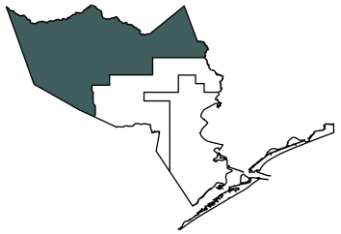
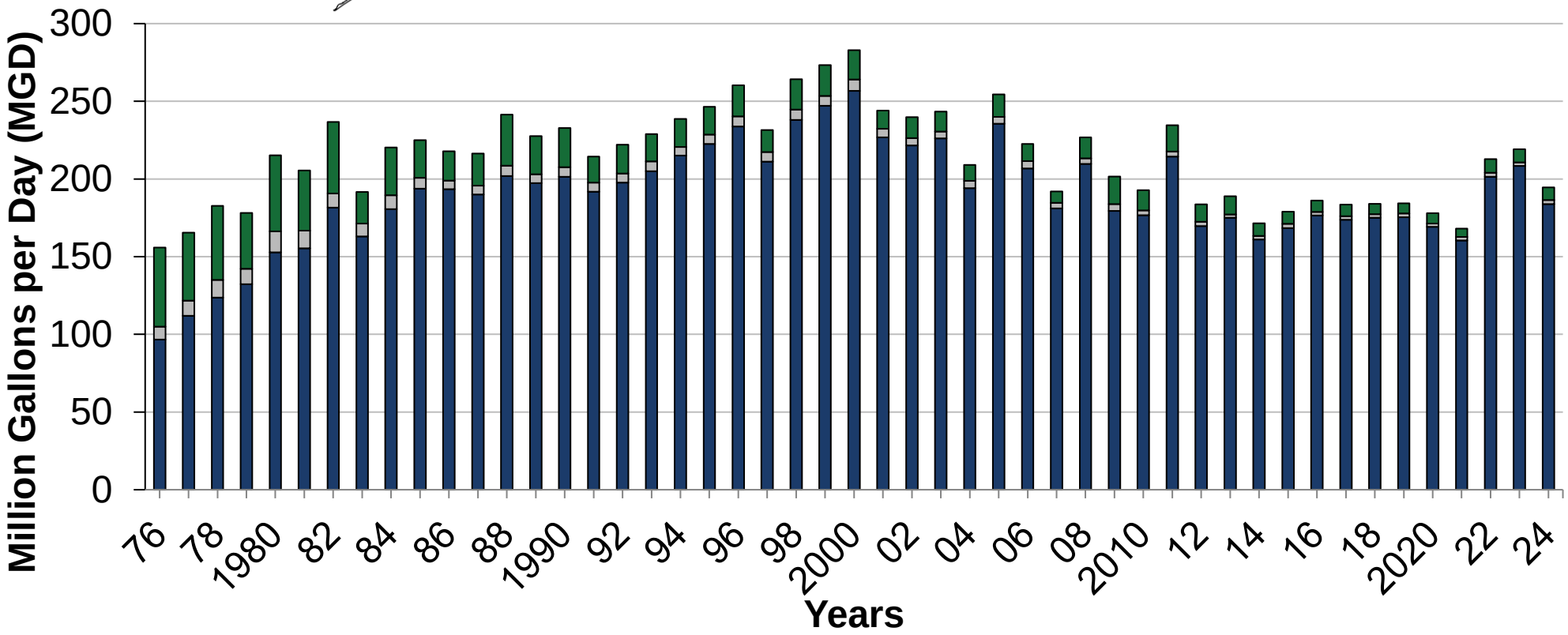


Exhibit 5 | Regulatory Area 3 Groundwater Use





2024: 194.7 MGD

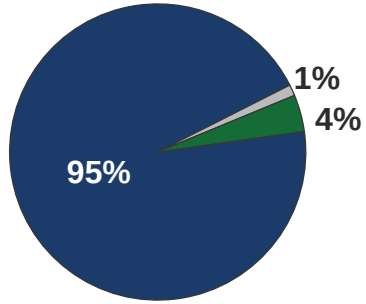
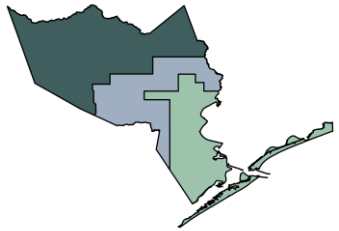
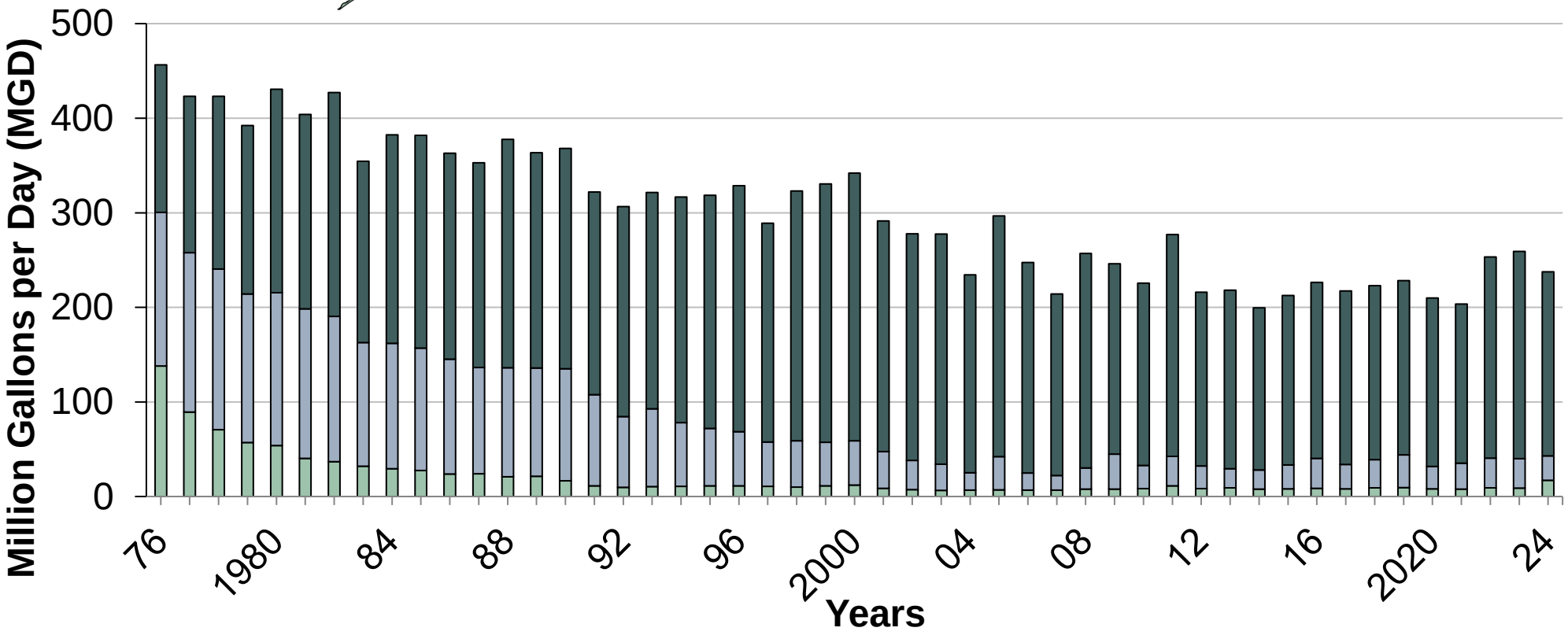


Exhibit 6 | All Regulatory Areas' Groundwater Use





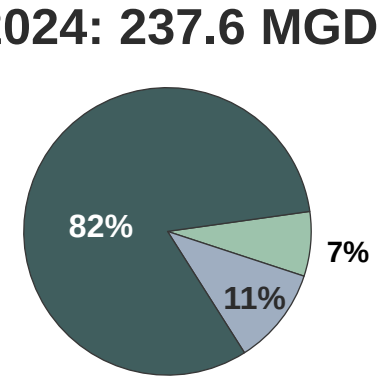
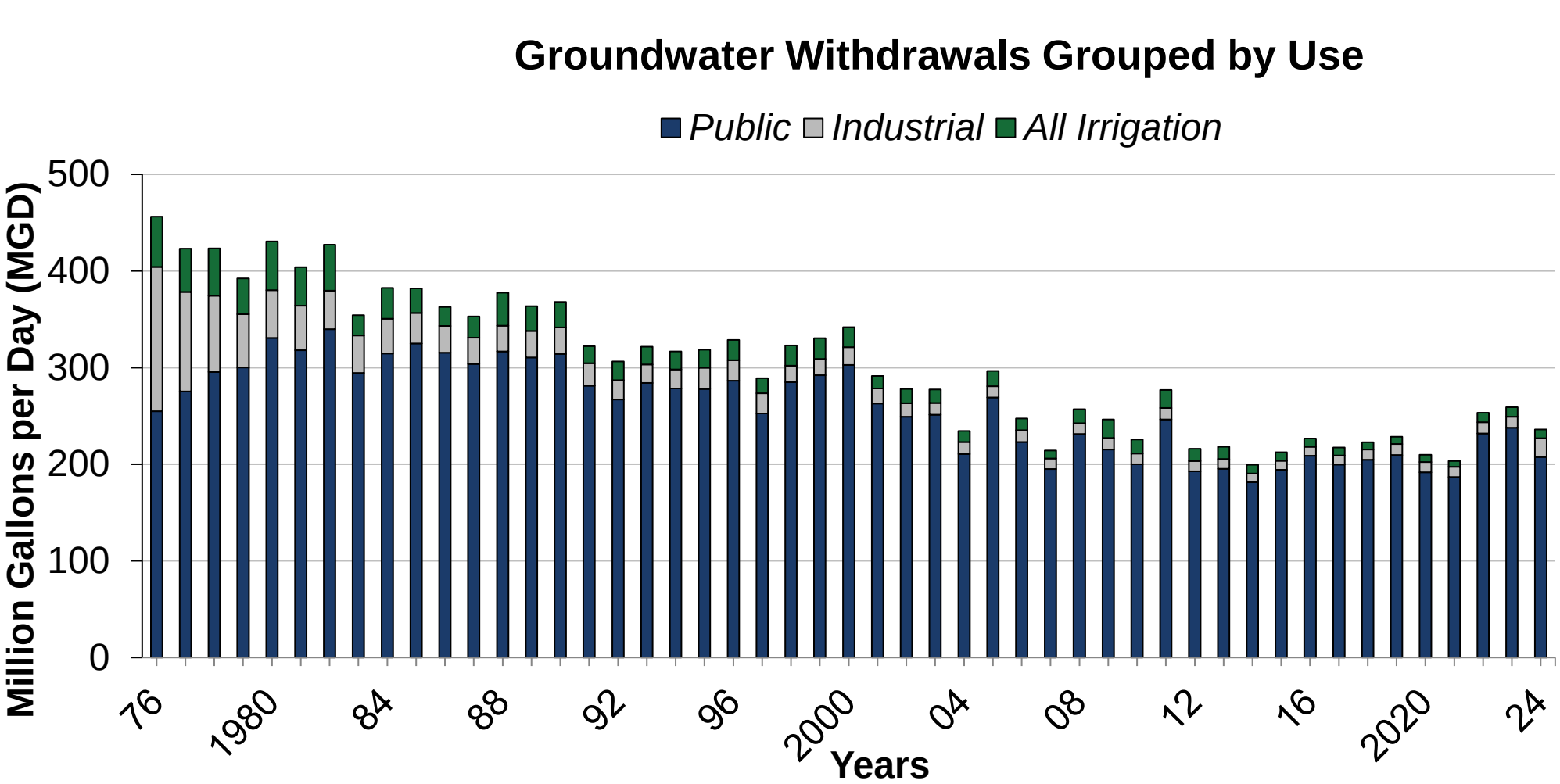
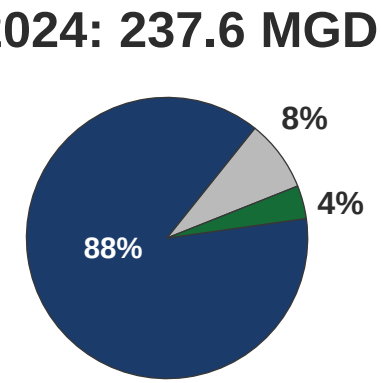


Exhibit 7 | Entire District Groundwater Use Type





Alternative Water Sources

Surface water sources:

- Trinity River
- San Jacinto River
- Brazos River

Reclaimed water is also utilized throughout the District.

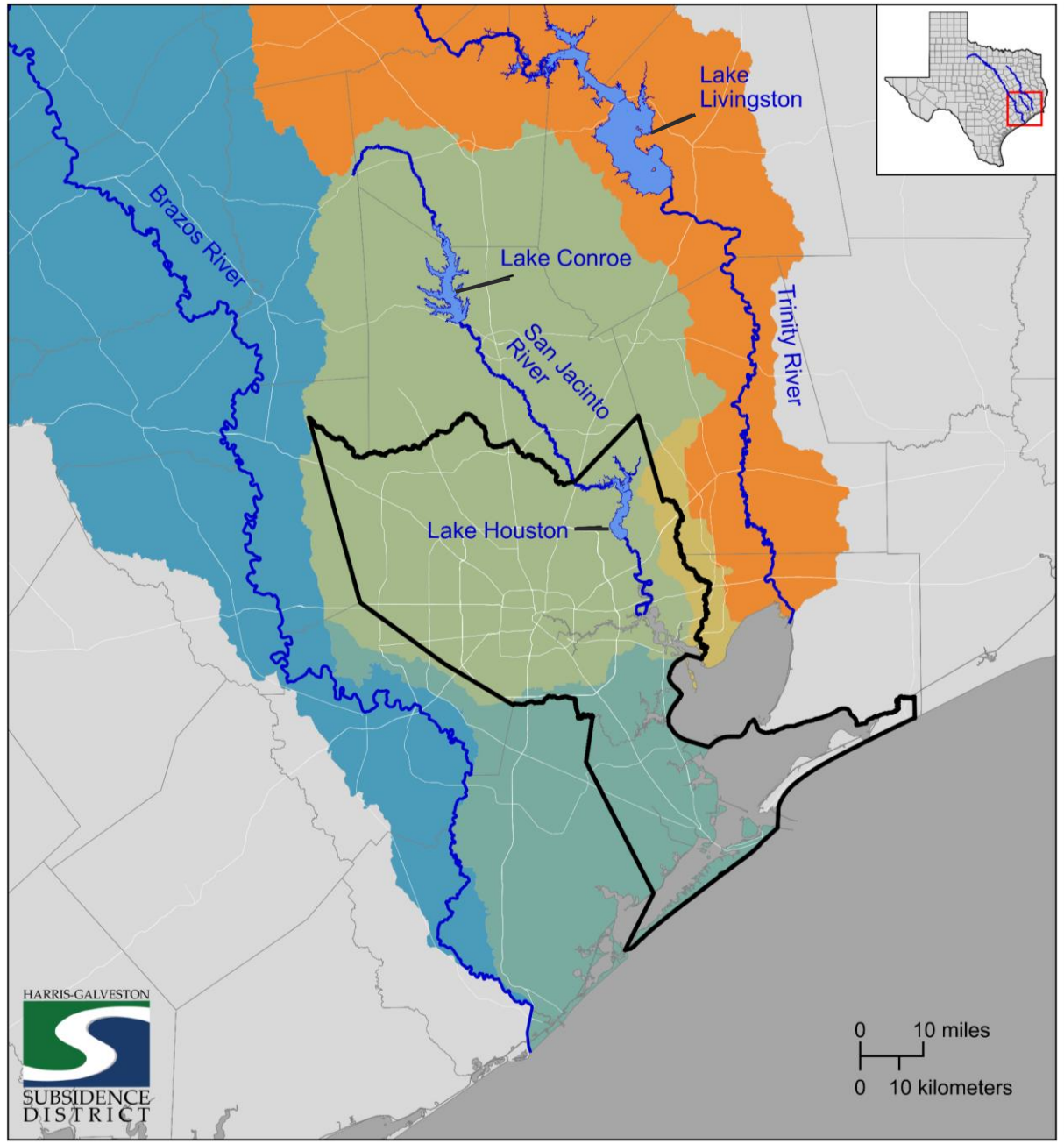


Exhibit 8 | Alternative Water Used for Entire District

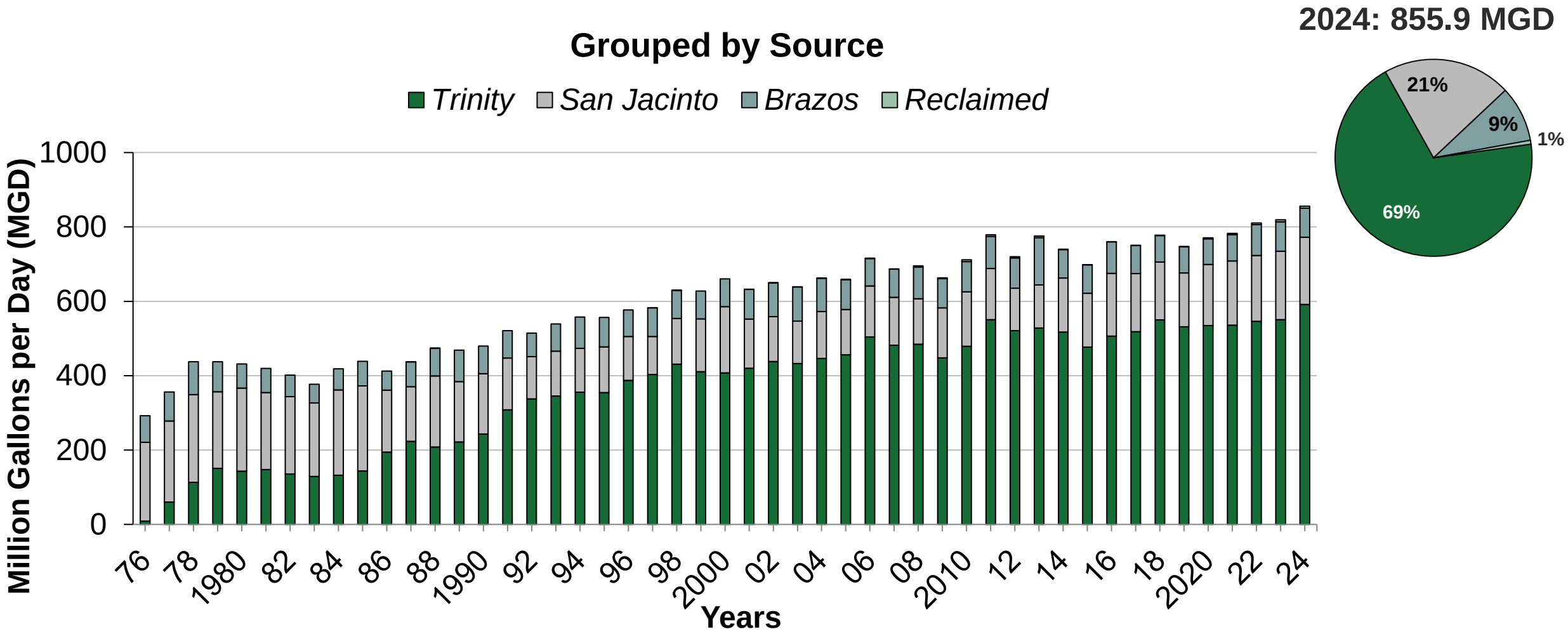
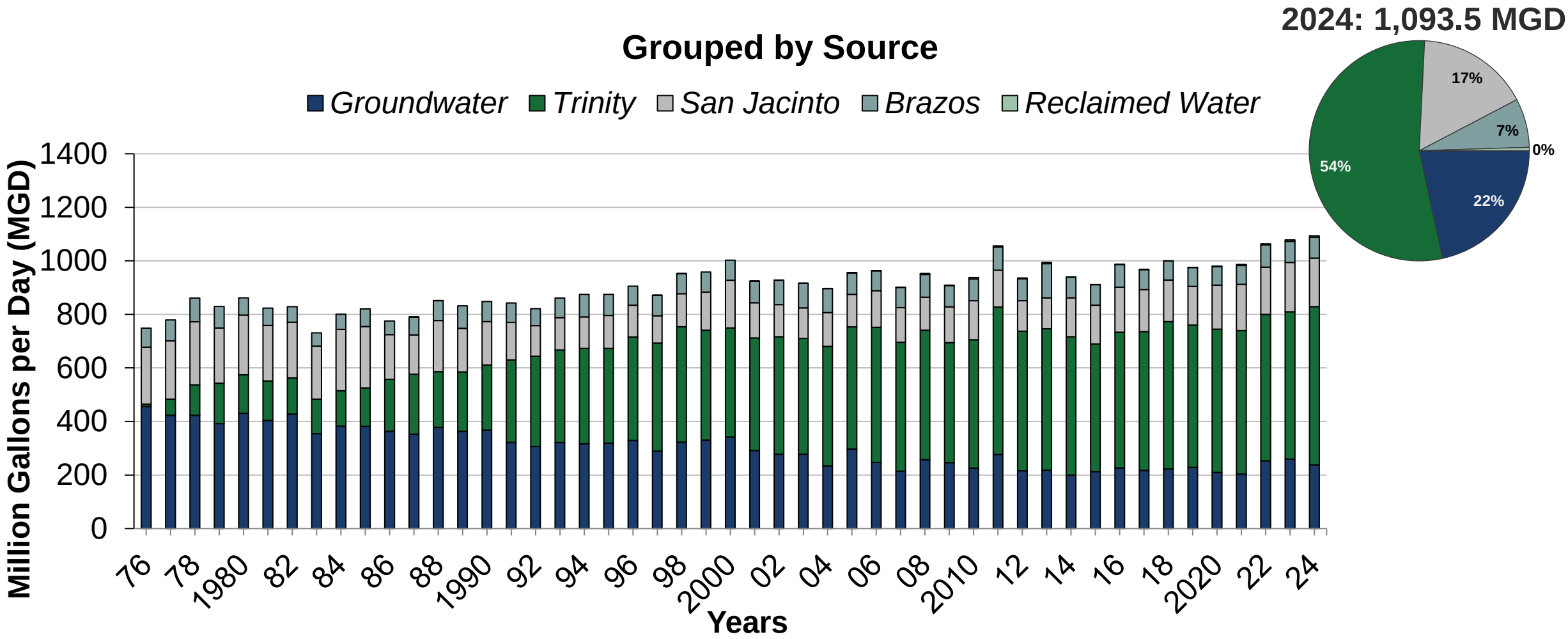


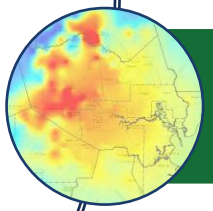
Exhibit 9 | Total Water Demand



Agenda


Climate


Water Use


Groundwater Levels


Subsidence

USGS
science for a changing world

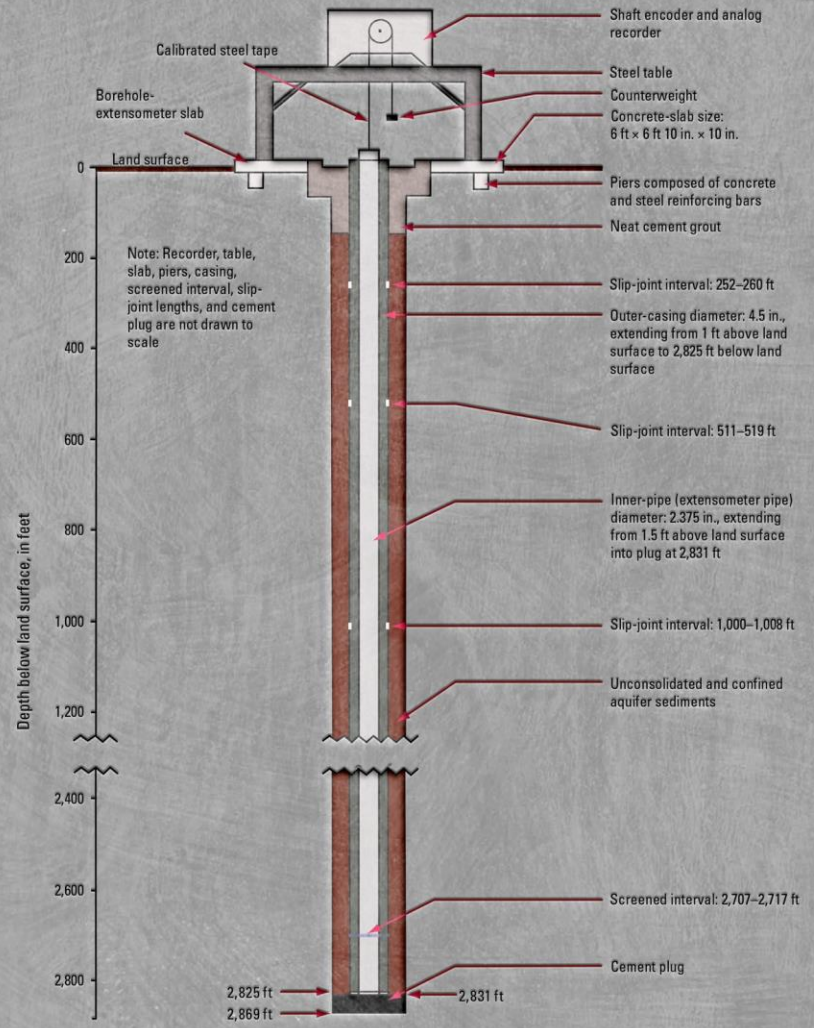


DIAGRAM OF A BOREHOLE EXTENSOMETER

HARRIS-GALVESTON SUBSIDENCE DISTRICT

FORT BEND SUBSIDENCE DISTRICT

Groundwater-level Altitudes, Long-Term Change & Compaction

CHICOT/EVANGELINE AND JASPER AQUIFERS

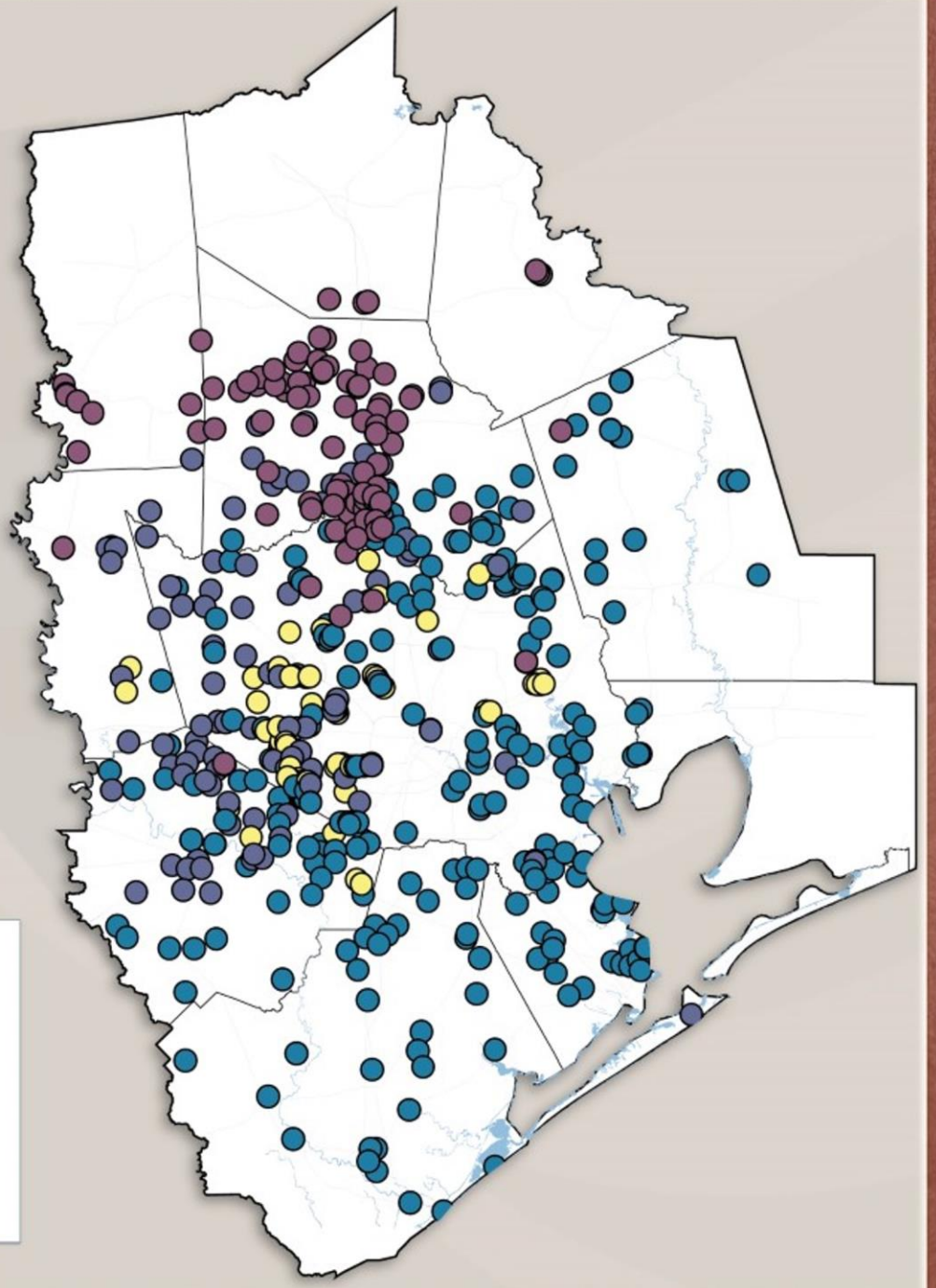
RESEARCH IN COOPERATION WITH THE HARRIS–GALVESTON & FORT BEND SUBSIDENCE DISTRICTS BRAZORIA GROUNDWATER CONSERVATION DISTRICT, THE CITY OF HOUSTON AND LONE STAR GROUNDWATER CONSERVATION DISTRICT

2025 Water-Level Map Series

- Chicot and Evangeline Aquifers (undifferentiated)
  - 2025 Water-Level Altitude
  - 2024 to 2025 Water-Level Change
  - 2020 to 2025 Water-Level Change
  - 1977 to 2025 Water-Level Change

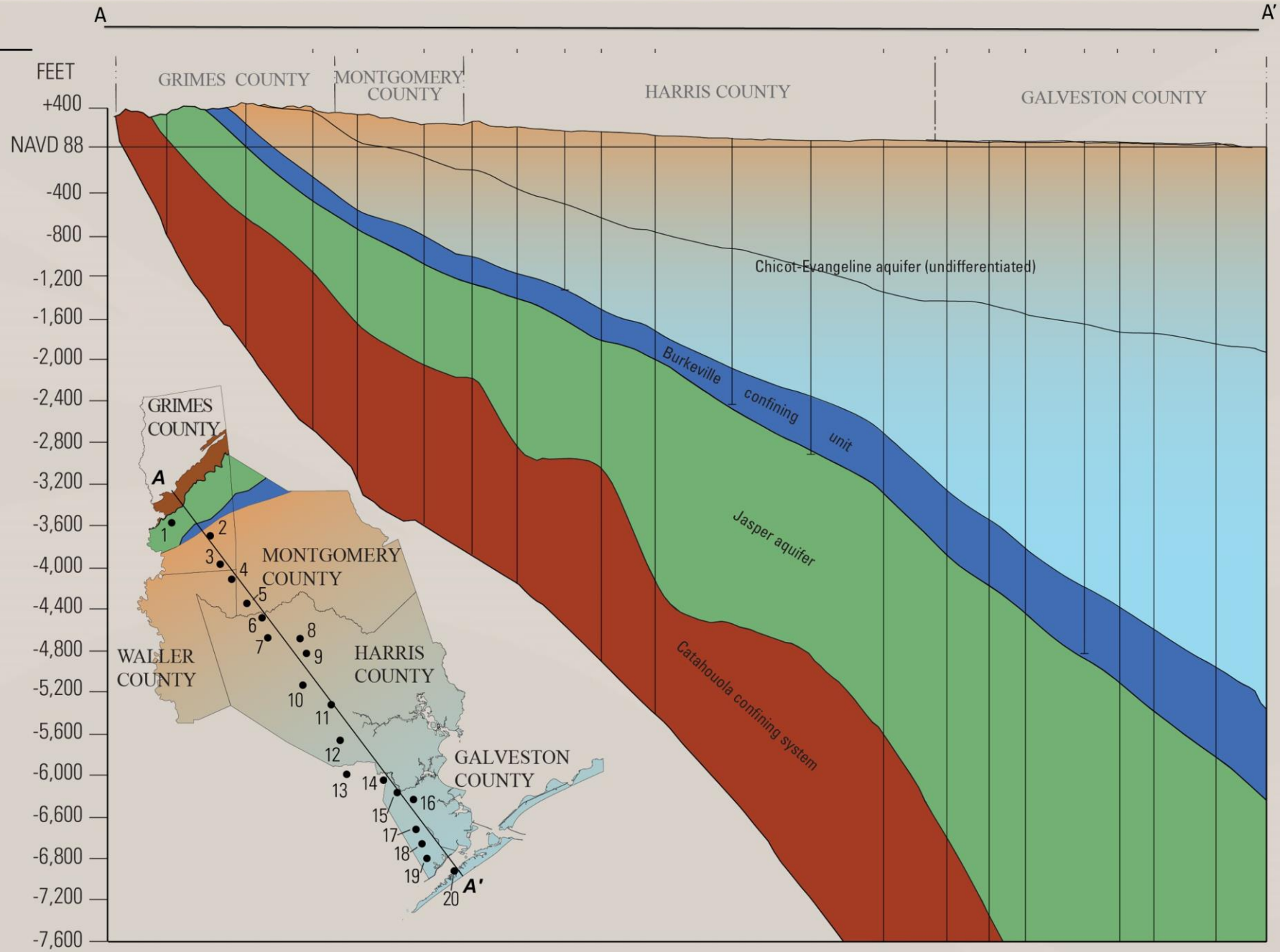
- Jasper Aquifer
  - 2025 Water-Level Altitude
  - 2024 to 2025 Water-Level Change
  - 2020 to 2025 Water-Level Change
  - 2000 to 2025 Water-Level Change

- Compaction 1973 to 2024
  - Compaction Data from 13 Extensometers



Geology and Hydrology

In 2021 and Moving Forward		
Geologic units[1]		Hydrogeologic units[1]
Alluvial, terrace, and dune deposits		Chicot - Evangeline aquifer (undifferentiated)
Beaumont Formation		
Lissie Formation	Montgomery Formation	
	Bentley Formation	
Willis Sand		
Goliad Sand (upper part)		
Goliad Sand (lower part)		
Lagarto Clay (upper part)		
Lagarto Clay (middle part)		Burkeville confining unit
Lagarto Clay (lower part)		Jasper aquifer
Oakville Sandstone		
Catahoula Formation	Upper Catahoula Formation	Catahoula Confining System
	Frio Formation	

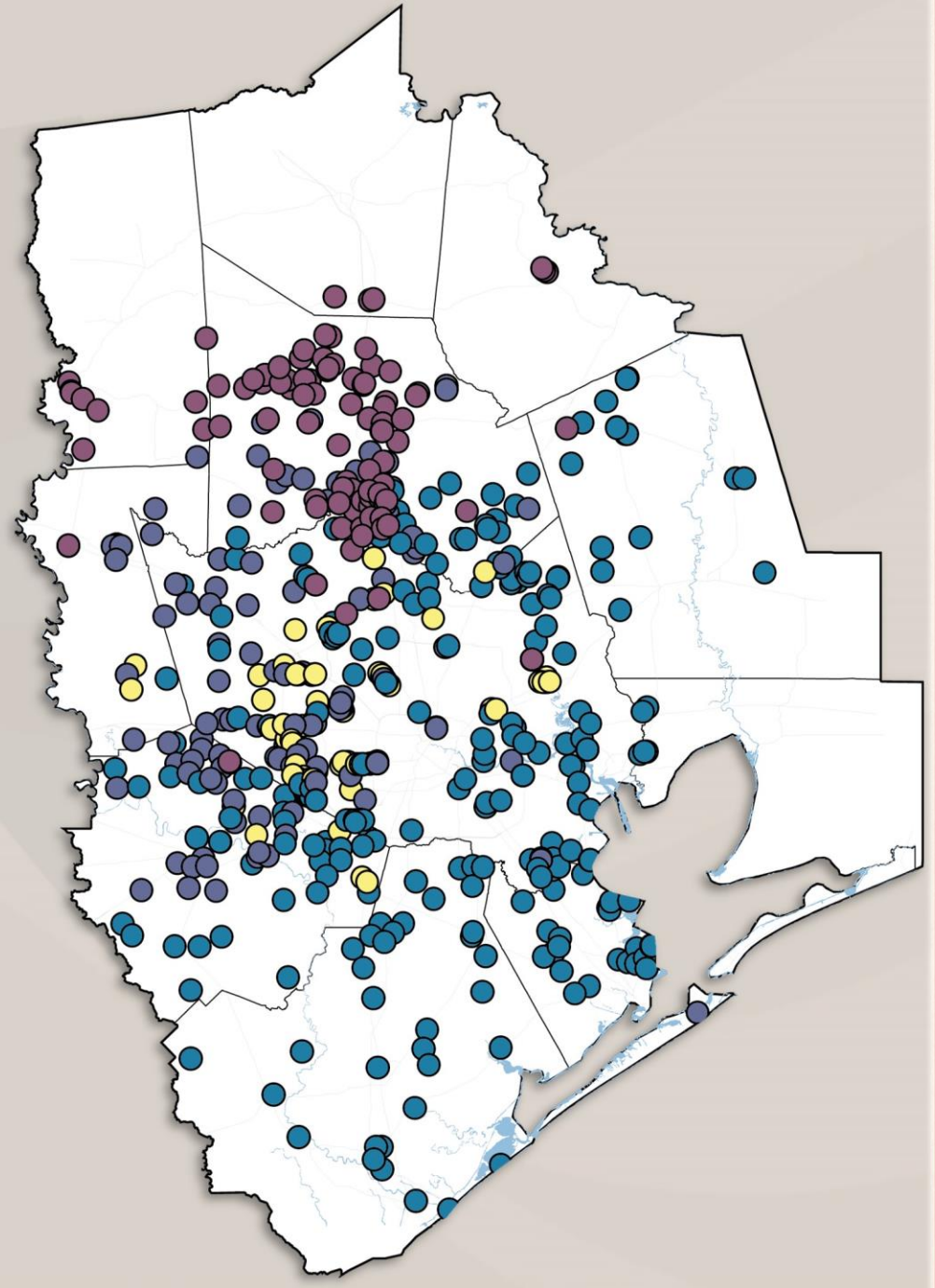


[1]Young, S.C., Kelley, V.A., Deeds, N., Hudson, C., Piemonti, D., Ewing, T.E., Banerji, D., Seifert, J., and Lyman, P., 2017

[1]Modified from Young and Draper, 2020 and Young and others (2012, 2014)

Network

- Data collected across 11 counties
- Data collection from 12-03-2024 to 3-13-2025
- Well Types:
  - Public Supply, Irrigation, Industrial, Observation
- Chicot and Evangeline (undifferentiated) water-levels: 562
- Jasper water-levels: 112
- Number of wells used to create the 2025 altitude maps
  - Chicot and Evangeline (undifferentiated): *525*
    - *Data from 39 wells were estimated*
  - Jasper: *108*
    - *Data from 15 wells were estimated*



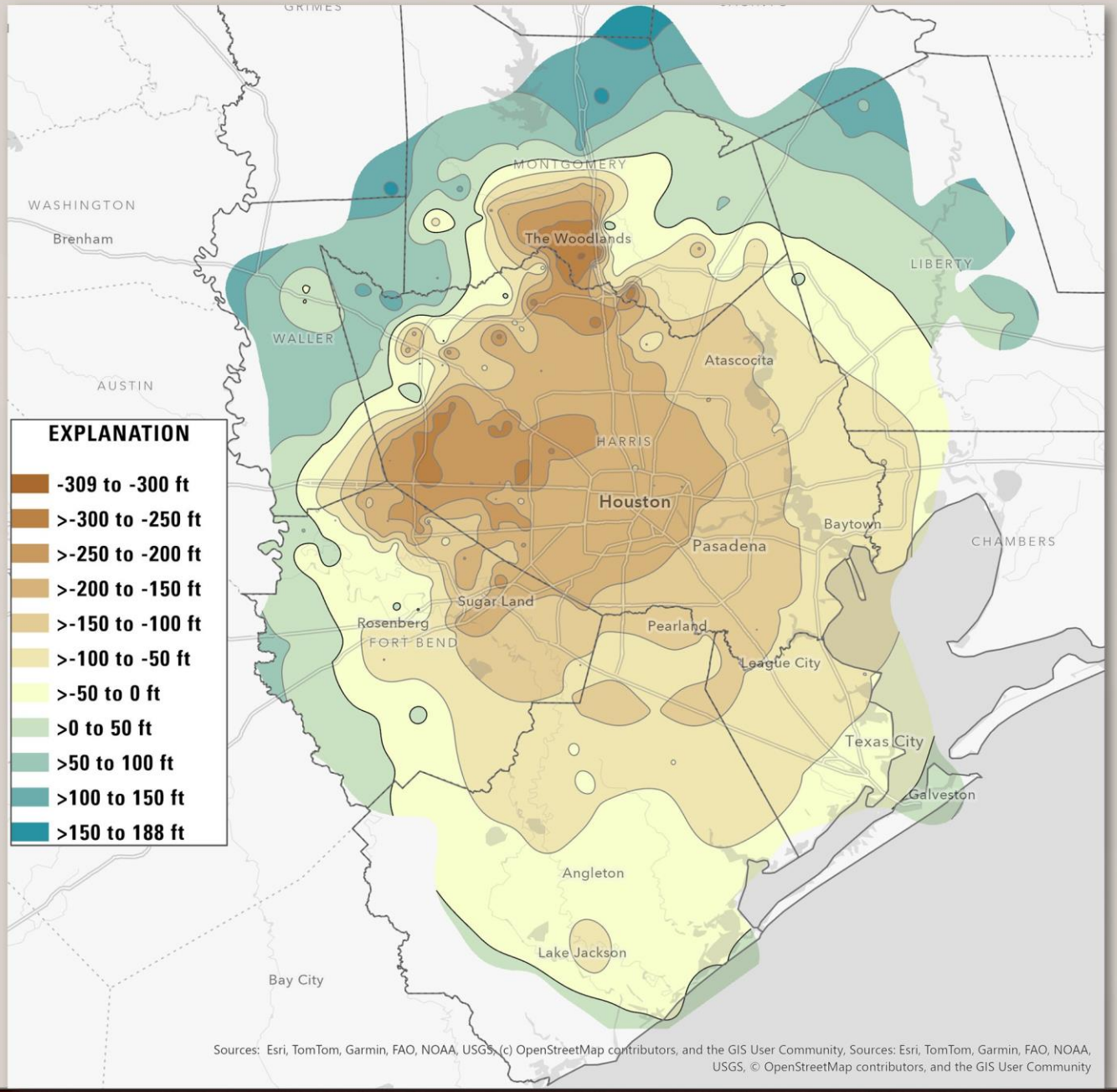
Water-Level Altitude

Chicot and Evangeline (undifferentiated)

Altitudes are referenced from NAVD 88

Lowest altitudes in south-central portion of Montgomery County and west and west-central Harris County

Highest altitudes in portions of south-eastern Grimes County, and northern Montgomery County



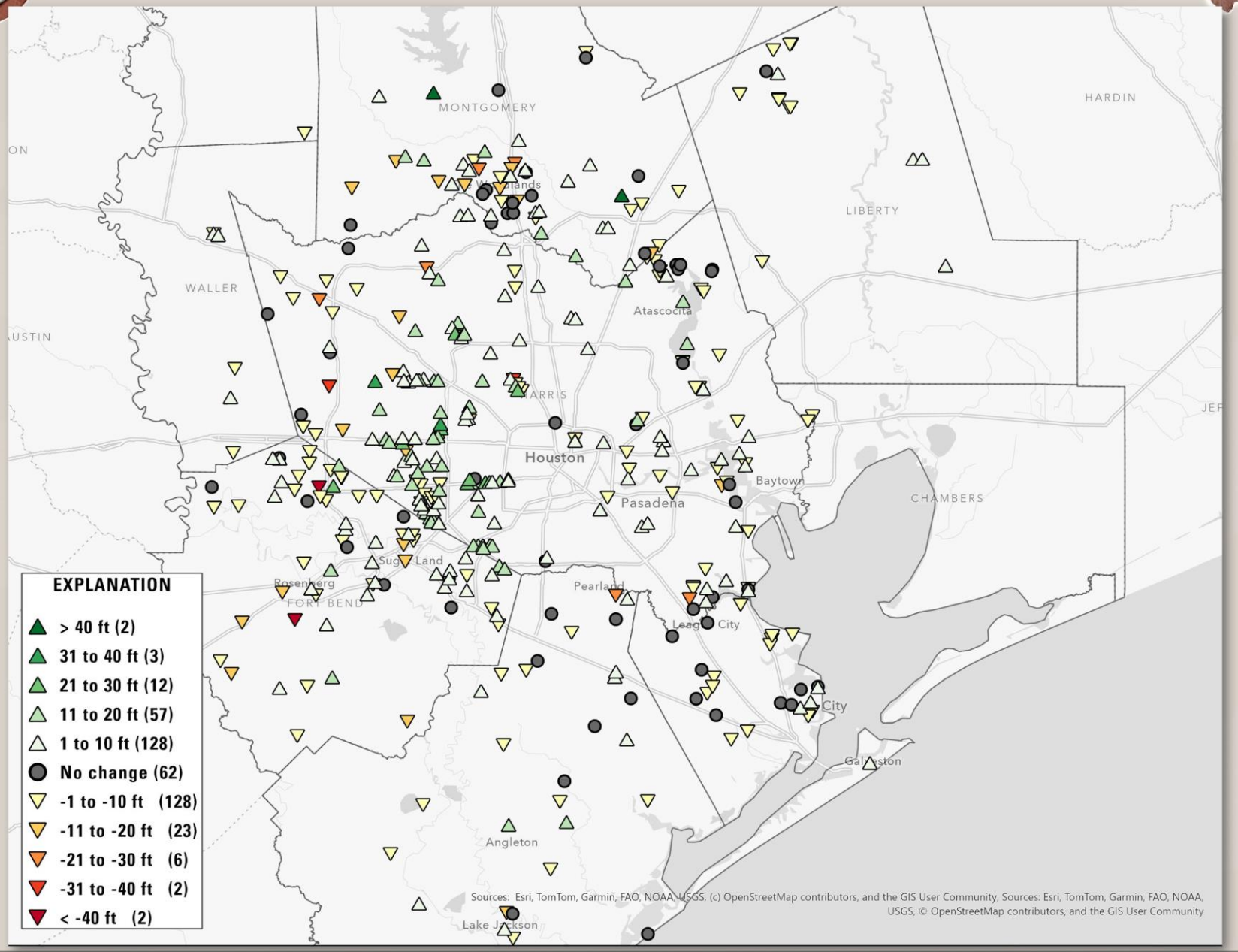
USGS science for a changing world

2024 to 2025 Water-Level Change

Chicot and Evangeline (undifferentiated)

- 427 water-level pairs*
  - About 47.3% were rises
    - Of the rises, about 63% were in the 1 to 10 ft range.
    - Largest rises (> 40 ft)
      - 2 in Montgomery County
  - About 38.2% were declines
    - Largest declines (< -40 ft)
      - 2 in Fort Bend County

* note: 26 wells used estimated data to produce the 1-year change.

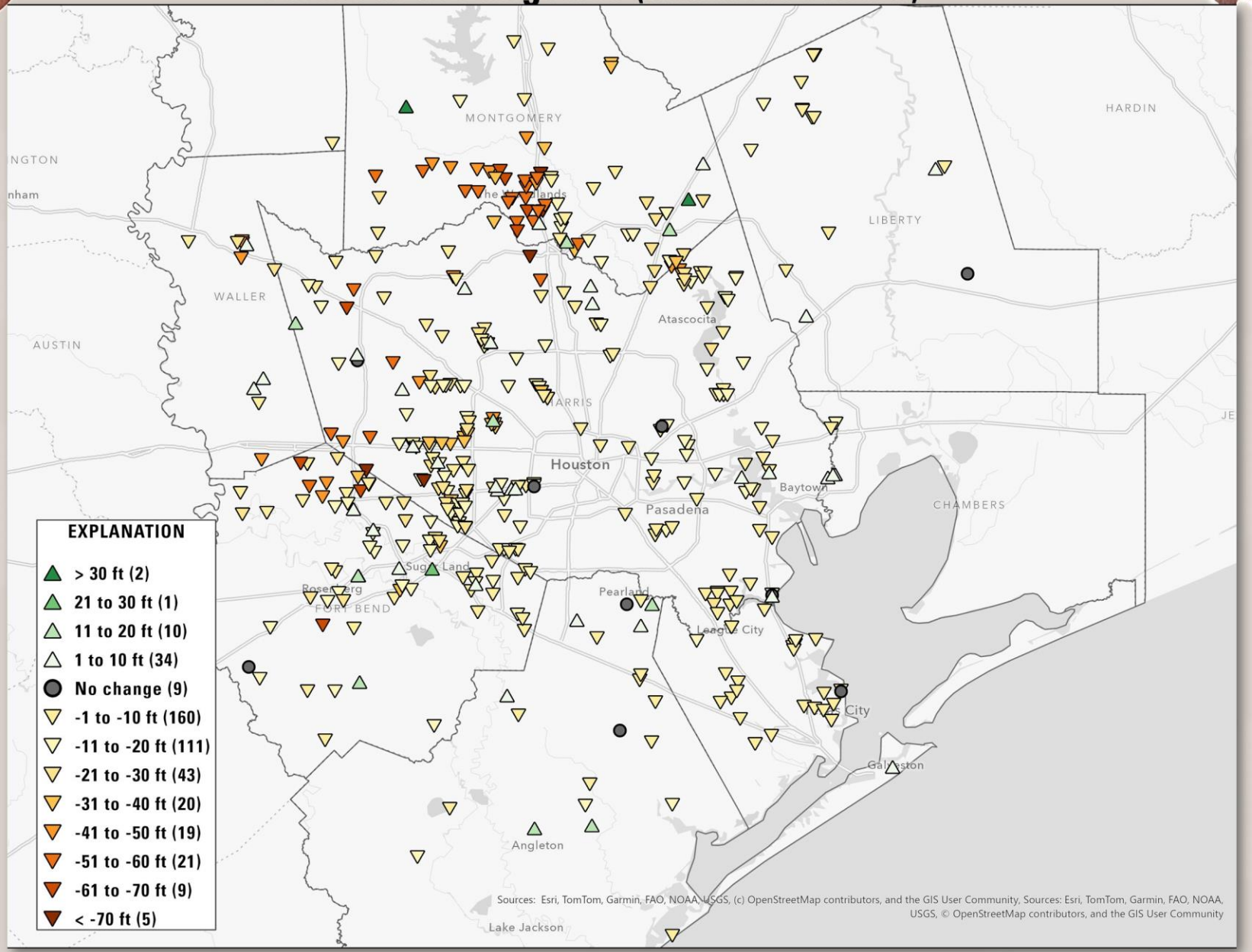


2020 to 2025 Water-Level Change

- 449 water-level pairs*
  - About 87.5% were declines
    - Of the declines, ~ 69% are in the 1 to 20 ft range.
    - Largest declines (>50 ft)
      - portions of southern Montgomery, northwestern and western Harris and northern Fort Bend counties
  - About 10.5% were rises
    - Rises primarily in southern Montgomery County, western portion of Harris County and Fort Bend County.
    - Largest rises (>30 ft)
      - Western and eastern Montgomery County

* note: 38 wells used estimated data to produce the 5-year change.

Chicot and Evangeline (undifferentiated)



USGS science for a changing world

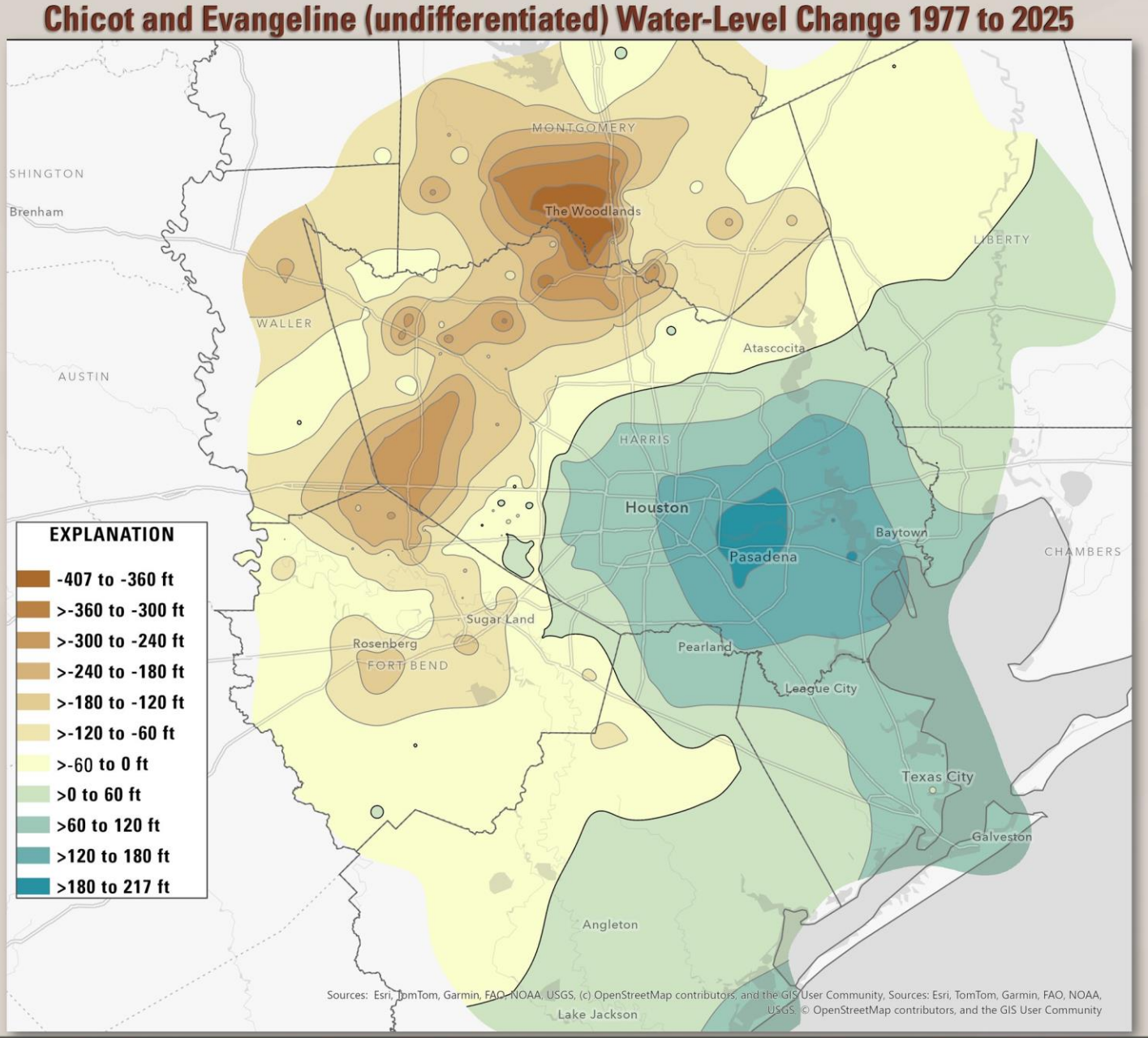
Long term change

Water-level rises (blues):

- most of central and eastern Harris County
- Galveston County
- Brazoria County

Water-level declines (yellows and browns):

- western Brazoria County
- much of Fort Bend County
- western and northern Harris County
- portions of Waller County
- portions of Montgomery County



Water-Level Altitude

Jasper

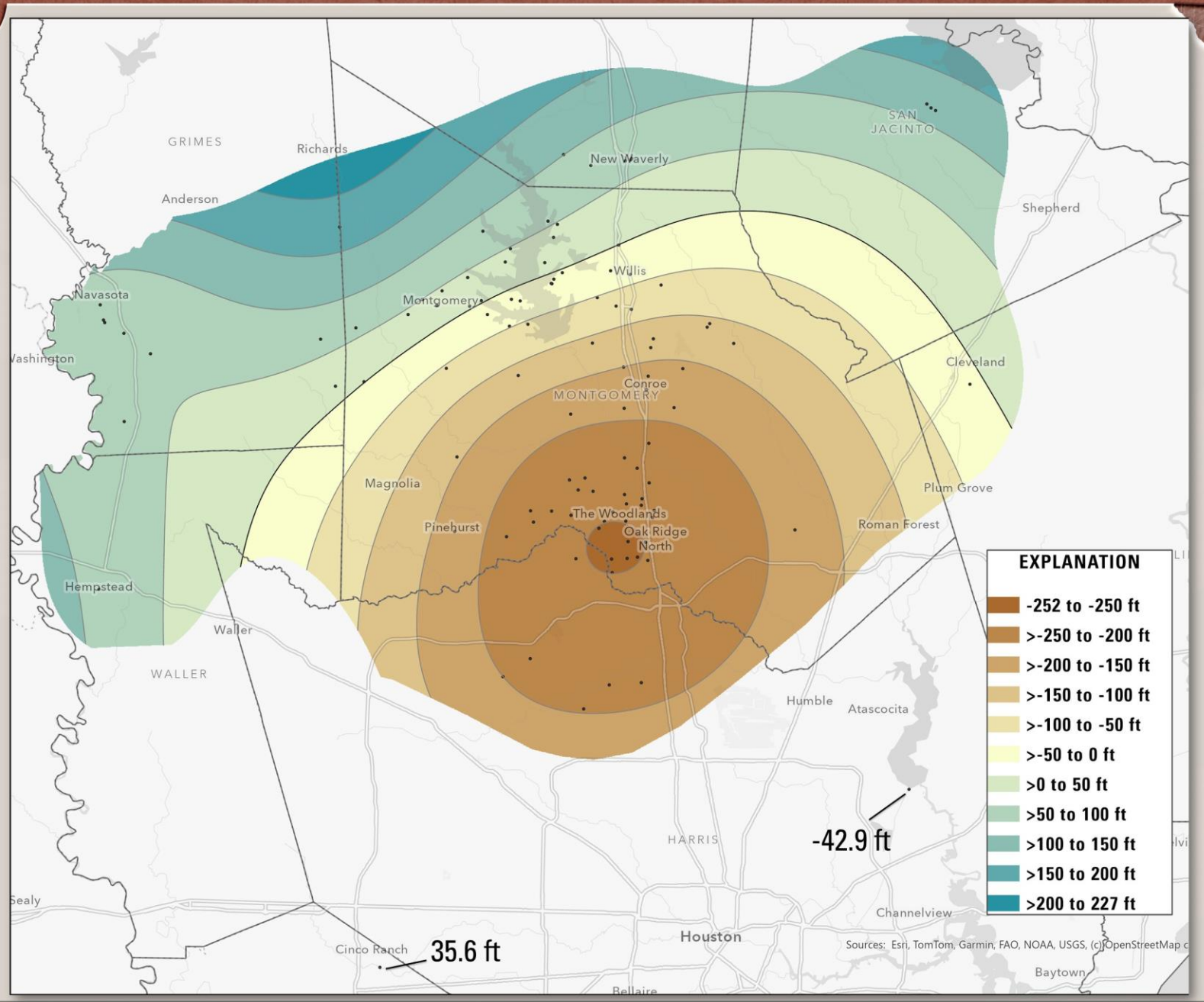
Altitudes are referenced from NAVD 88

General trend of altitudes deepening in down-dip direction (NW-SE)

Lowest altitudes in south-central Montgomery County and north-central Harris County

Cinco Mud (Fort Bend County): 35.6 ft above NAVD 88

Monitoring well in Harris County: -42.9 ft above NAVD 88



2024 to 2025 Water-Level Change

Jasper

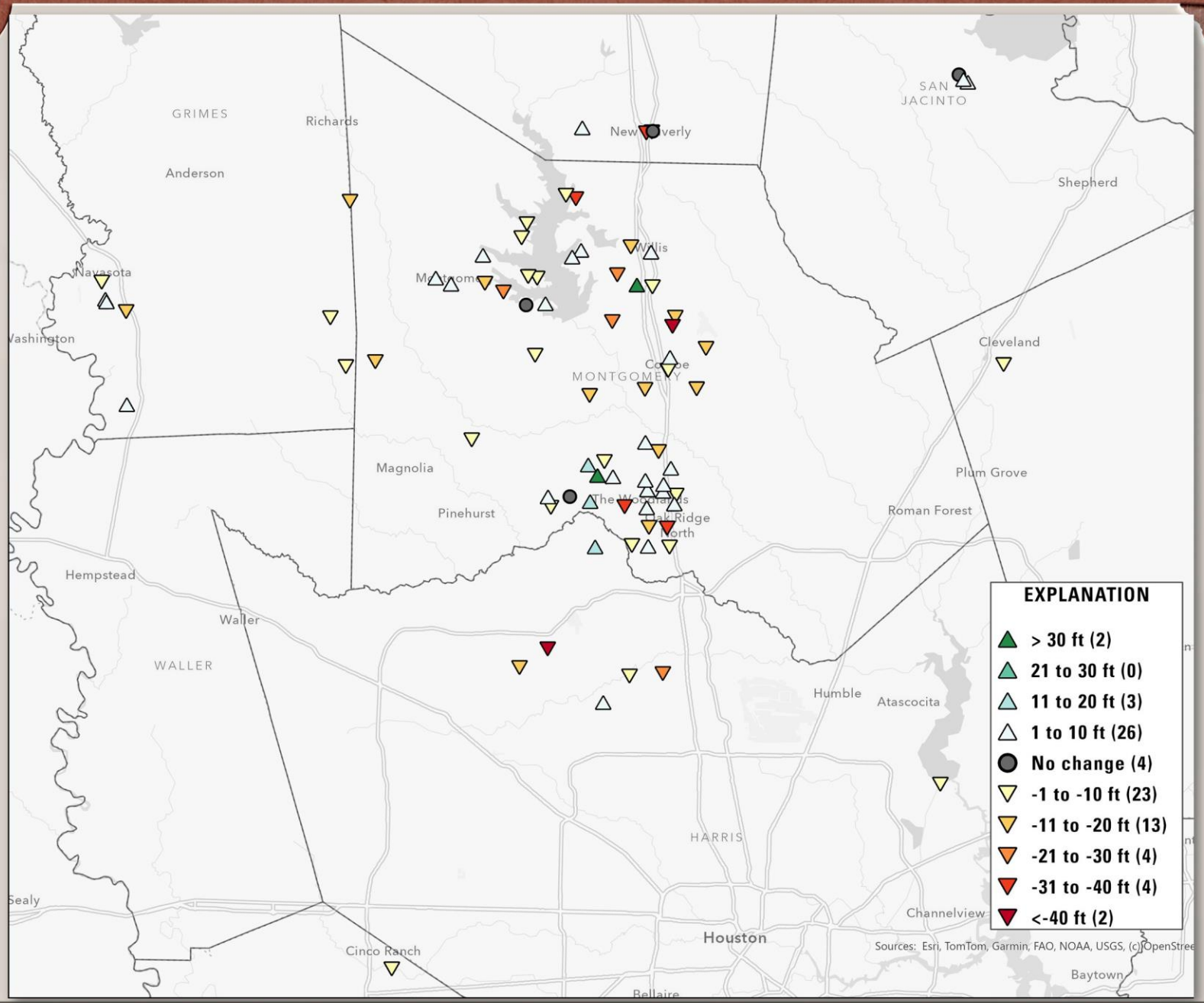
- 81 water-level pairs*
  - ~ 57% declines
  - ~ 38% rises
  - ~ 5% no change

Most changes within 1 to 10 ft

– Largest declines (>40 ft):
  - 1 in northwest Harris County
  - 1 in central Montgomery County

– Largest rises (> 30 ft):
  - 1 in west-central Montgomery County
  - 1 in south-central Montgomery County

* note: 11 wells used estimated data to produce the 1-year change.



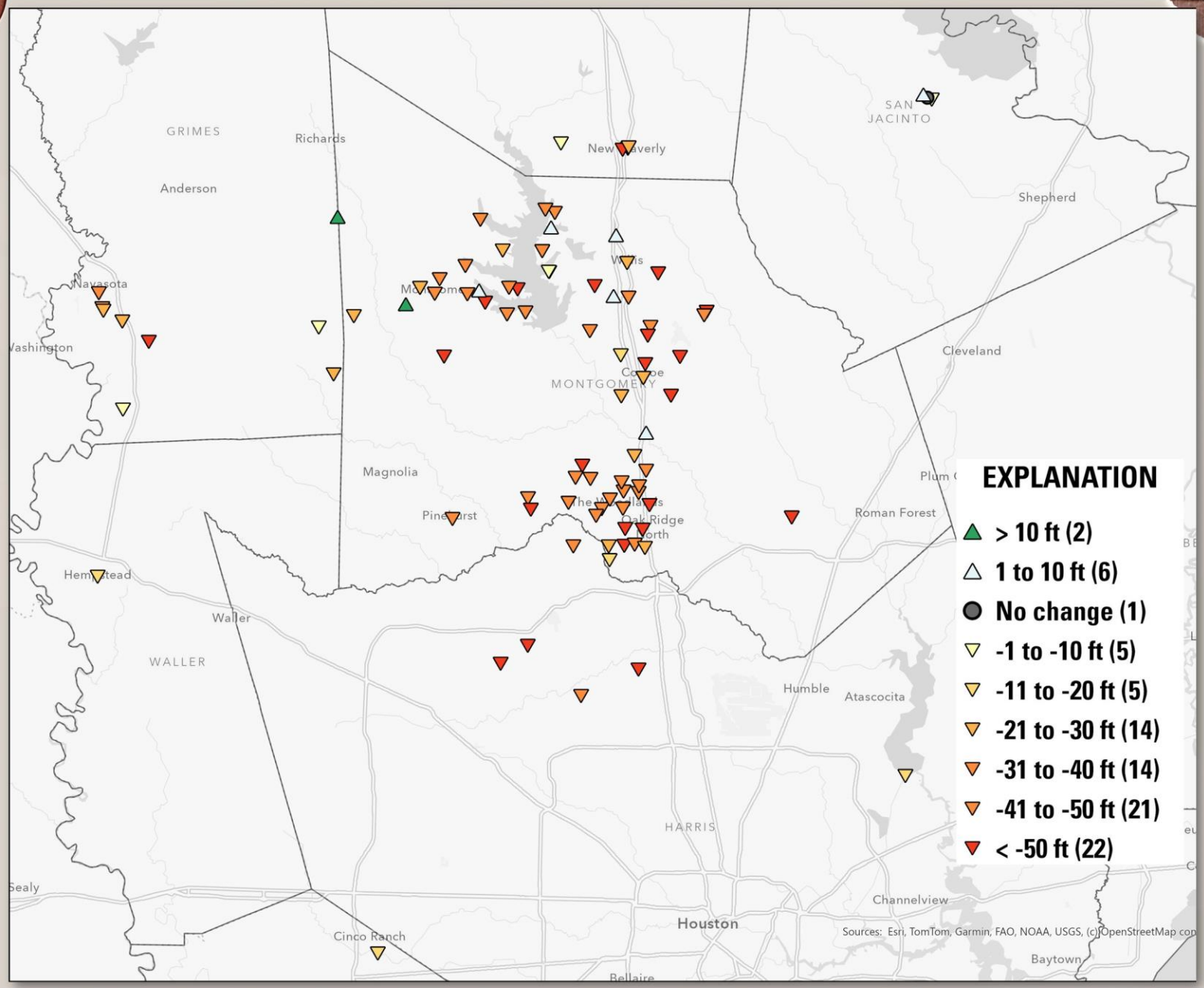
2020 to 2025 Water-Level Change

Jasper

- 90 water-level pairs*
  - ~ 90% declines
  - ~ 9% rises
  - ~ 1% no change

Declines >50 ft across much of central and southern Montgomery County and northern Harris County

* note: 12 wells used estimated data to produce the 5-year change.



Long term change

Water-level rises (blues):

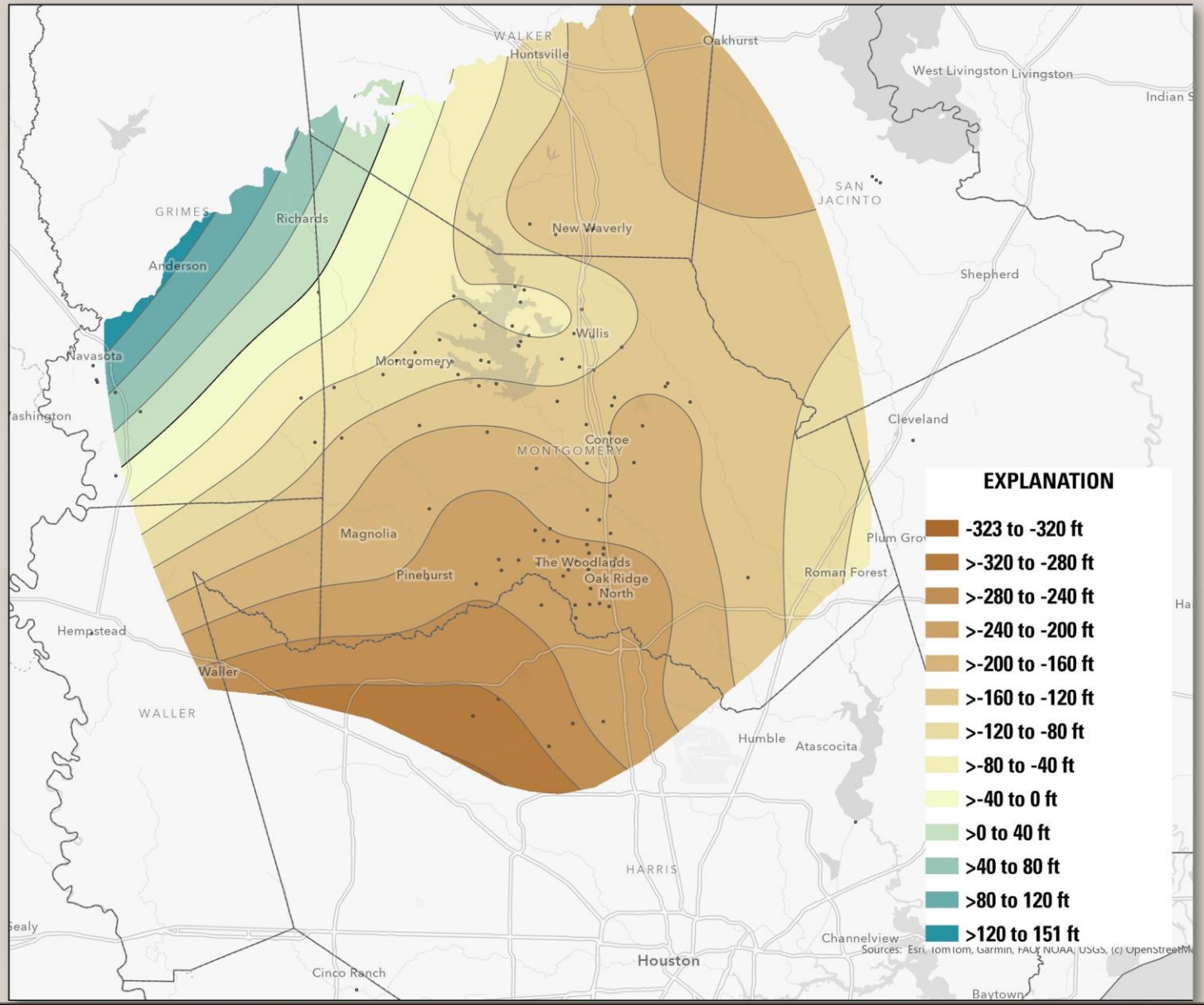
- Rises in northwestern Montgomery County and portions of central Grimes County

Water-level declines (yellows and browns):

- Most of Montgomery County – declines increasing in general down-dip direction into northern Harris County

*note that some extreme estimates are beyond data control points

Jasper Water-Level Change 2000 to 2025



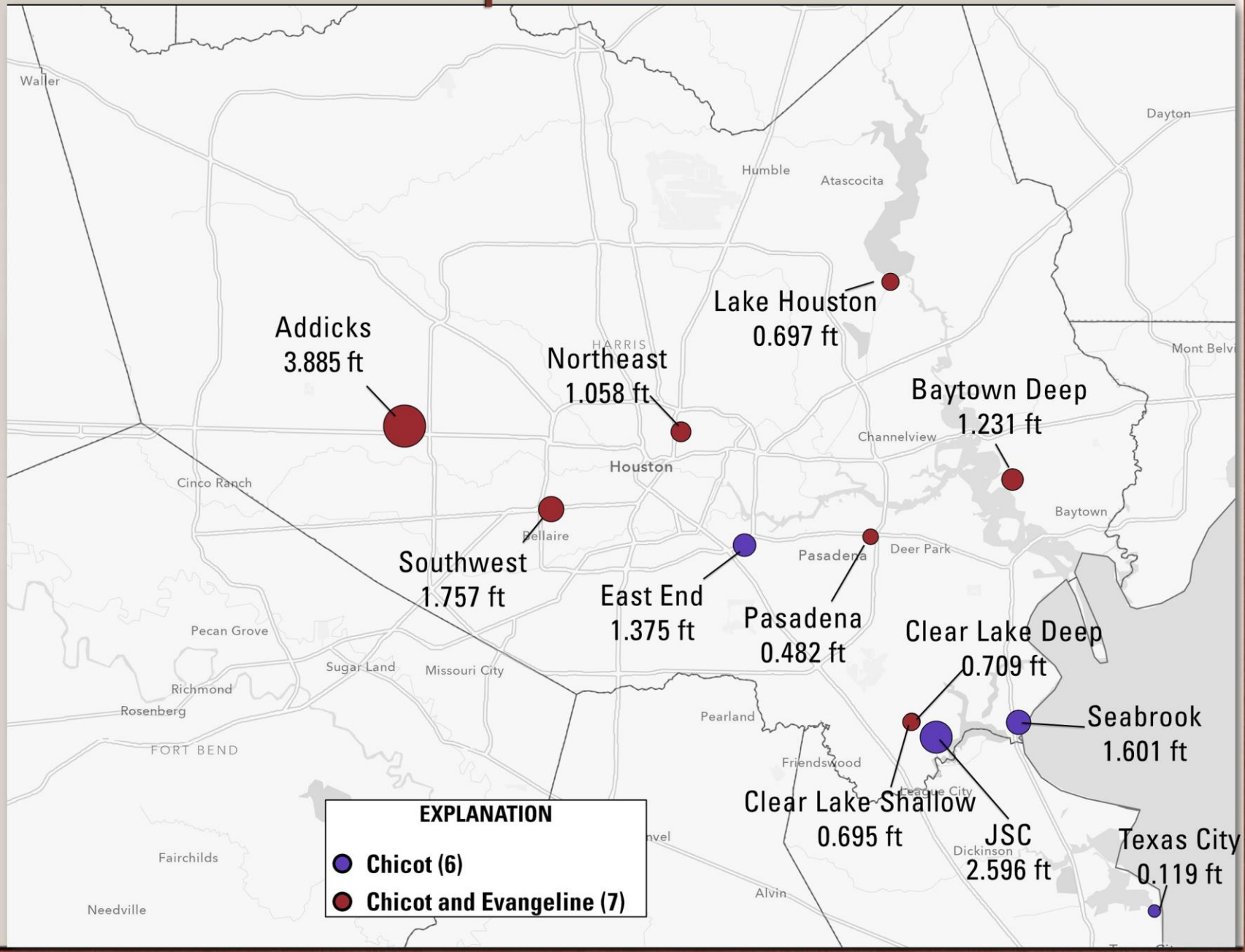
Compaction 1973 - 2024

Compaction Interval:
Chicot

1. 1973 | Baytown Shallow 1.032 ft.
2. 1973 | East End 1.375 ft.
3. 1962 | Johnson Space Center 2.596 ft.
4. 1973 | Seabrook 1.601 ft.
5. 1973 | Texas City 0.119 ft.
6. 1976 | Clear Lake Shallow 0.695 ft.

Compaction Interval:
Chicot and Evangeline

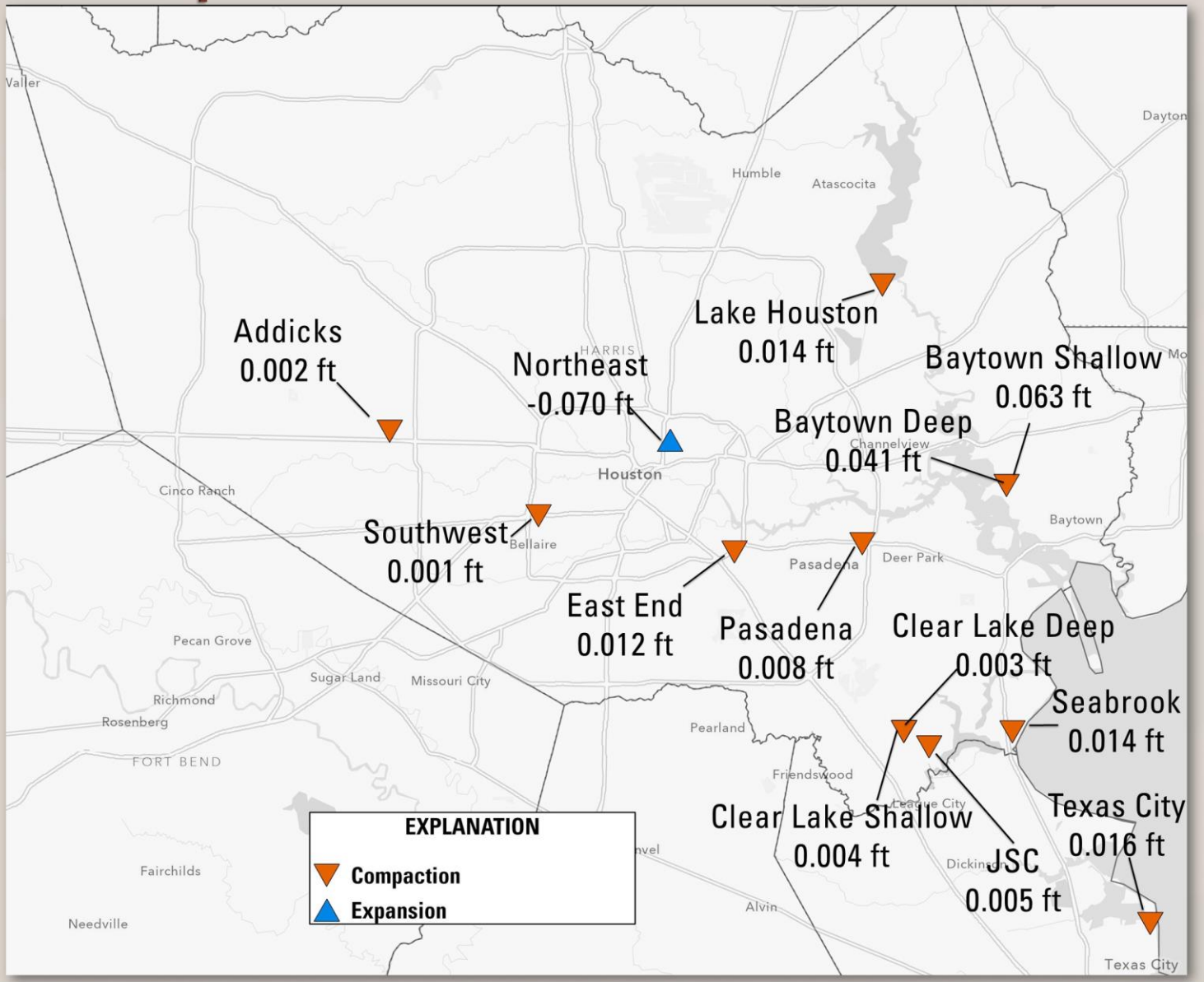
7. 1973 | Baytown Deep 1.231 ft.
8. 1974 | Addicks 3.885 ft.
9. 1974 | Pasadena 0.482 ft.
10. 1976 | Clear Lake Deep 0.709 ft.
11. 1980 | Lake Houston 0.697 ft.
12. 1980 | Northeast 1.058 ft.
13. 1980 | Southwest 1.757 ft.
14. 2017 | Cinco MUD --- ft.



2024 Compaction Summary

- Northeast recorded expansion for the period
- All other sites recorded compaction
- Compaction ranged from -0.070 ft (expansion) to 0.063 ft (compaction)

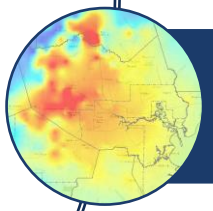
Compaction December 2023 to December 2024



Agenda

Climate

Water Use



Groundwater Levels

Subsidence

Subsidence Monitoring

All HGSD-operated global positioning system (GPS) stations are constructed in a custom design.

GPS data are collected for one week every two months (periodic monitoring). A conversion to continuous monitoring (data collection every day of the year) began in 2023 and will continue through 2027.

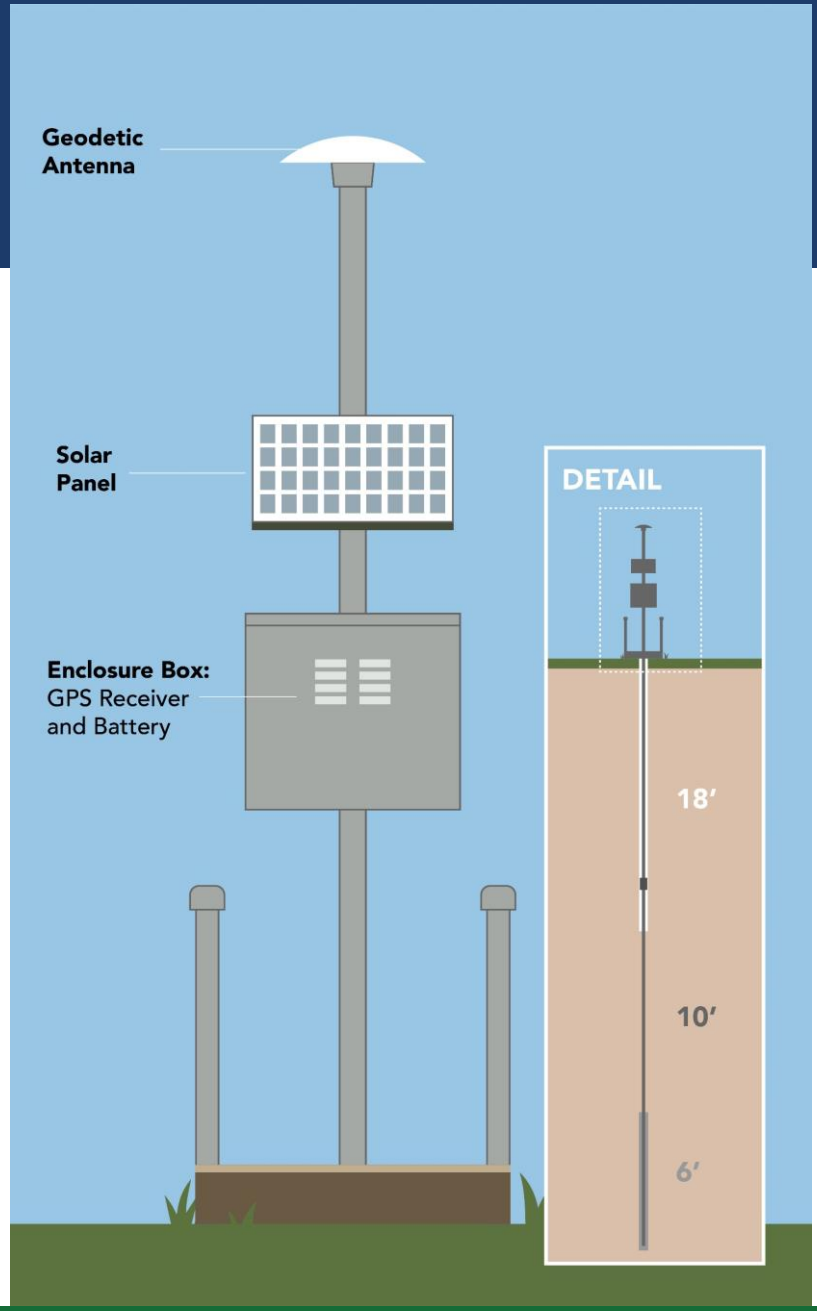
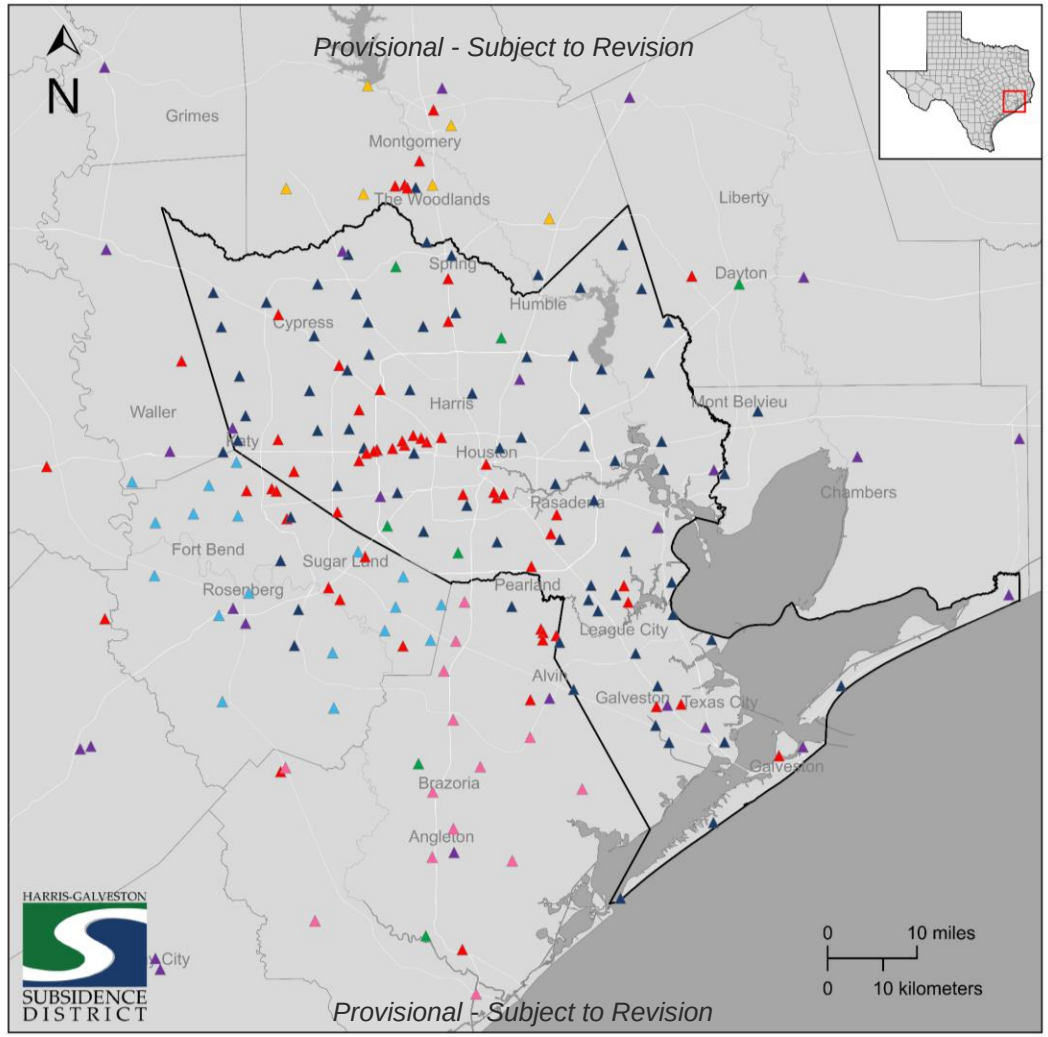


Exhibit 10 | Subsidence Monitoring Network

Location and operator of GPS stations that monitor land surface deformation periodically or continuously within southeast Texas in 2024.

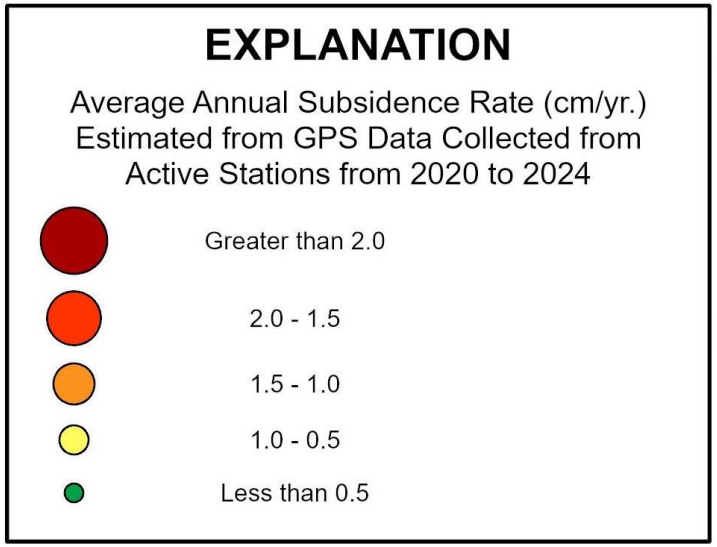


EXPLANATION

- HGSD Jurisdiction
- Harris-Galveston Subsidence District
- Fort Bend Subsidence District
- University of Houston
- Texas Department of Transportation
- Brazoria County Groundwater Conservation District
- Lone Star Groundwater Conservation District
- Other Operators

Exhibit 11 | Subsidence Rates from GPS Stations

Annual subsidence rate, in centimeters per year (cm/yr.), estimated from GPS data collected at active stations with three or more years of data averaged from 2020 to 2024.



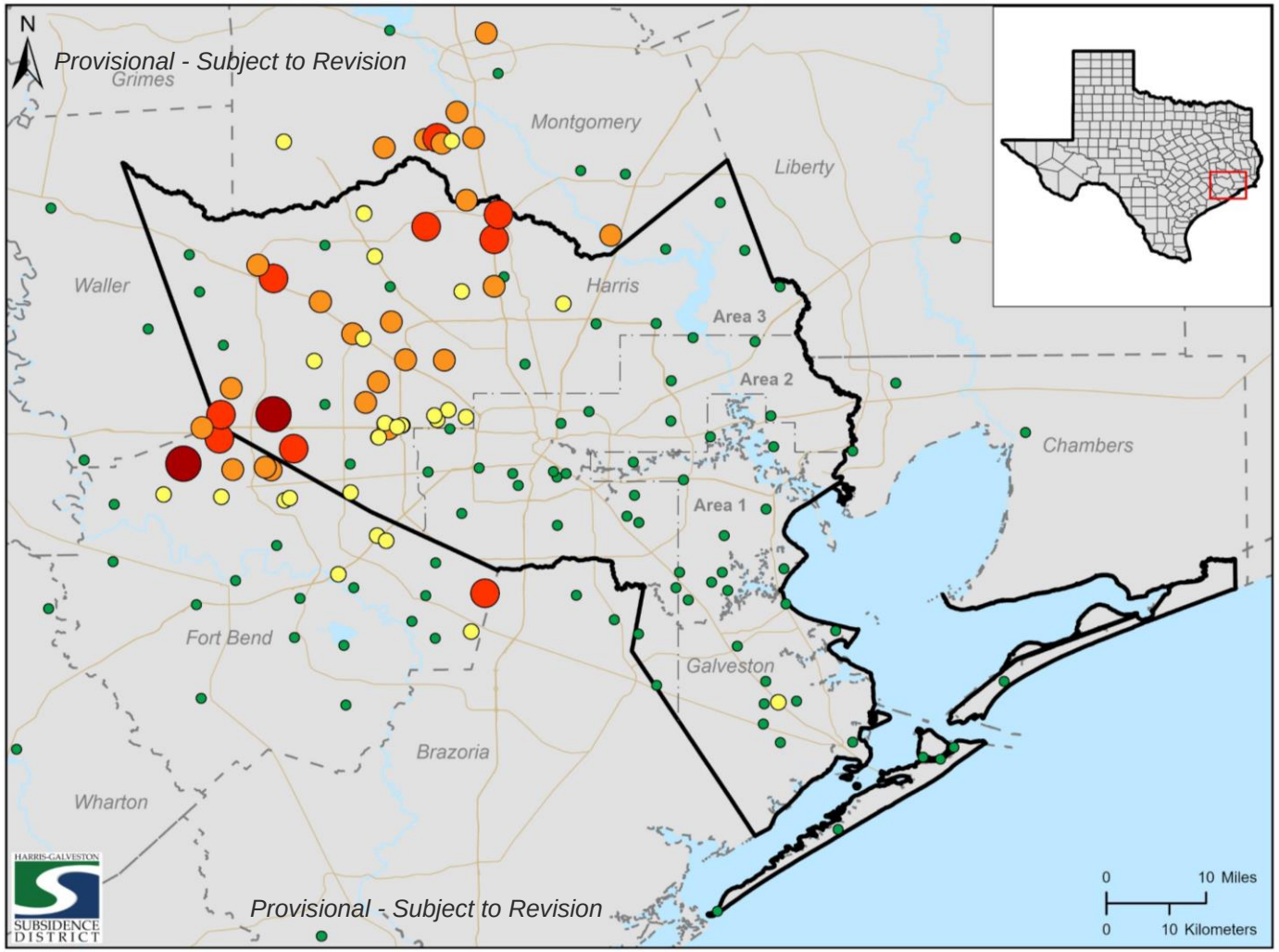
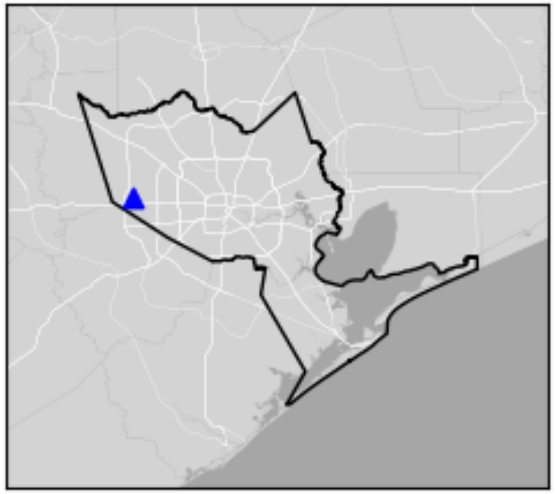
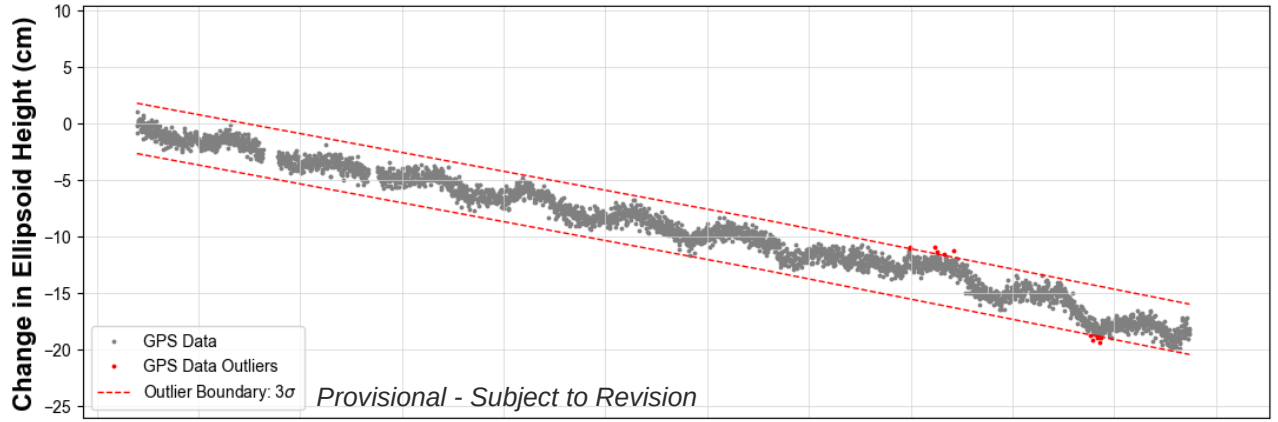


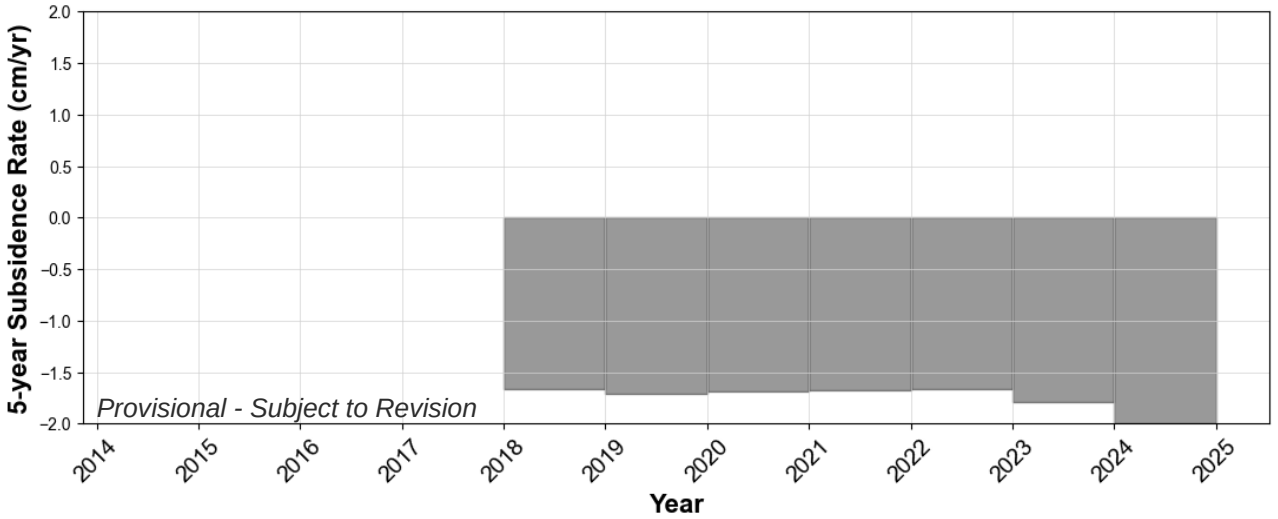
Exhibit 12 | Greatest Subsidence Rate

GPS station **MRHK**, located in Katy, has measured a total of 18.2 cm of subsidence since 2014 with an average rate of 2.07 cm/yr.



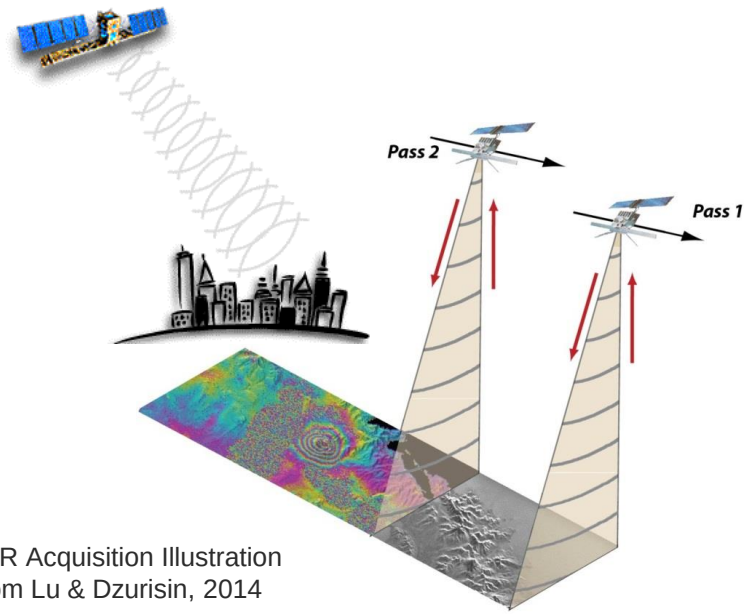
Processed GPS data (source: UH) over period of record. Processed data (grey circles) located inside the outlier boundary (red dashed lines) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are excluded from subsidence rate calculations and are shown for informational purposes only.





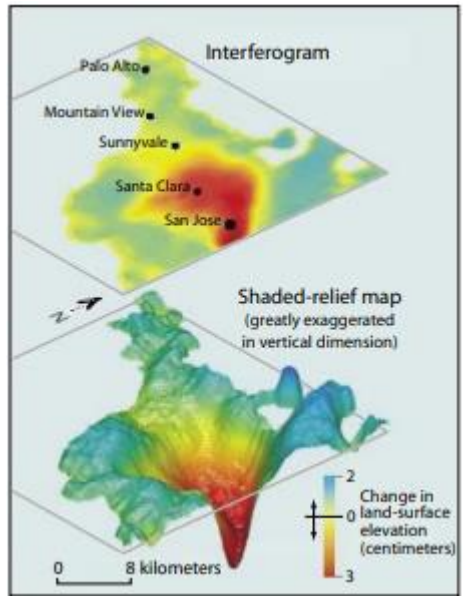
Interferometric Synthetic Aperture Radar (InSAR)

- Synthetic aperture radar (SAR) data are generated by transmitting radio waves from the sensor to the ground and back to the sensor.
- InSAR compares two SAR images of the same area at different times to detect small changes in distances between them. This processed pair of SAR images is the interferogram.
- Processing techniques can be used to achieve an accuracy of millimeters.



InSAR Acquisition Illustration
from Lu & Dzurisin, 2014

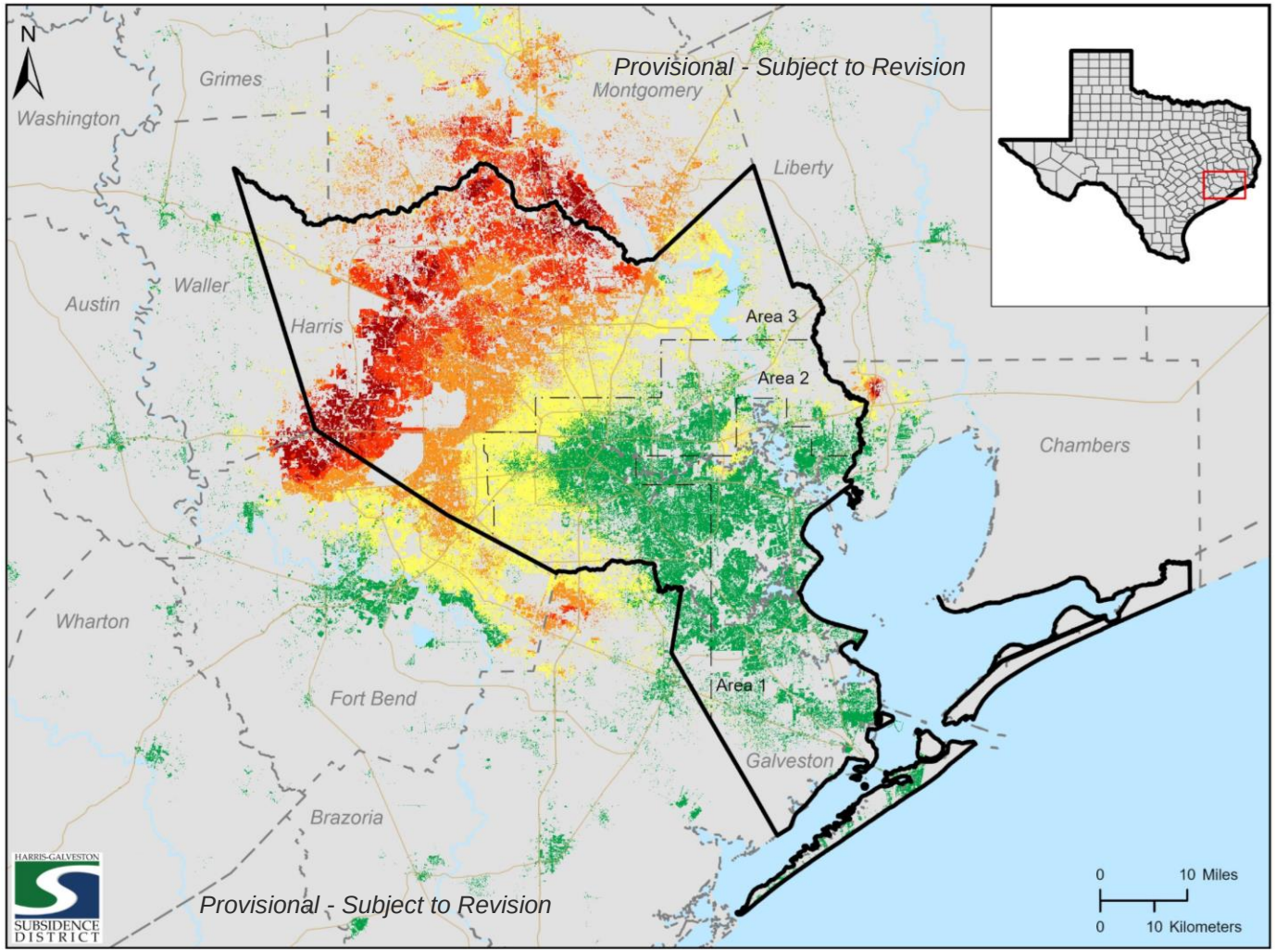
Processing



Interferogram (top) and 3-D topography (bottom)
from USGS Fact Sheet 2005-3025

Exhibit 13 | Subsidence Rates from InSAR

Annual subsidence rate, in centimeters per year (cm/yr.), estimated from Sentinel 1A derived time-series interferograms averaged from 2020 to 2024.



EXPLANATION

Sentinel-1 Derived Average Annual Subsidence Rate (cm/yr.) Processed from 2020 to 2024

- Greater than 2.0
- 2.0 - 1.5
- 1.5 - 1.0
- 1.0 - 0.5
- Less than 0.5

Gray areas show no data as the accuracy of InSAR decreases in rural areas due to tropospheric errors and seasonal vegetative growth.

Testimony and Public Comment

Any person who wishes to appear at the hearing and present testimony, evidence, exhibits, or other information may do so in person, by counsel, via email to **info@subsidence.org**, or any combination of these options.

Thank you for attending the 2024 Annual Groundwater Report Public Hearing

- The record will remain open until **May 7, 2025**. You may provide comments by sending an email to **info@subsidence.org**.

- The 2024 Annual Groundwater Report will be presented to the Harris-Galveston Subsidence District Board of Directors at their next meeting on **May 14, 2025,** for approval.

- Upon Board approval, the 2024 Annual Groundwater Report will be posted on our website, **hgsubsidence.org** - located within the Science and Research section.

Scan the QR code to visit the Annual Groundwater Reports page on our website. →

HARRIS-GALVESTON SUBSIDENCE DISTRICT
1975 - 2025

Contact Information

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Friendswood, TX 77546

Appendix B – Period of Record Data

A comprehensive table is provided, which includes the GPS station name, coordinates, dates of operation, sample count, total vertical displacement, and the annual rate of change in ellipsoidal height (i.e., subsidence rate) from 2020 to 2024. A period of record time-series plot and a five-year subsidence rate graph are also included for each GPS station that actively collected data in 2024 and has been in operation for at least three years.

Site Name	Latitude (Decimal degrees)	Longitude (Decimal degrees)	Start of POR (Decimal year)	End of POR (Decimal Year)	Length of POR (Years)	Number of Samples (Days)	Total Vertical Displacement over POR (cm)	Annual Rate of Change in Ellipsoidal Height 2020-2024 (cm/yr.)
ADKS	29.791	-95.586	1993.520	2025.002	31.482	9475	-2.6	-0.06
ALEF	29.692	-95.635	2014.259	2024.742	10.483	3825	-6.0	-0.93
AULT	29.998	-95.745	2015.557	2024.742	9.185	3254	-10.8	-1.58
CFHS	29.919	-95.632	2015.595	2024.742	9.147	3285	-12.5	-1.49
CFJV	29.882	-95.556	2015.773	2024.742	8.969	3265	-8.0	-1.24
CMFB	29.681	-95.729	2014.409	2024.742	10.333	3738	-5.2	-0.72
COH6	30.040	-95.185	2004.249	2024.197	19.948	3300	-10.0	-0.43
COTM	29.394	-94.998	2015.097	2024.643	9.547	3183	-2.4	-0.07
CSTE	29.796	-95.511	2015.387	2024.742	9.355	3281	-4.3	-0.61
DEN1	29.510	-95.258	2011.778	2024.424	12.646	4443	-2.6	-0.35
DMFB	29.623	-95.584	2014.771	2024.742	9.971	3640	-5.3	-0.80
FSFB	29.556	-95.630	2014.371	2024.742	10.371	3644	-1.3	-0.45
GSEC	30.197	-95.528	2015.756	2024.742	8.986	2858	-5.9	-1.11
HCC1	29.788	-95.561	2012.914	2024.742	11.828	4299	-7.4	-0.90
HCC2	29.788	-95.562	2013.139	2024.441	11.302	3641	-8.9	-0.94
HPEK	29.755	-95.716	2014.396	2024.082	9.687	2365	-15.1	-1.86
HSMN	29.800	-95.470	2013.298	2024.742	11.444	4170	-3.9	-0.54
KKES	29.850	-95.595	2015.598	2024.742	9.144	2607	-10.4	-1.38
KPCD	29.926	-95.924	2016.441	2024.430	7.989	2908	-2.8	-0.27
KPCS	29.926	-95.924	2016.441	2024.430	7.989	2316	-1.9	-0.32
LGC1	30.045	-94.075	2013.531	2024.742	11.211	3592	1.4	0.04
LKHU	29.913	-95.146	1996.402	2025.002	28.600	9861	-0.2	0.14
MDWD	29.771	-95.595	2013.303	2024.742	11.439	4128	-6.5	-0.86
MEPD	29.658	-95.240	2014.040	2024.742	10.702	3738	1.0	0.03
MRHK	29.804	-95.745	2014.396	2024.742	10.346	3679	-18.2	-2.07
N301	29.311	-94.792	2018.530	2024.742	6.212	2175	-0.4	-0.03
NASA	29.552	-95.096	2014.201	2024.591	10.390	3539	-0.4	0.10
NETP	29.791	-95.334	1993.517	2025.002	31.484	9130	-0.1	-0.13
OKEK	29.725	-95.803	2014.575	2024.819	10.244	3247	-7.9	-1.15
P100	29.934	-95.198	2019.309	2024.860	5.550	335	-1.4	-0.32
P108	29.772	-95.121	2021.244	2024.871	3.627	208	0.1	-0.10
P109	29.986	-95.022	2021.148	2024.944	3.797	210	-1.7	0.11
P110	29.548	-95.442	2021.189	2024.988	3.799	149	-6.4	-1.60
P111	29.733	-95.873	2021.285	2024.832	3.548	137	-10.7	-3.31
P113	29.388	-95.642	2023.339	2024.939	1.600	76	-0.0	n/a
P114	29.592	-95.513	2023.411	2024.999	1.589	79	-0.2	n/a
P115	30.153	-95.306	2024.465	2024.884	0.419	29	-0.1	n/a
P000	29.539	-95.152	1996.003	2024.849	28.846	1801	-2.2	0.07
P001	29.912	-95.617	1994.164	2024.944	30.780	2555	-74.3	-0.79
P002	30.001	-95.416	1994.318	2024.849	30.531	2481	-64.8	-0.41
P003	29.821	-95.613	1994.328	2024.961	28.847	1819	-56.6	-1.13
P004	29.630	-95.597	1994.660	2024.591	29.932	2414	-30.9	-0.61
P005	29.791	-95.586	1996.698	2024.947	28.249	2114	-33.5	-0.96
P006	29.818	-95.672	2014.276	2024.961	10.684	504	-10.9	-0.32
P007	29.936	-95.577	1999.115	2024.862	25.748	1905	-61.2	-1.36
P008	29.980	-95.476	1999.610	2025.002	25.391	1607	-42.3	-0.91
P009	30.038	-95.071	1999.345	2025.002	25.657	1640	-3.2	-0.46
P010	29.566	-95.799	1999.266	2024.890	25.624	1764	-8.1	-0.09

Site Name	Latitude (Decimal degrees)	Longitude (Decimal degrees)	Start of POR (Decimal year)	End of POR (Decimal Year)	Length of POR (Years)	Number of Samples (Days)	Total Vertical Displacement over POR (cm)	Annual Rate of Change in Ellipsoidal Height 2020-2024 (cm/yr.)
P011	30.032	-95.865	1999.345	2024.980	25.635	1839	-9.4	0.10
P012	30.060	-95.263	2000.895	2024.961	24.066	1539	-16.1	-1.10
P013	30.195	-95.490	2000.914	2024.898	23.984	1500	-27.1	-0.60
P014	29.474	-95.644	2000.879	2024.942	24.063	1331	-5.8	-0.23
P016	29.544	-95.527	2000.860	2024.964	24.104	1361	-7.6	-0.37
P017	30.091	-95.615	2000.895	2025.002	24.107	1424	-39.0	-0.98
P018	29.965	-95.678	2000.862	2024.468	23.606	1345	-39.0	-1.17
P019	29.841	-95.805	2000.892	2024.578	23.685	1301	-23.0	-1.19
P020	29.533	-95.013	2002.041	2025.002	22.961	1412	2.5	0.55
P021	29.545	-95.312	2002.200	2024.849	22.649	1506	-3.3	-0.04
P022	29.335	-95.021	2002.041	2025.002	22.961	1360	-4.5	0.14
P023	29.335	-94.918	2002.060	2024.750	22.690	1385	2.4	0.21
P024	29.669	-95.041	2002.118	2024.788	22.671	1340	4.5	0.31
P026	29.210	-94.938	2002.194	2024.996	22.802	3473	-0.4	0.14
P027	29.583	-95.016	2002.367	2024.884	22.517	1310	-4.7	0.08
P028	29.751	-94.918	2002.194	2024.575	22.381	1321	1.4	0.33
P029	29.769	-95.822	2007.320	2025.002	17.682	1099	-28.8	-1.62
P030	29.689	-95.902	2007.350	2024.777	17.427	909	-7.2	-0.55
P031	29.398	-95.848	2007.350	2024.881	17.531	799	4.8	0.69
P032	29.541	-95.707	2007.350	2025.002	17.652	814	-0.4	-0.05
P033	29.490	-95.224	2006.323	2024.966	18.643	969	-1.1	-0.01
P034	29.422	-95.042	2010.356	2025.002	14.646	4903	-5.1	-0.09
P035	29.473	-95.082	2006.621	2024.846	18.224	821	5.7	0.70
P036	29.494	-94.942	2006.966	2024.857	17.891	1027	-0.2	0.41
P037	29.631	-95.101	2007.372	2024.923	17.550	916	5.9	0.33
P038	29.649	-95.223	2007.356	2024.808	17.452	889	4.4	0.28
P039	29.645	-95.339	2011.093	2024.827	13.734	675	-0.6	-0.12
P040	29.493	-95.462	2007.353	2024.819	17.465	833	-9.3	-0.53
P041	29.662	-95.476	2007.337	2025.002	17.665	983	-8.6	-0.41
P042	29.732	-95.635	2007.334	2024.923	17.589	836	-10.5	-0.43
P043	29.093	-95.111	2006.545	2025.002	18.457	3308	-0.3	0.04
P044	29.880	-95.687	2007.320	2024.996	17.676	829	-21.9	-0.97
P045	29.876	-95.385	2007.331	2024.988	17.657	884	-5.3	-0.21
P046	30.030	-95.600	2007.323	2024.881	17.558	829	-25.8	-0.96
P047	30.090	-95.424	2007.339	2025.002	17.663	921	-31.1	-1.88
P048	30.045	-95.672	2007.320	2024.783	17.463	807	-17.4	-0.26
P049	29.422	-94.702	2006.279	2024.038	17.759	2444	-2.2	-0.30
P050	29.848	-94.856	2006.835	2024.865	18.030	1177	-0.7	-0.08
P051	29.933	-95.284	2007.339	2024.865	17.526	850	-9.4	-0.34
P052	29.852	-95.177	2007.339	2024.887	17.548	850	-0.8	-0.21
P053	29.908	-95.057	2007.339	2024.879	17.539	819	-1.2	-0.31
P054	29.801	-95.034	2006.816	2024.923	18.107	921	-1.9	-0.28
P055	29.794	-95.177	2006.799	2024.958	18.159	866	2.4	-0.11
P056	29.903	-95.817	2007.320	2024.942	17.621	725	-7.6	-0.19
P057	29.684	-95.722	2009.137	2024.816	15.679	667	-7.3	-0.94
P058	29.485	-95.715	2010.591	2024.903	14.312	641	-2.4	-0.16
P059	29.617	-95.740	2010.572	2024.890	14.318	627	-3.5	-0.22
P060	29.686	-95.820	2012.068	2025.002	12.934	601	-8.4	-0.78

Site Name	Latitude (Decimal degrees)	Longitude (Decimal degrees)	Start of POR (Decimal year)	End of POR (Decimal Year)	Length of POR (Years)	Number of Samples (Days)	Total Vertical Displacement over POR (cm)	Annual Rate of Change in Ellipsoidal Height 2020-2024 (cm/yr.)
P061	29.675	-95.972	2011.129	2025.002	13.873	697	-3.1	0.11
P062	29.593	-95.974	2011.129	2024.851	13.723	572	-4.2	-0.07
P063	29.508	-95.547	2011.432	2025.002	13.569	693	-2.5	-0.32
P065	30.106	-95.107	2012.432	2024.829	12.397	615	-5.4	0.52
P066	30.017	-95.767	2011.167	2024.925	13.758	641	-20.7	-1.35
P067	29.532	-95.855	2011.109	2025.002	13.892	652	-2.1	-0.03
P068	30.185	-95.587	2011.799	2024.580	12.781	766	-14.0	-1.38
P069	30.199	-95.459	2011.747	2024.599	12.852	769	-15.4	-1.26
P070	30.291	-95.424	2011.761	2024.638	12.877	729	-6.8	-0.29
P071	30.353	-95.579	2011.780	2024.542	12.762	787	-5.6	-0.44
P072	30.147	-95.242	2011.994	2024.613	12.619	616	-8.7	-0.45
P073	30.193	-95.730	2012.052	2024.561	12.509	781	-11.6	-0.96
P074	29.736	-95.231	2011.972	2024.961	12.989	617	2.2	0.52
P075	29.758	-95.031	2012.432	2025.002	12.569	867	1.3	0.35
P076	29.361	-95.045	2012.643	2024.868	12.224	581	-5.2	-0.23
P077	29.979	-95.850	2013.197	2024.547	11.350	512	-2.2	0.83
P078	29.739	-96.016	2014.331	2024.832	10.501	486	-3.3	-0.12
P079	29.035	-95.471	2014.827	2025.002	10.175	2933	-1.7	-0.25
P080	29.578	-95.165	2014.862	2024.961	10.099	3459	0.6	0.07
P081	29.556	-95.170	2014.854	2025.002	10.148	3500	-0.6	-0.06
P087	29.058	-95.677	2016.090	2024.851	8.761	263	-1.2	-0.28
P089	29.566	-95.799	2015.766	2024.197	8.431	345	-0.8	-0.13
P090	29.710	-95.160	2015.975	2024.942	8.967	544	2.8	0.07
P091	29.783	-95.493	2016.320	2024.923	8.602	537	-4.0	-0.27
P092	29.881	-95.501	2016.320	2024.903	8.583	503	-6.7	-1.08
P093	29.417	-95.197	2017.241	2024.731	7.490	403	-1.5	-0.08
P094	29.722	-95.524	2017.298	2024.942	7.643	464	-2.6	-0.28
P095	29.808	-95.294	2017.203	2024.977	7.775	490	-1.3	-0.17
P096	29.724	-95.748	2017.624	2024.944	7.320	2479	-1.7	-1.07
P097	29.785	-95.847	2018.104	2025.002	6.898	701	-13.1	-1.24
P098	29.803	-95.820	2018.120	2025.002	6.882	484	-13.9	-1.83
P099	29.986	-95.579	2018.140	2024.884	6.745	371	-2.3	-0.31
PWES	30.199	-95.511	2015.220	2024.739	9.520	3435	-11.8	-1.69
RDCT	29.810	-95.495	2013.563	2024.742	11.179	3797	-4.6	-0.66
ROD1	30.072	-95.527	2007.003	2024.742	17.739	6032	-20.4	-1.57
RPFB	29.484	-95.514	2014.773	2024.742	9.969	3633	-1.0	-0.35
SANJ	30.507	-95.289	2022.419	2024.887	2.468	602	-0.2	n/a
SESG	29.987	-95.430	2014.678	2024.742	10.064	3655	-9.2	-1.20
SHSG	30.054	-95.430	2014.721	2024.742	10.021	3653	-13.0	-1.80
SISD	29.762	-96.174	2015.176	2024.742	9.566	3365	0.0	0.02
SPBH	29.802	-95.515	2013.303	2024.742	11.439	4173	-5.6	-0.77
TDAM	29.314	-94.817	2013.435	2024.742	11.307	3850	-1.7	0.06
THSU	29.714	-95.340	2012.953	2024.742	11.789	4005	0.2	-0.15
TMCC	29.702	-95.395	2003.271	2024.591	21.320	5587	-3.1	-0.22
TXAC	29.778	-94.671	2011.124	2024.742	13.618	4914	2.6	0.13
TXB1	30.161	-94.181	2013.191	2024.742	11.551	3895	2.1	-0.09
TXB7	31.472	-96.047	2021.350	2024.742	3.392	1211	2.6	0.23
TXBC	29.000	-95.972	2009.405	2024.742	15.337	5531	-2.4	-0.36

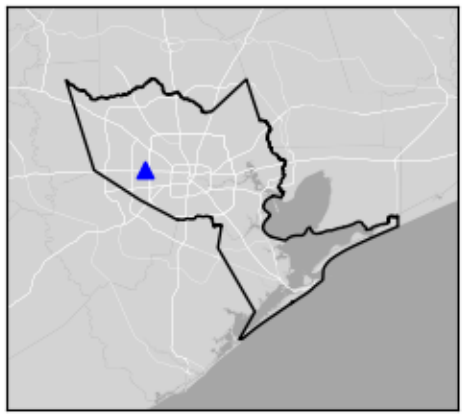
Site Name	Latitude (Decimal degrees)	Longitude (Decimal degrees)	Start of POR (Decimal year)	End of POR (Decimal Year)	Length of POR (Years)	Number of Samples (Days)	Total Vertical Displacement over POR (cm)	Annual Rate of Change in Ellipsoidal Height 2020-2024 (cm/yr.)
TXBX	30.718	-96.397	2013.191	2024.742	11.551	4172	7.3	0.05
TXCK	31.323	-95.436	2012.022	2024.742	12.720	4572	1.3	-0.18
TXCM	29.703	-96.577	2010.437	2024.742	14.305	5183	0.2	-0.17
TXCN	30.349	-95.441	2005.580	2024.742	19.162	6965	-20.3	-1.44
TXED	28.968	-96.634	2009.429	2024.742	15.313	3945	0.2	-0.07
TXEX	29.564	-95.119	2010.881	2025.002	14.120	4580	3.3	0.10
TXGA	29.328	-94.773	2005.580	2024.734	19.154	6777	-3.9	-0.34
TXGN	31.061	-95.136	2012.022	2024.742	12.720	4240	0.9	0.13
TXH1	30.893	-96.602	2013.191	2024.742	11.551	3893	0.8	-0.17
TXHE	30.099	-96.063	2005.580	2024.742	19.162	6955	-5.4	-0.32
TXHP	31.334	-93.865	2012.022	2024.742	12.720	4571	-1.0	-0.27
TXKO	30.395	-94.332	2011.770	2024.742	12.972	4687	1.0	-0.19
TXLF	31.356	-94.718	2005.580	2024.742	19.162	6957	1.5	-0.29
TXLI	30.056	-94.771	2005.580	2024.742	19.162	6897	1.6	-0.45
TXLM	29.392	-95.024	2005.580	2024.742	19.162	6955	-5.6	-0.82
TXLV	30.745	-94.922	2011.778	2024.742	12.964	4705	-0.2	-0.32
TXMD	30.960	-95.915	2010.584	2024.742	14.157	4825	2.3	-0.22
TXNE	30.848	-93.775	2013.191	2024.742	11.551	3801	-0.2	-0.26
TXPV	28.638	-96.619	2010.292	2024.742	14.450	5229	0.7	-0.25
TXVA	28.835	-96.910	2005.092	2024.742	19.650	6995	2.5	-0.18
TXWH	29.325	-96.112	2010.426	2024.742	14.316	5169	-0.9	0.03
TXWO	30.782	-94.424	2013.191	2024.485	11.294	3574	-2.1	-0.29
TXXR	31.785	-95.126	2021.555	2024.742	3.187	1132	1.8	0.03
UH01	29.722	-95.345	2012.745	2024.657	11.912	3307	-0.5	-0.33
UHC1	29.390	-95.044	2014.137	2025.002	10.865	3862	0.8	0.40
UHC2	29.390	-95.044	2014.137	2024.999	10.862	3865	-0.5	0.22
UHC3	29.390	-95.044	2014.137	2024.999	10.862	3755	-3.7	-0.17
UHCL	29.578	-95.104	2014.242	2024.742	10.500	3627	1.0	0.09
UHCR	29.728	-95.757	2014.123	2025.002	10.879	3677	-12.8	-1.35
UHEB	29.526	-96.066	2014.595	2024.646	10.051	3370	-1.3	-0.02
UHEP	29.719	-95.327	2014.365	2024.736	10.371	3701	-0.4	-0.05
UHF1	30.236	-95.483	2014.390	2024.646	10.256	3317	-9.8	-1.17
UHKD	29.724	-95.748	2018.969	2024.934	5.964	2102	-5.5	-1.13
UHKS	29.724	-95.748	2018.411	2024.936	6.526	2379	-4.7	-0.92
UHRI	29.719	-95.403	2014.330	2024.646	10.316	3751	-3.0	-0.24
UHSL	29.575	-95.652	2014.185	2024.578	10.393	3273	-3.7	-0.51
UHSW	29.727	-95.451	2022.861	2024.348	1.487	524	1.0	n/a
UTEX	29.786	-95.568	2012.496	2024.331	11.836	4088	-8.0	-0.99
WCHT	29.783	-95.581	2013.295	2024.742	11.447	4063	-9.5	-1.08
WEPD	29.688	-95.229	2014.075	2024.742	10.667	3800	2.0	0.03
WHCR	30.194	-95.505	2014.779	2024.742	9.963	3634	-6.7	-1.10
YORS	30.110	-95.469	2020.827	2024.977	4.151	1507	-5.7	-1.23
ZHU1	29.962	-95.331	2003.042	2024.742	21.700	7556	-17.2	-0.82

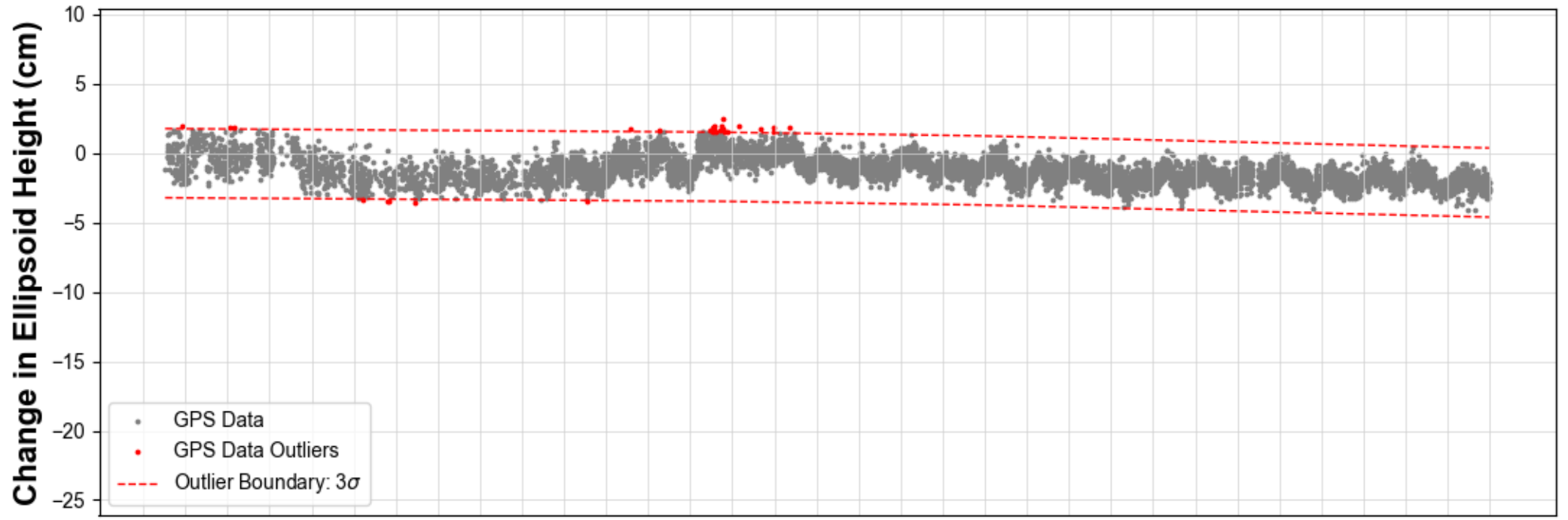
Notes:

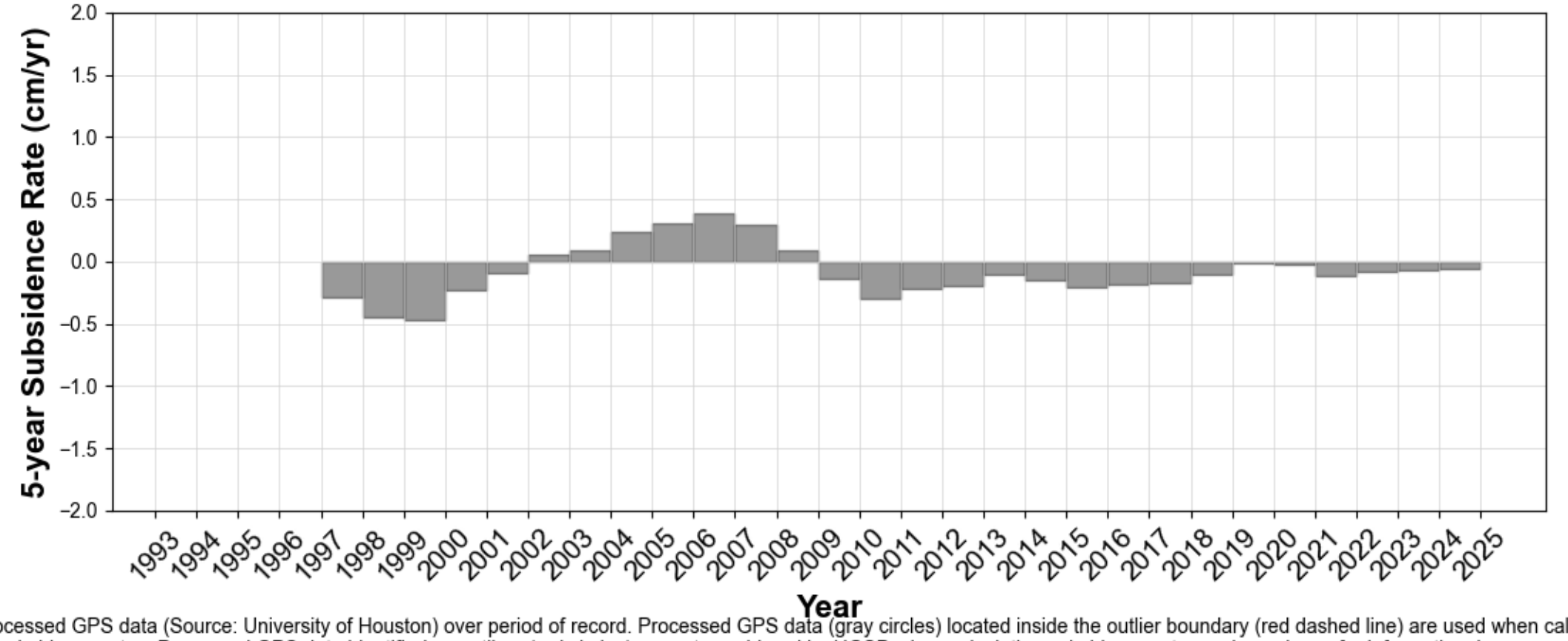
n/a: rate of change in ellipsoidal height not calculated.

ADKS

Houston, TX



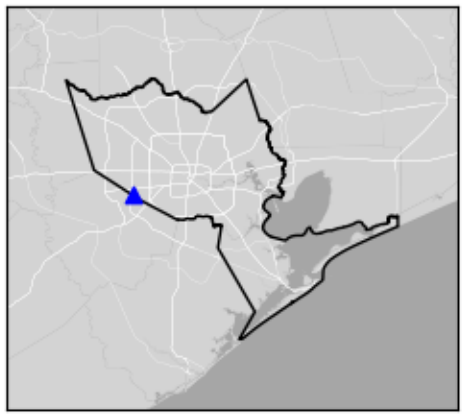


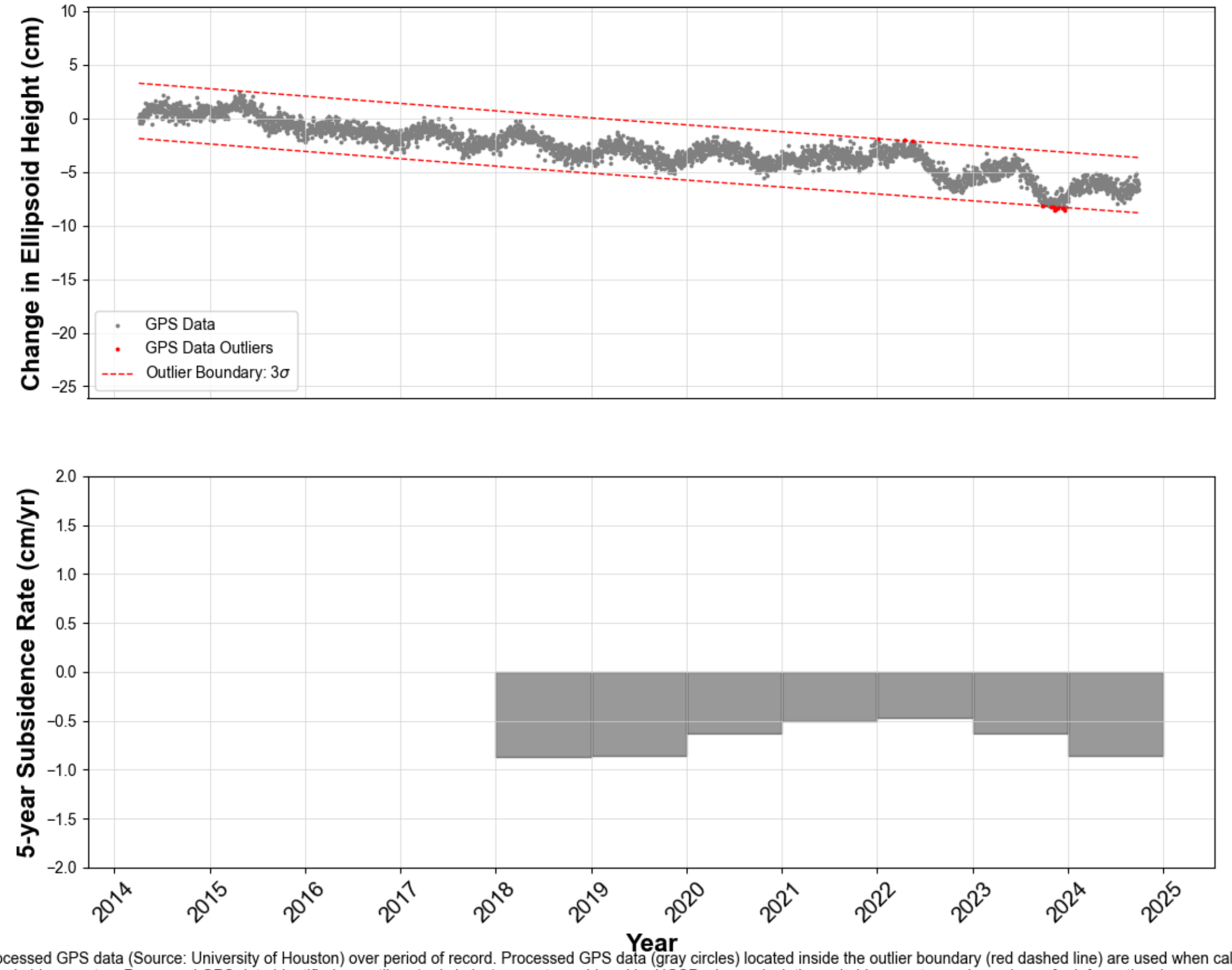


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

ALEF

Houston, TX





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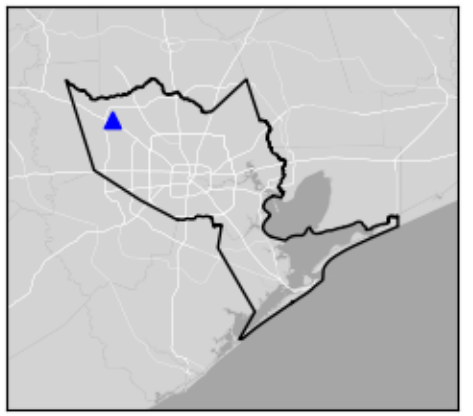
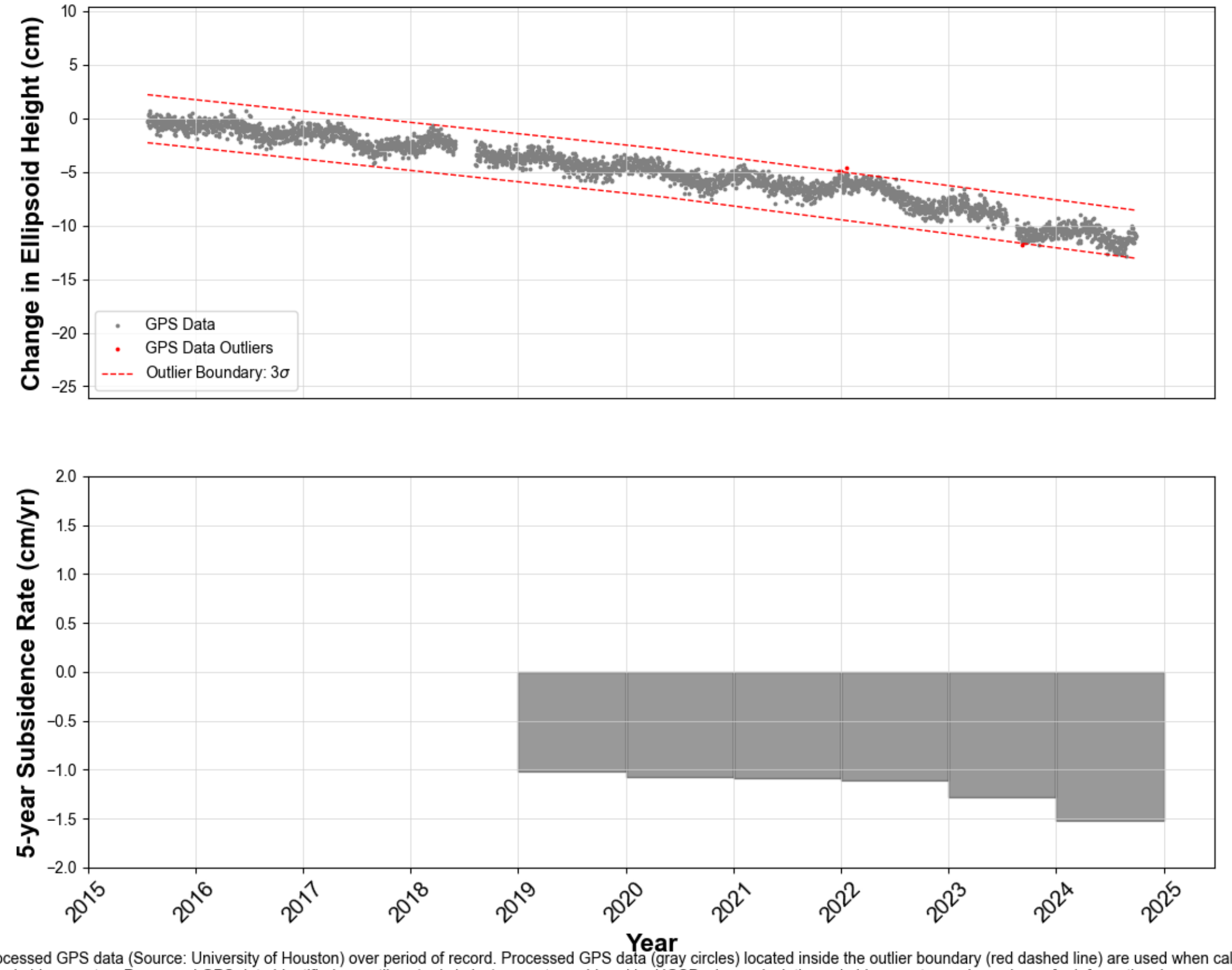
AULT

Cypress, TX





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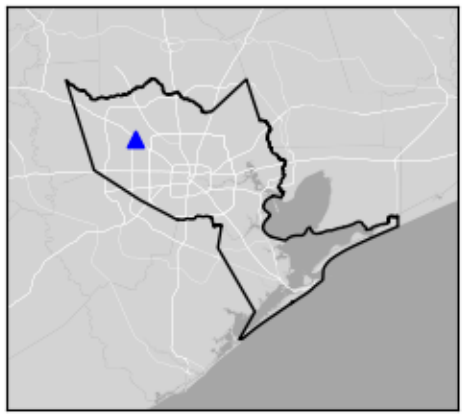
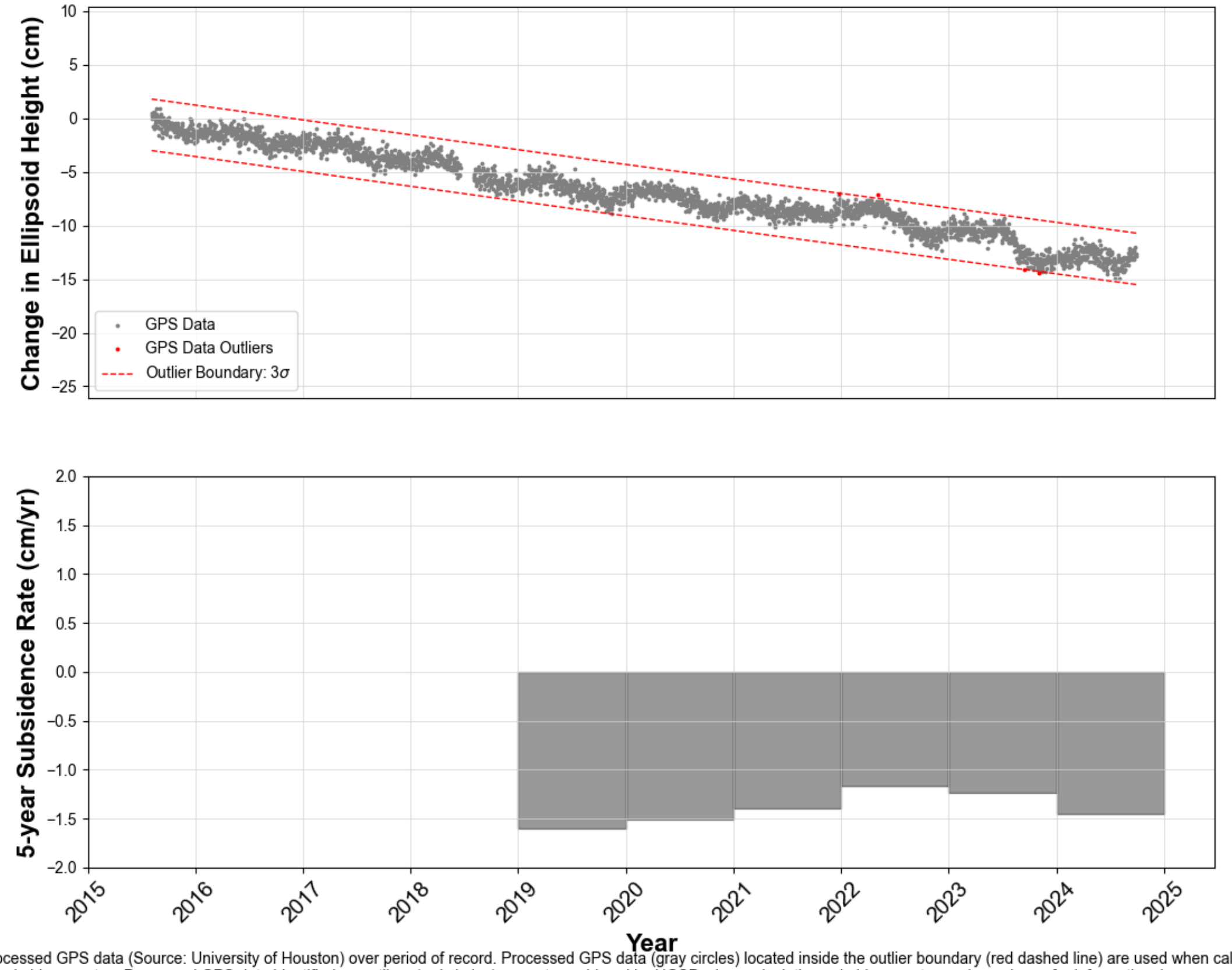
CFHS

Houston, TX





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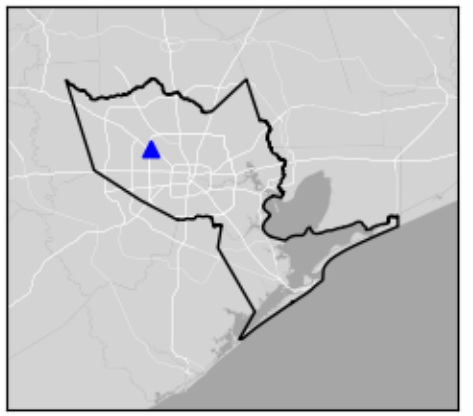
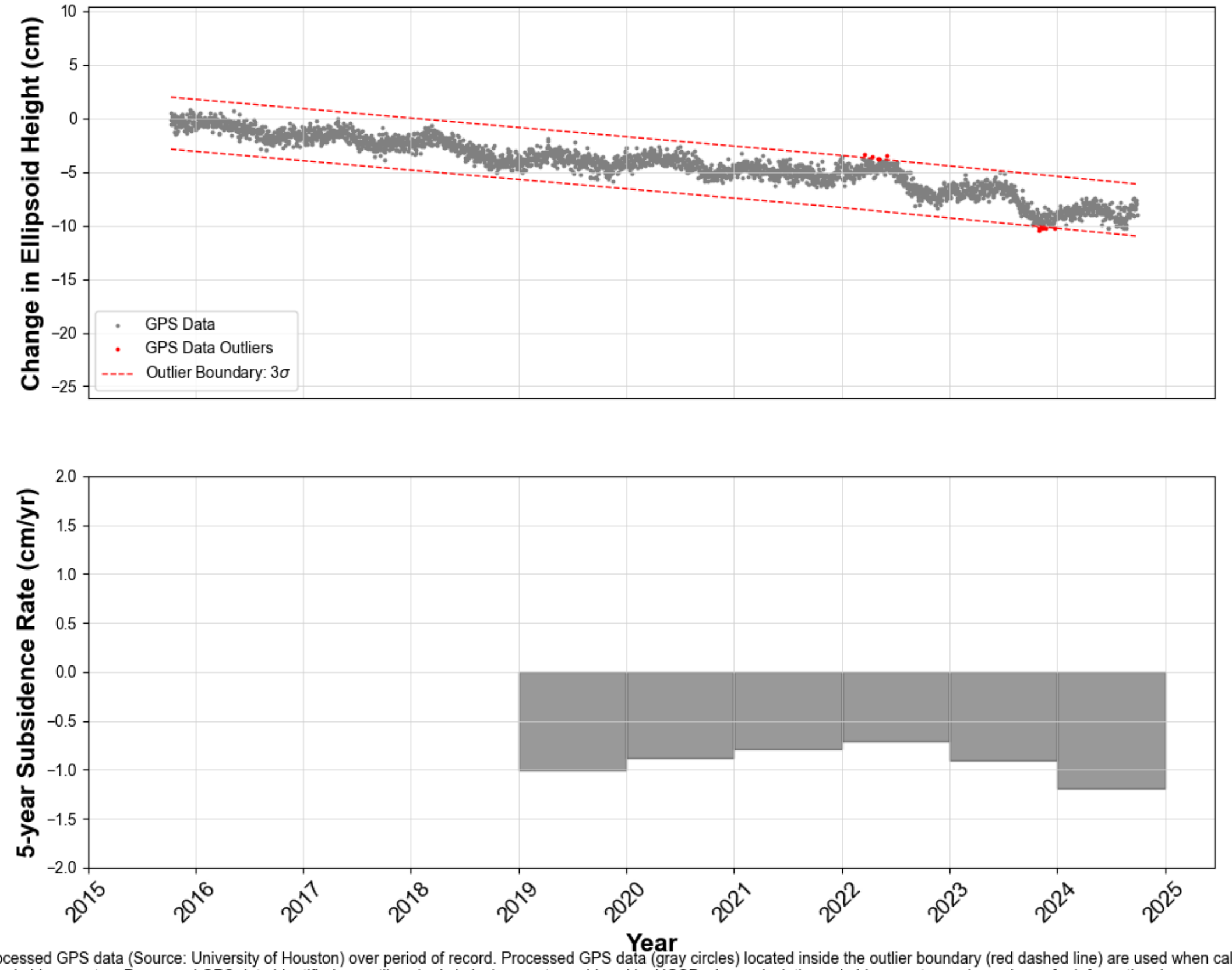
CFJV

Jersey Village, TX





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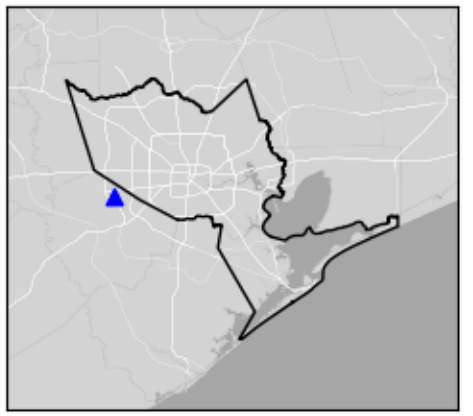
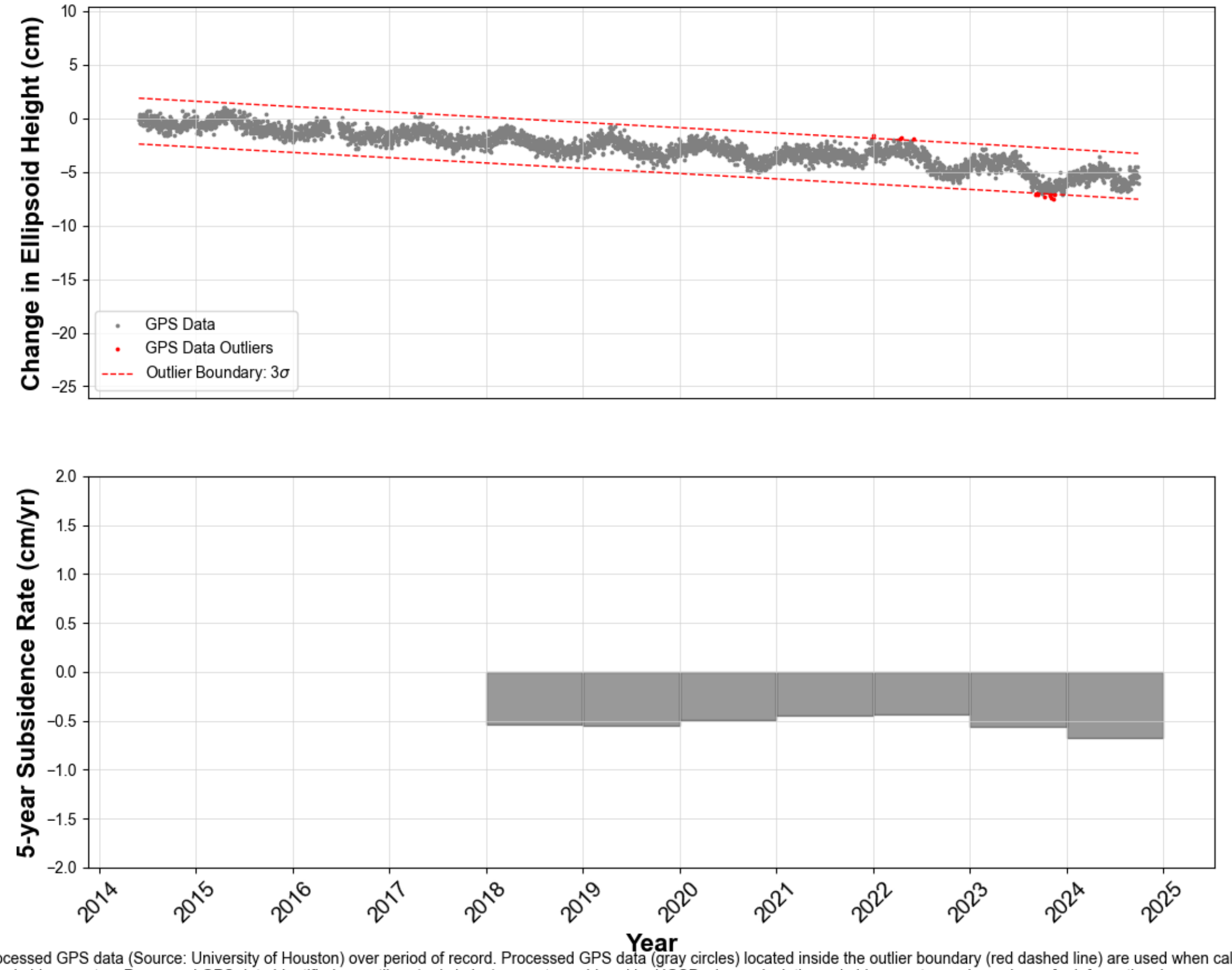
CMFB

Richmond, TX





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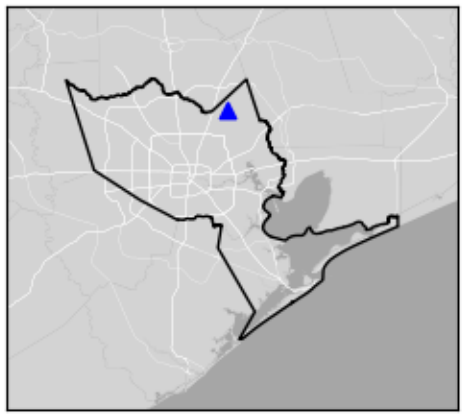
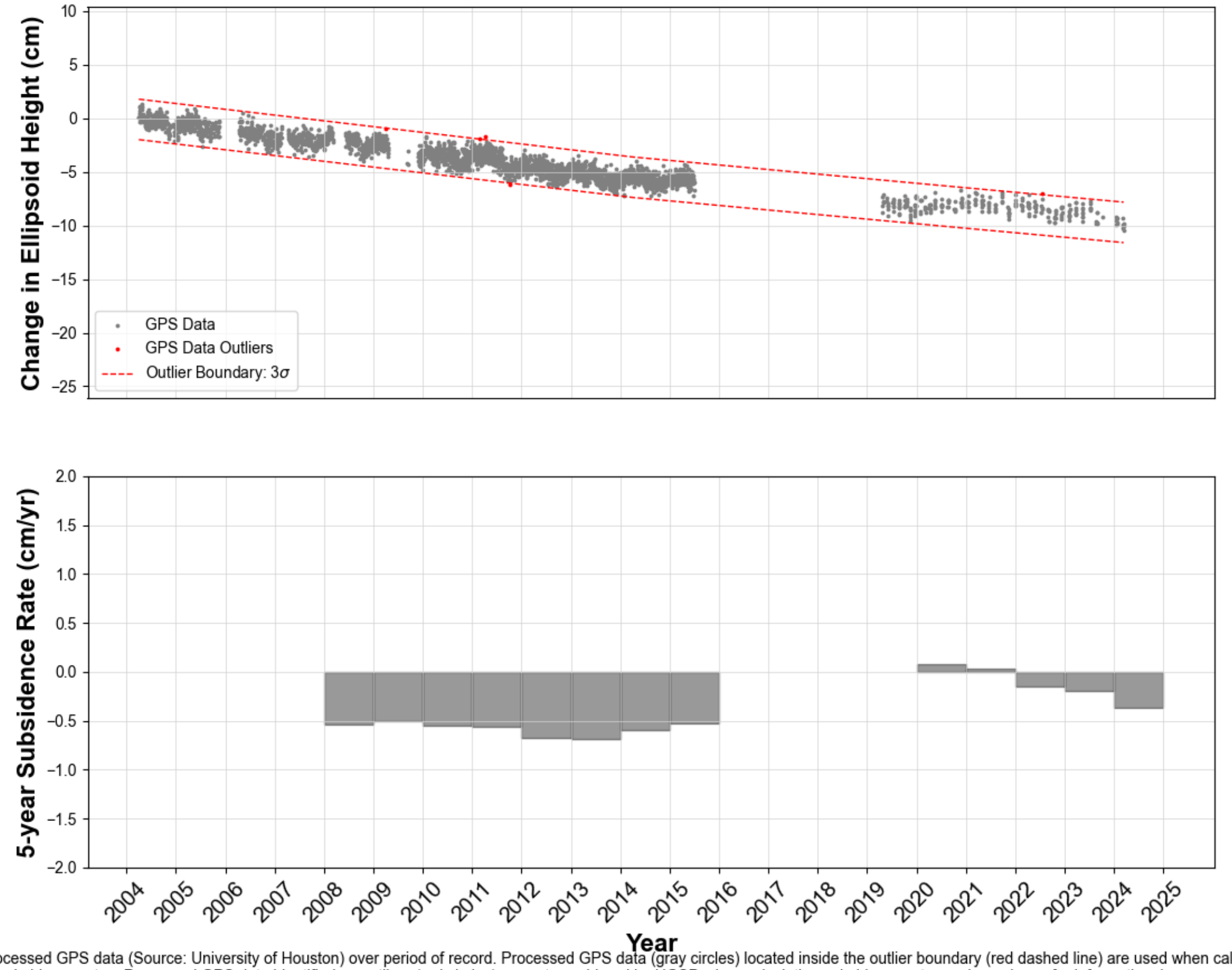
COH6

Humble, TX





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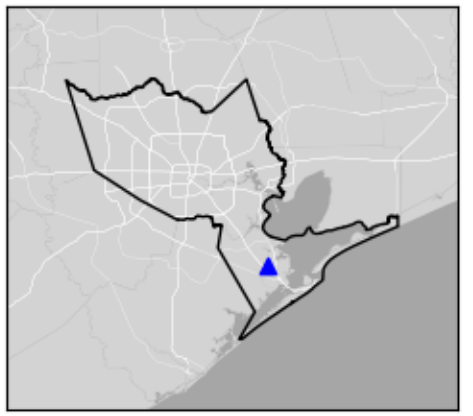
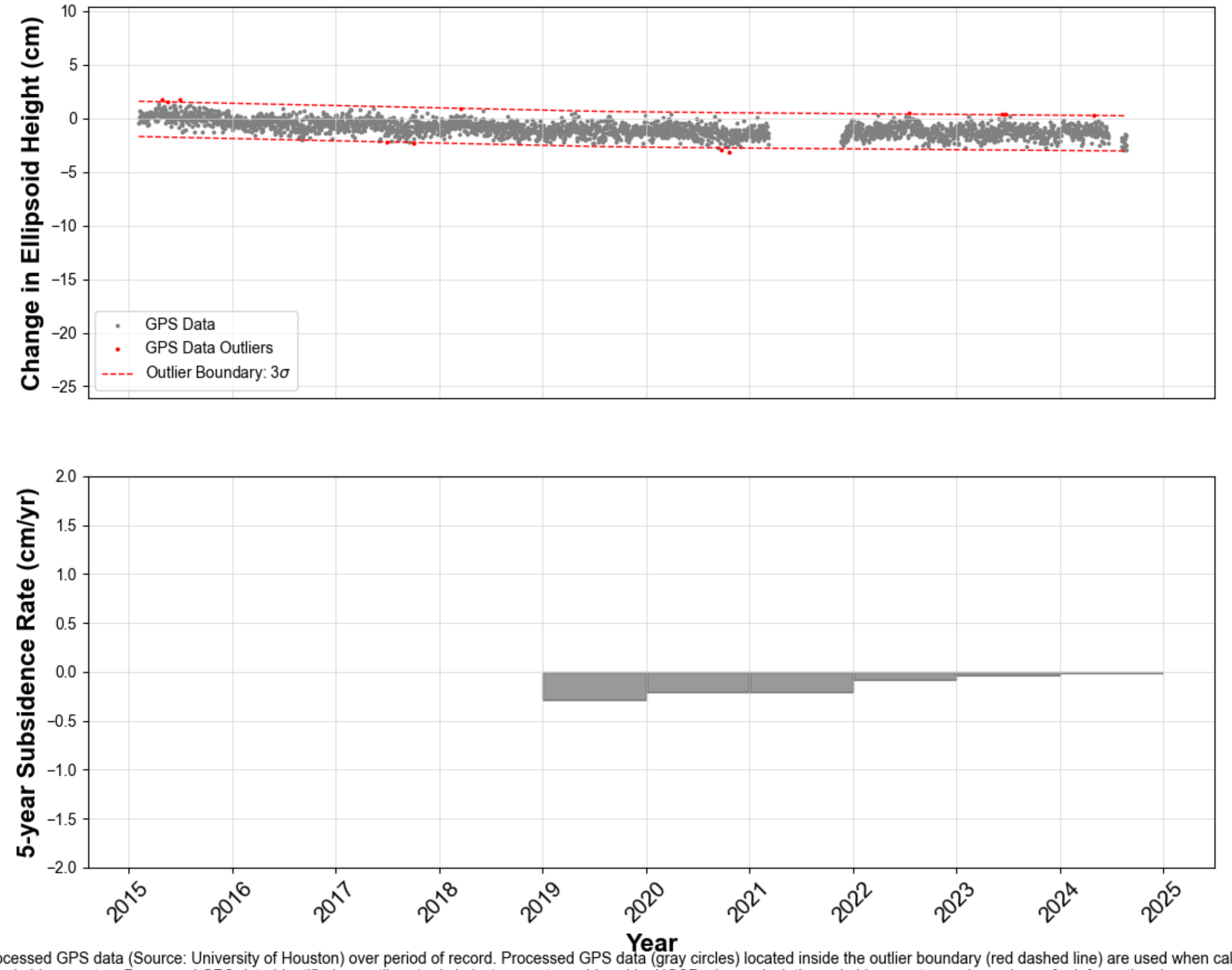
COTM

Texas City, TX





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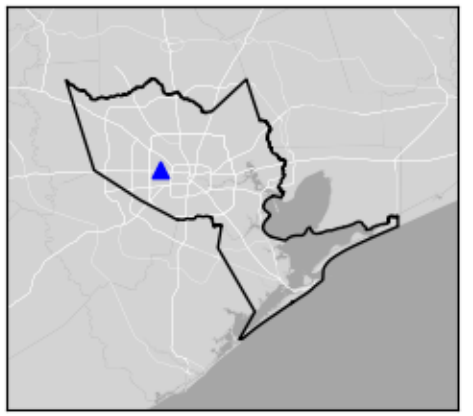
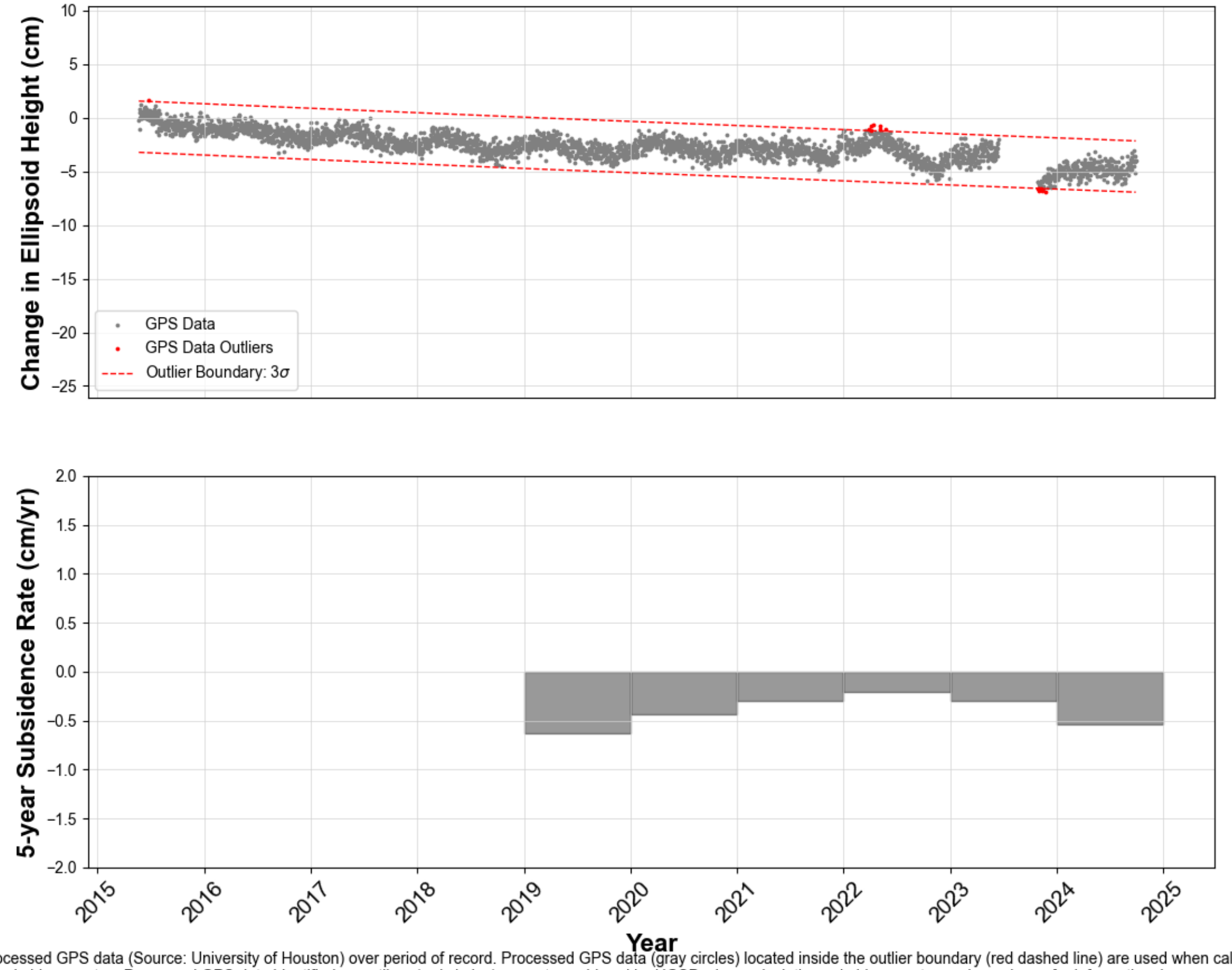
CSTE

Houston, TX





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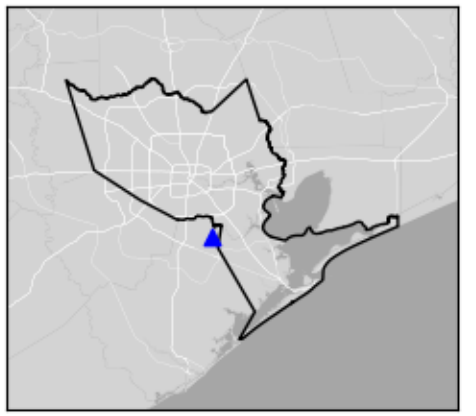
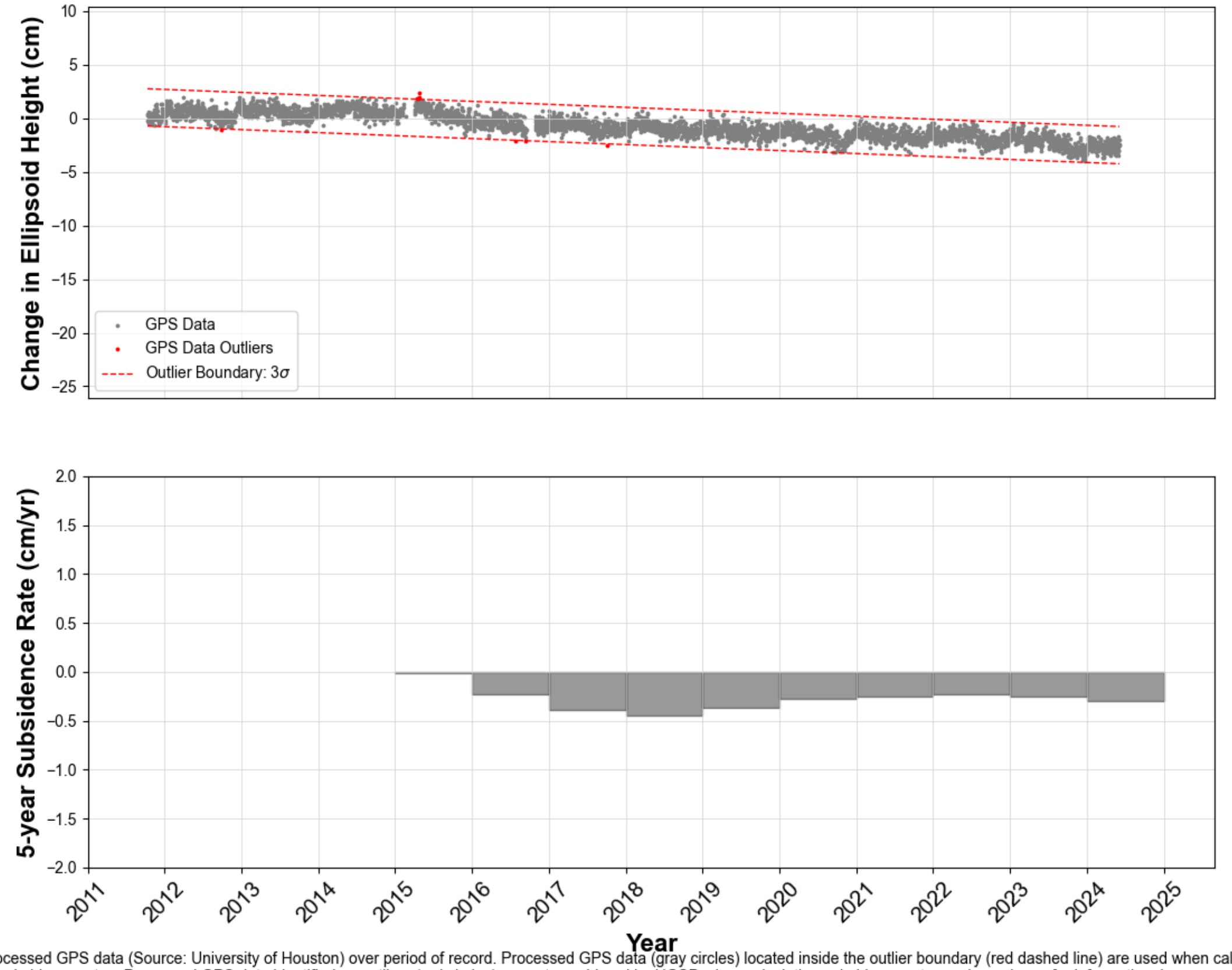
DEN1

Alvin, TX

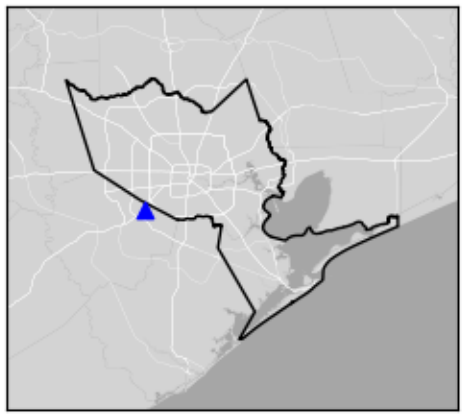


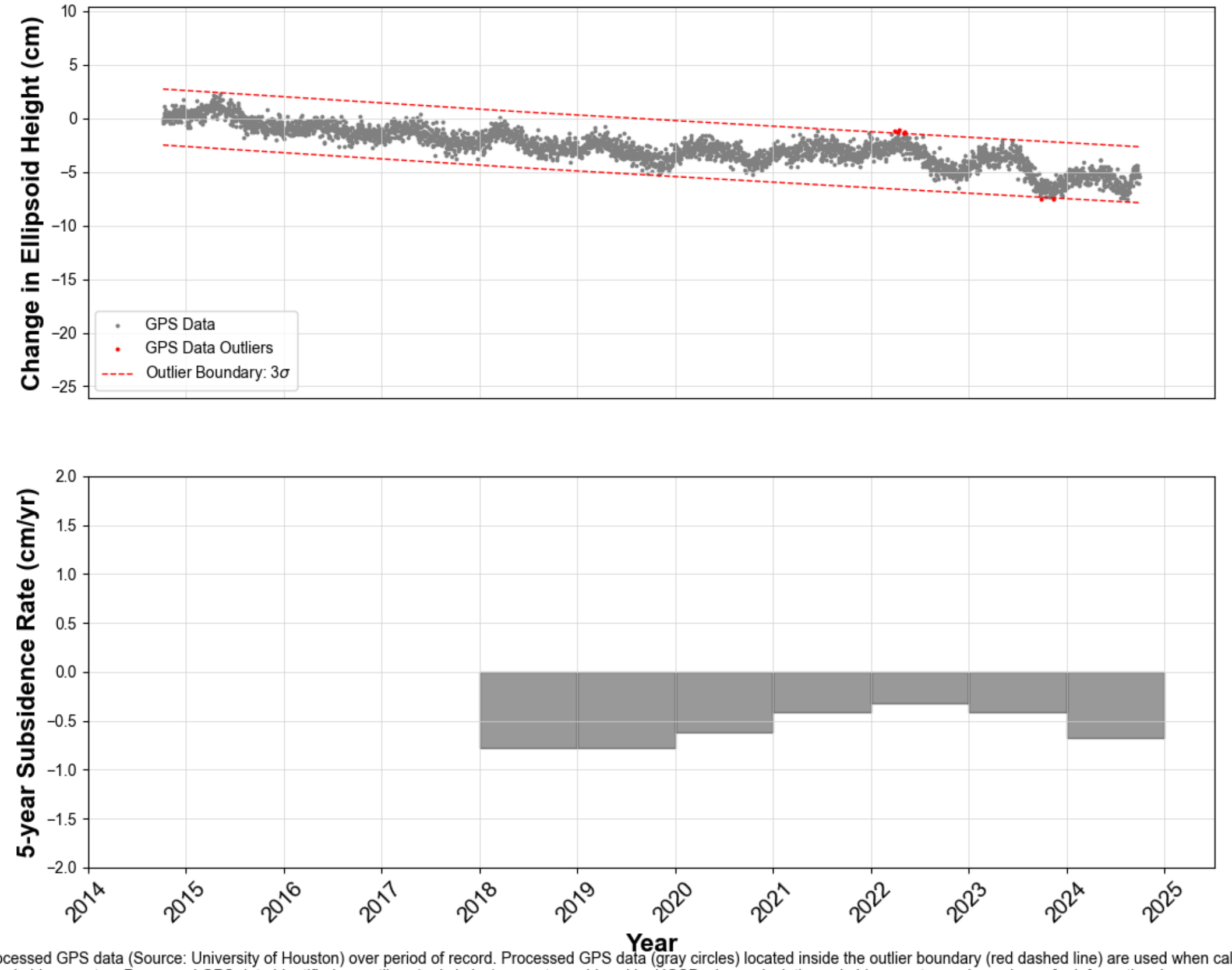


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

DMFB

Sugar Land, TX





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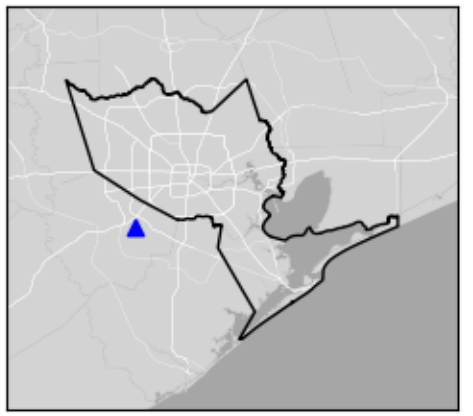
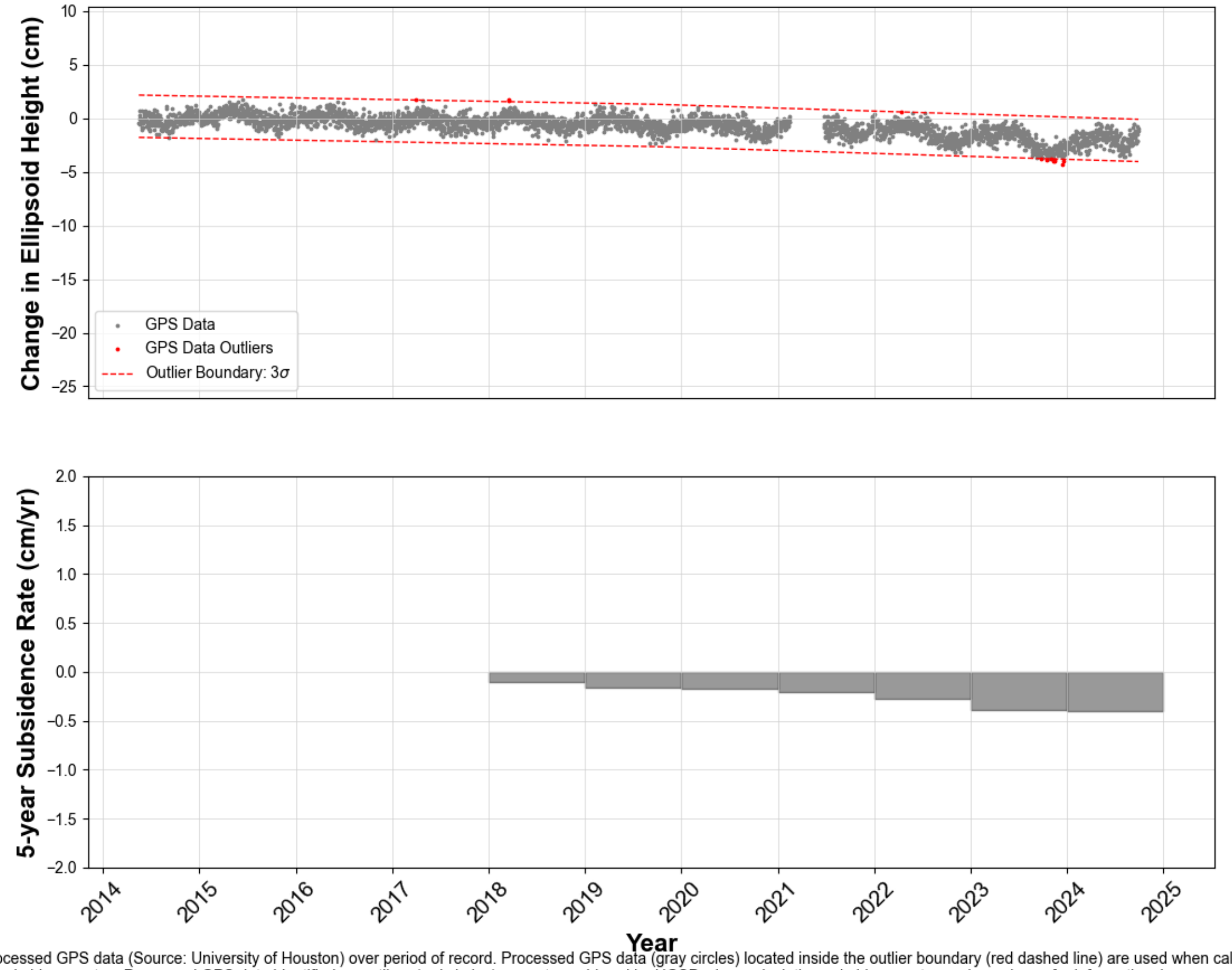
FSFB

Sugar Land, TX





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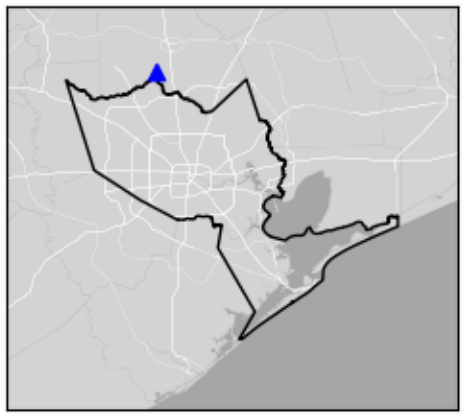
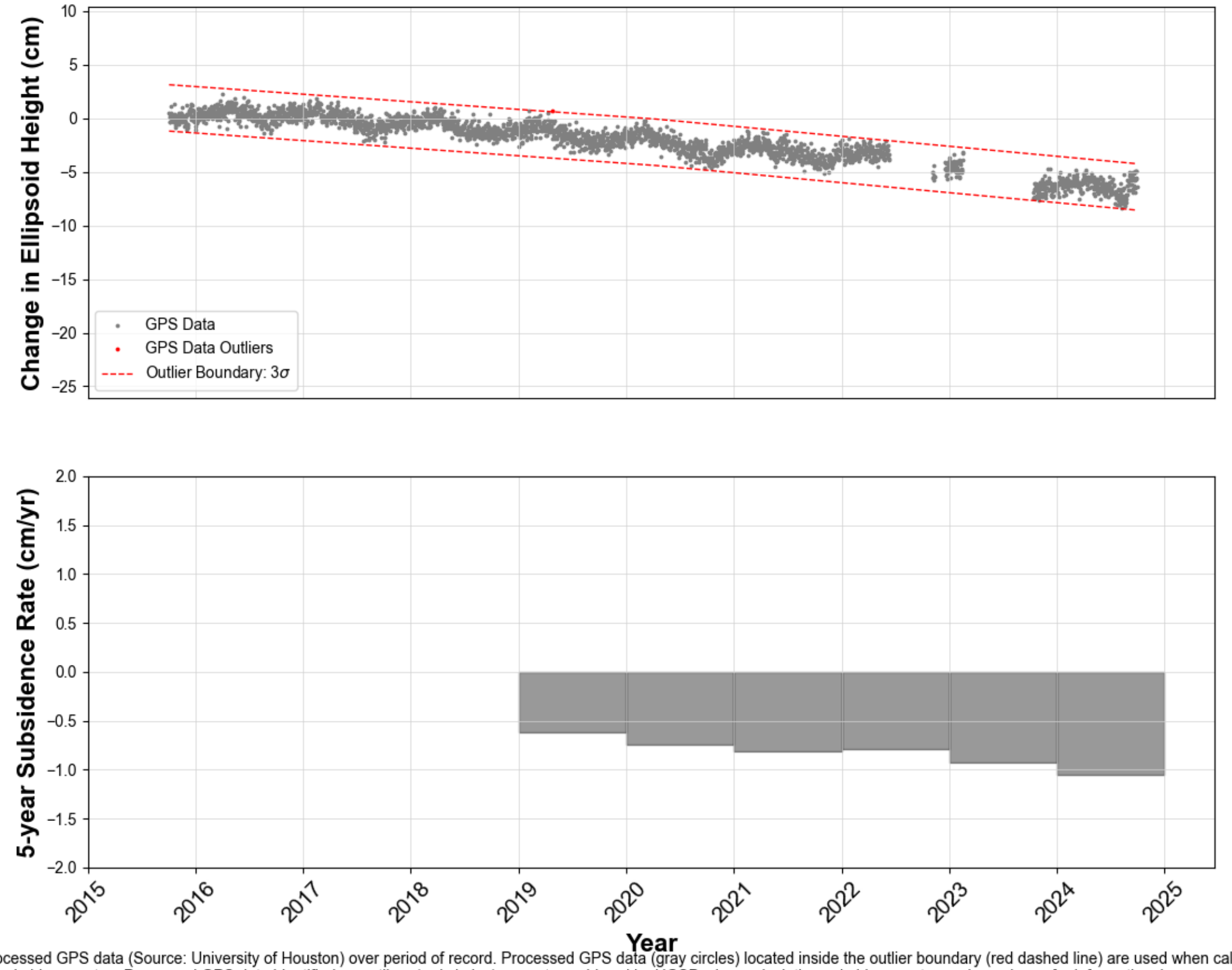
GSEC

Spring, TX





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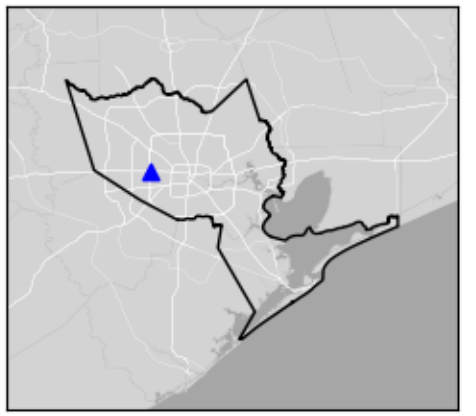
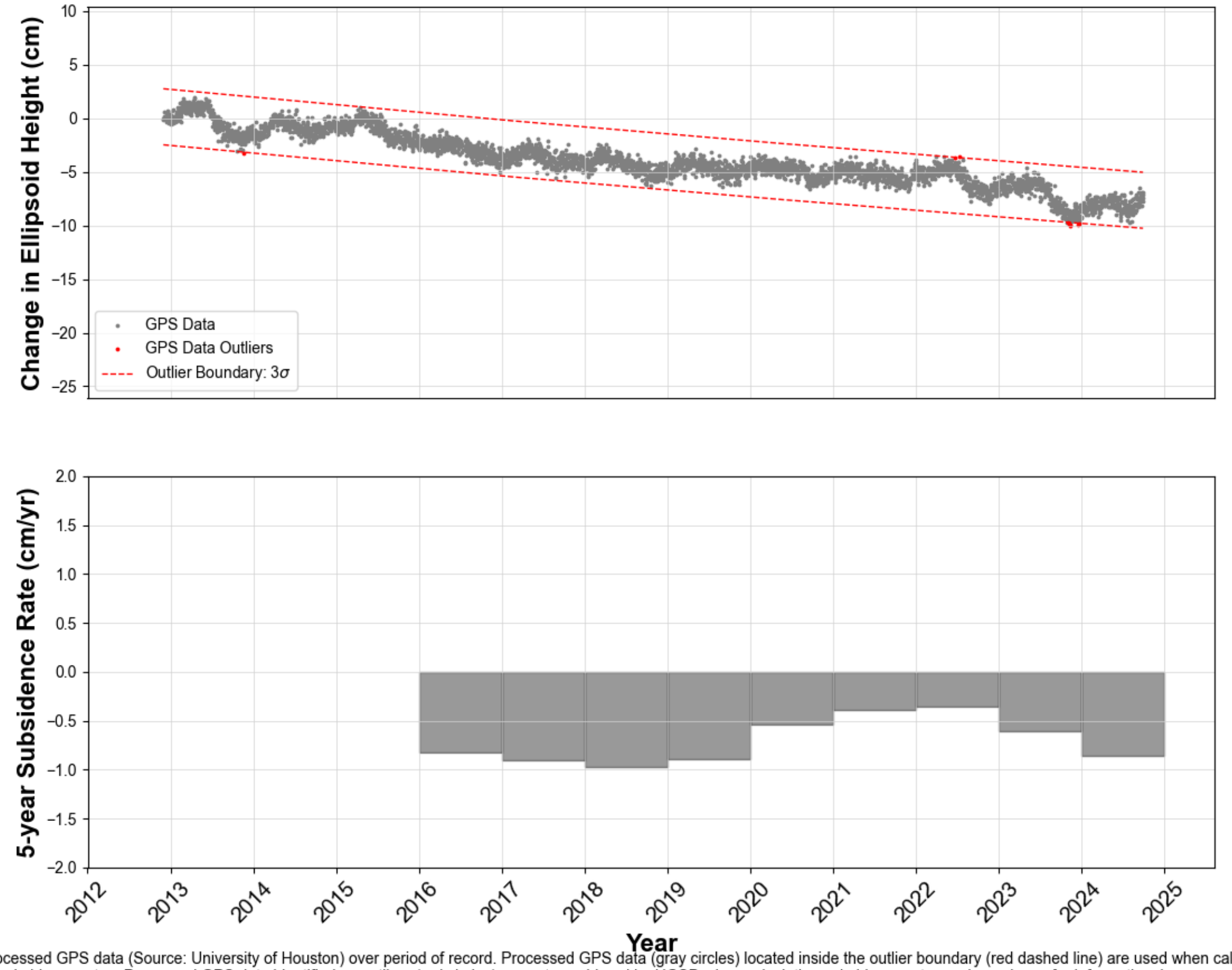
HCC1

Houston, TX

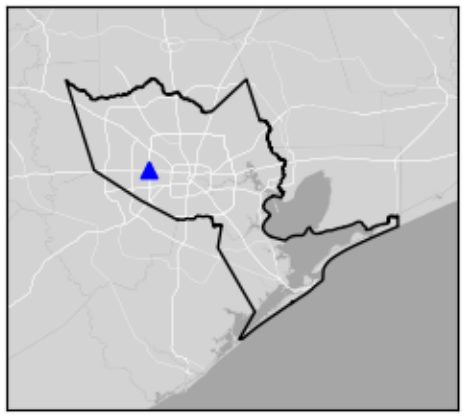


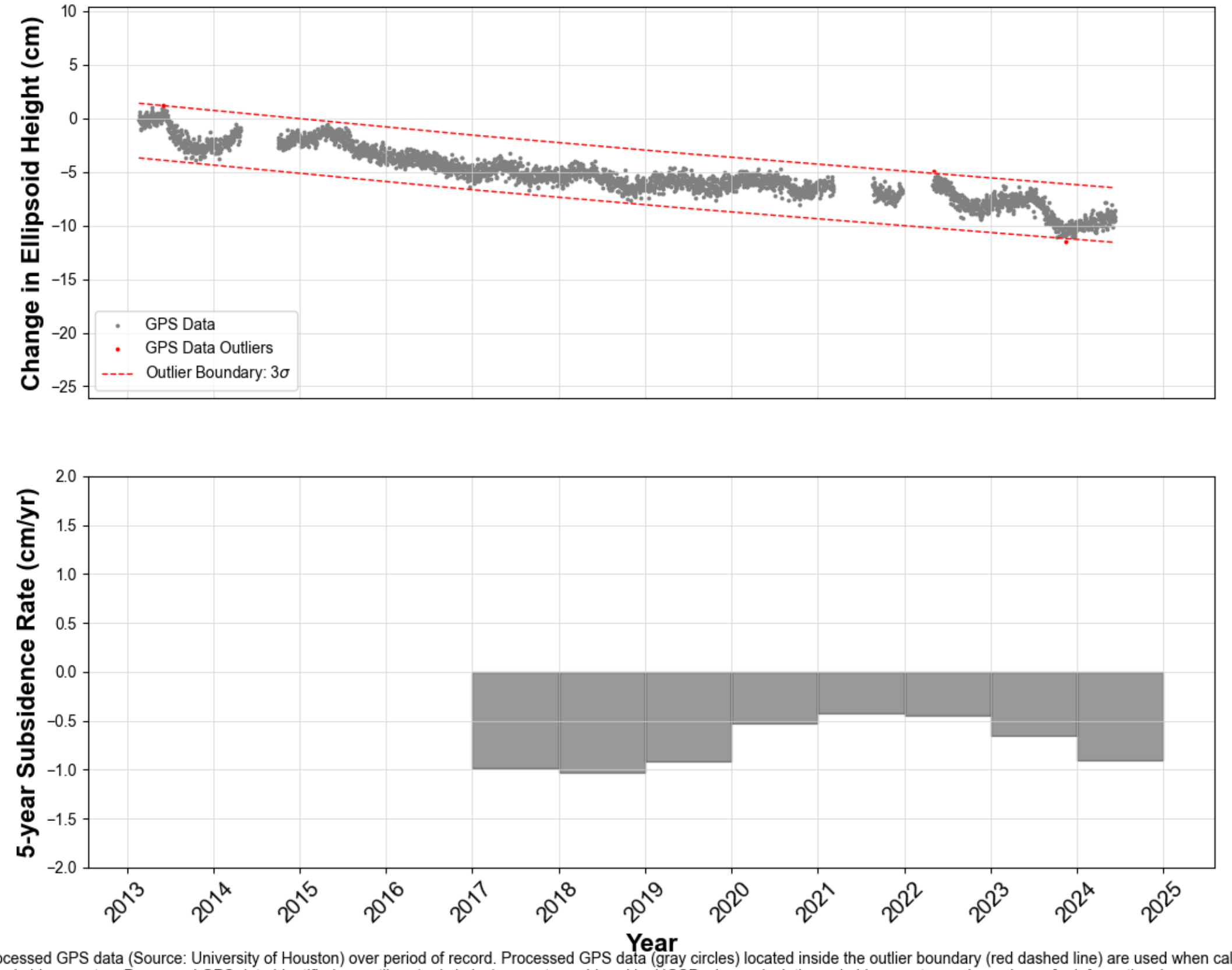


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

HCC2

Houston, TX





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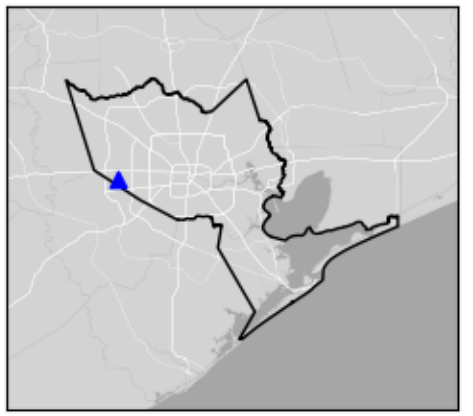
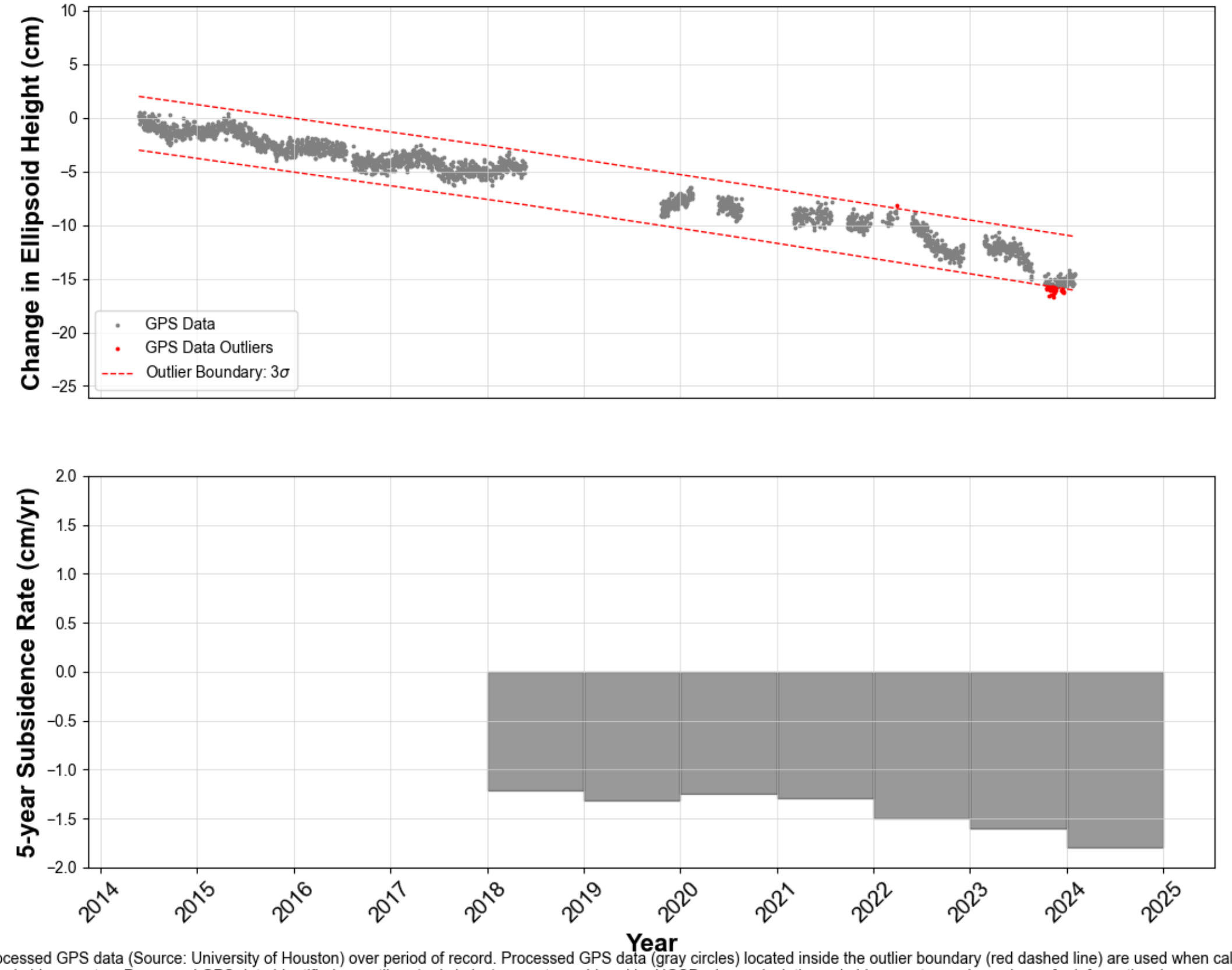
HPEK

Katy, TX





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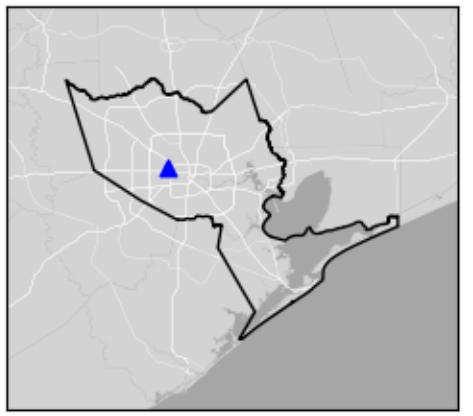
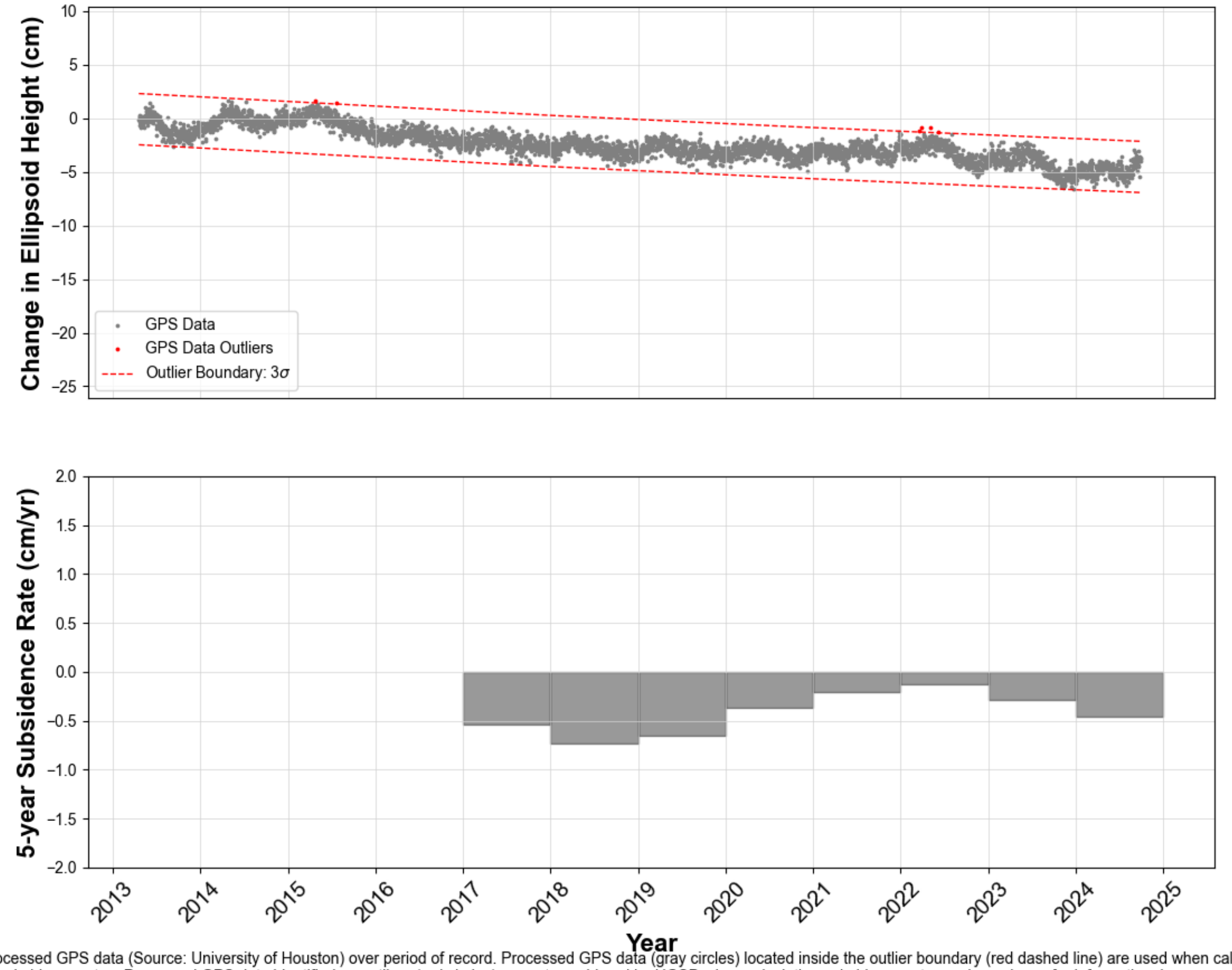
HSMN

Houston, TX

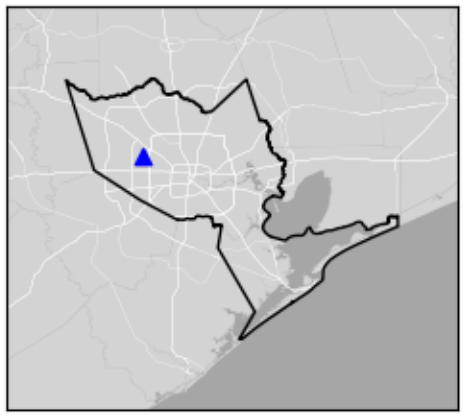


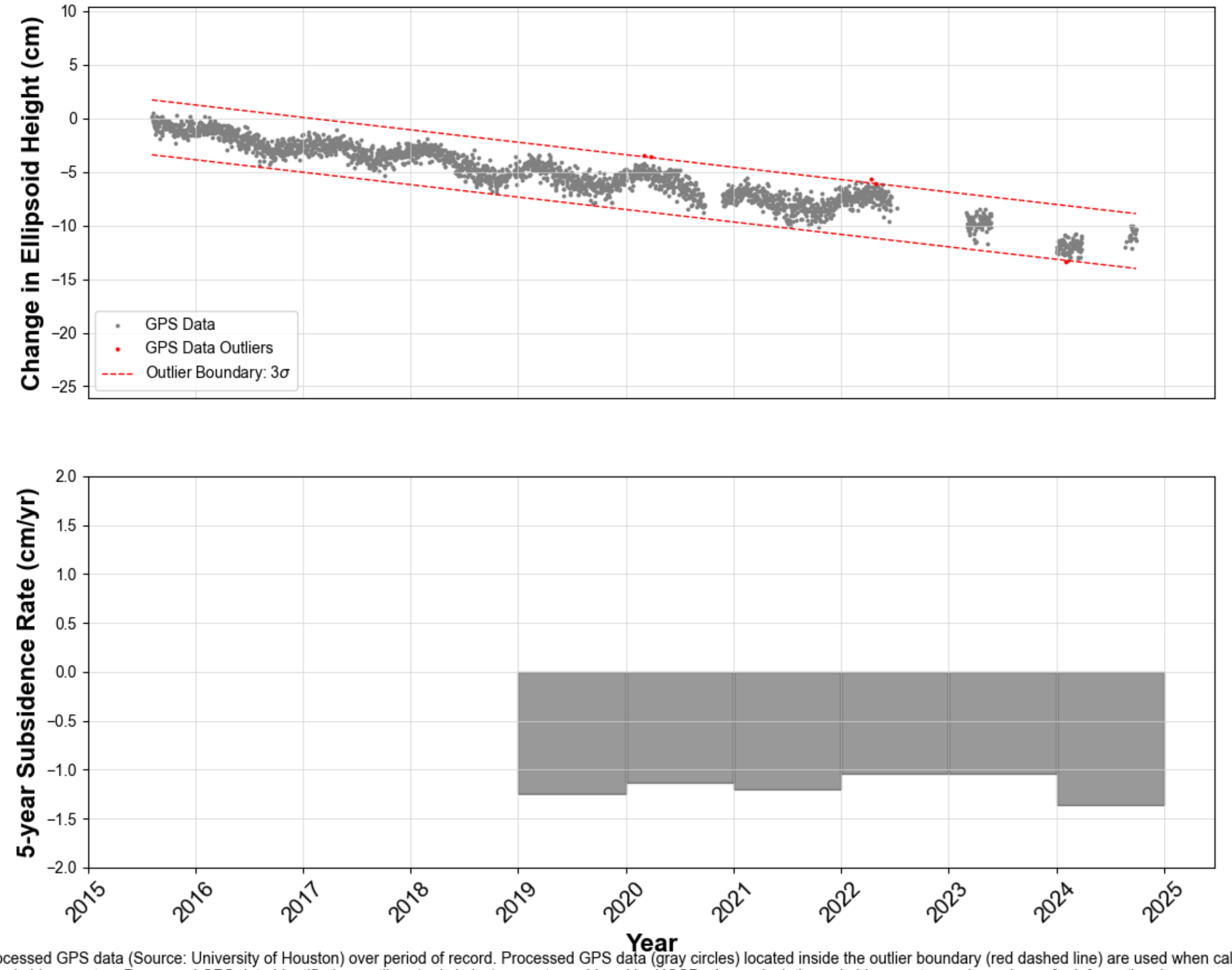


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

KKES

Houston, TX

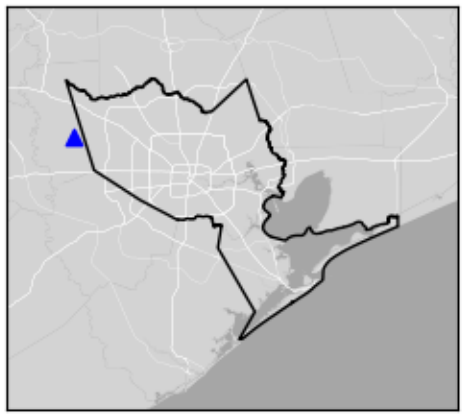


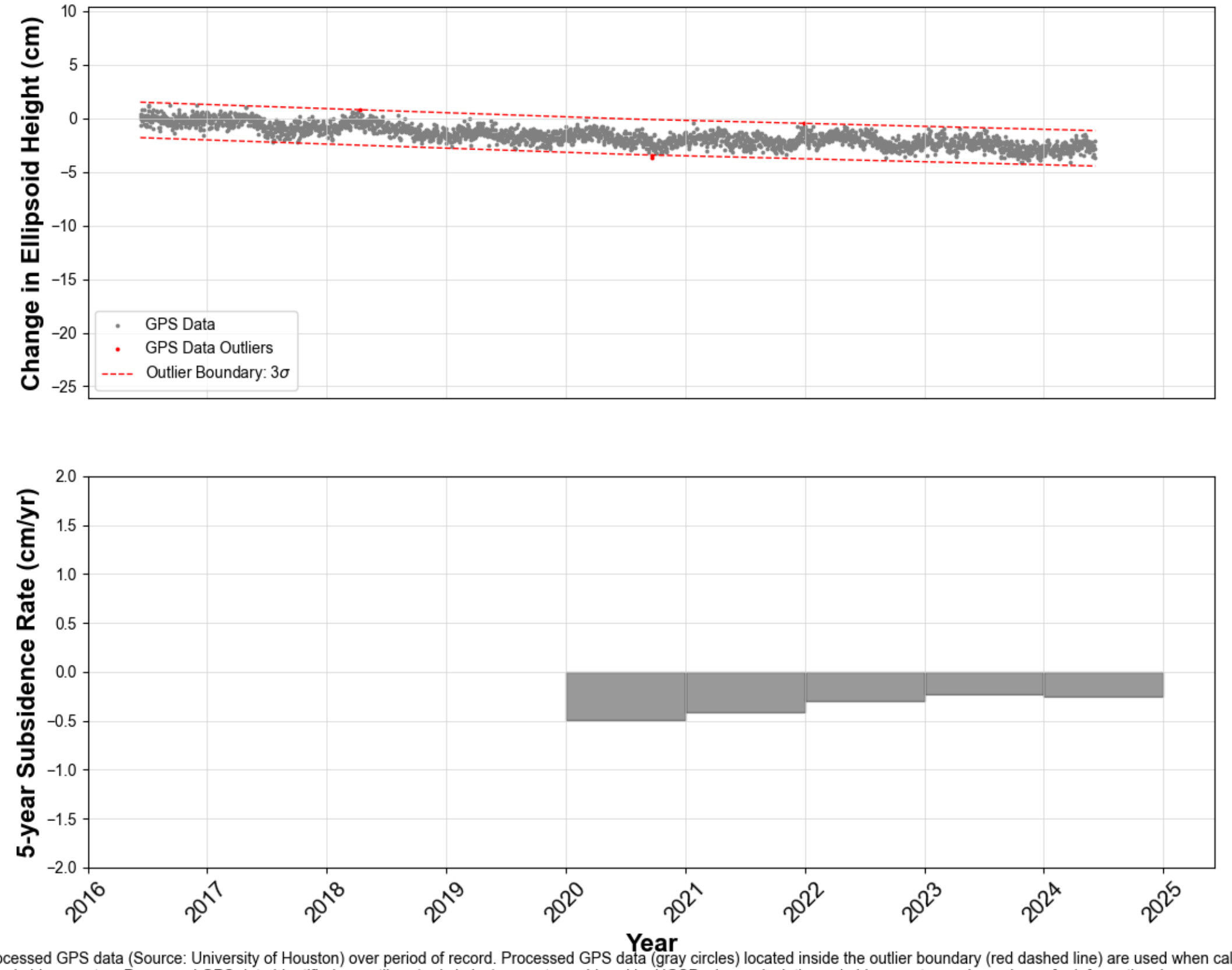


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

KPCD

Pattison, TX

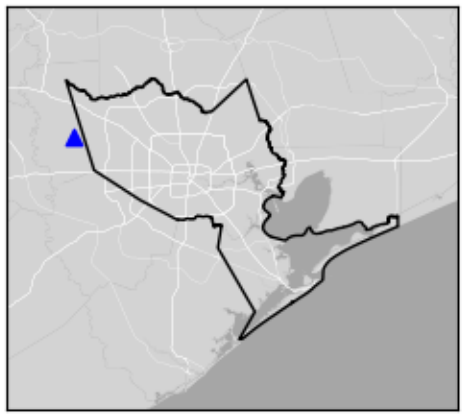


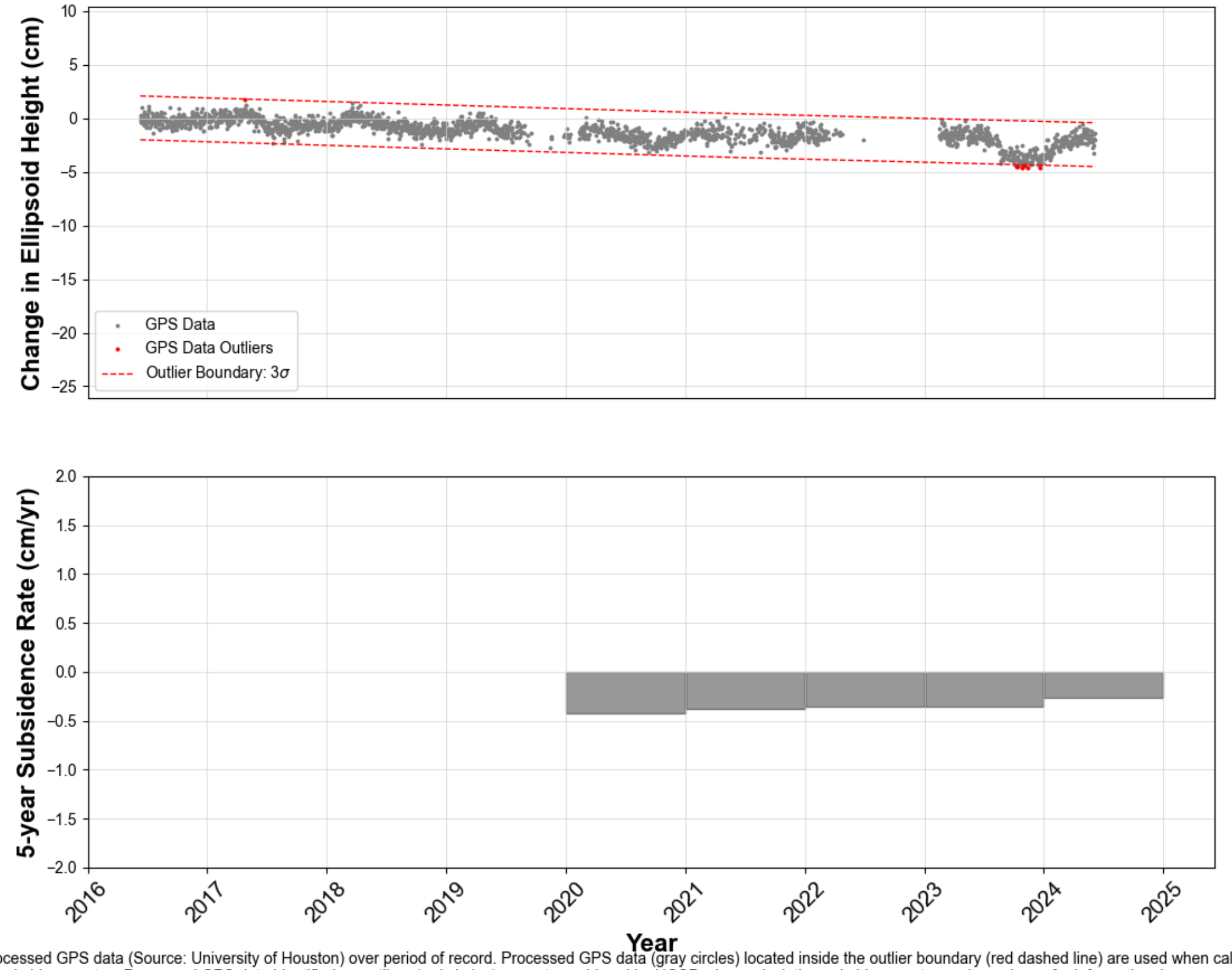


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

KPCS

Pattison, TX

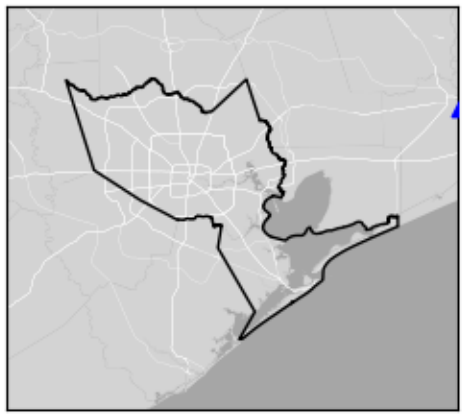


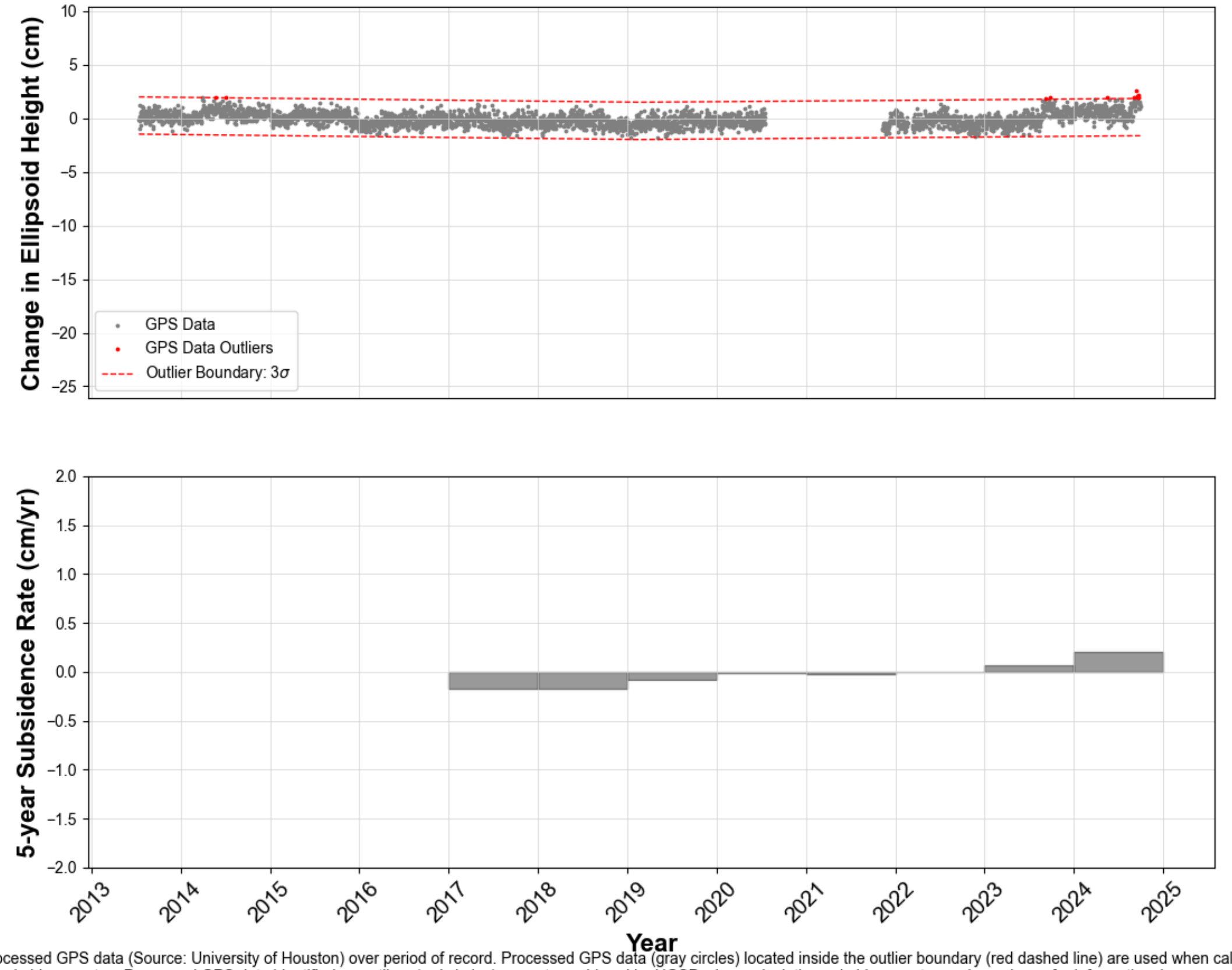


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

LGC1

Beaumont, TX

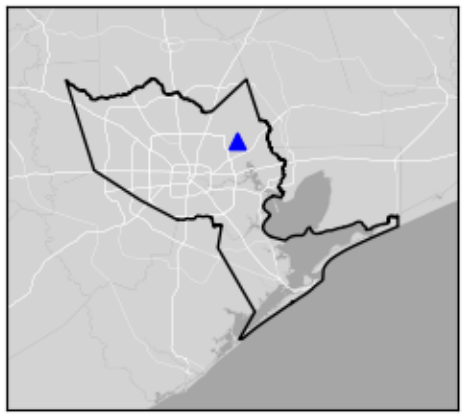


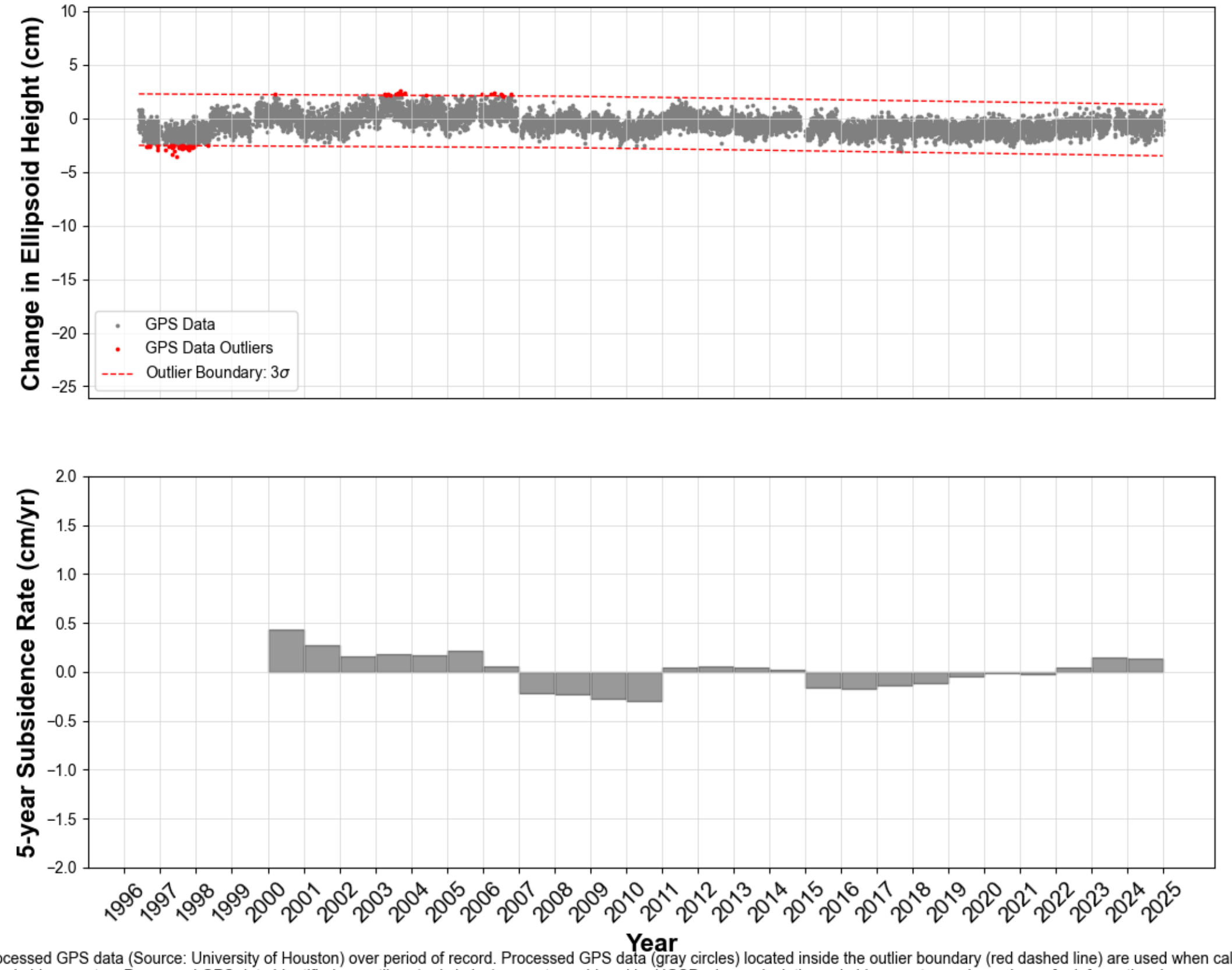


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

LKHU

Houston, TX

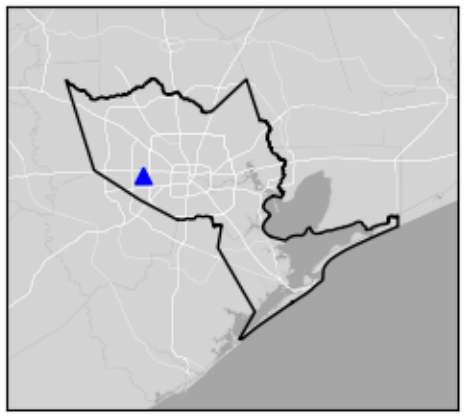


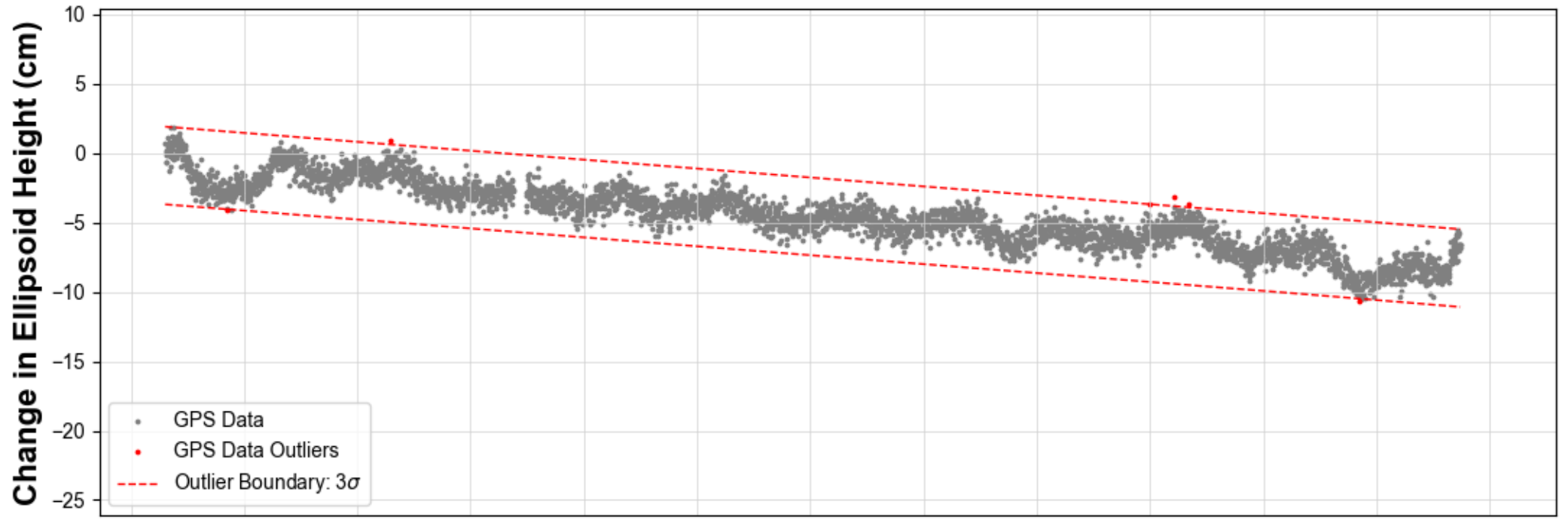


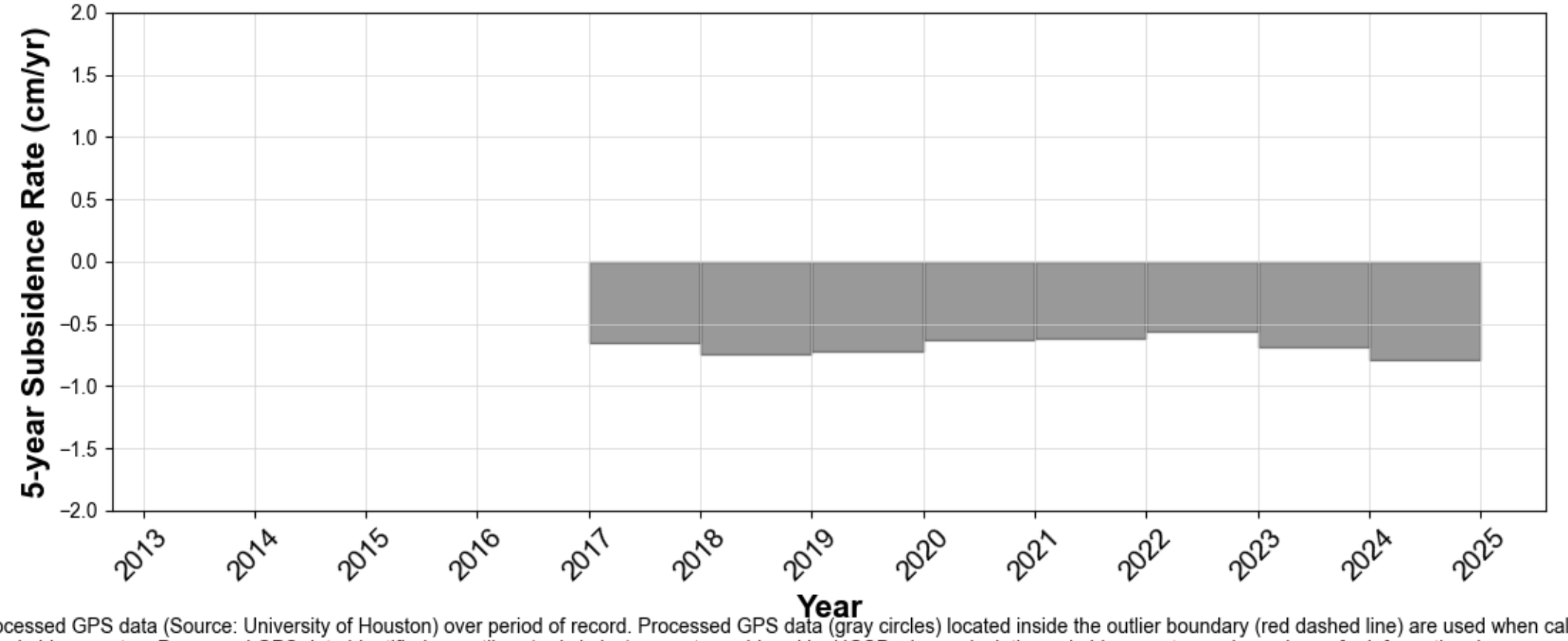
Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

MDWD

Houston, TX



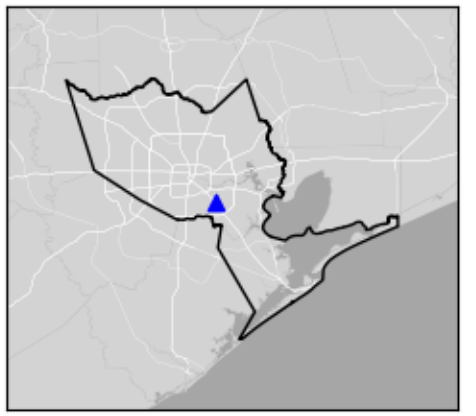


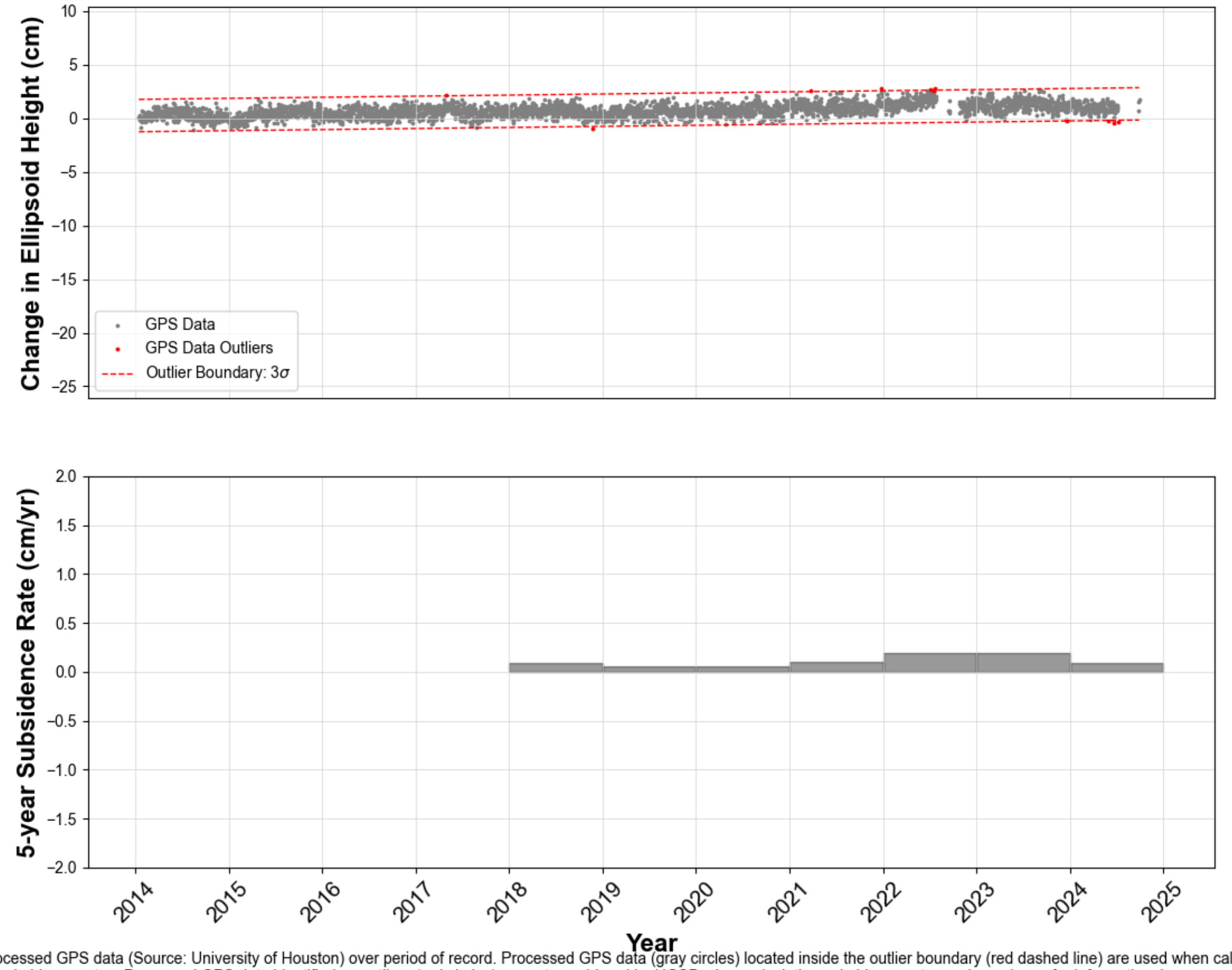


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

MEPD

South Houston, TX

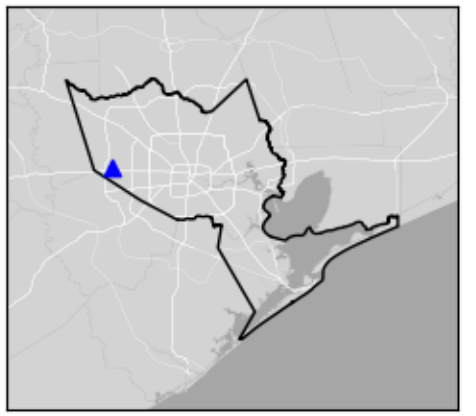


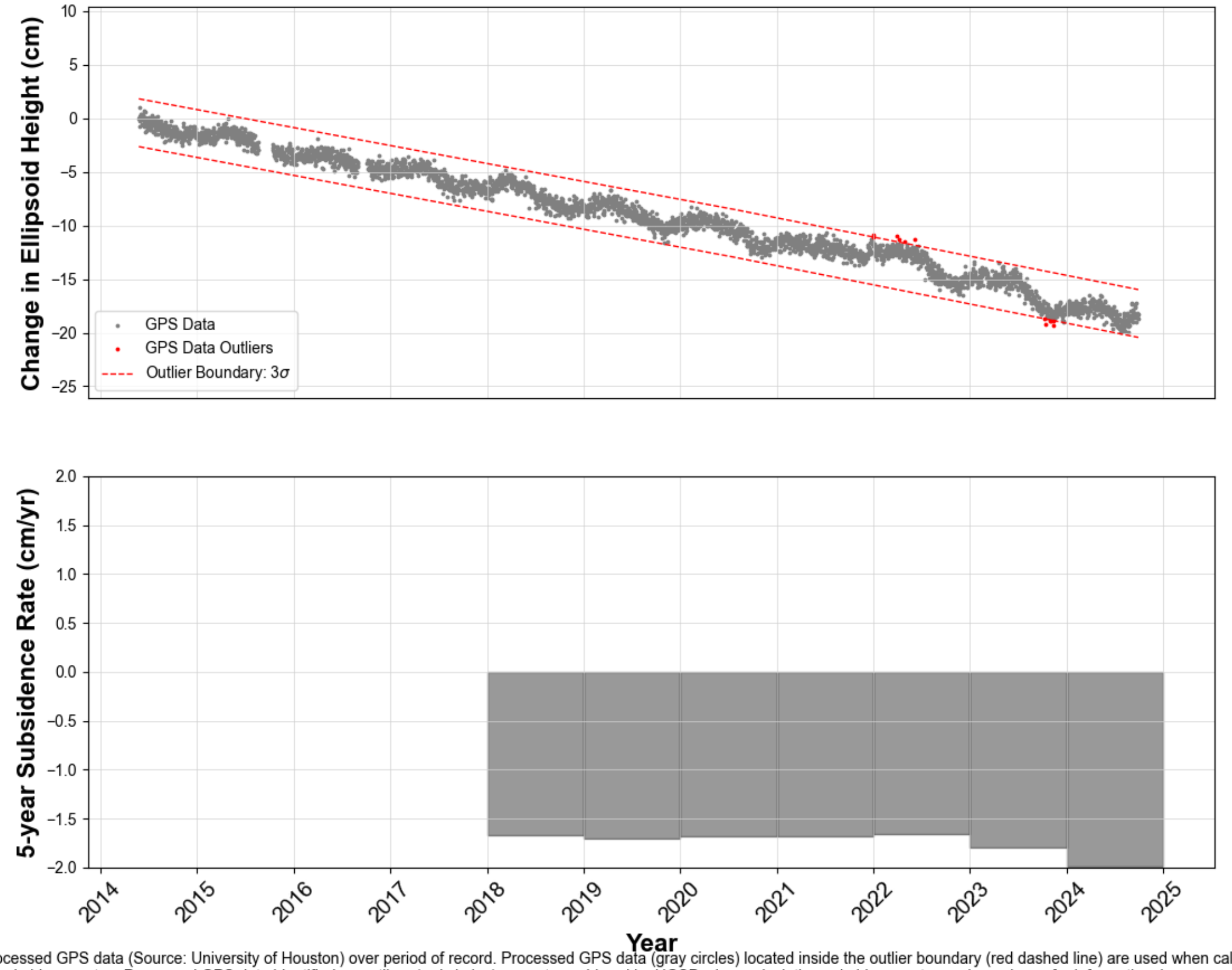


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

MRHK

Katy, TX

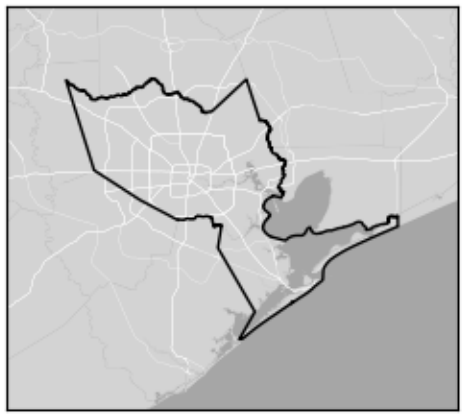


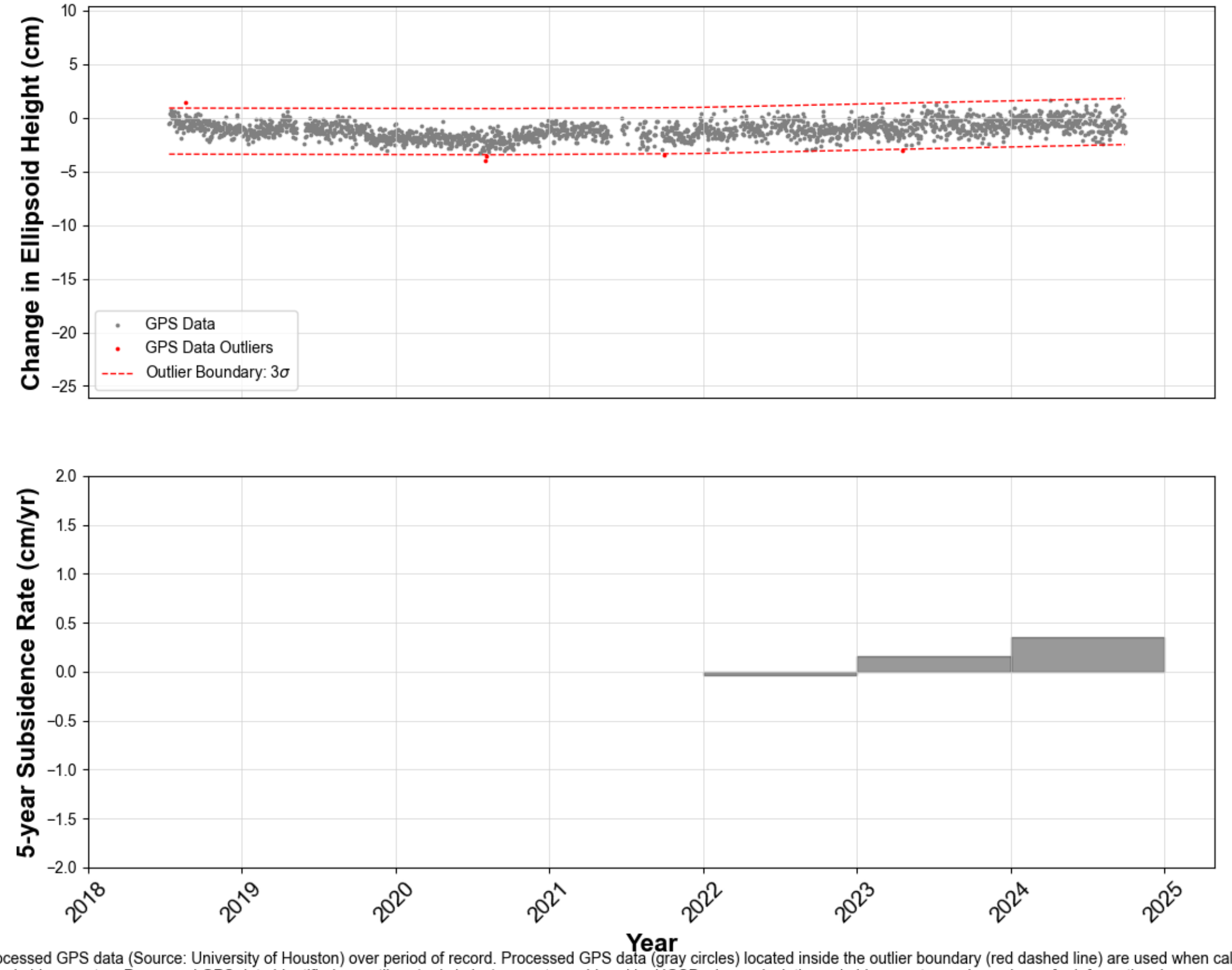


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

N301

Galveston, TX

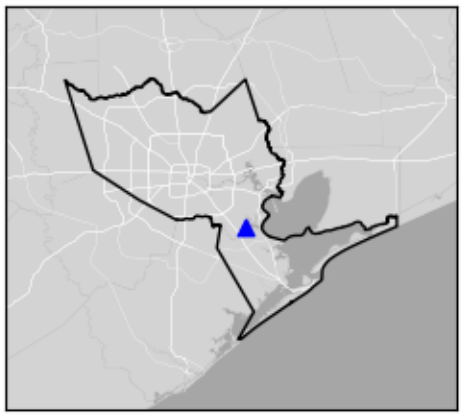


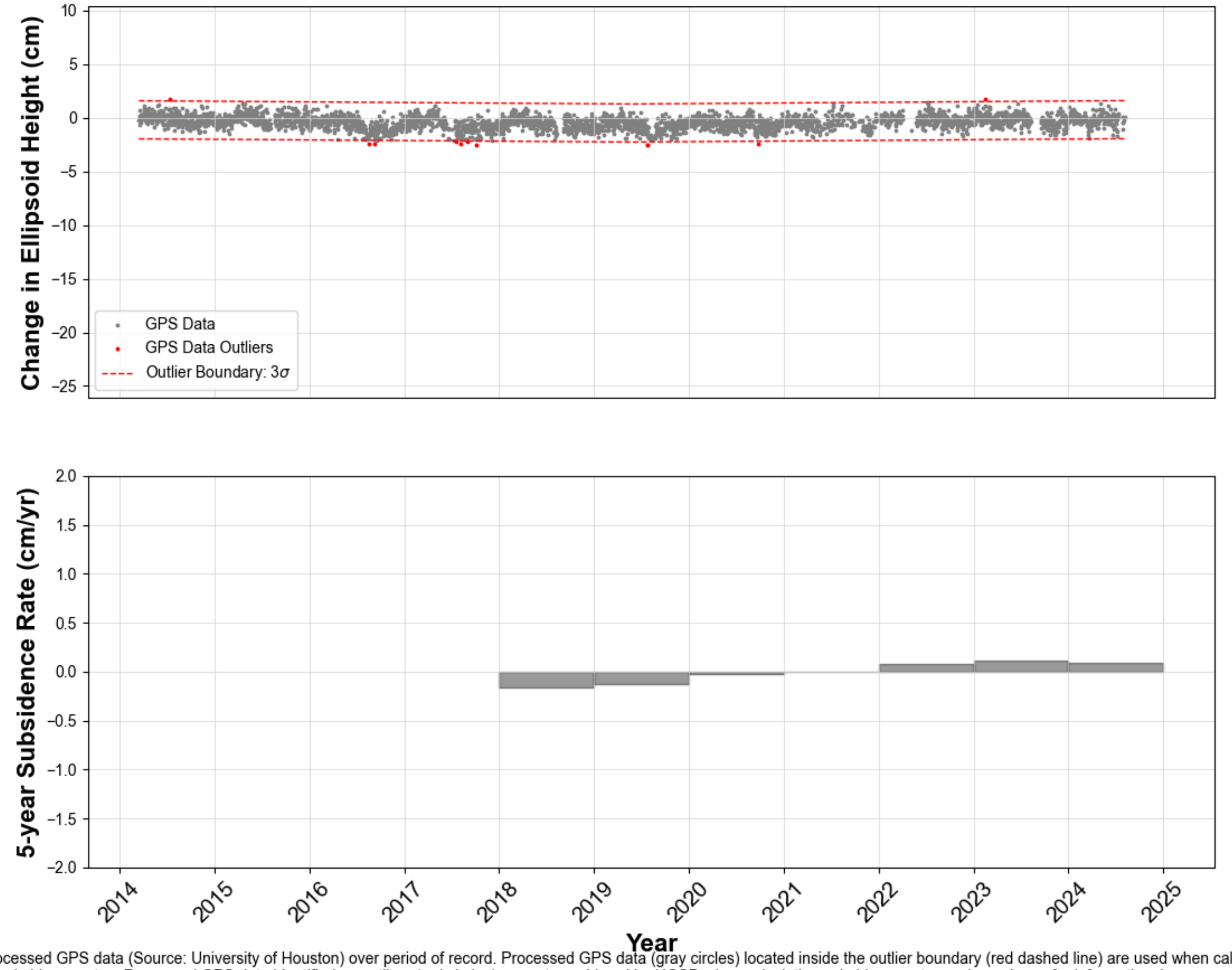


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

NASA

Houston, TX

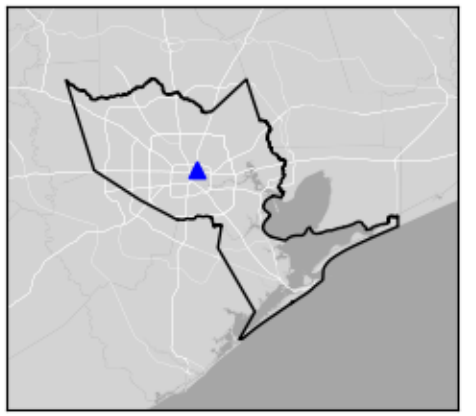


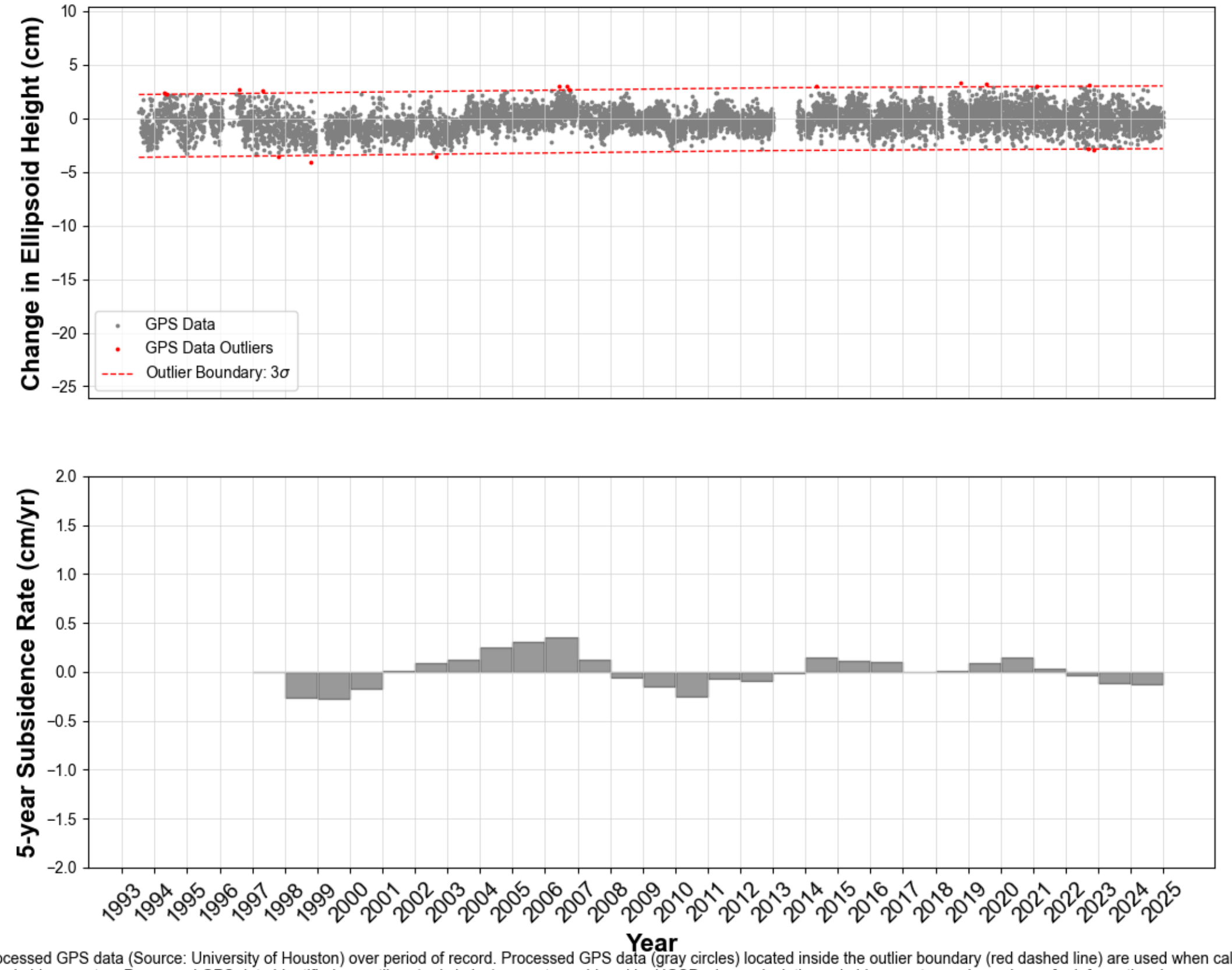


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

NETP

Houston, TX

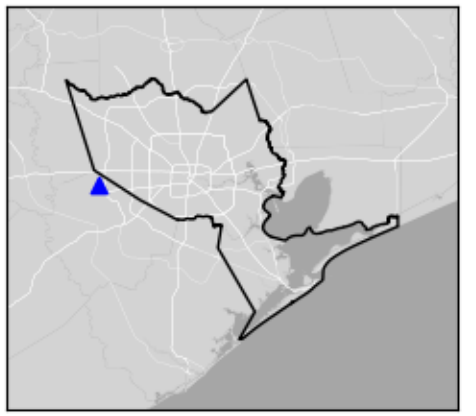


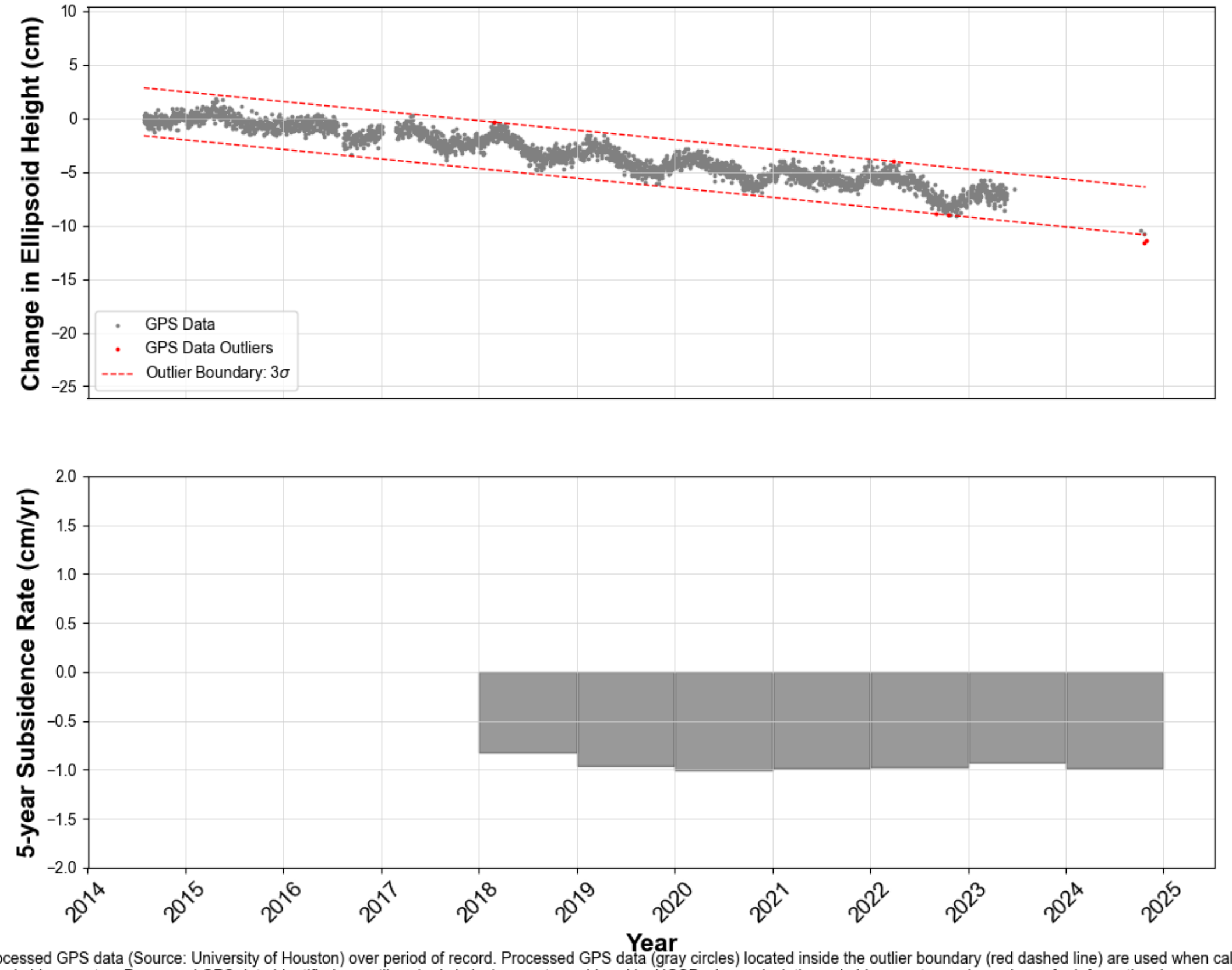


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

OKEK

Katy, TX

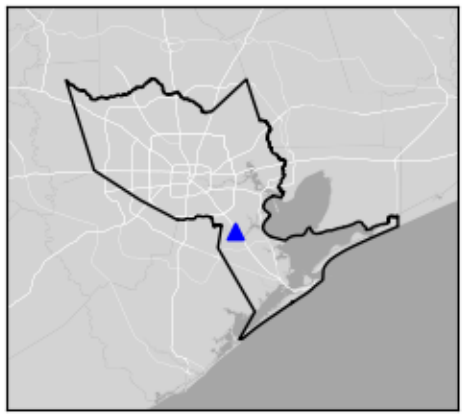


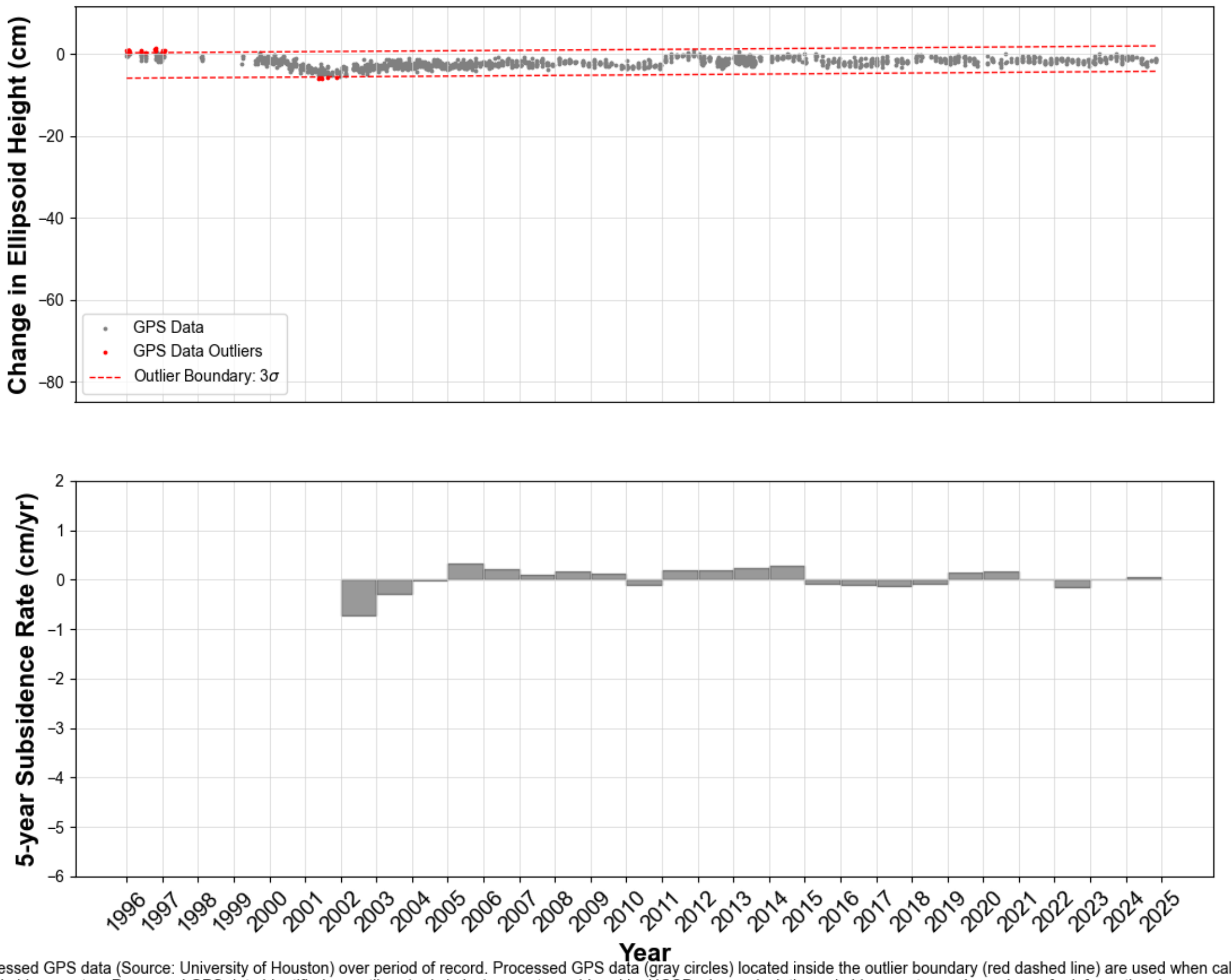


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P000

Friendswood, TX

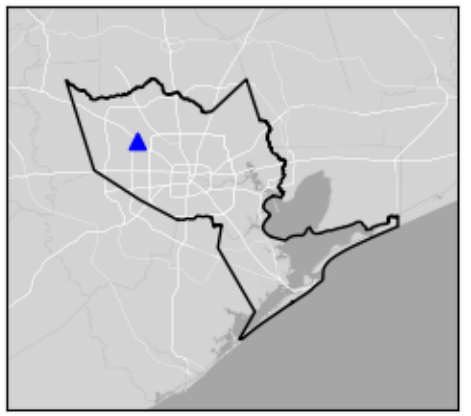


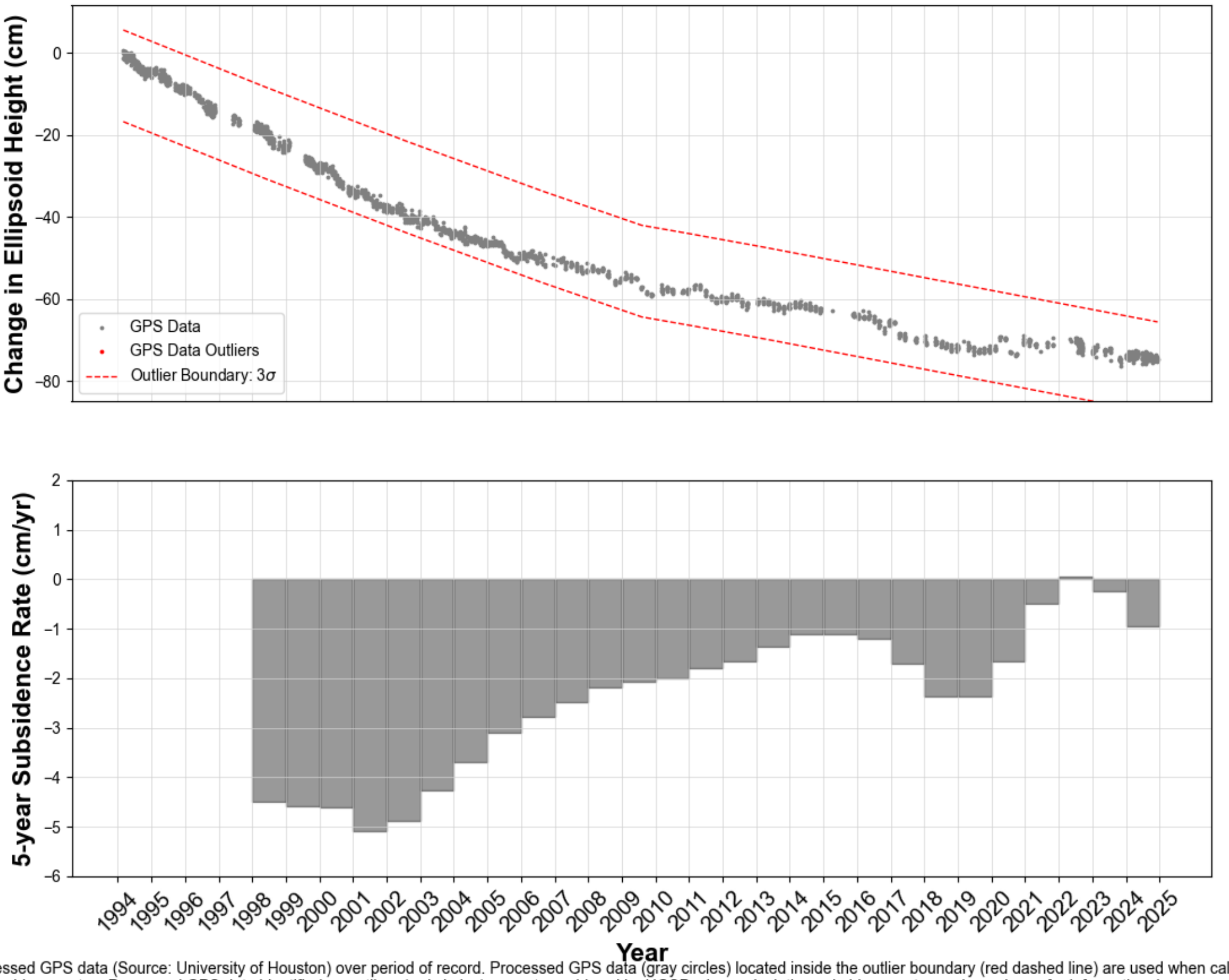


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

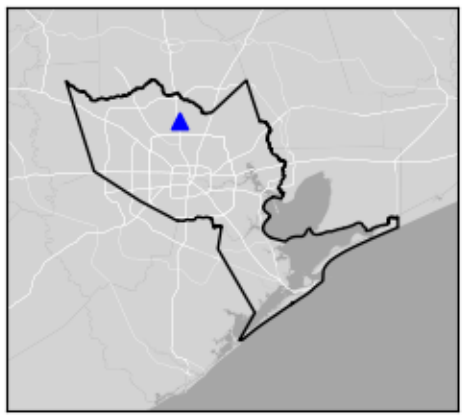
P001

Houston, TX



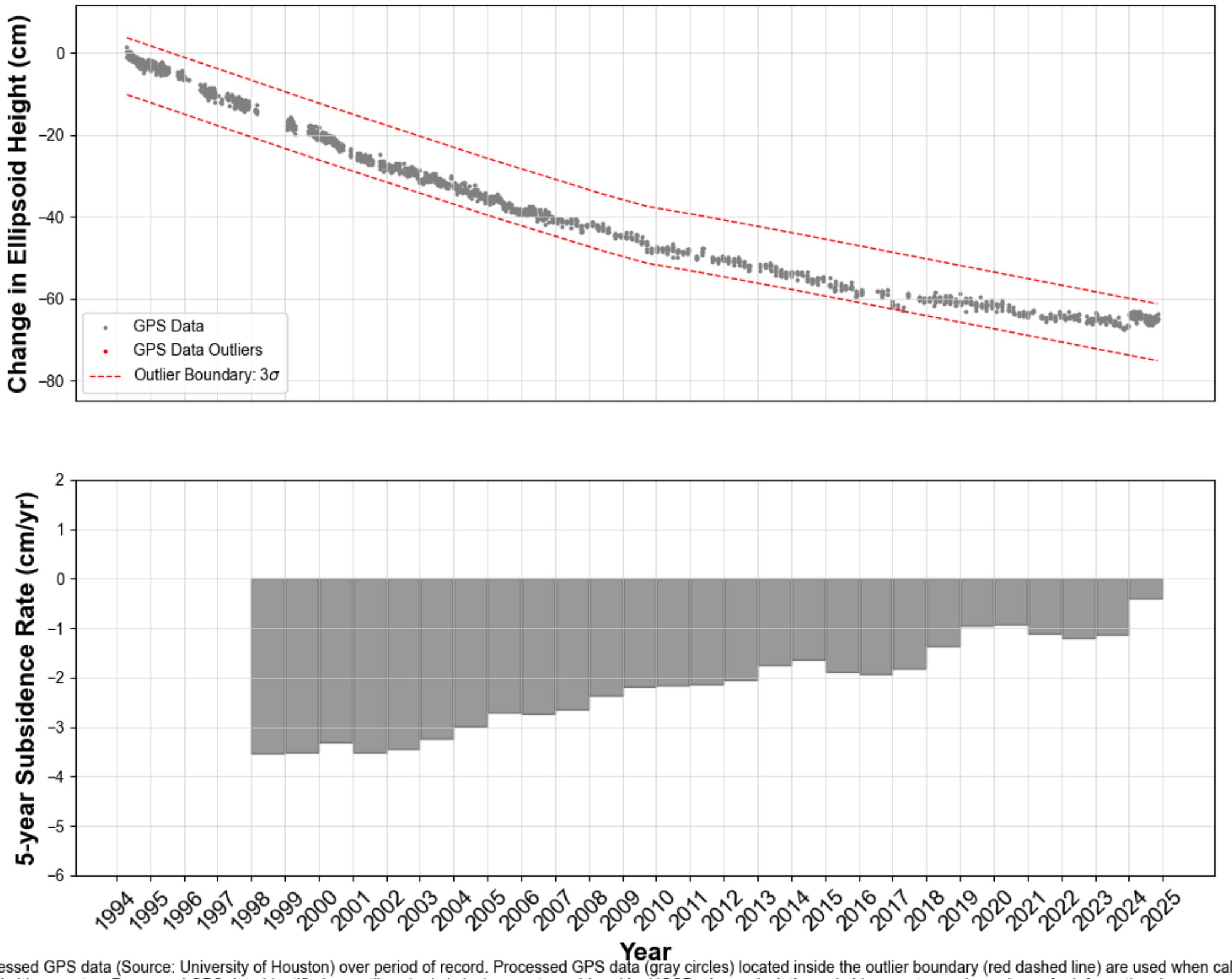


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P002

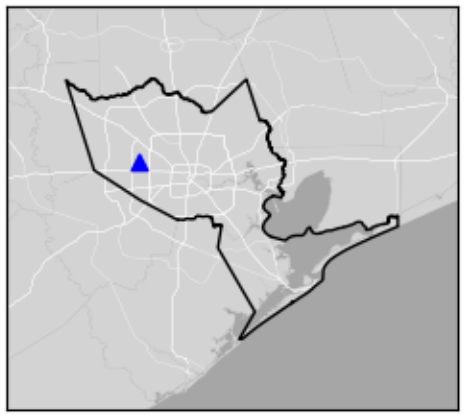
Houston, TX

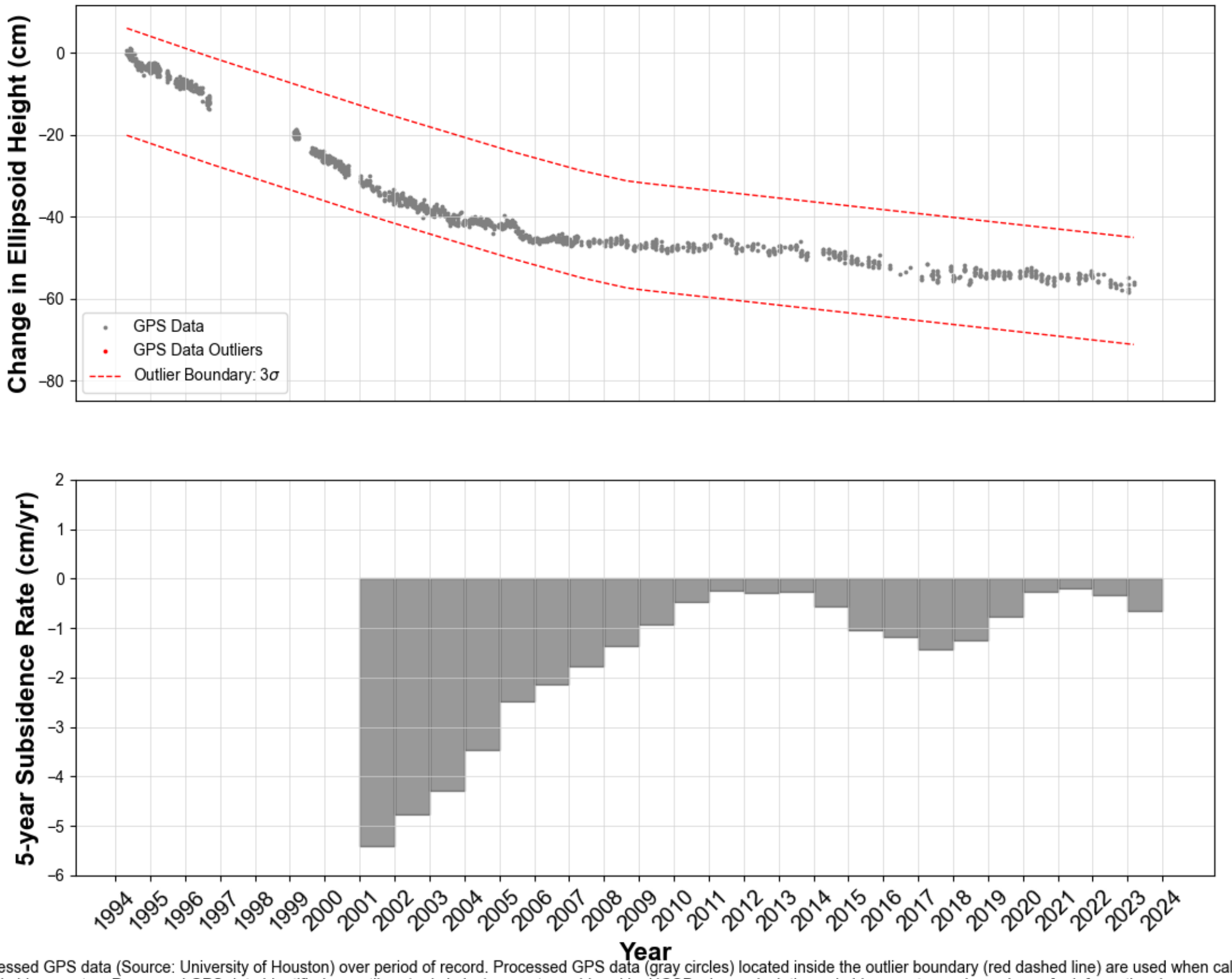


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P003

Houston, TX

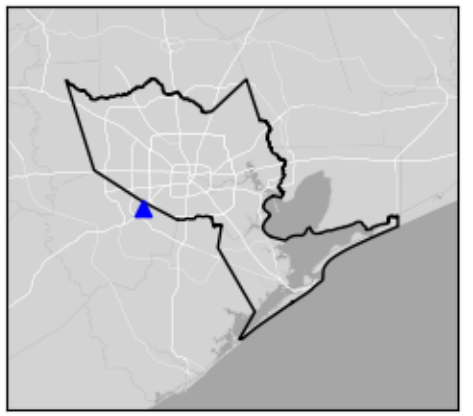


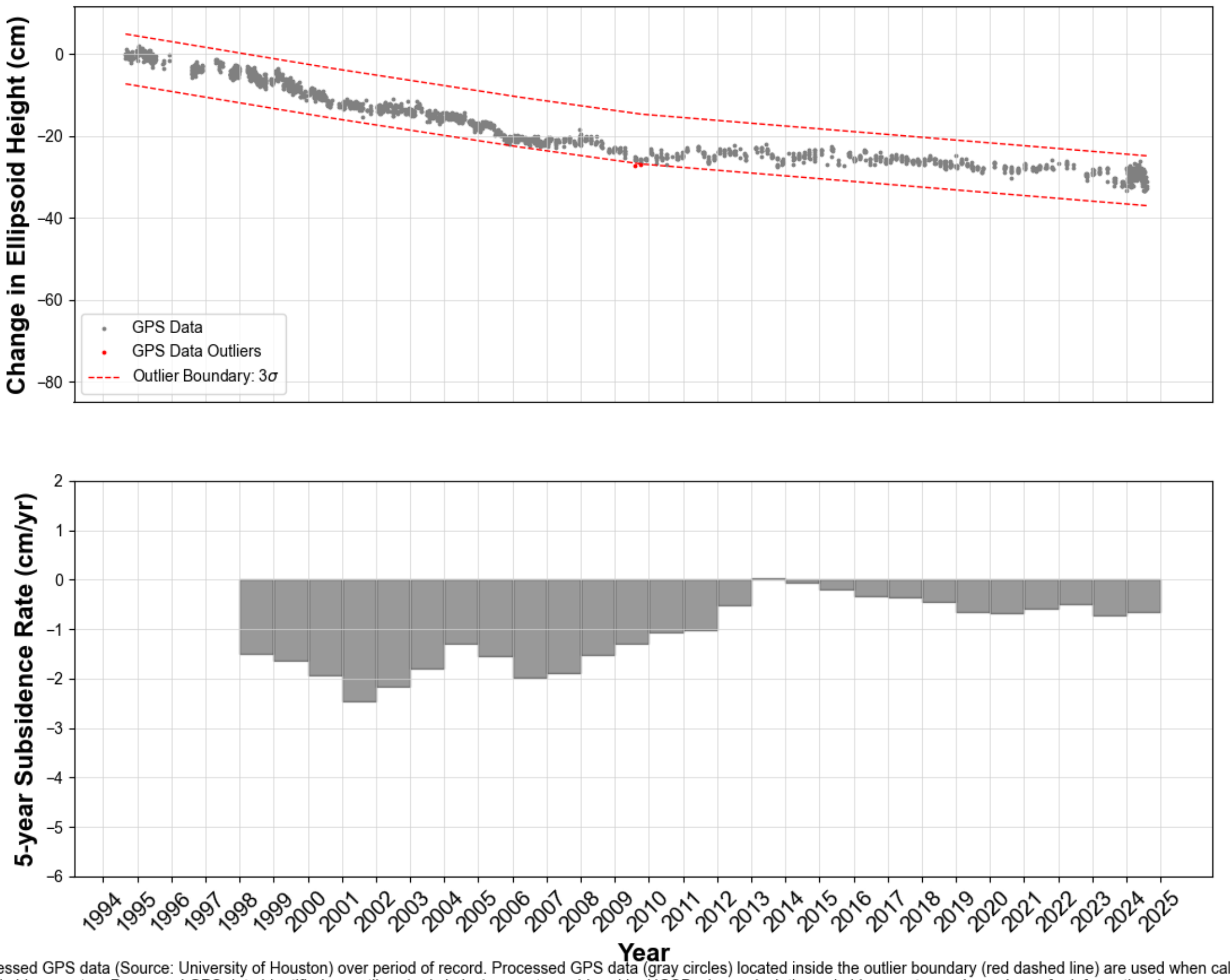


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

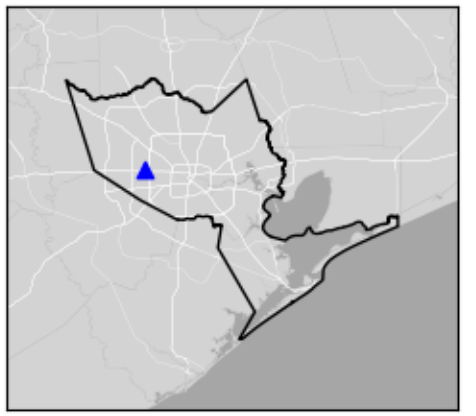
P004

Sugar Land, TX



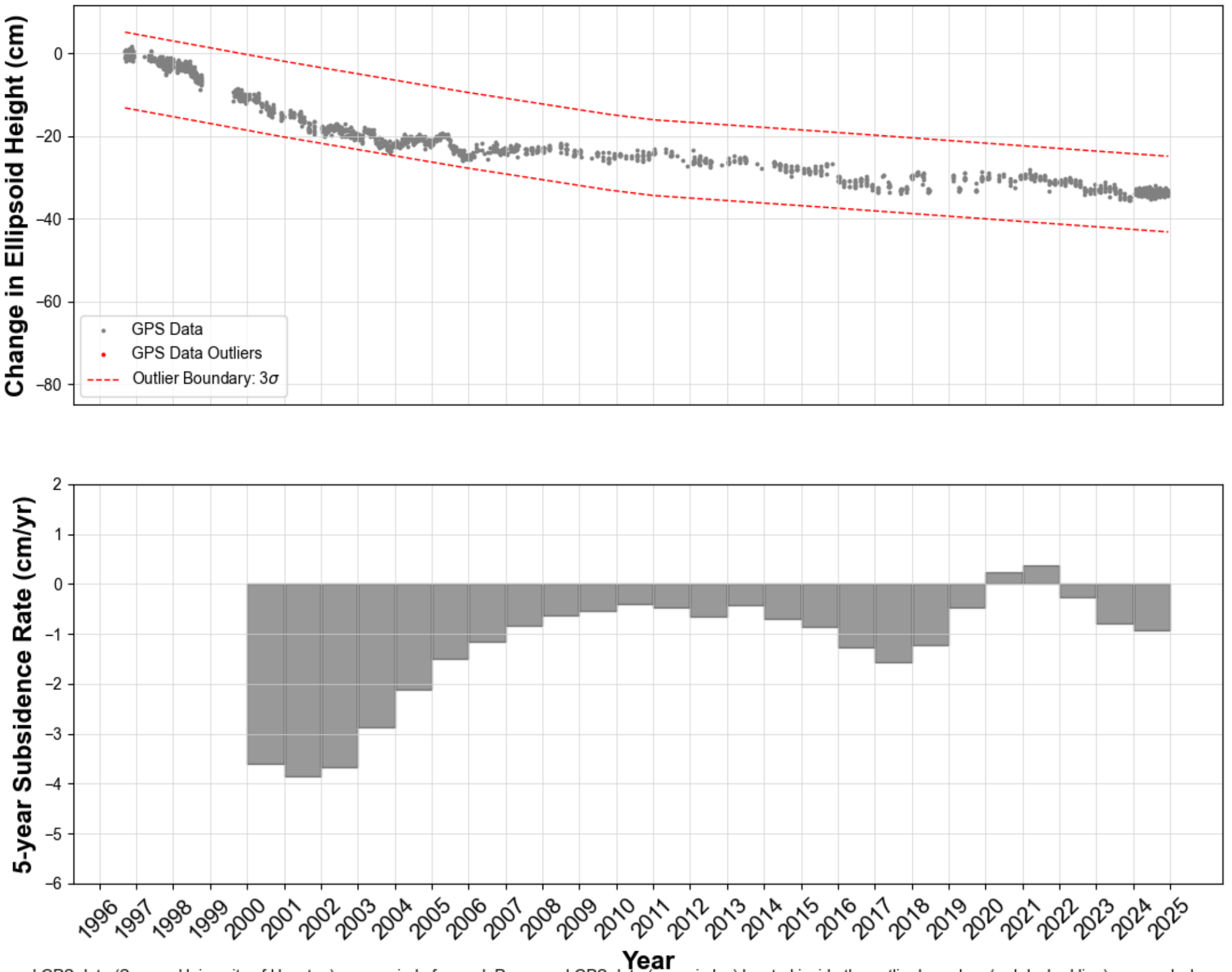


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P005

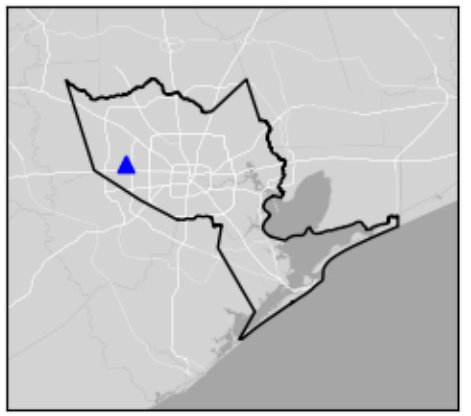
Houston, TX

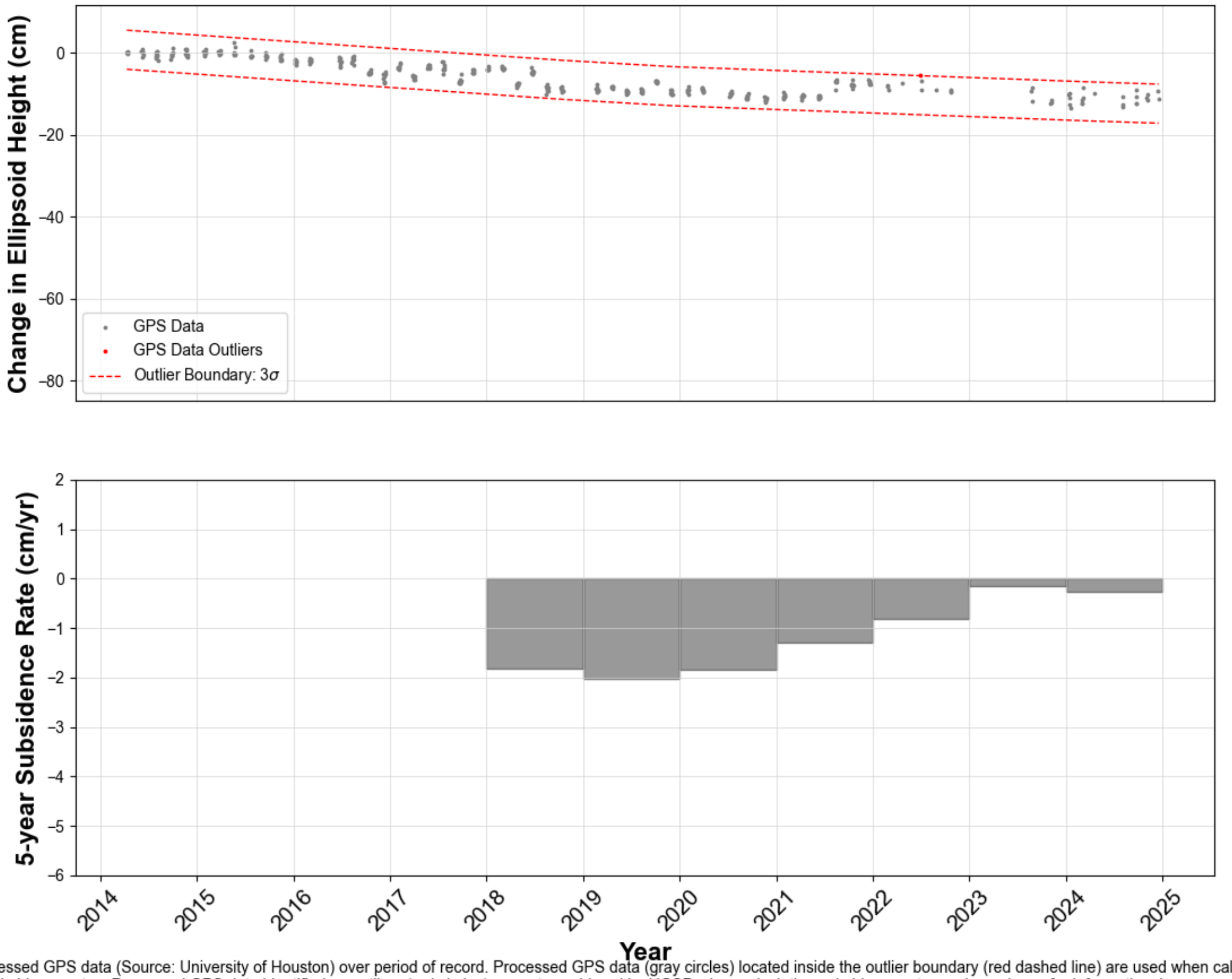


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P006

Houston, TX

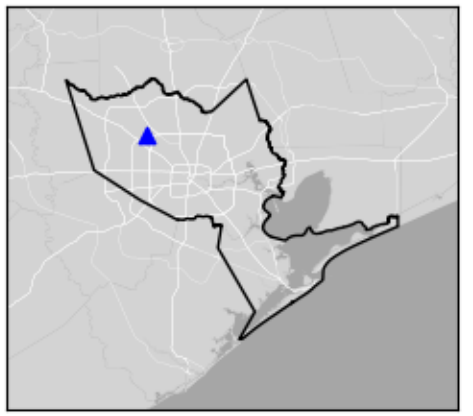


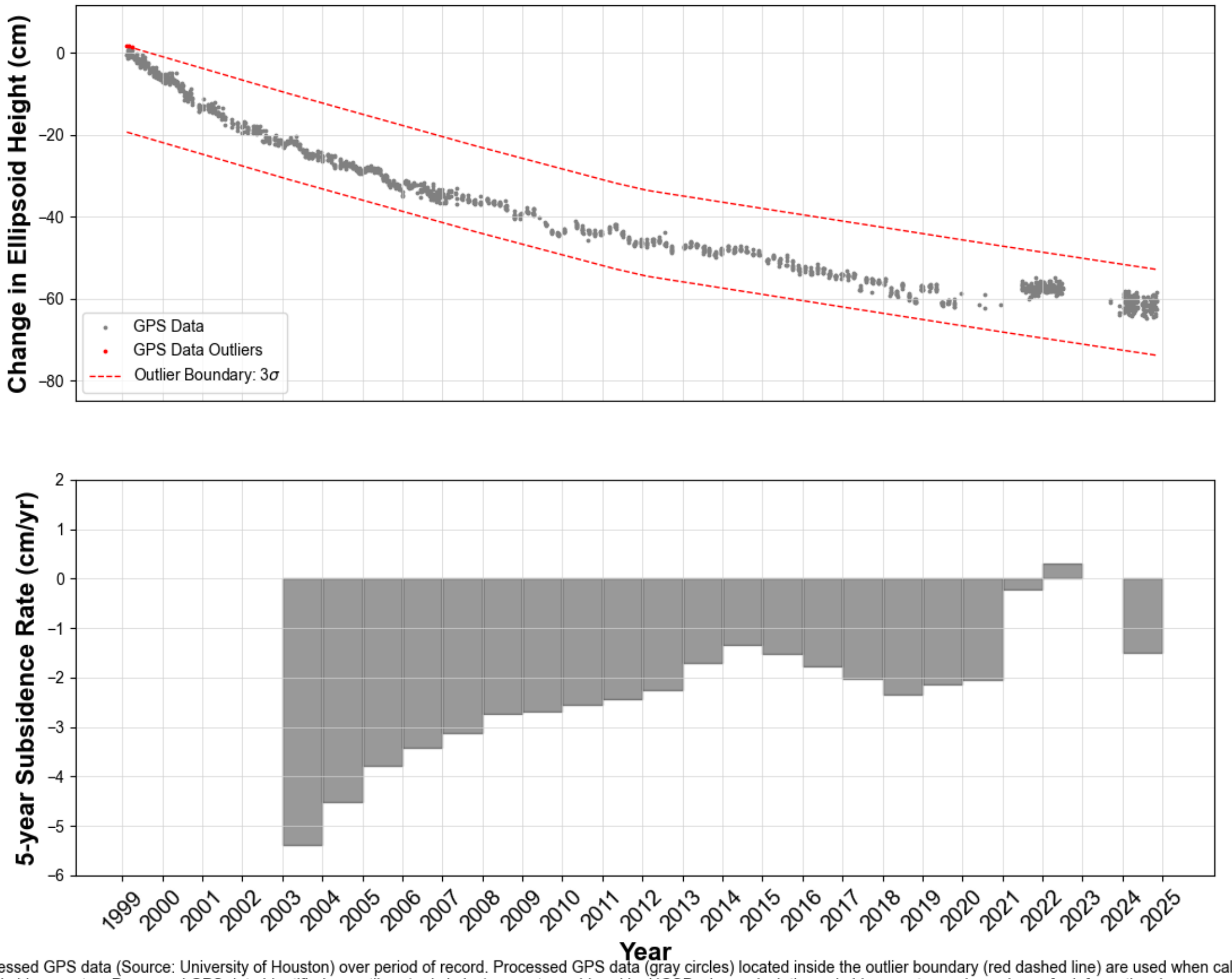


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P007

Houston, TX

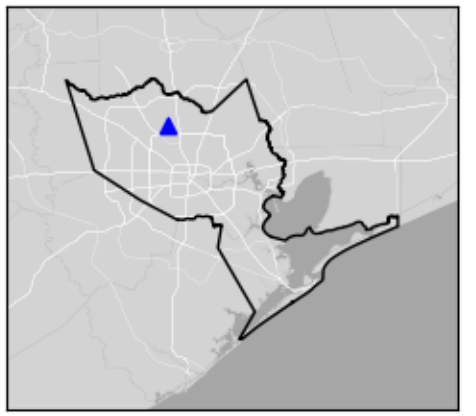


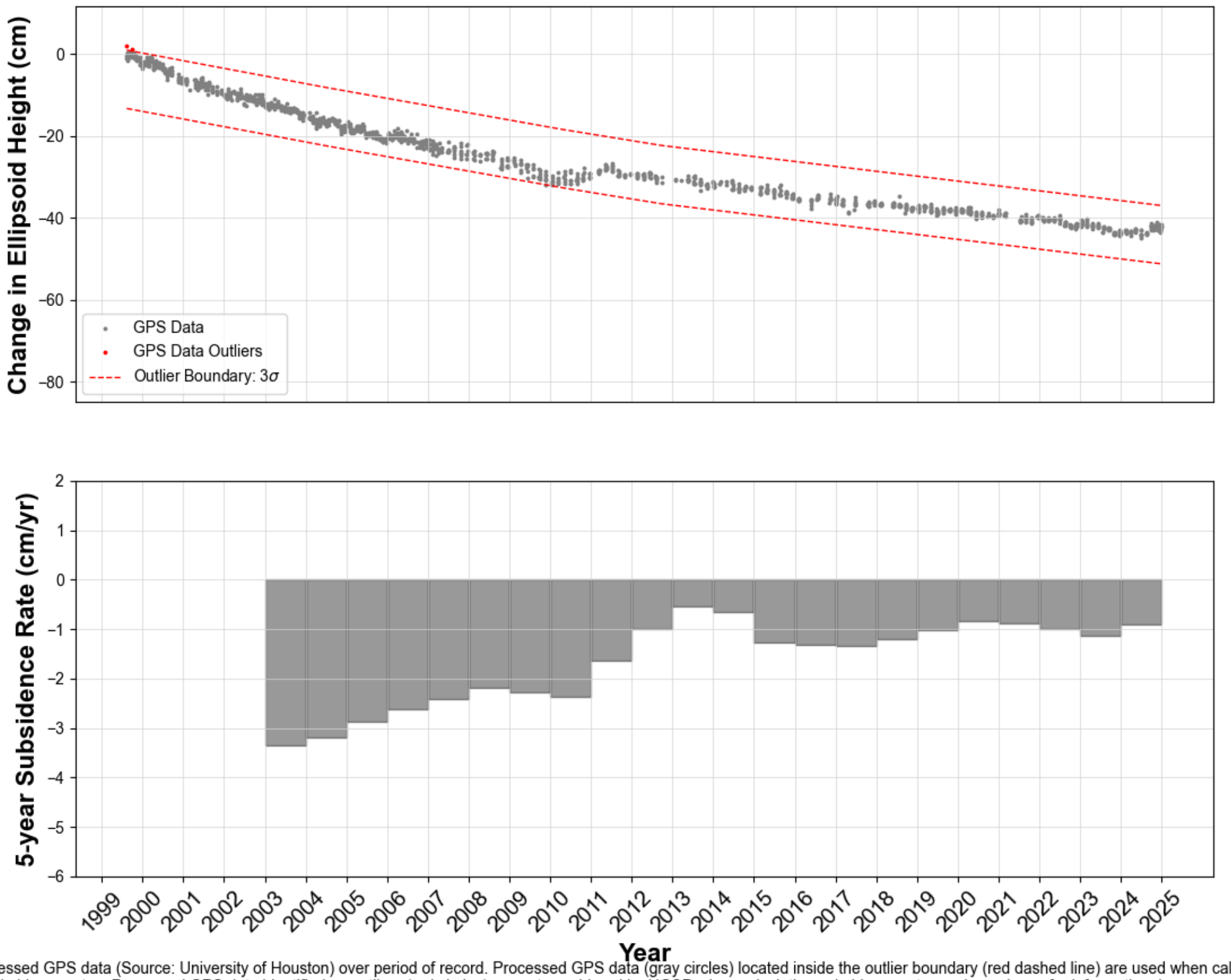


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P008

Houston, TX

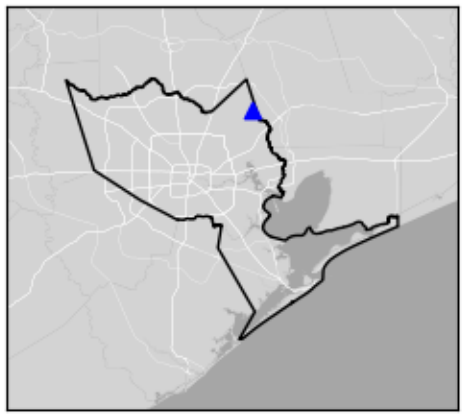


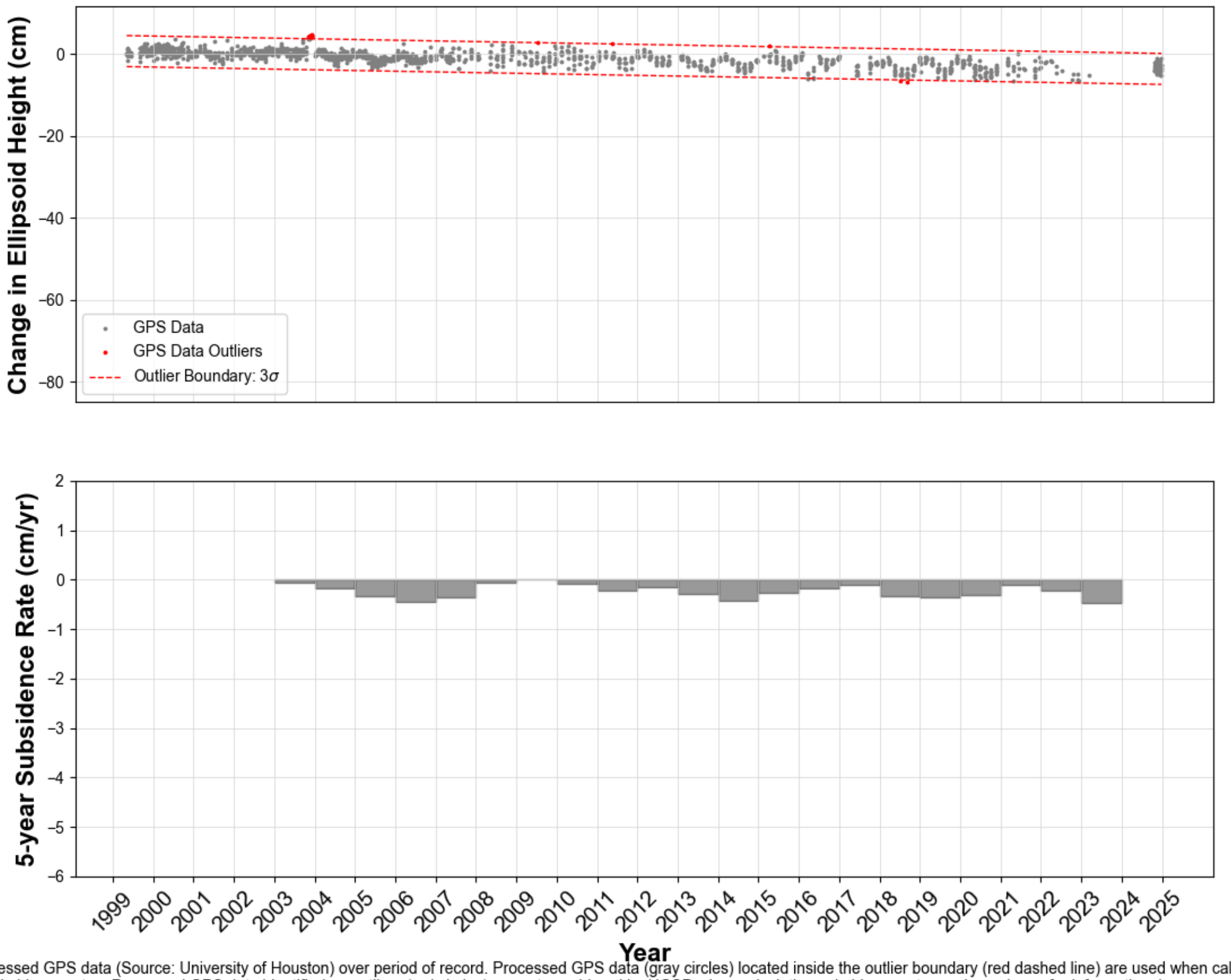


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P009

Huffman, TX

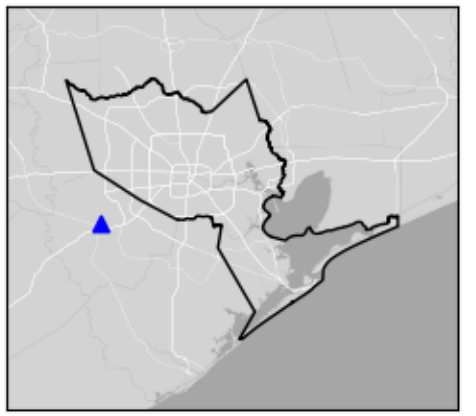


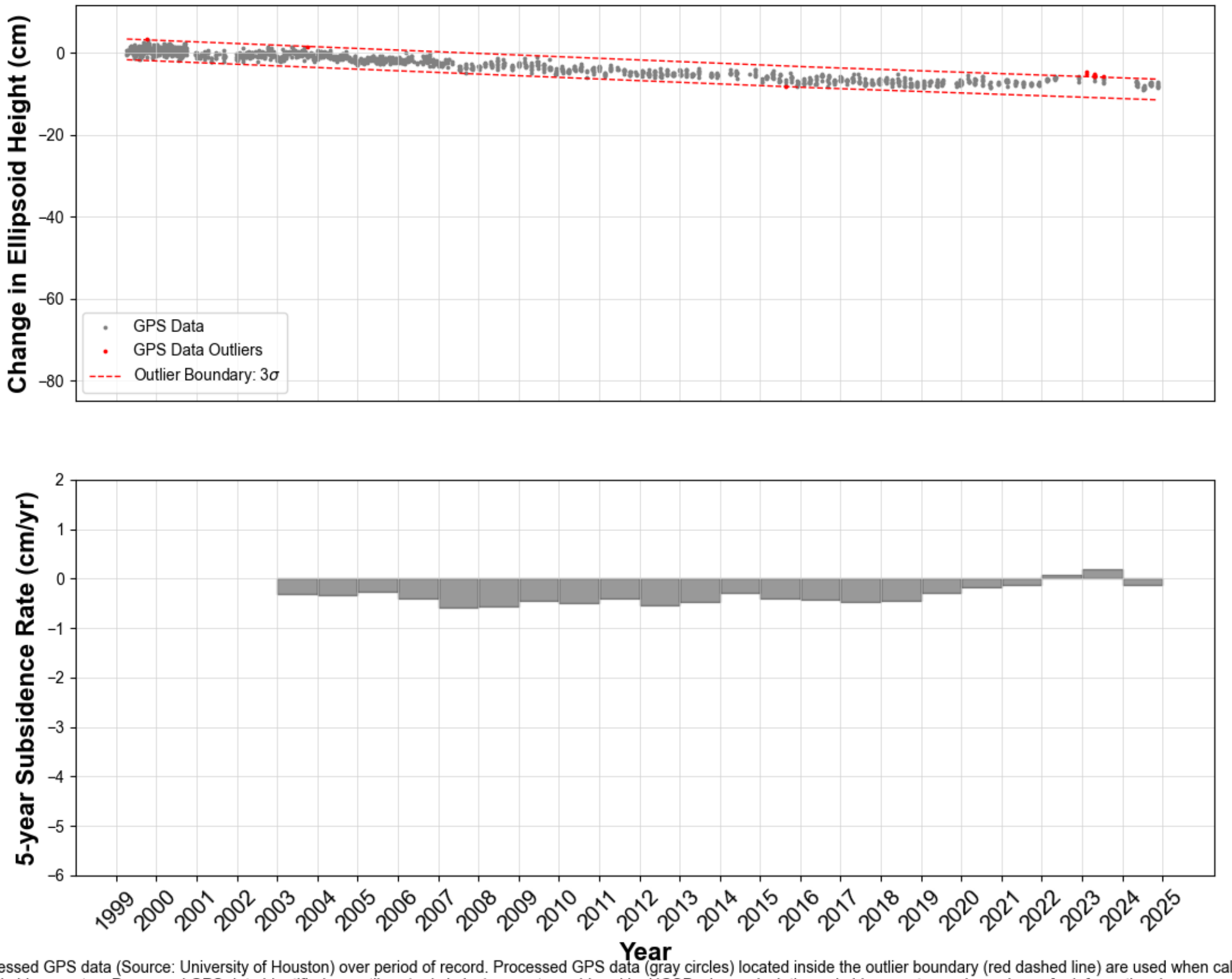


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P010

Rosenberg, TX

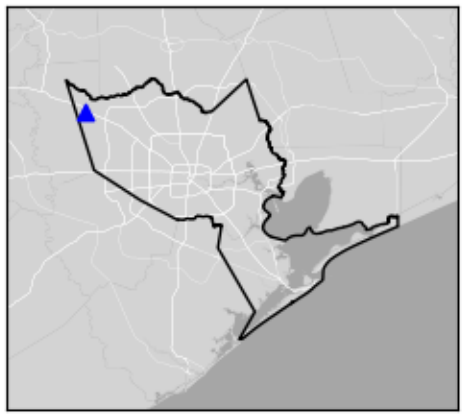


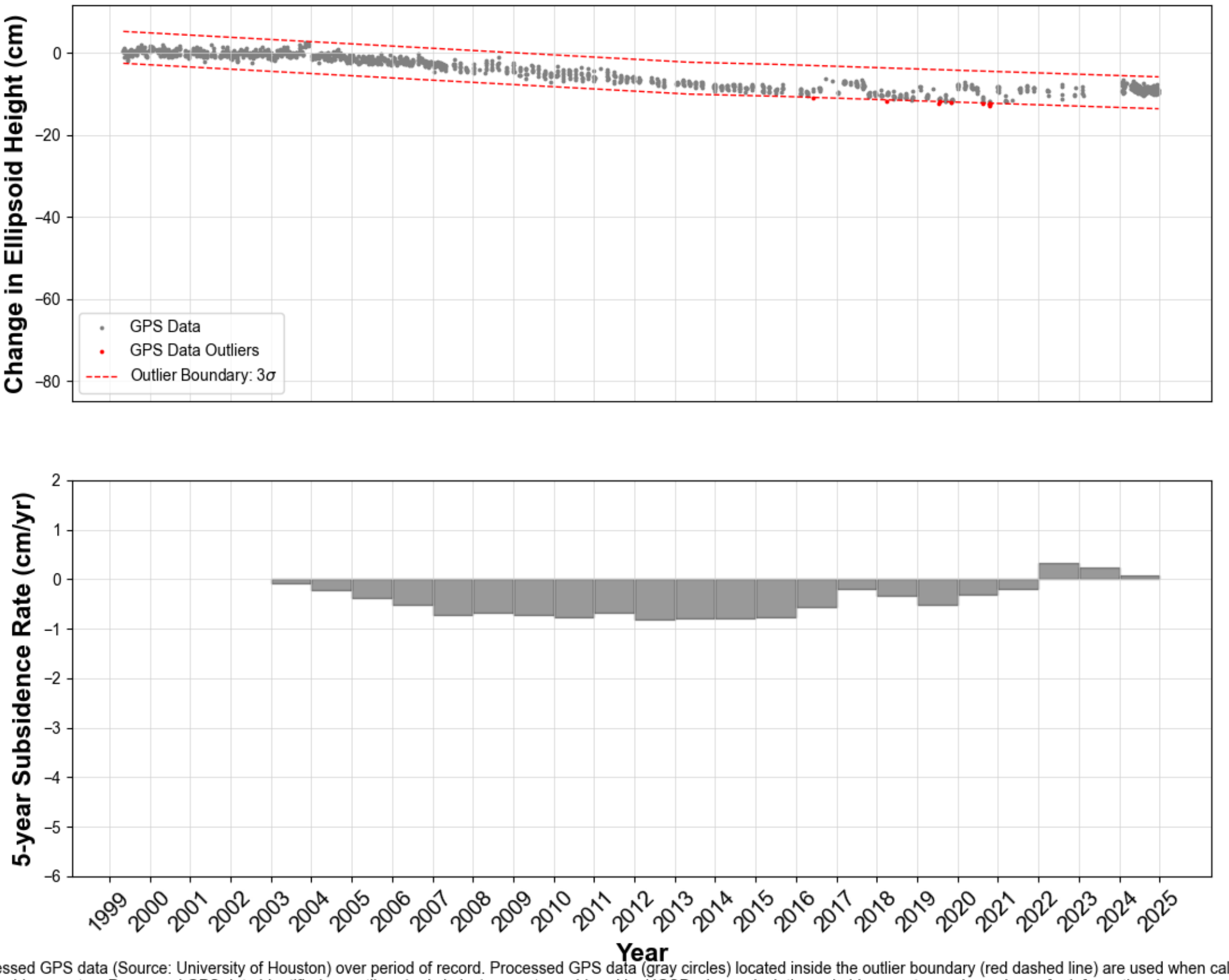


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P011

Hockley, TX

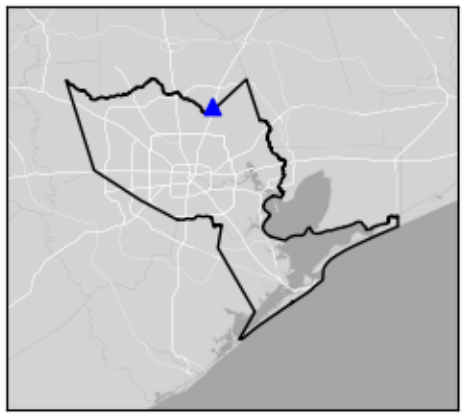


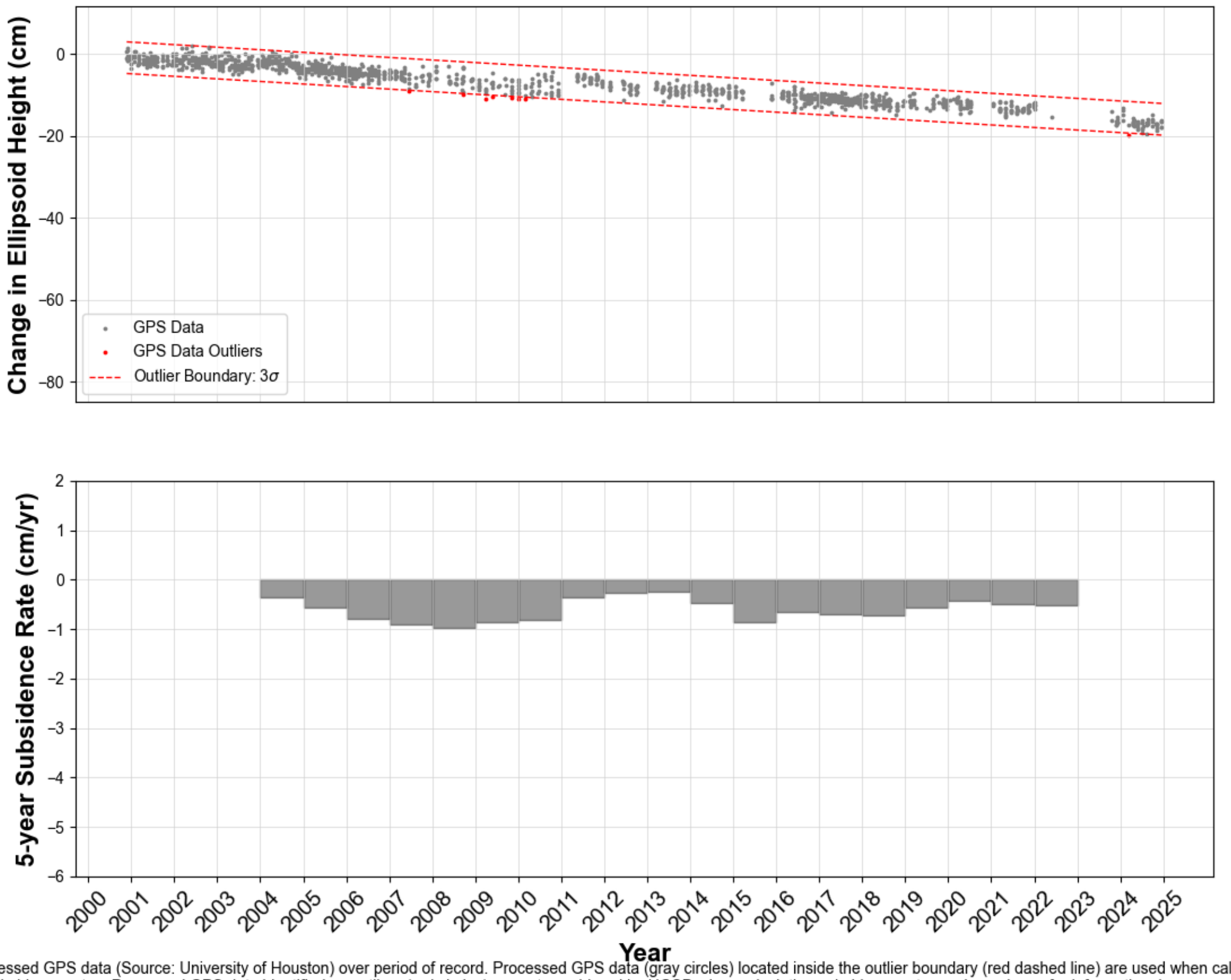


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

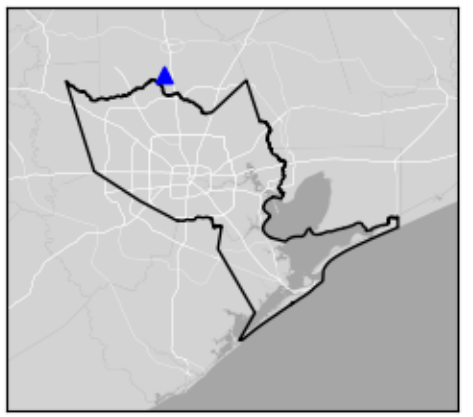
P012

Porter, TX



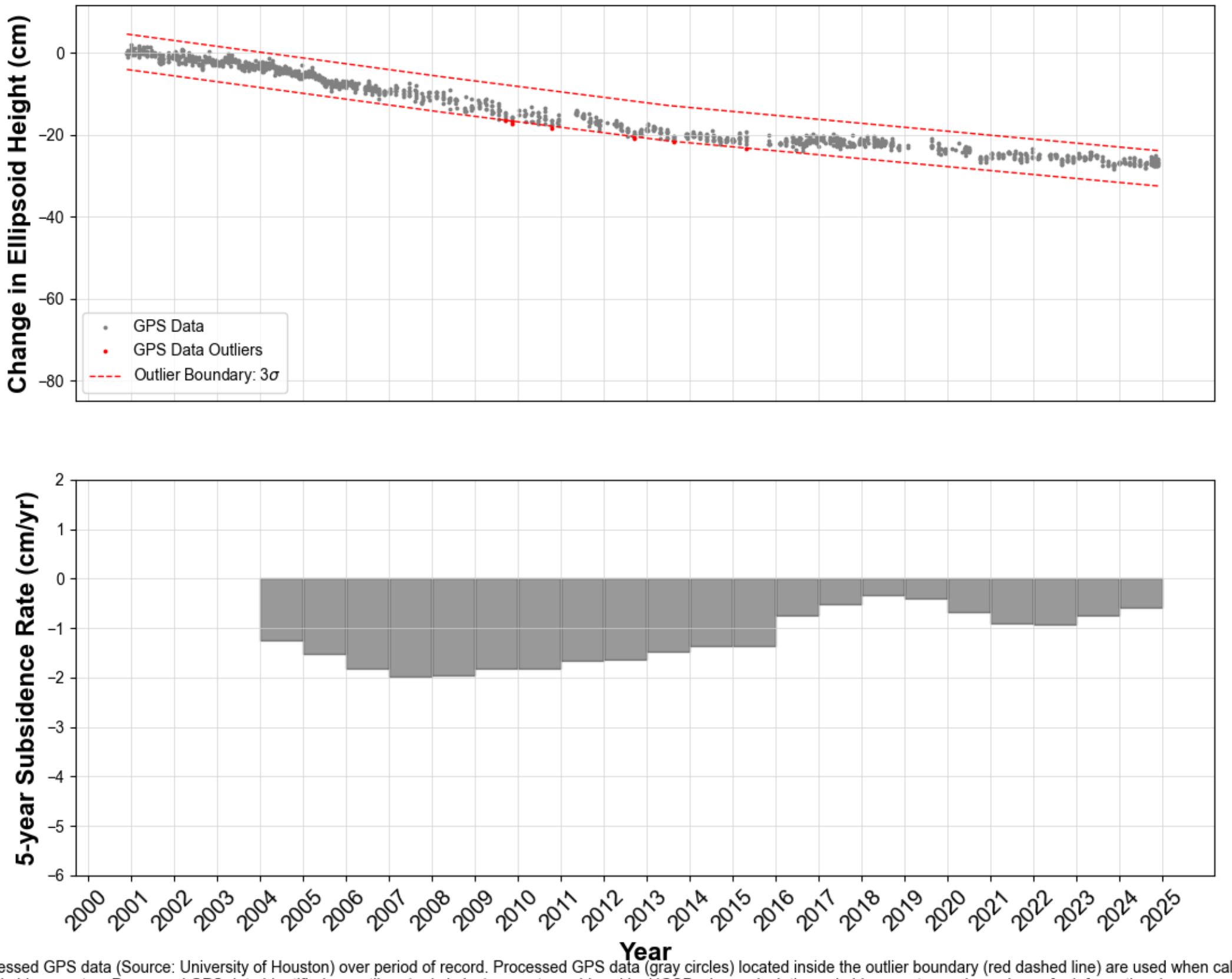


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P013

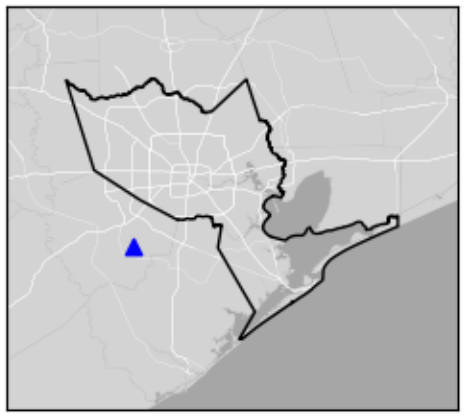
The Woodlands, TX

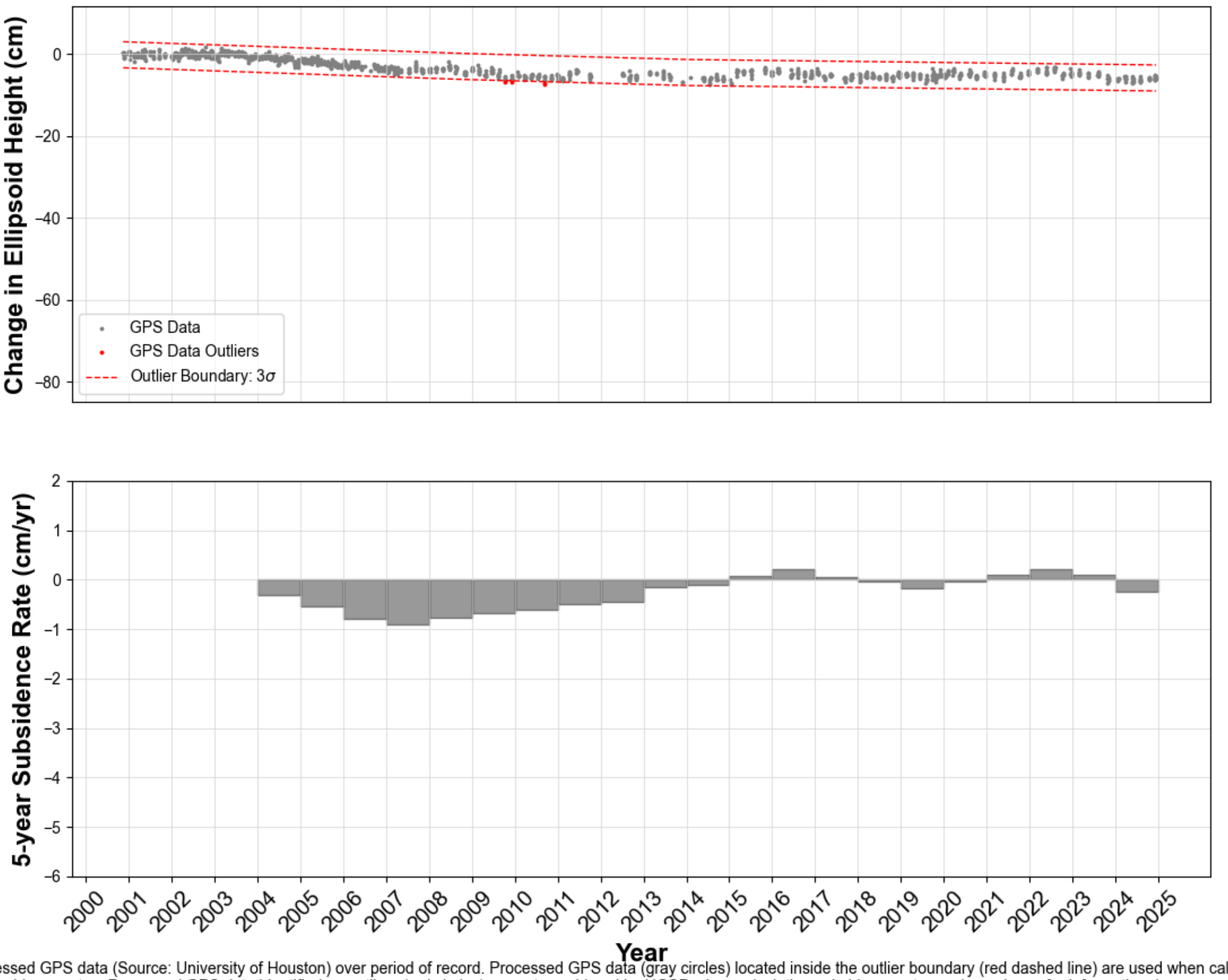


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P014

Thompsons, TX

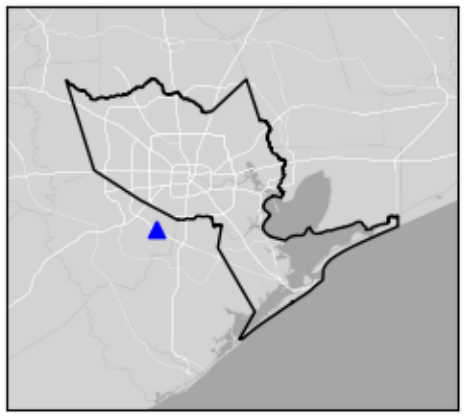


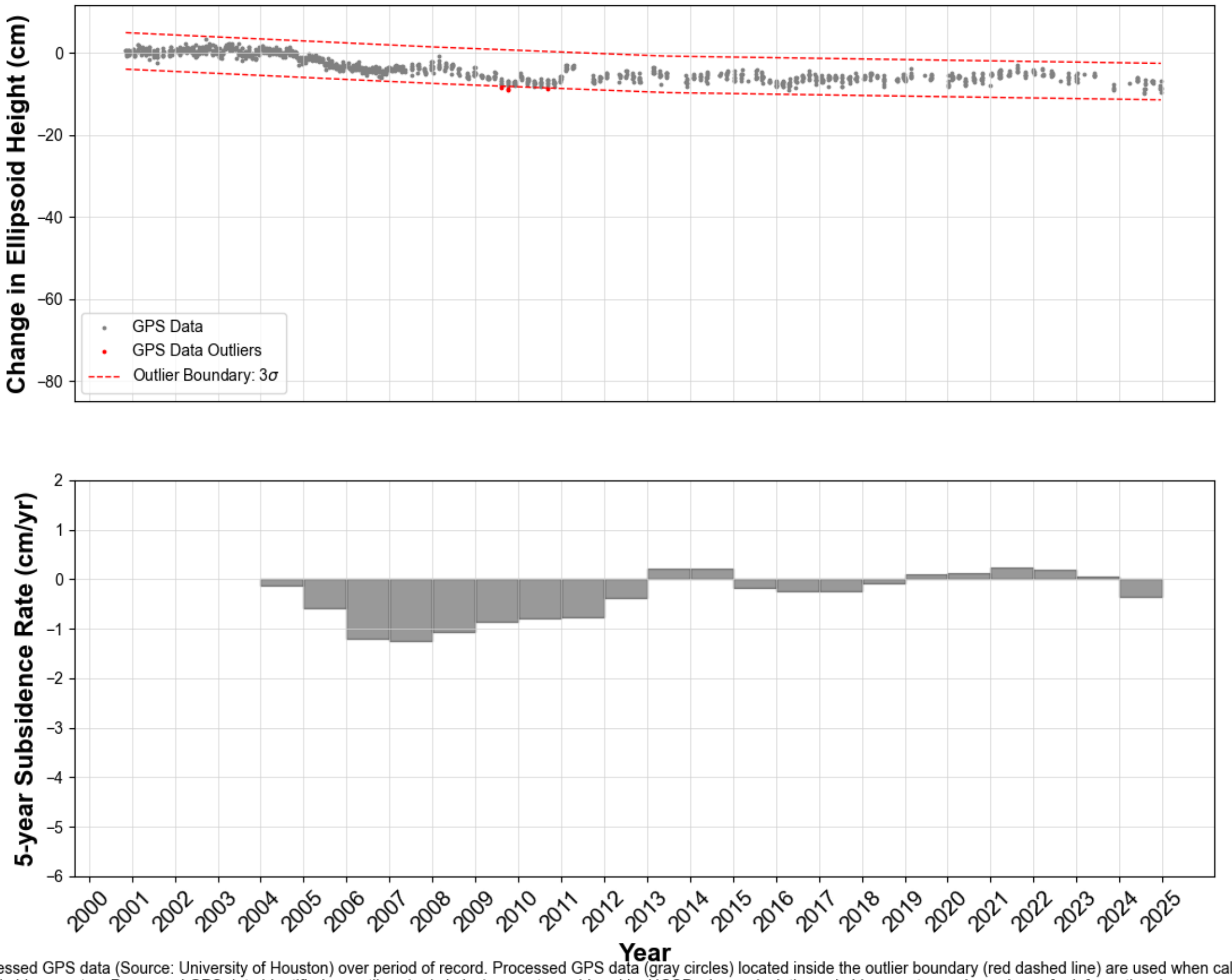


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P016

Missouri City, TX

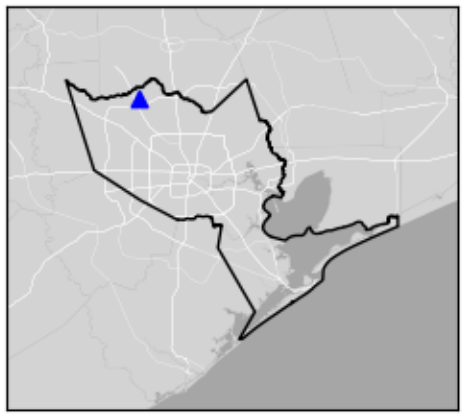


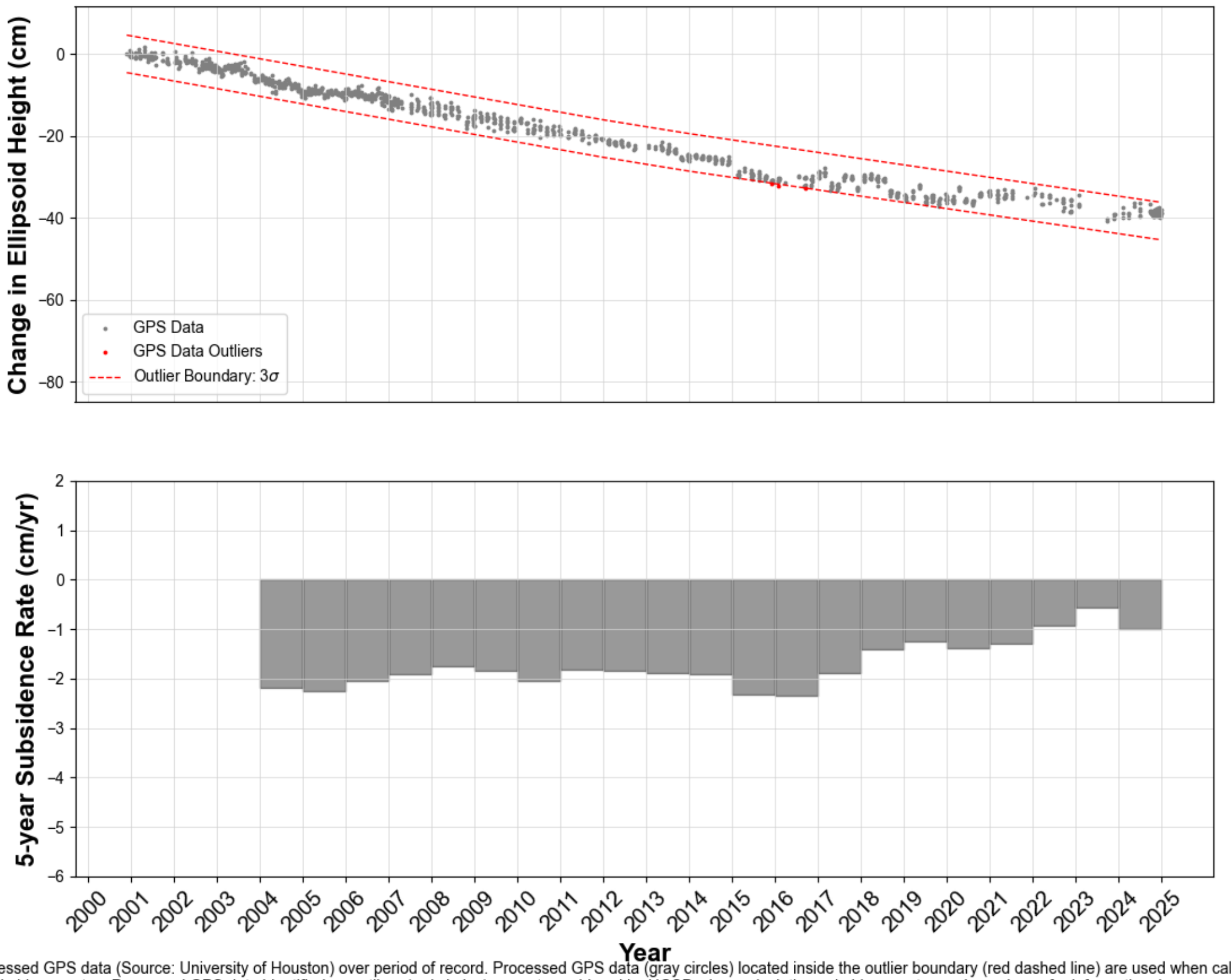


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

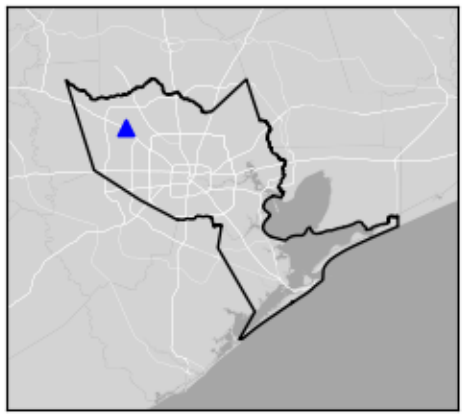
P017

Tomball, TX



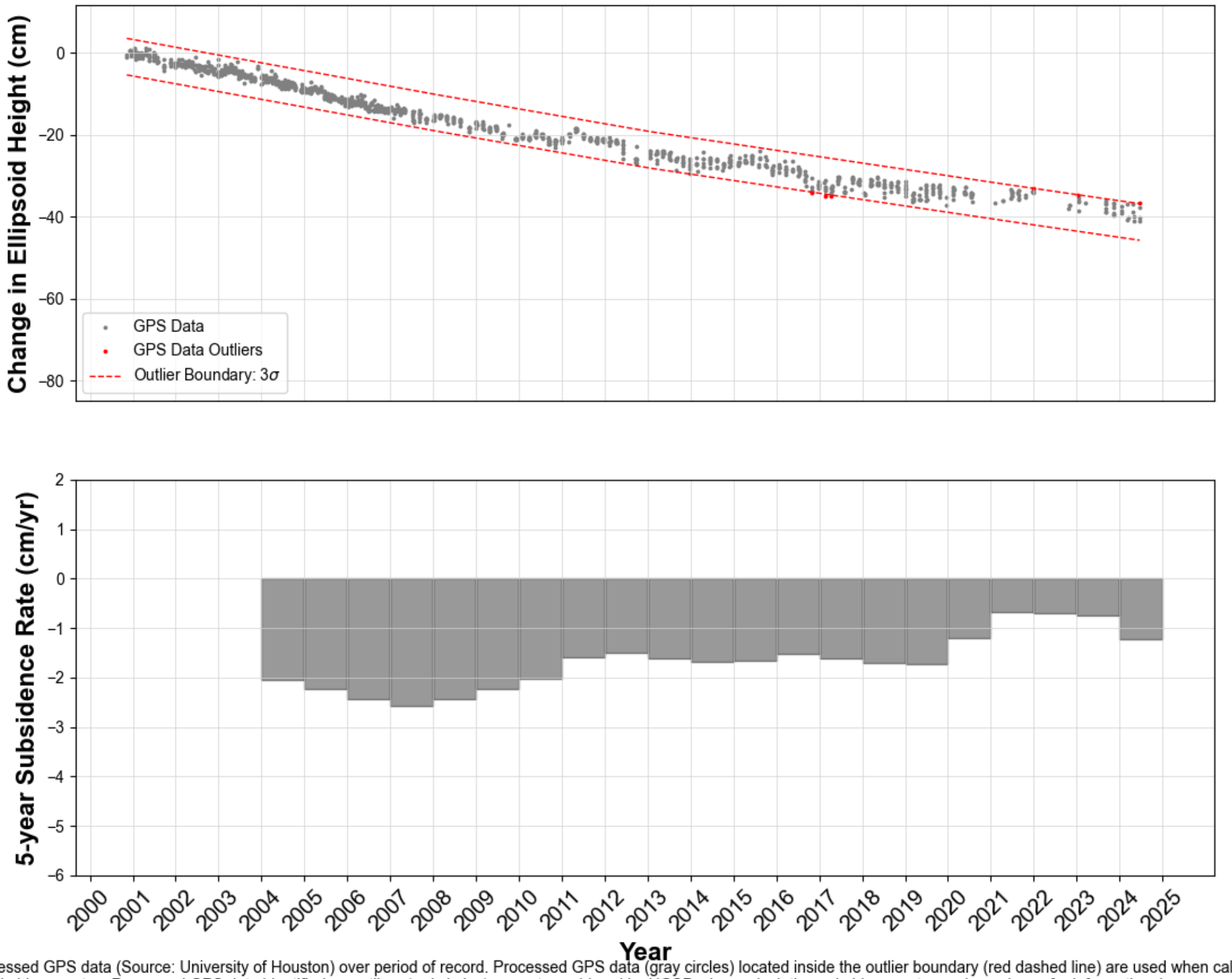


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P018

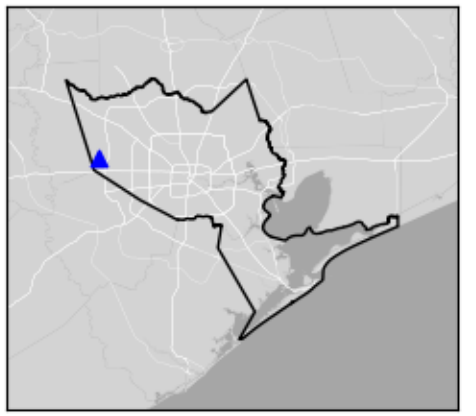
Cypress, TX

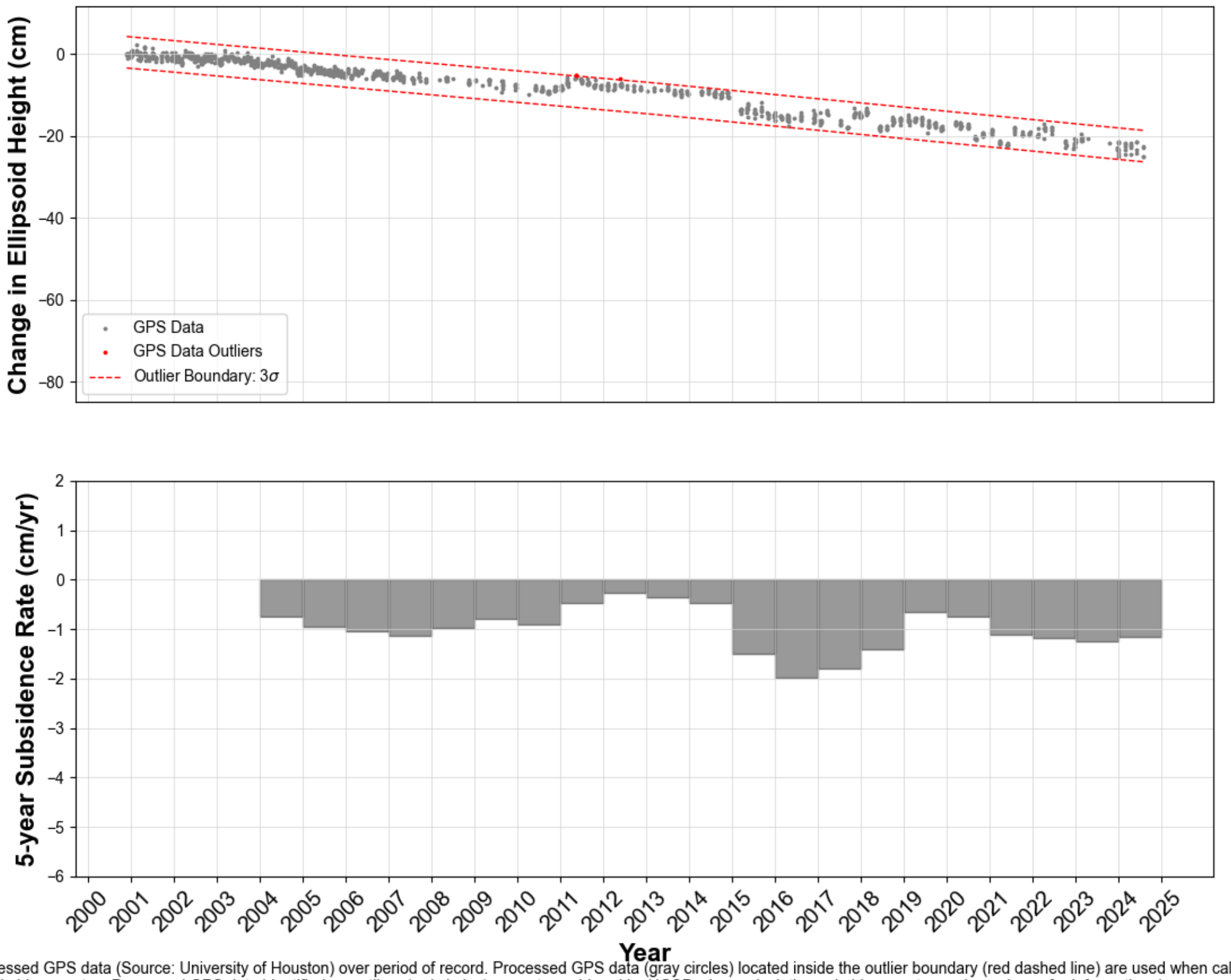


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P019

Katy, TX

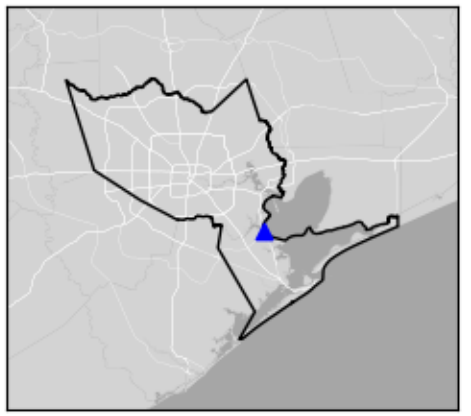


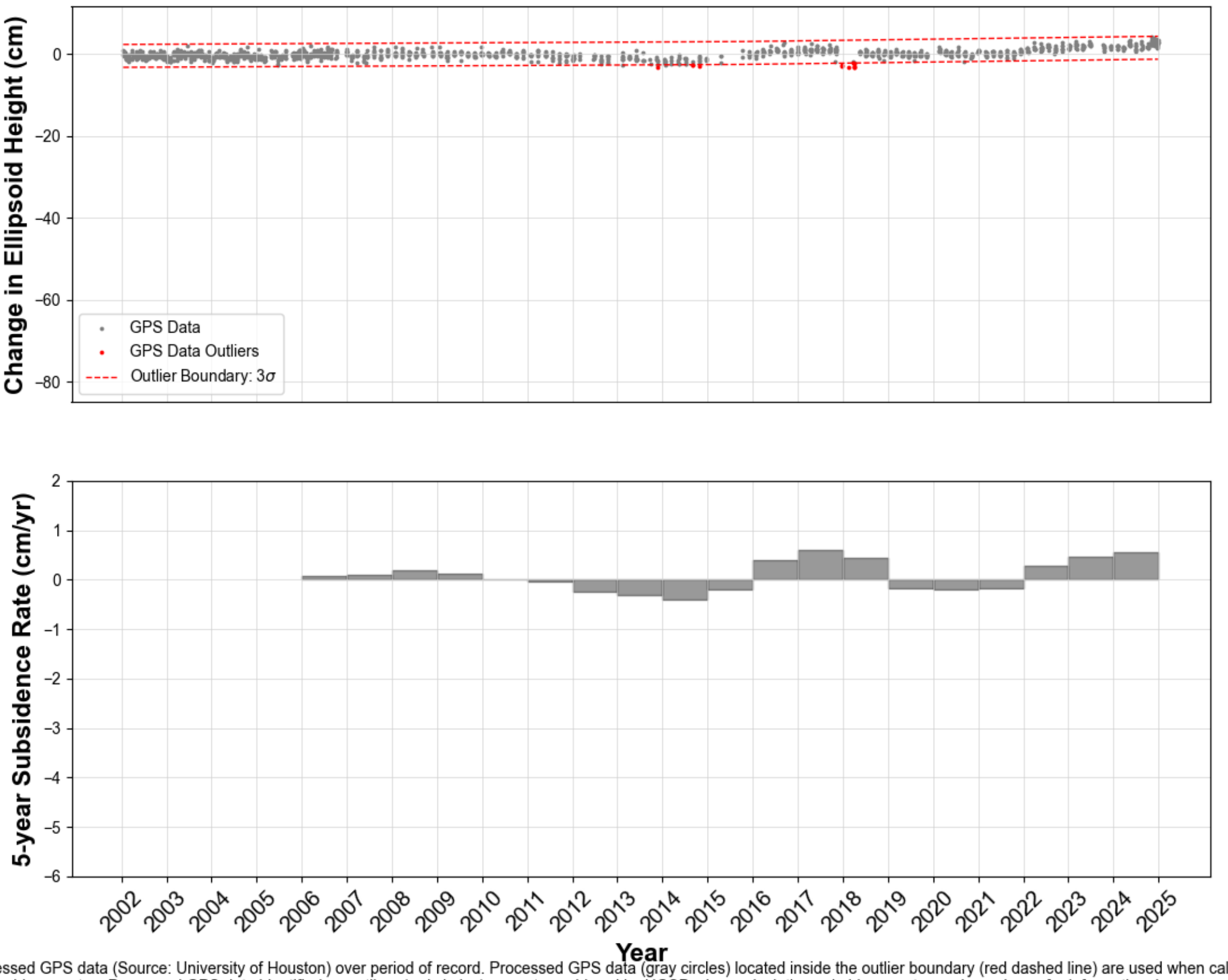


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P020

Kemah, TX

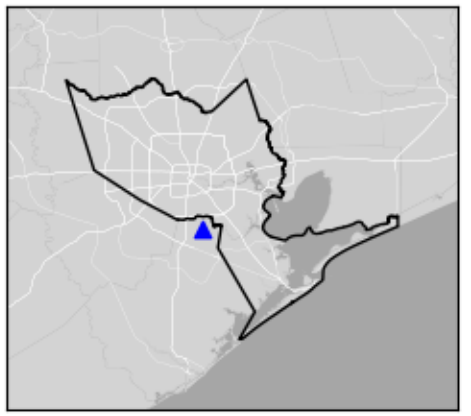


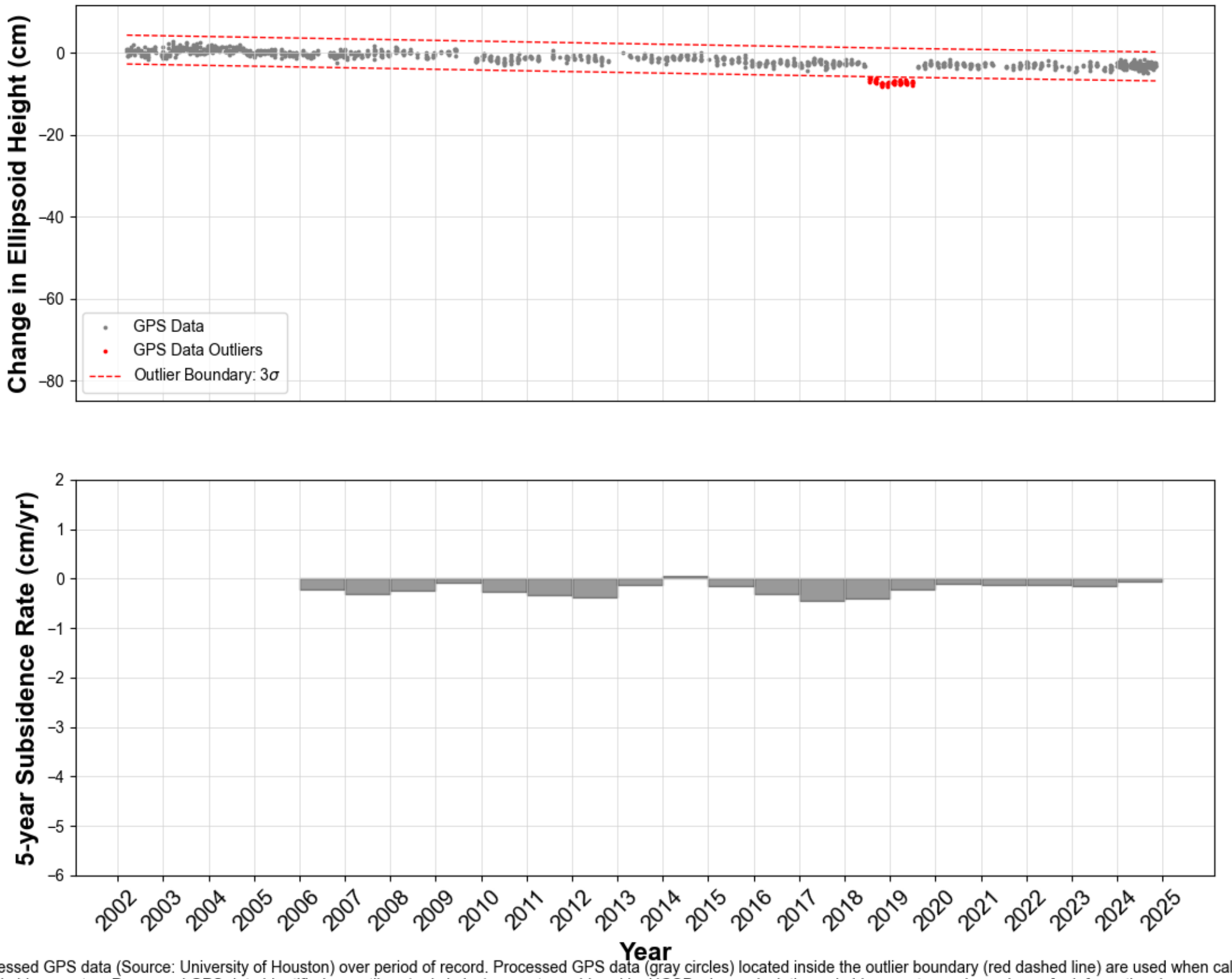


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P021

Pearland, TX

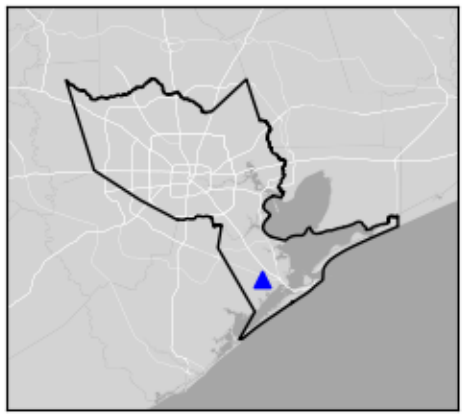


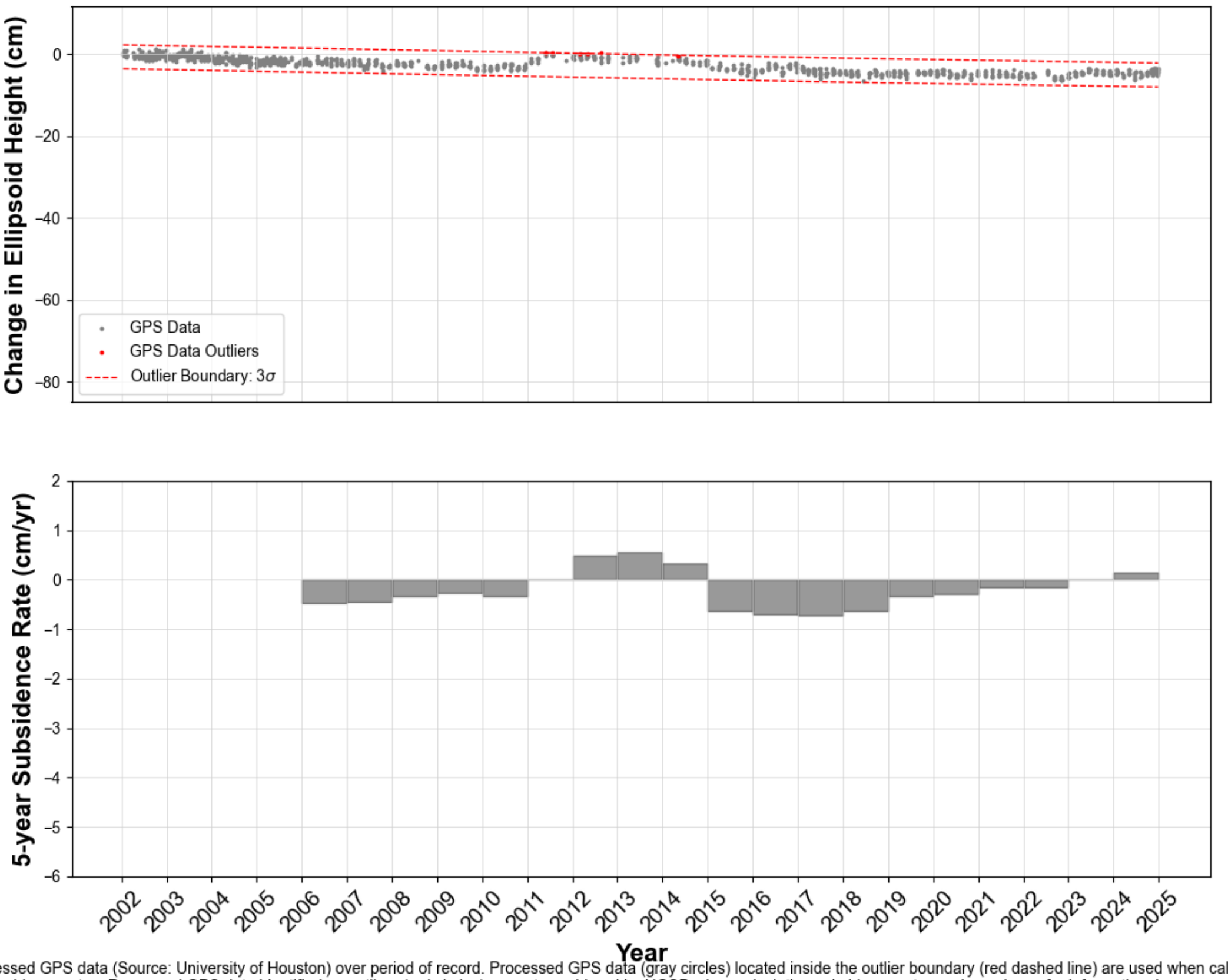


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P022

Hitchcock, TX

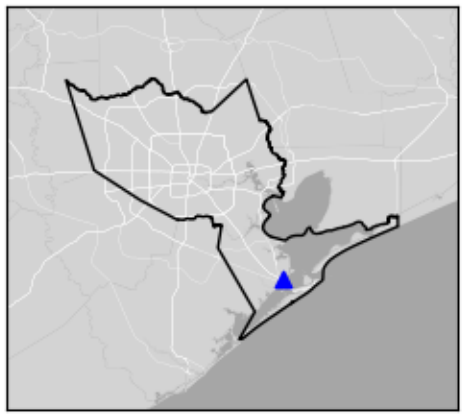


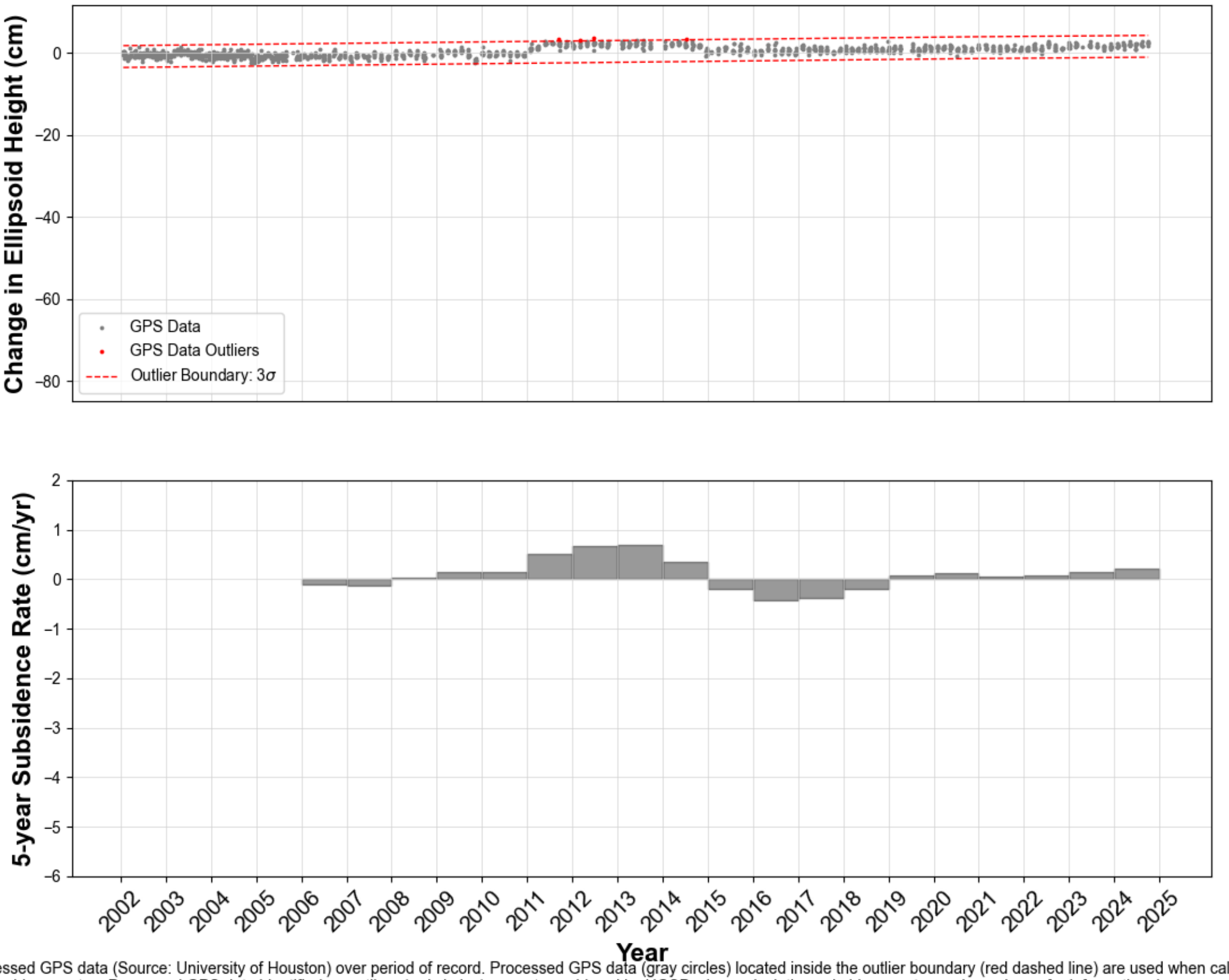


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P023

Texas City, TX

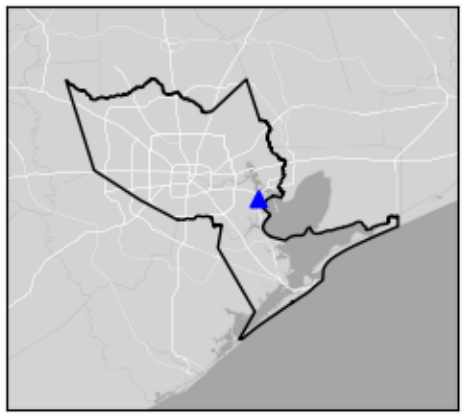


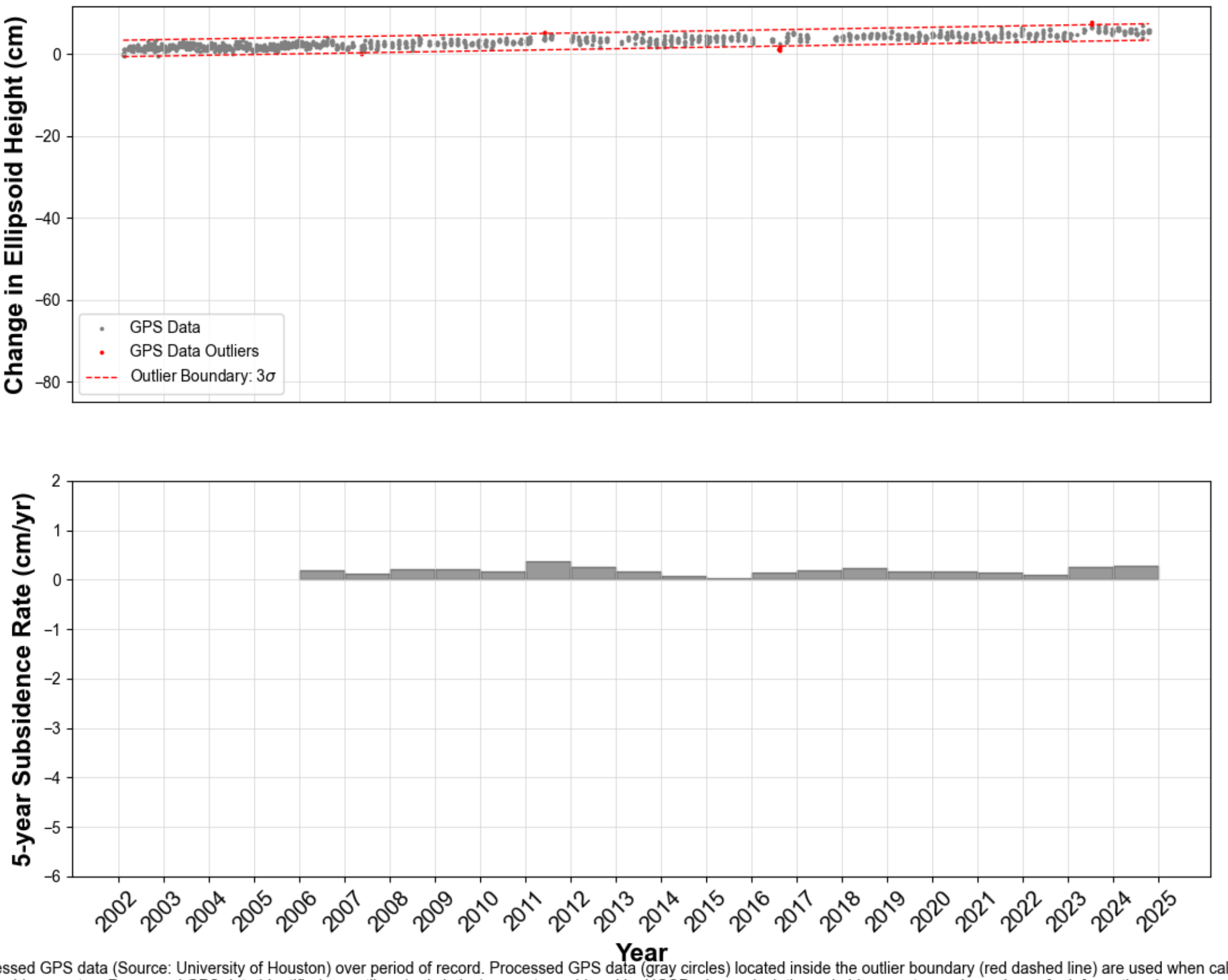


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P024

La Porte, TX

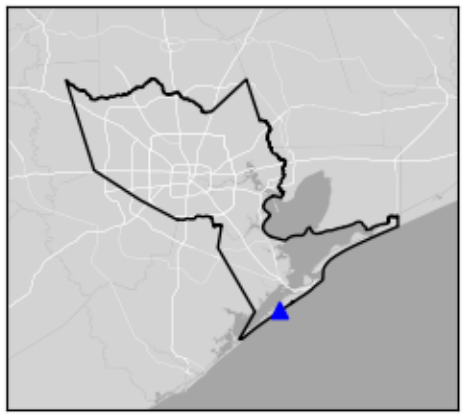


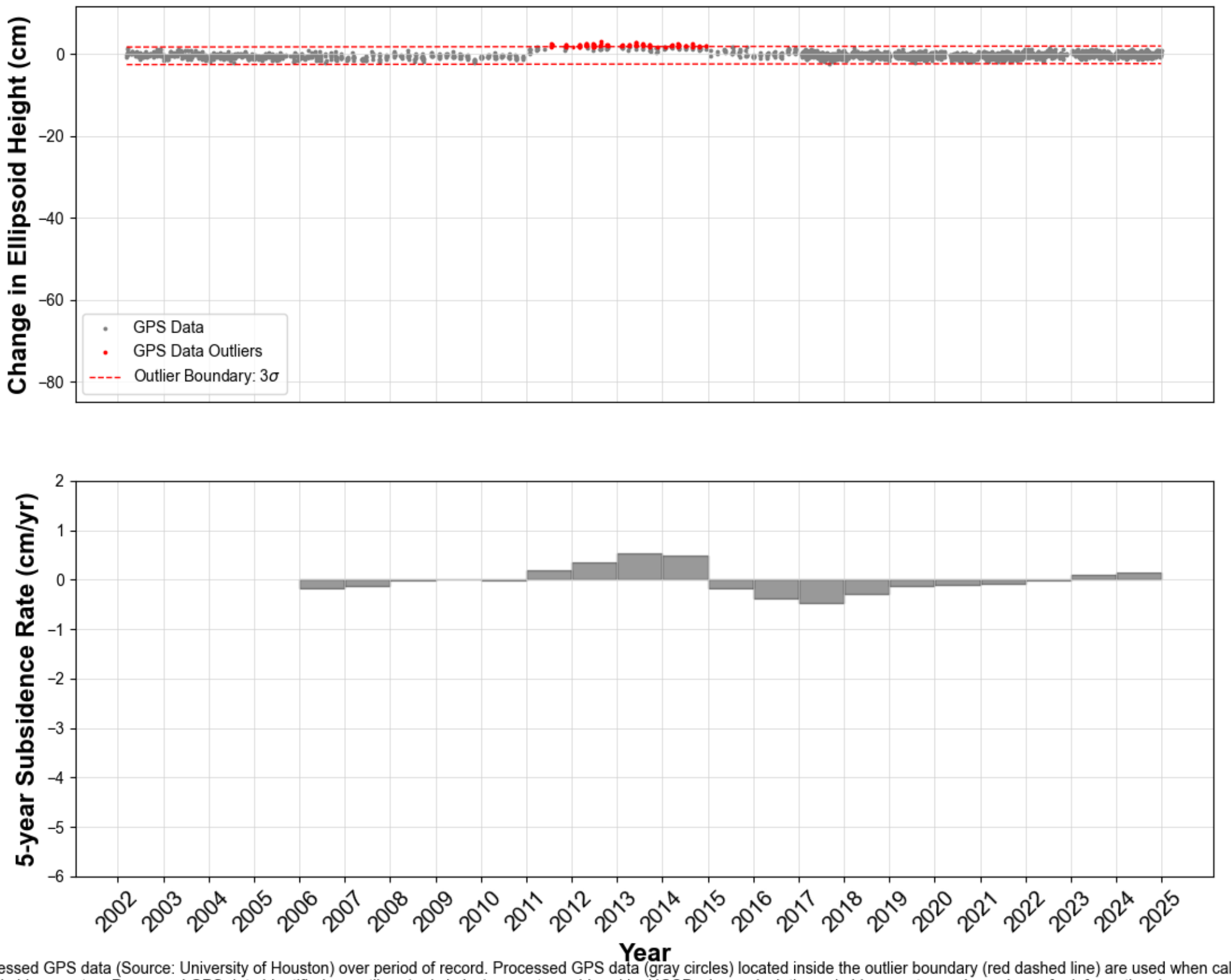


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P026

Galveston, TX

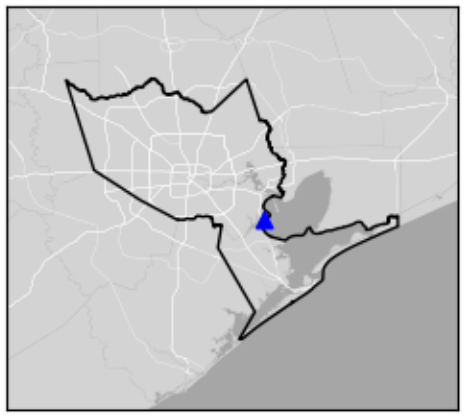


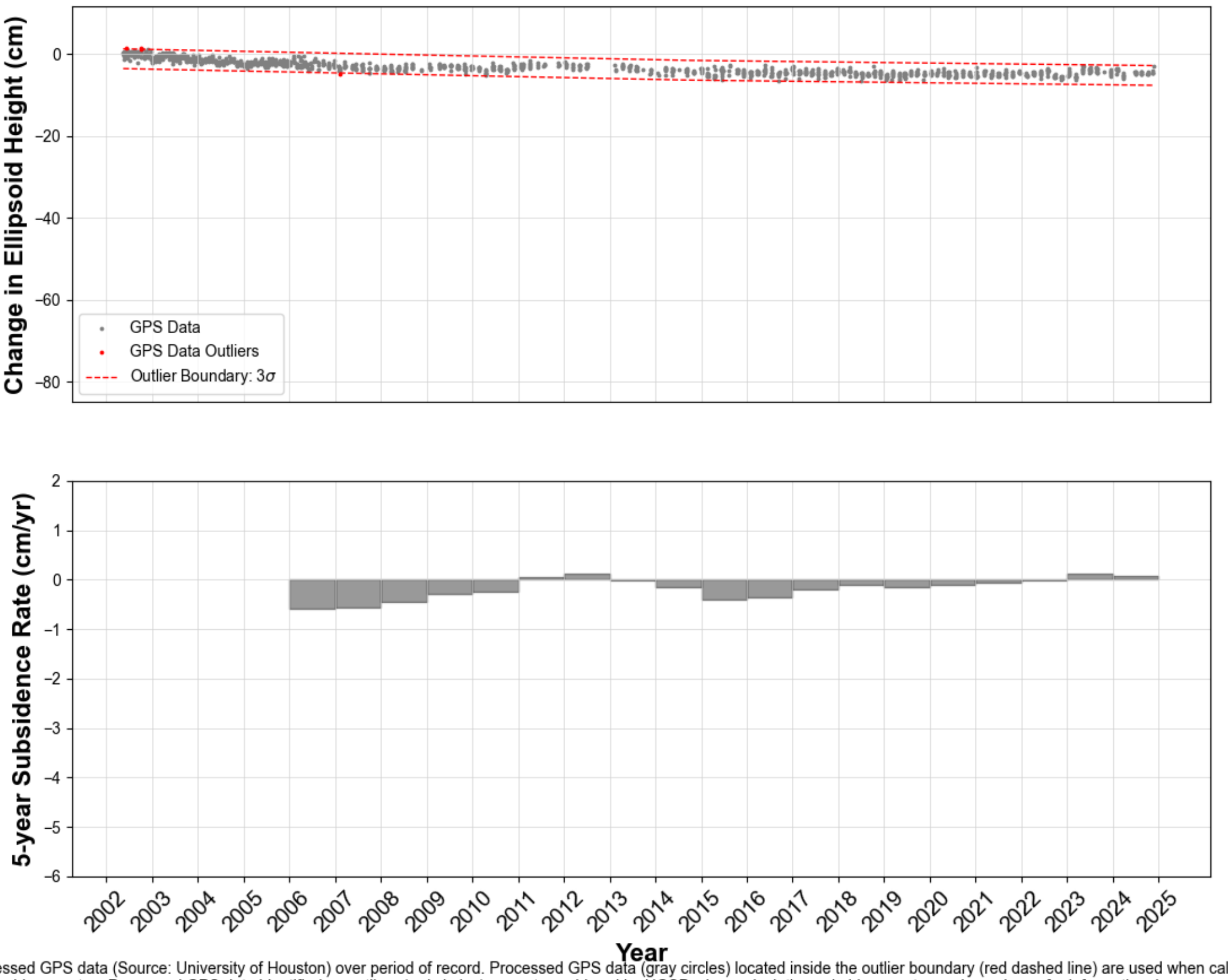


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P027

Seabrook, TX

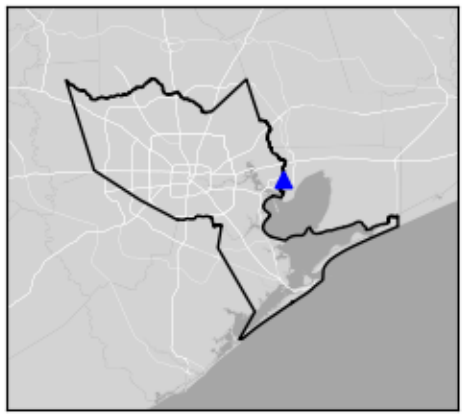


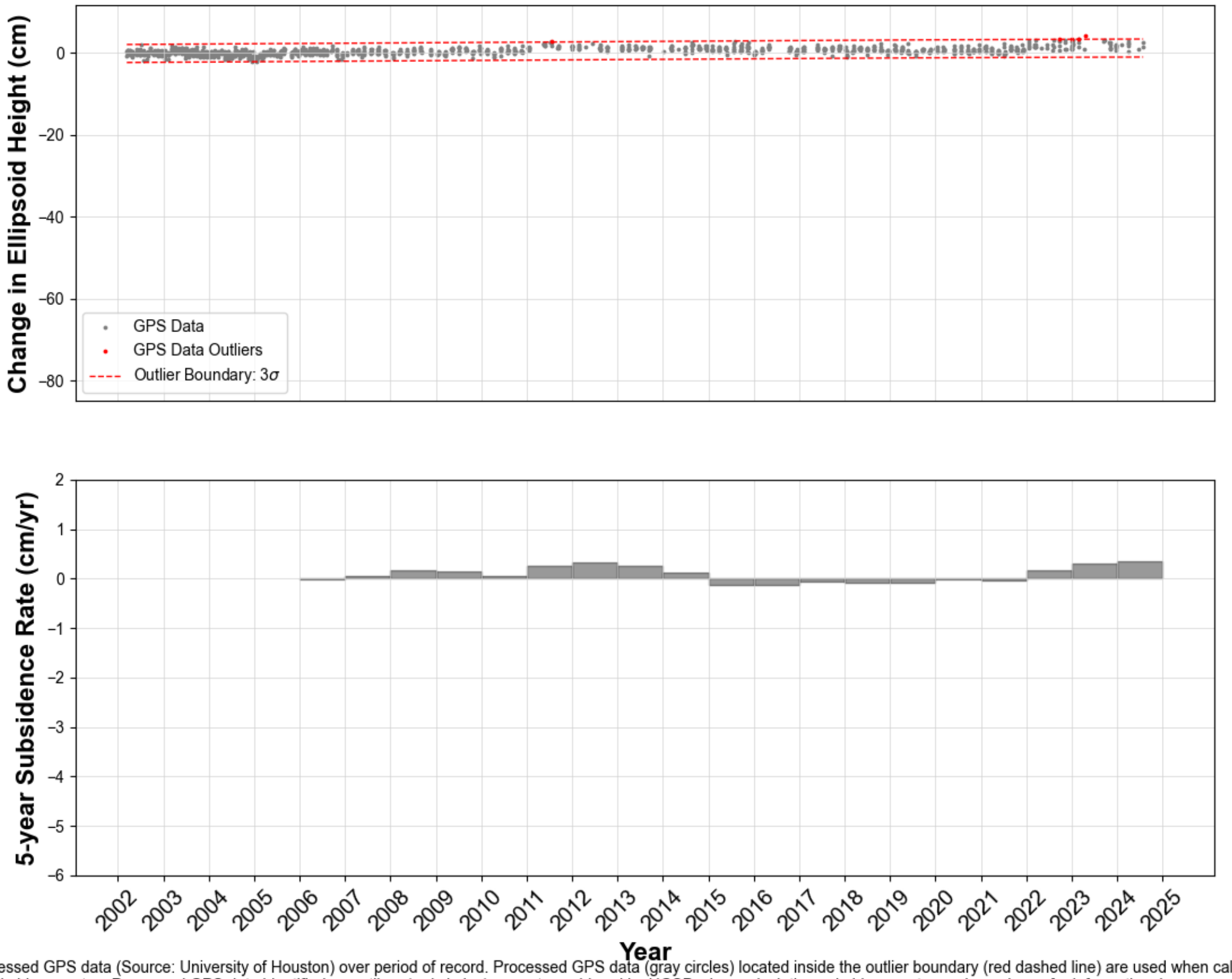


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P028

Baytown, TX

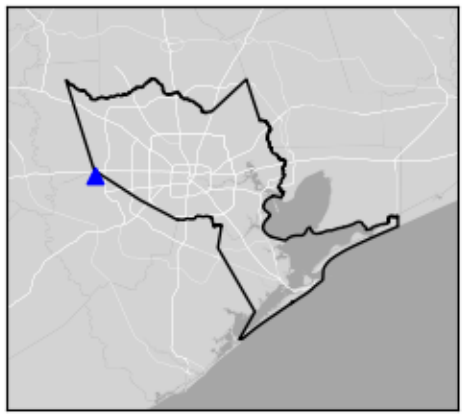


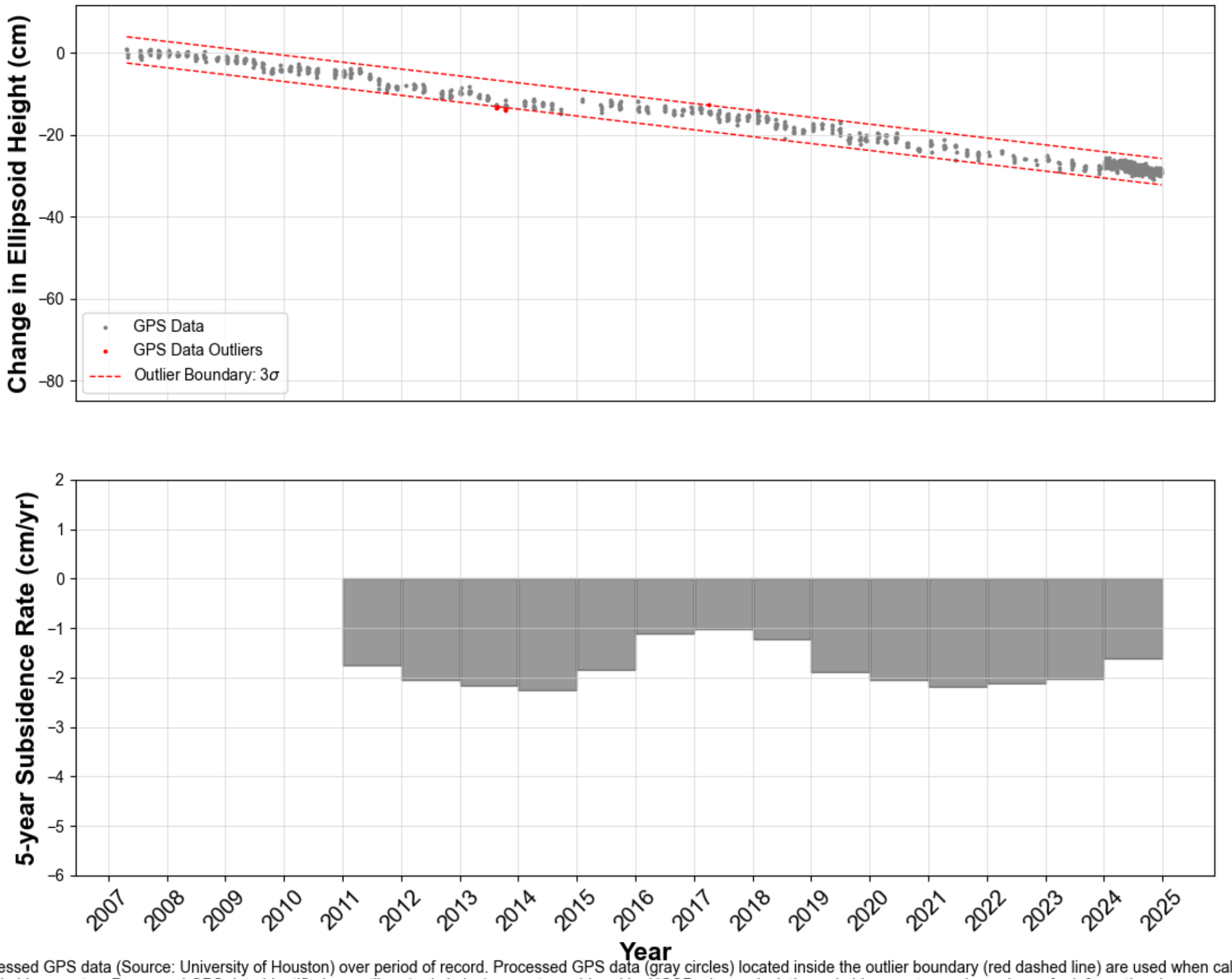


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P029

Katy, TX

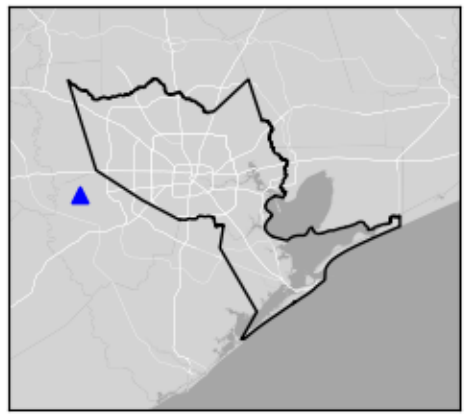


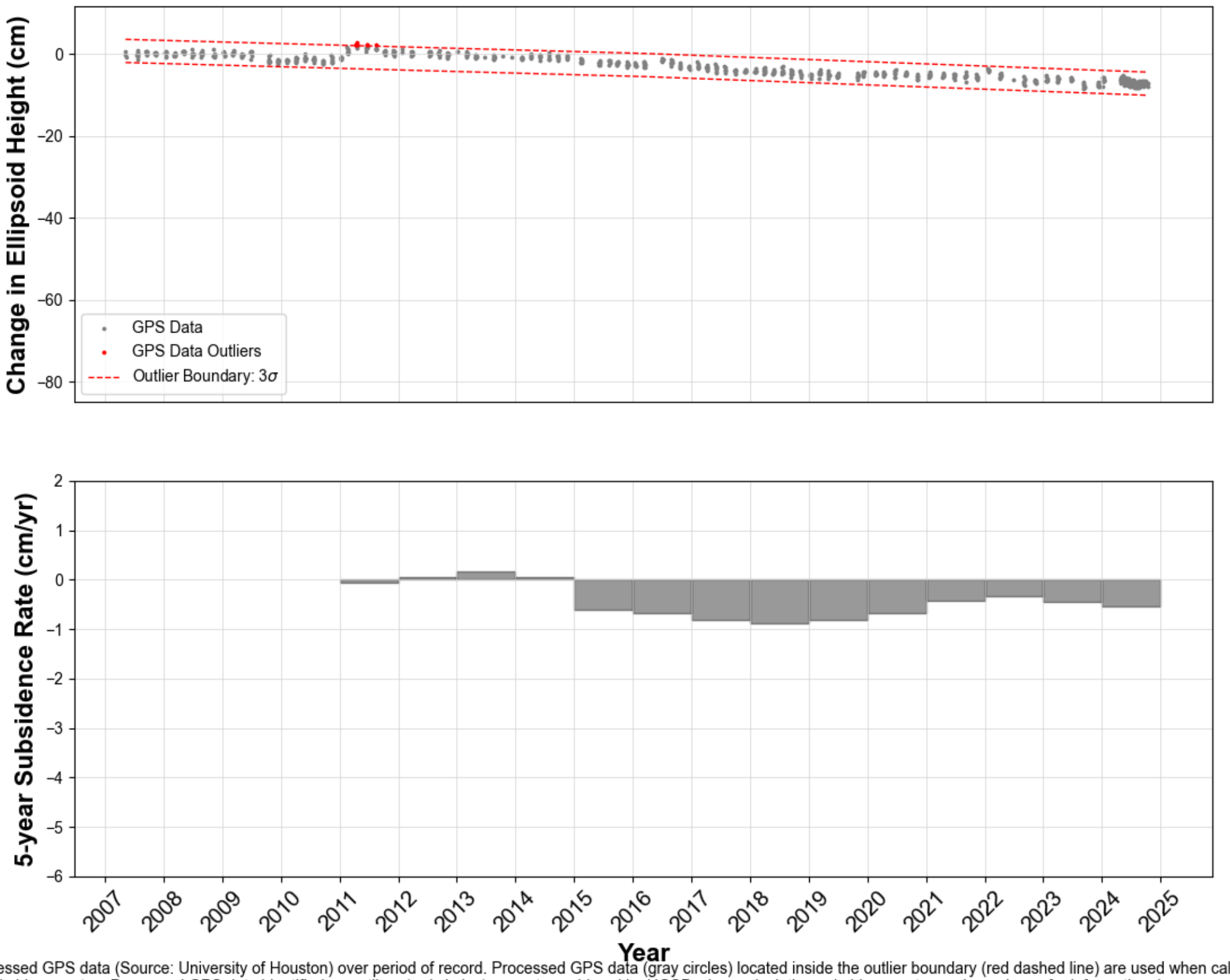


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P030

Fulshear, TX

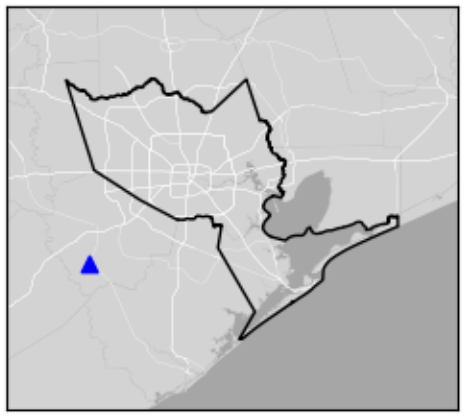


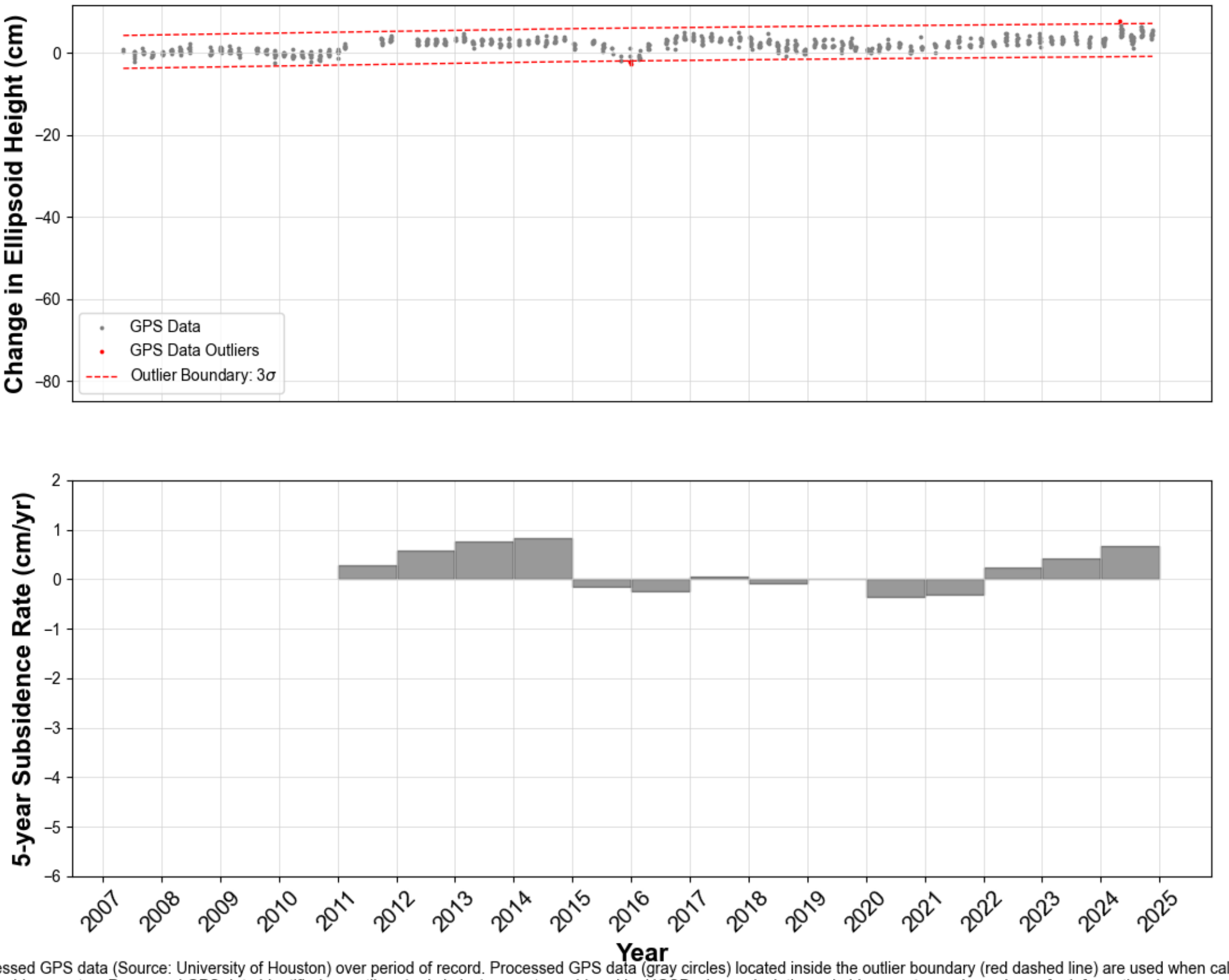


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P031

Needville, TX

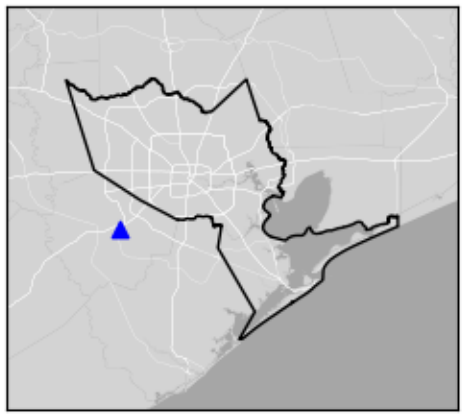


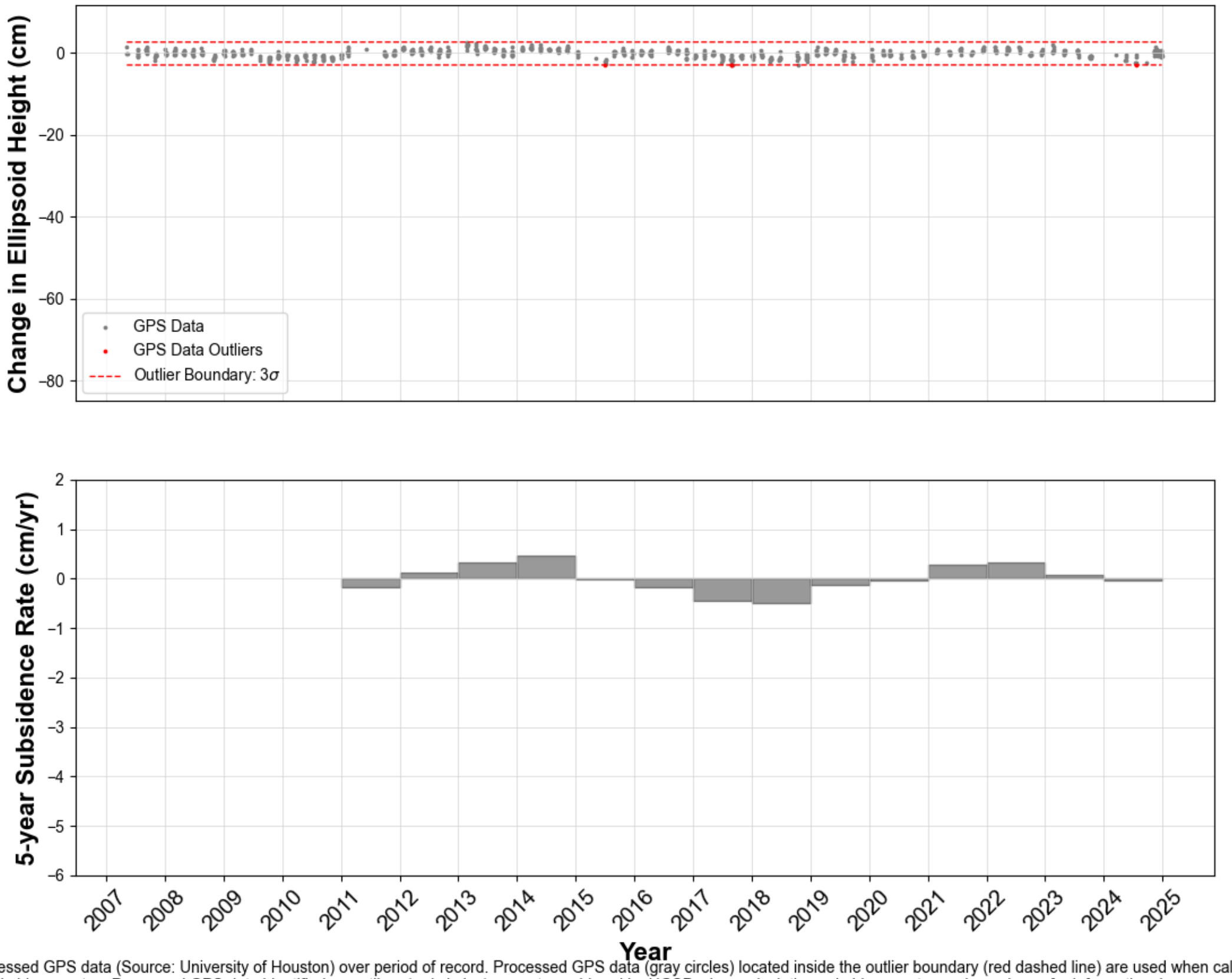


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P032

Richmond, TX

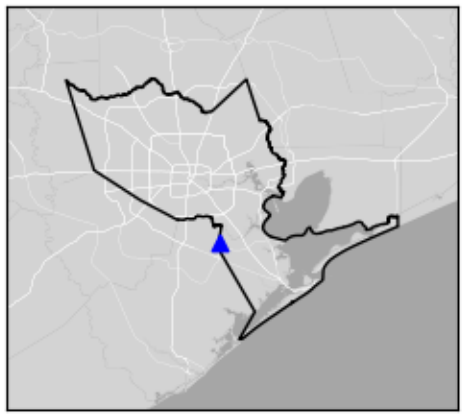


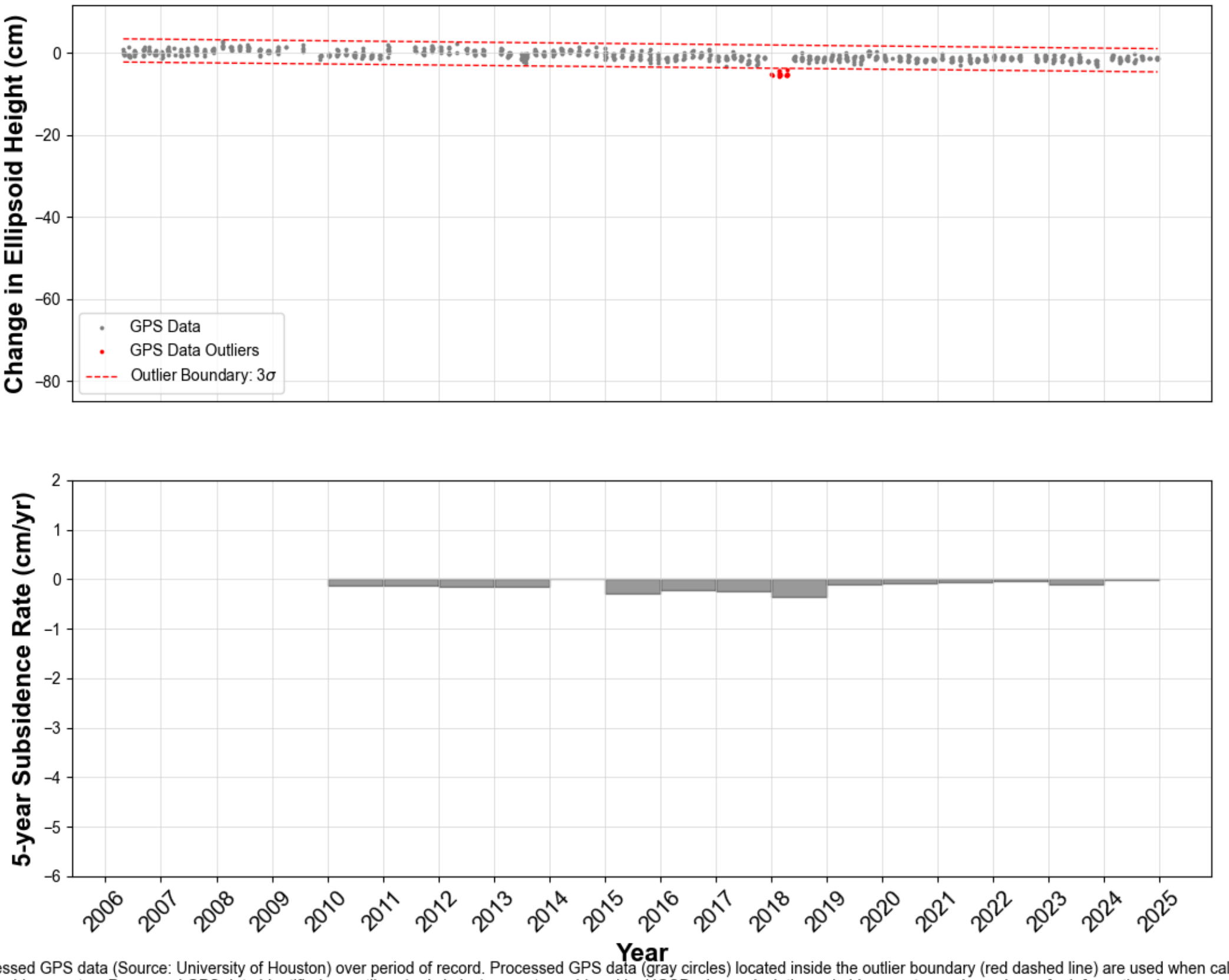


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P033

Friendswood, TX

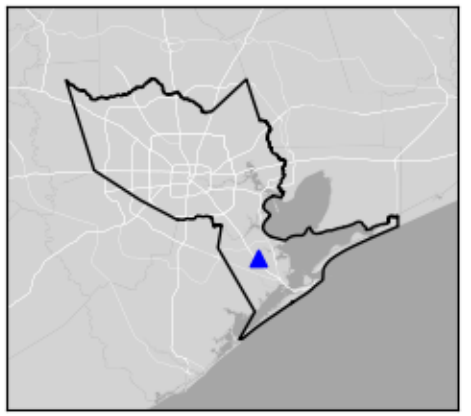


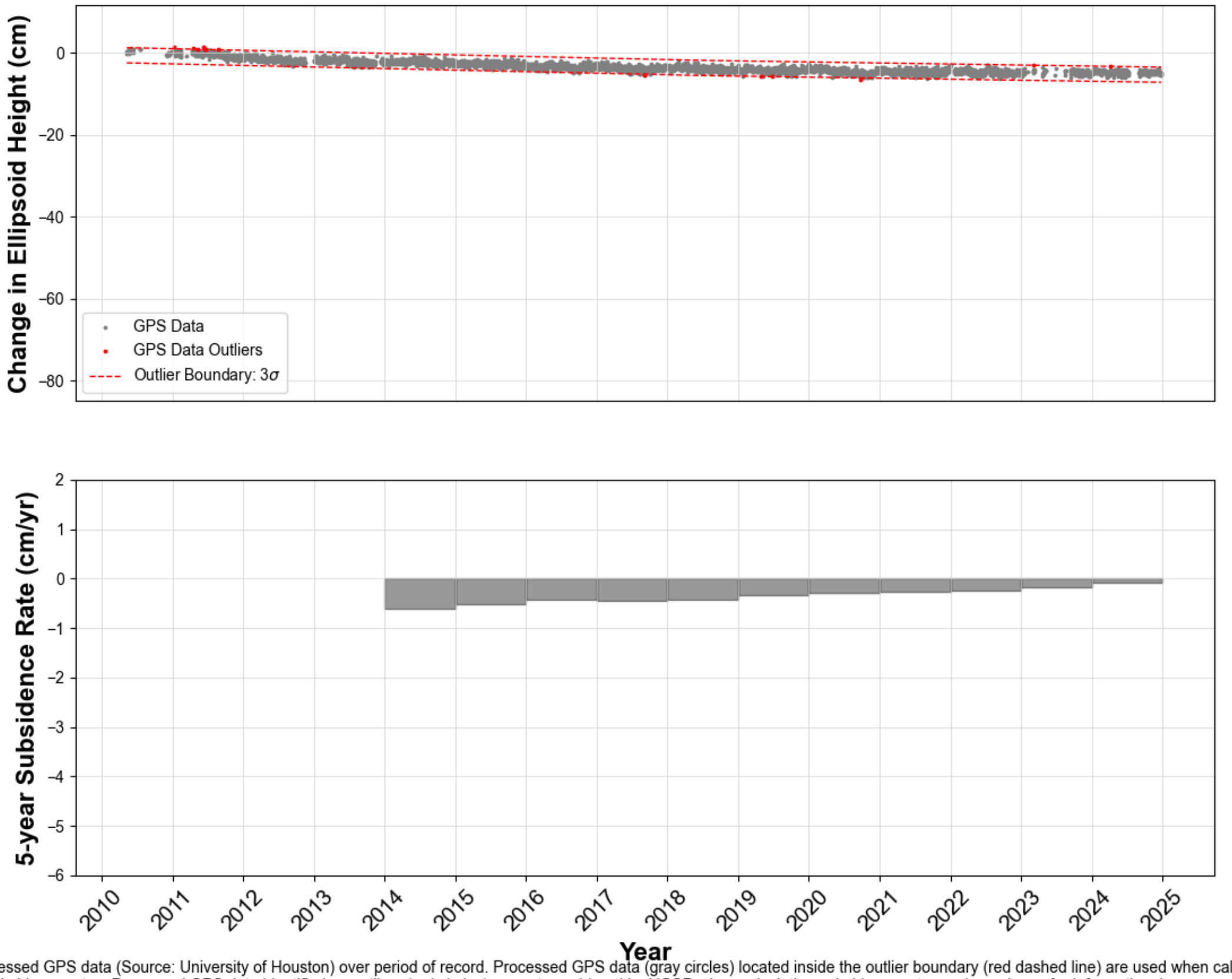


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P034

Texas City, TX

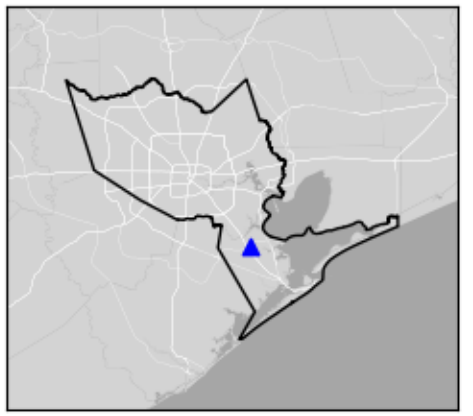


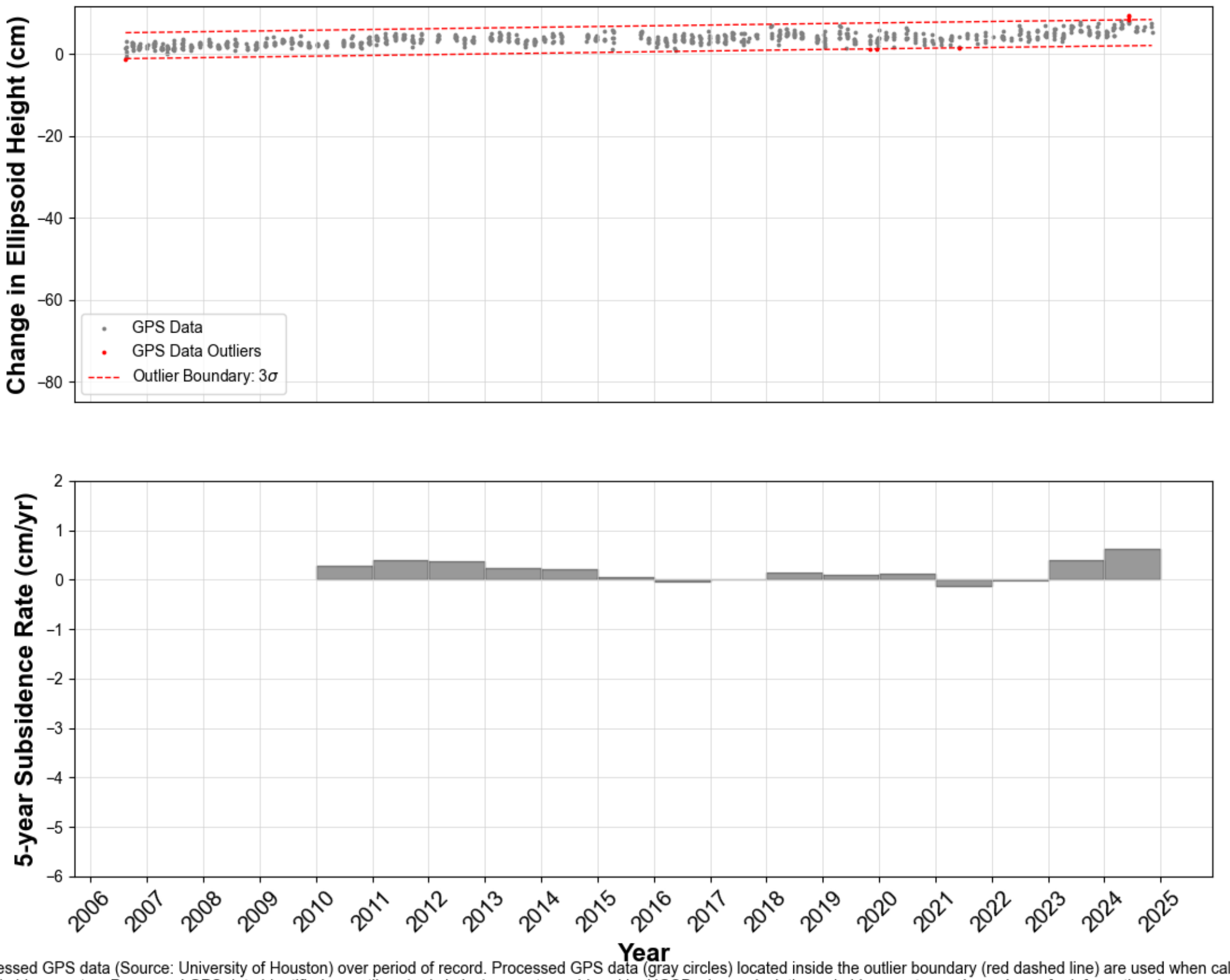


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P035

League City, TX

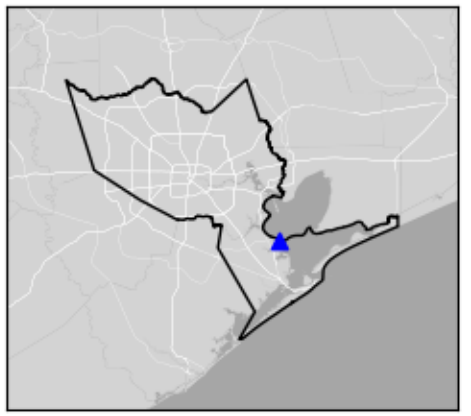


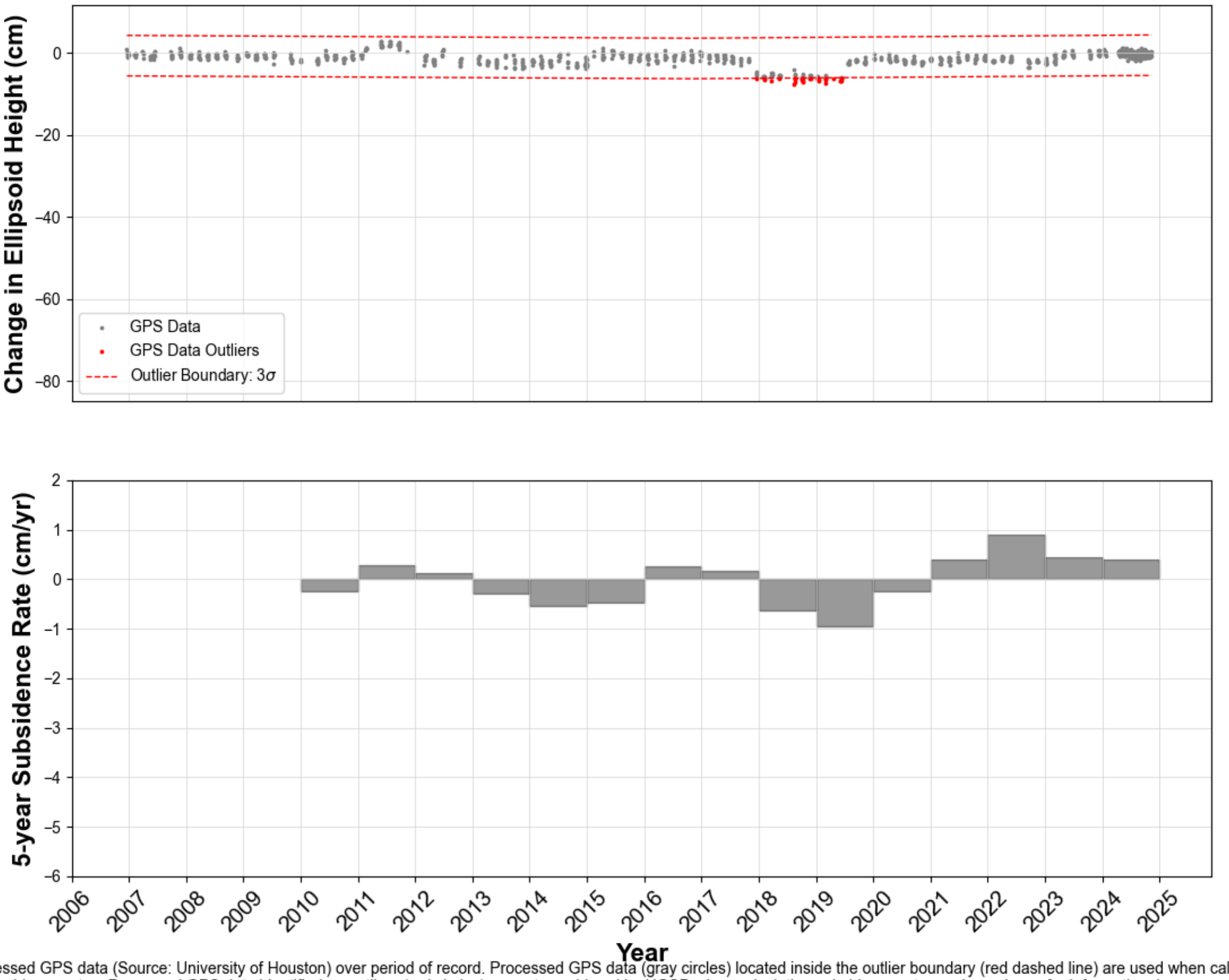


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P036

San Leon, TX

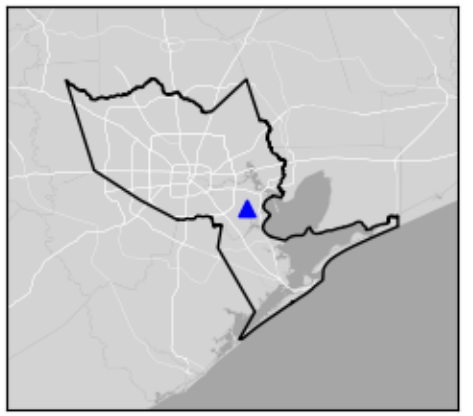


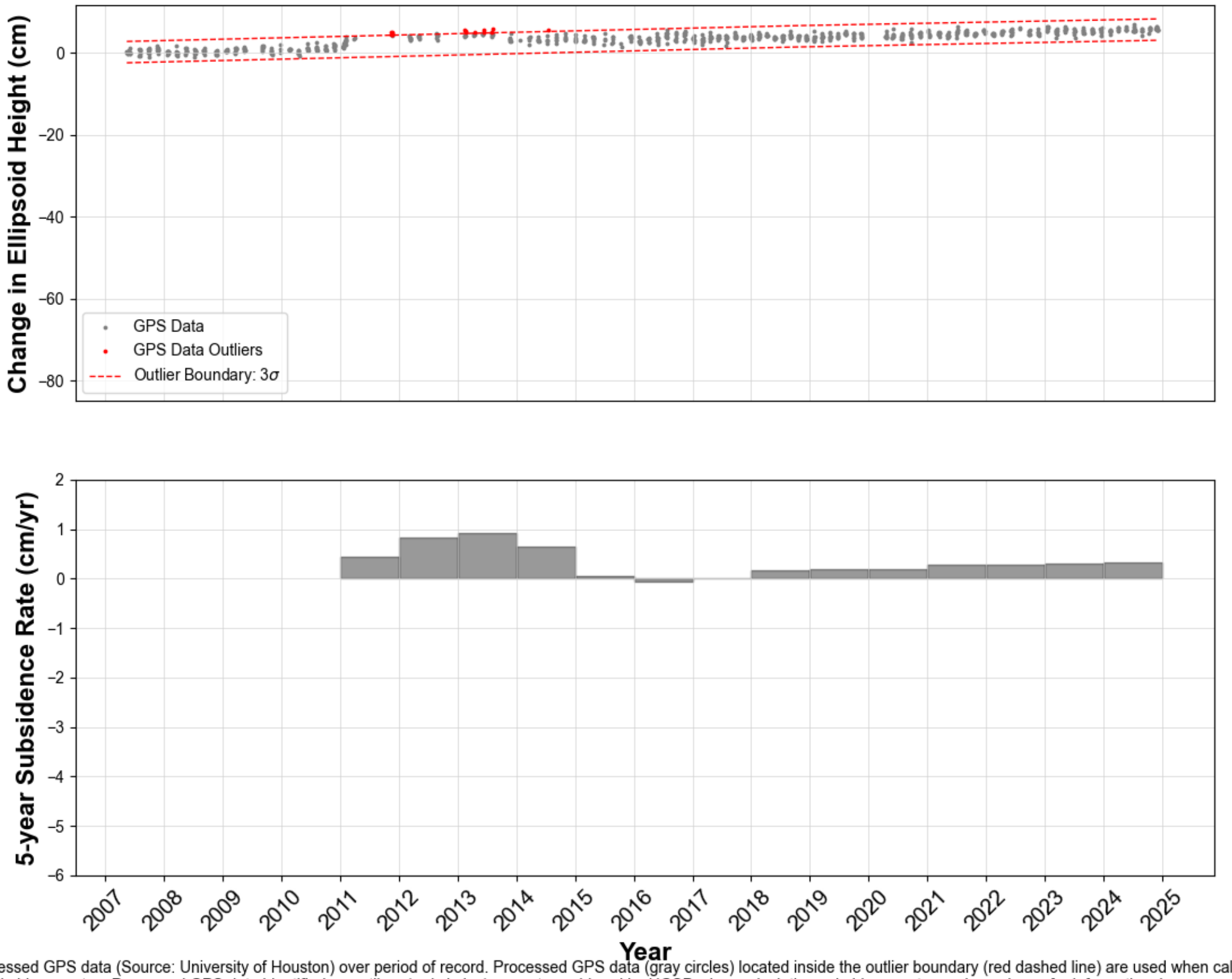


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P037

Pasadena, TX

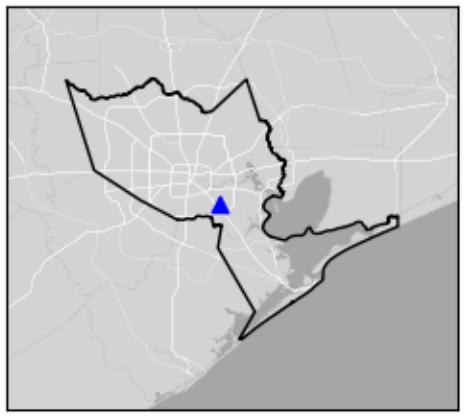


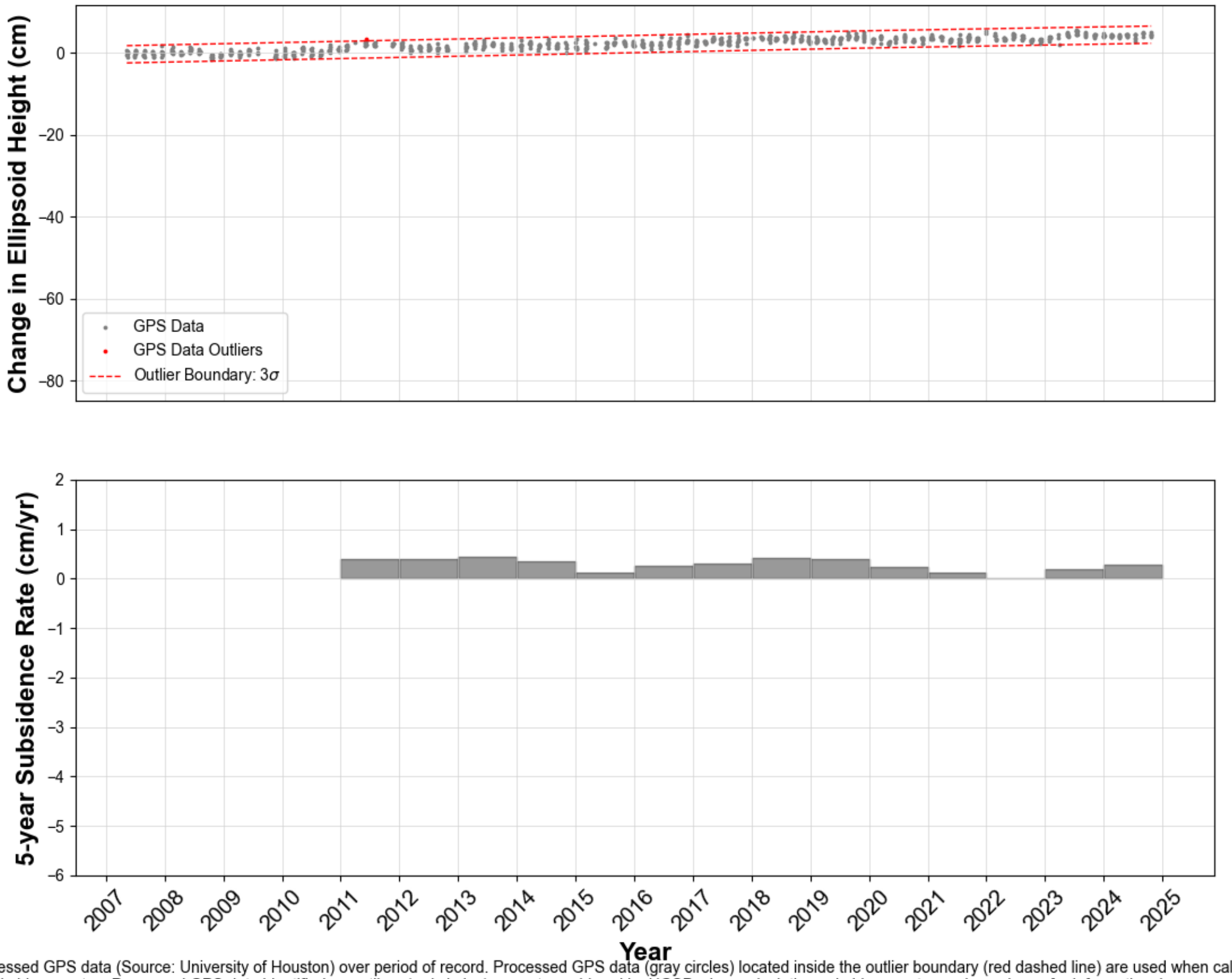


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P038

Houston, TX

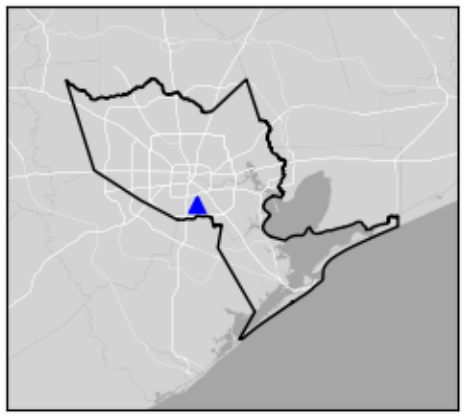


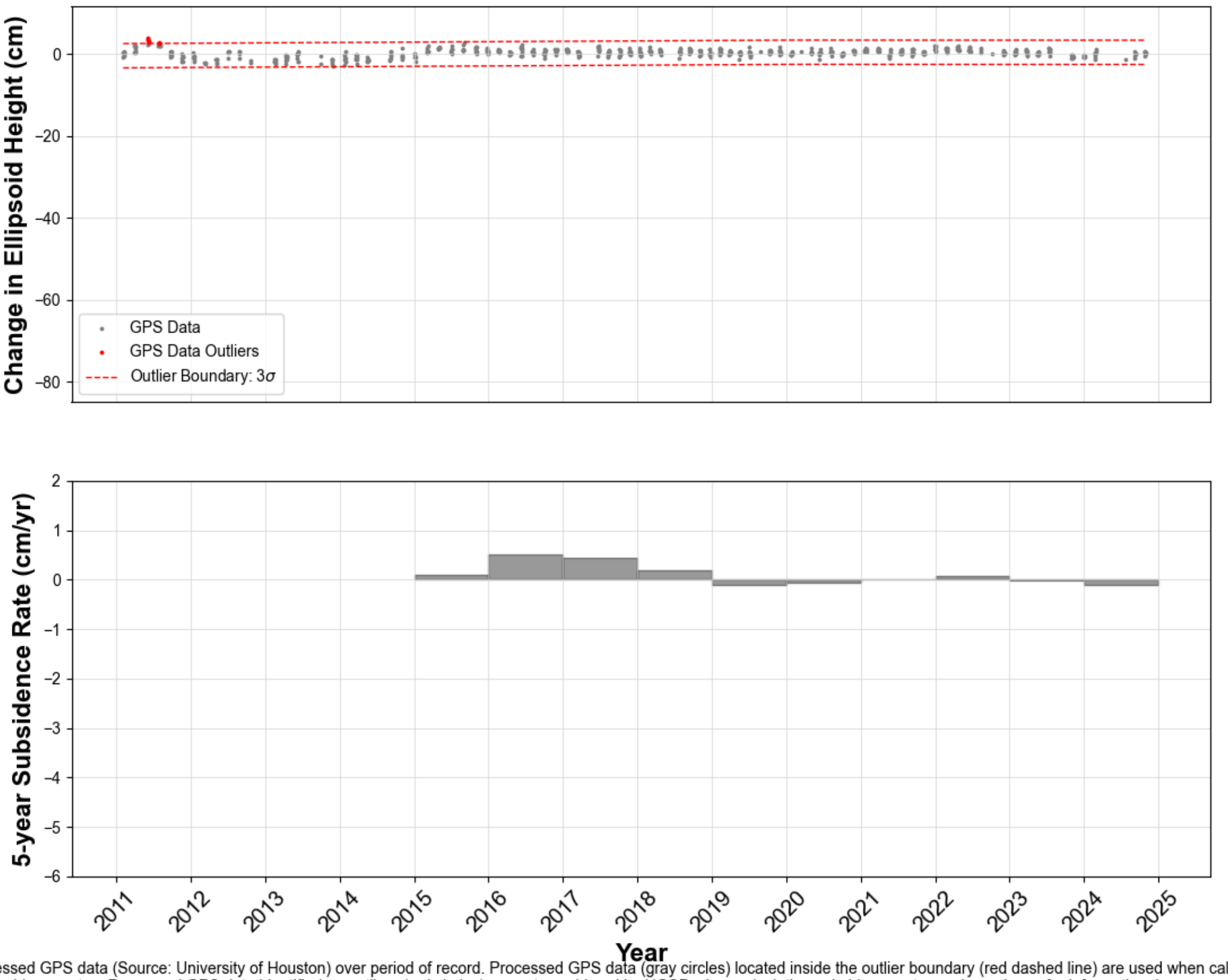


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P039

Houston, TX

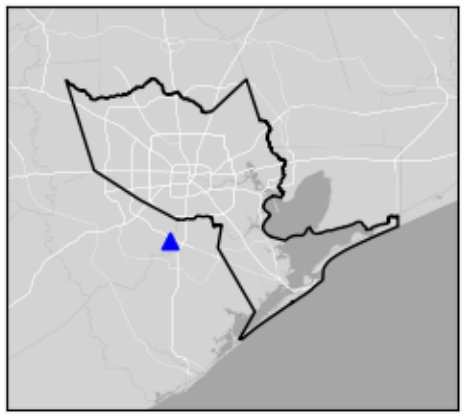


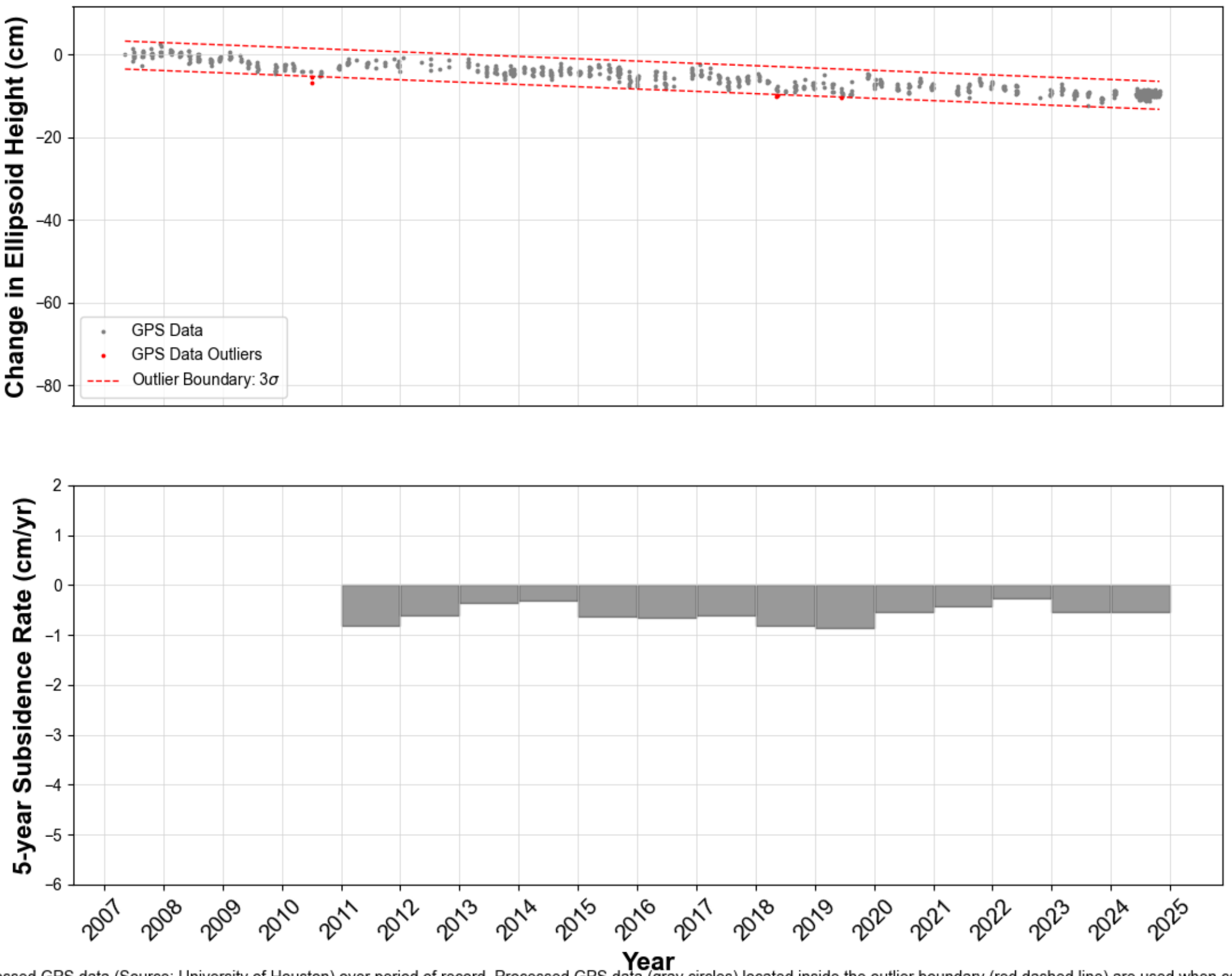


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P040

Rosharon, TX

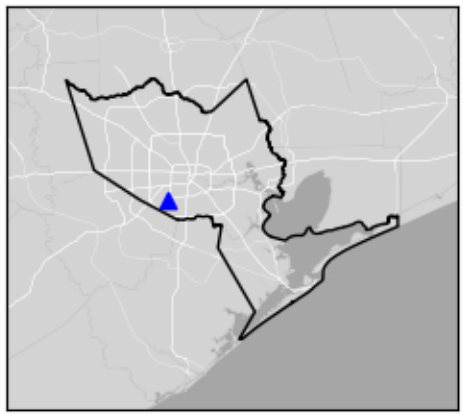


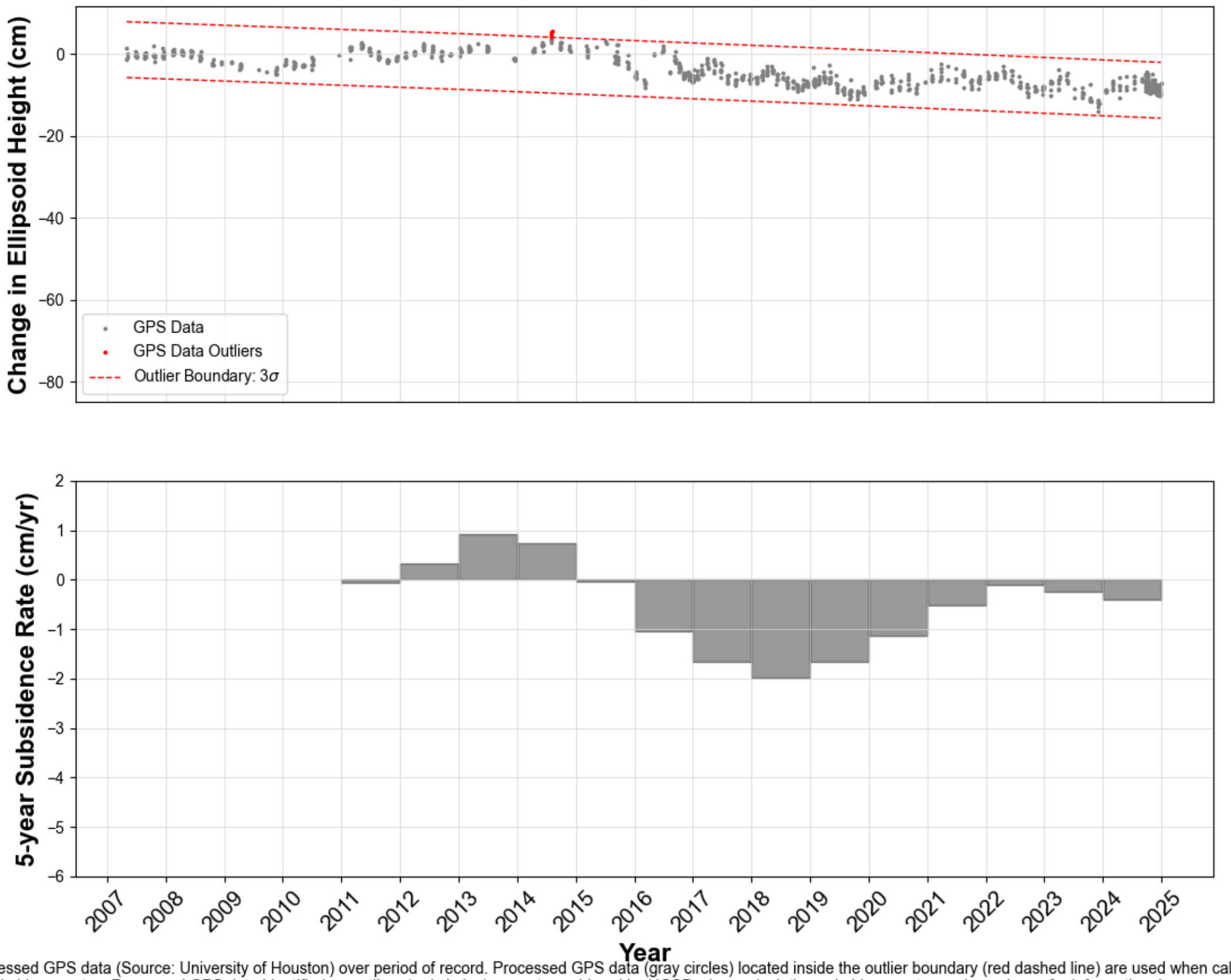


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P041

Houston, TX

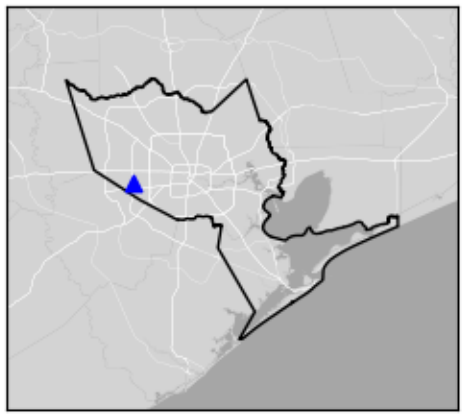


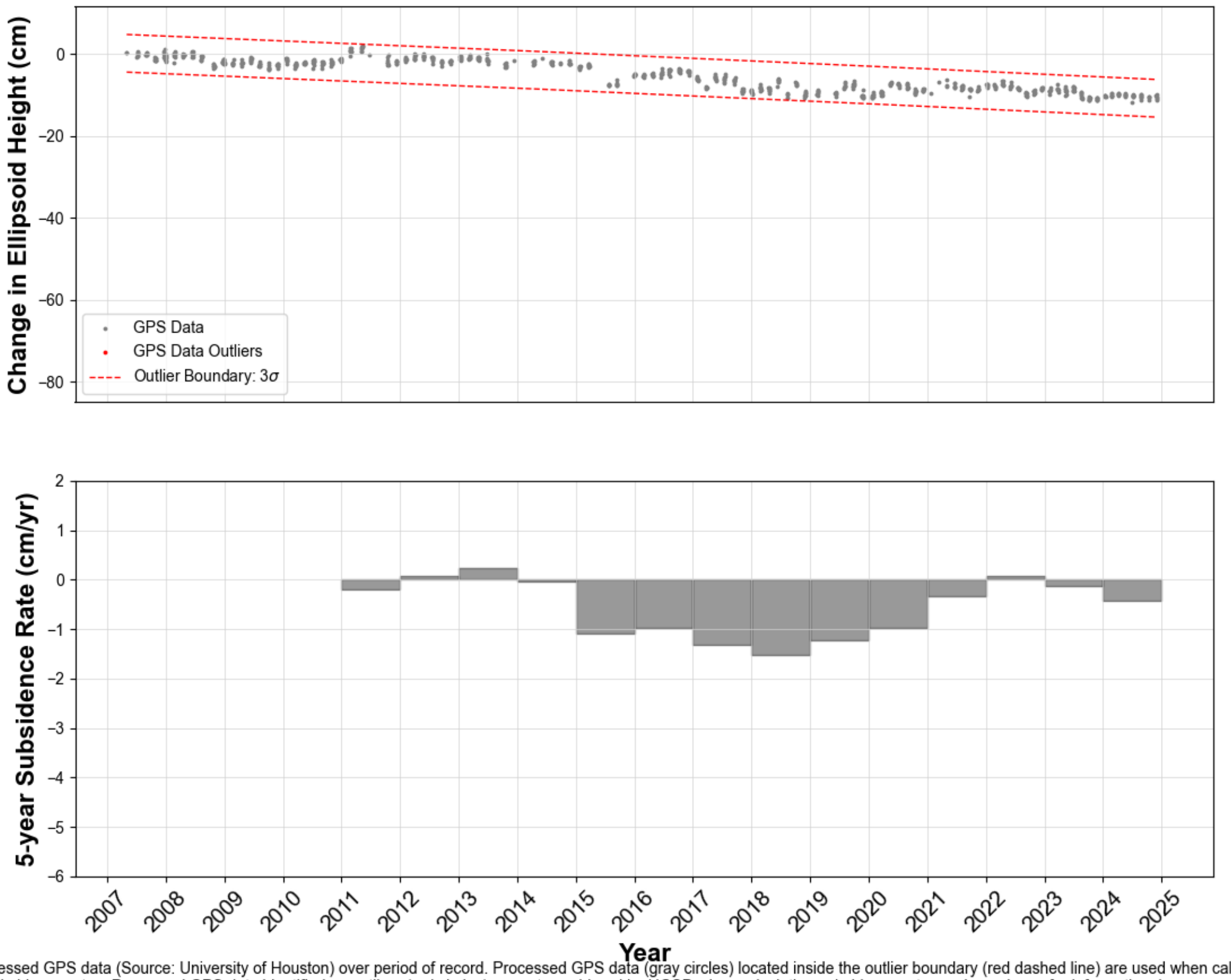


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P042

Houston, TX

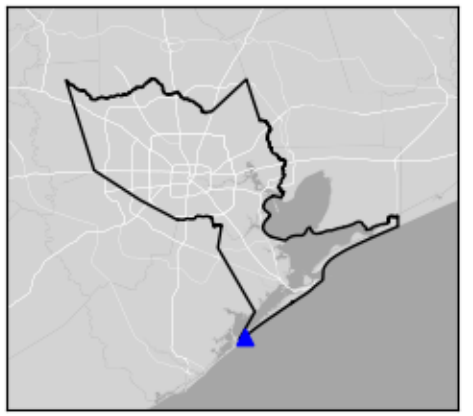


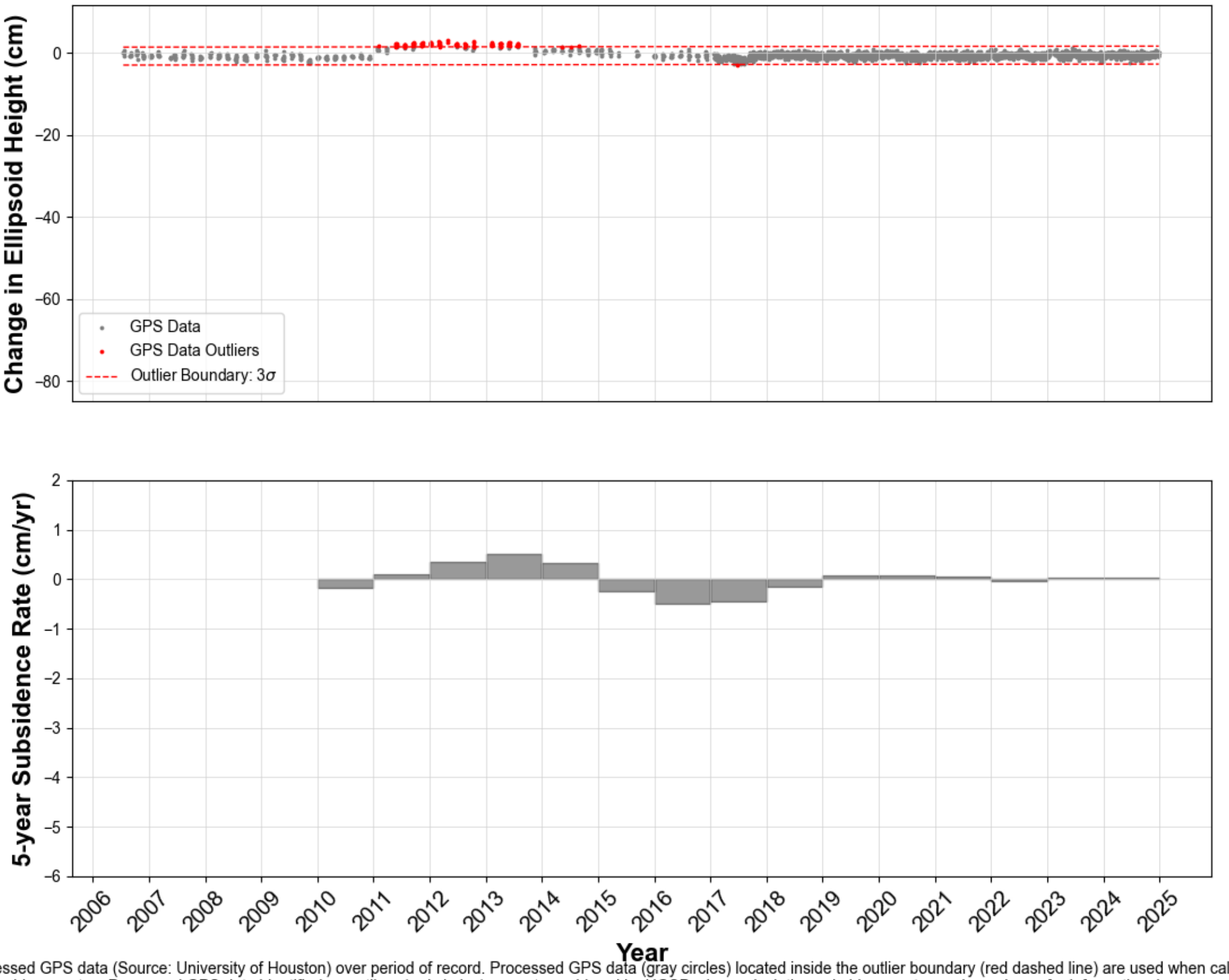


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P043

Galveston, TX

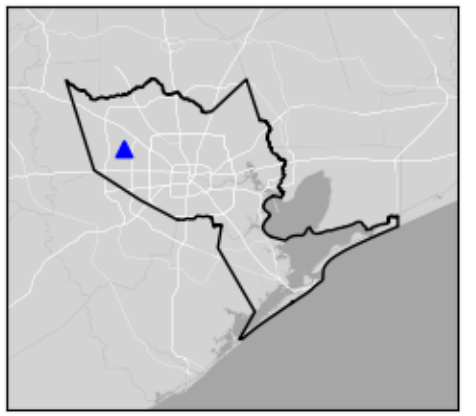


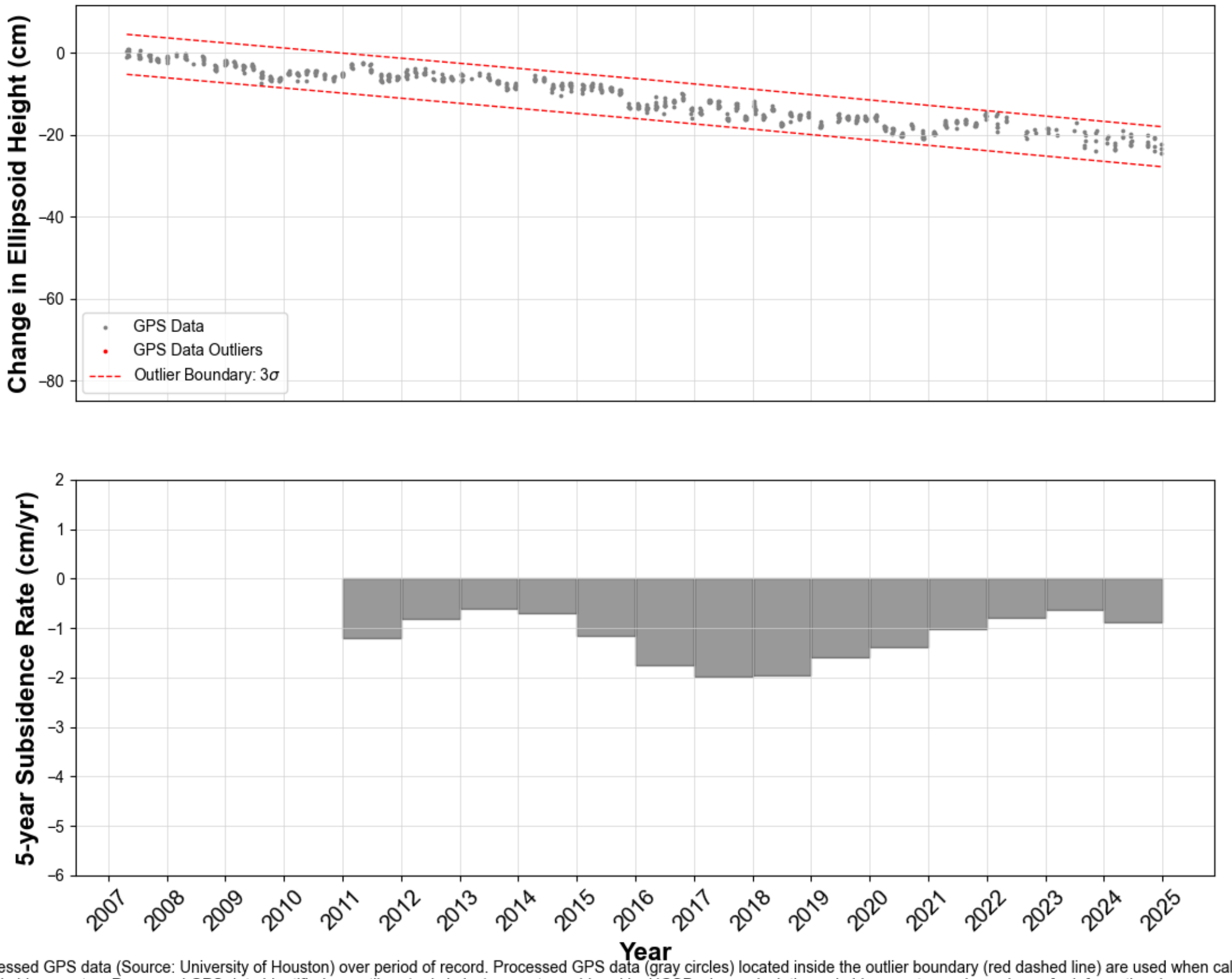


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P044

Cypress, TX

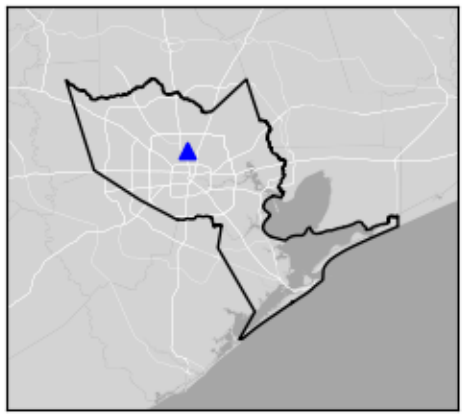


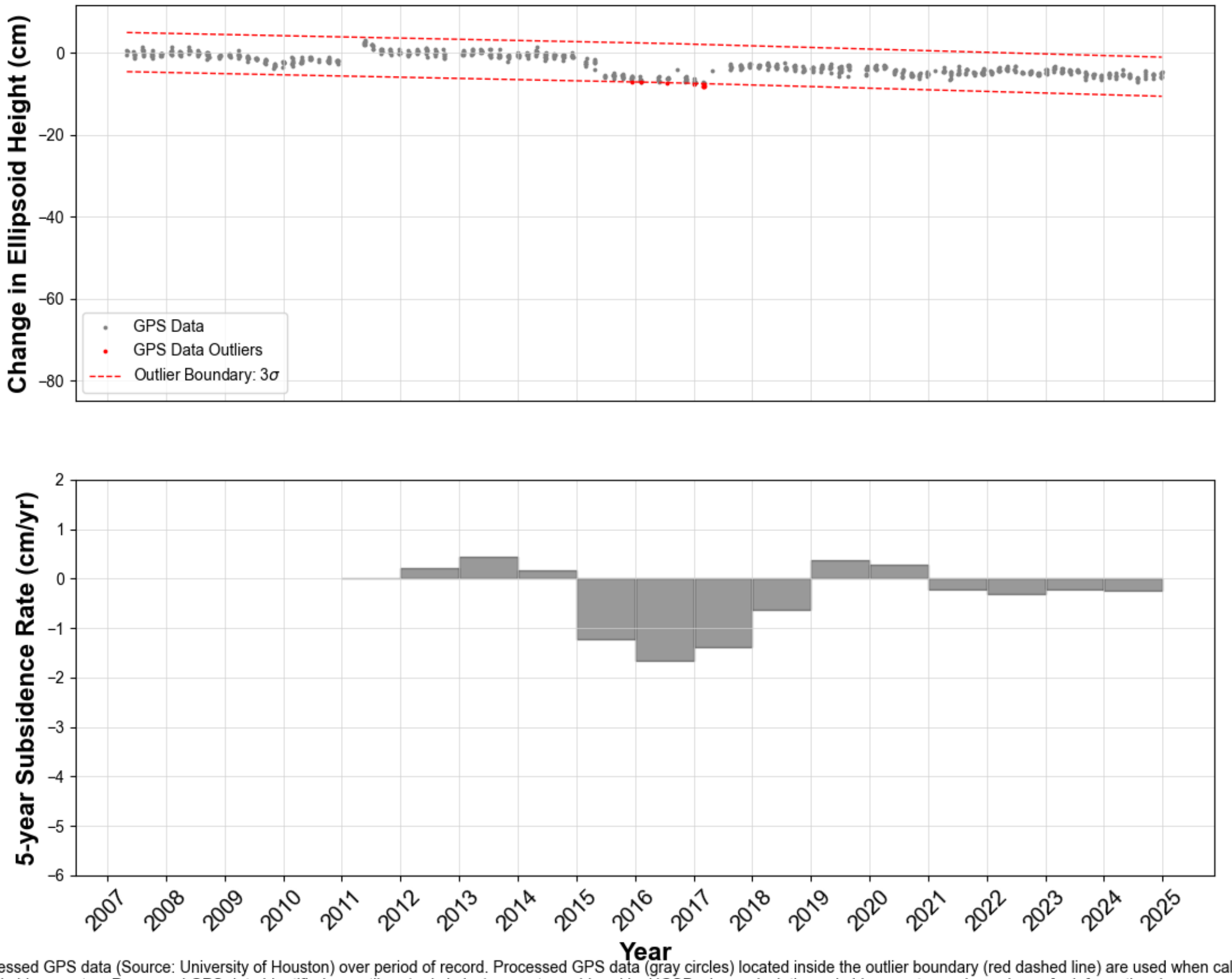


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P045

Houston, TX

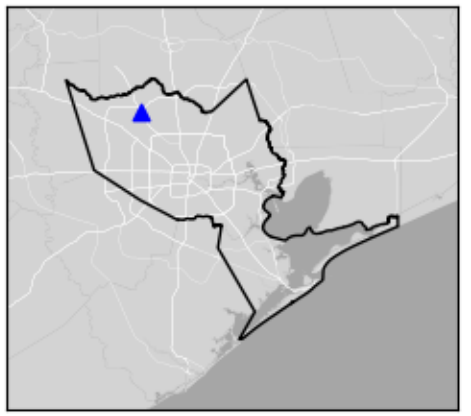


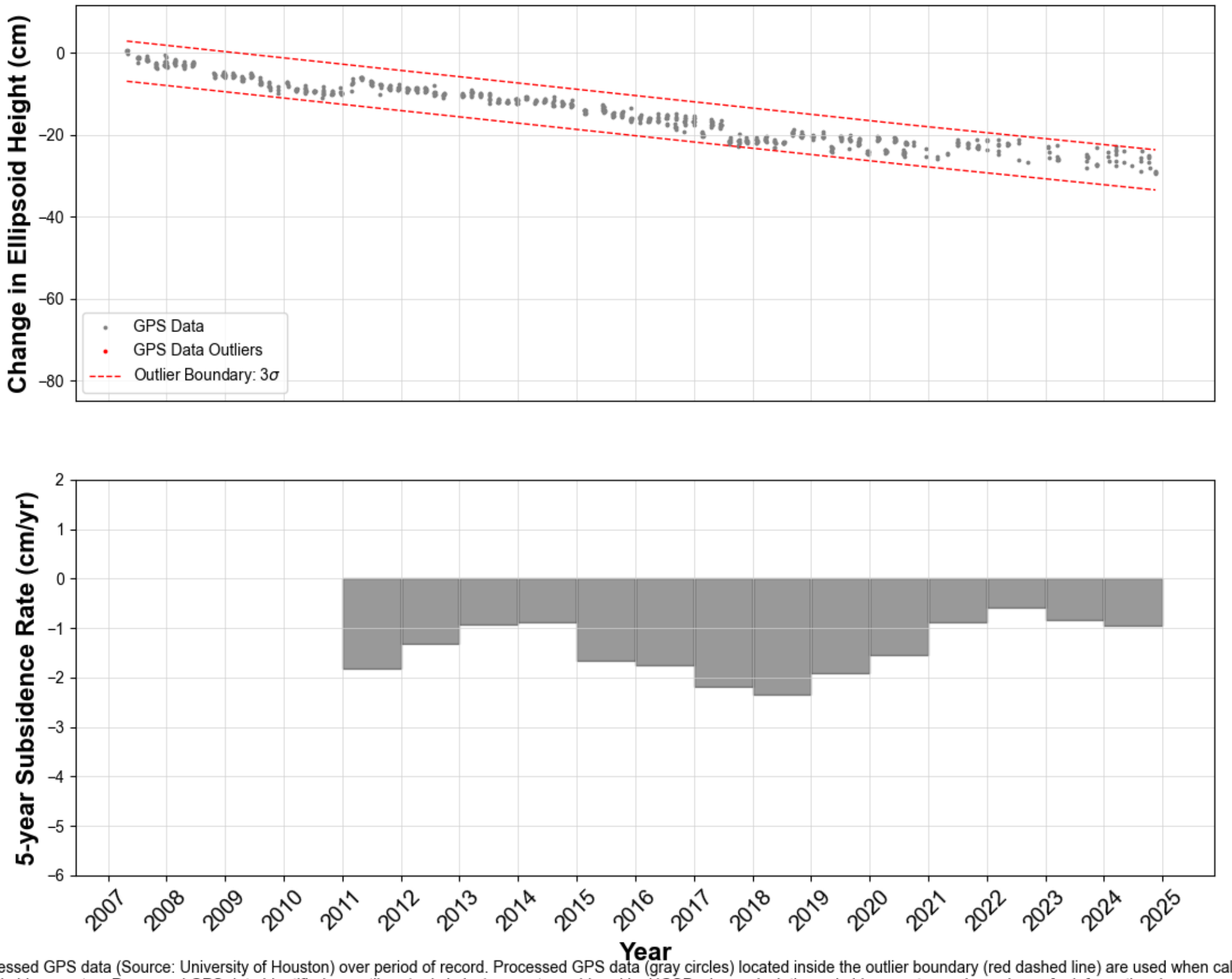


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P046

Tomball, TX

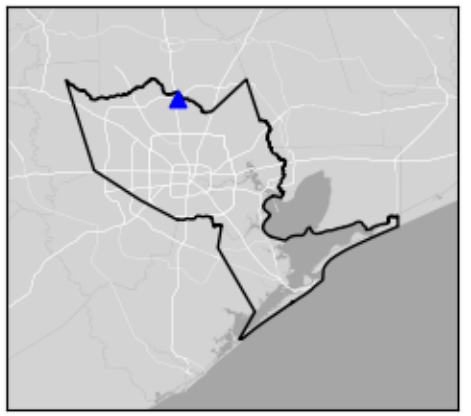


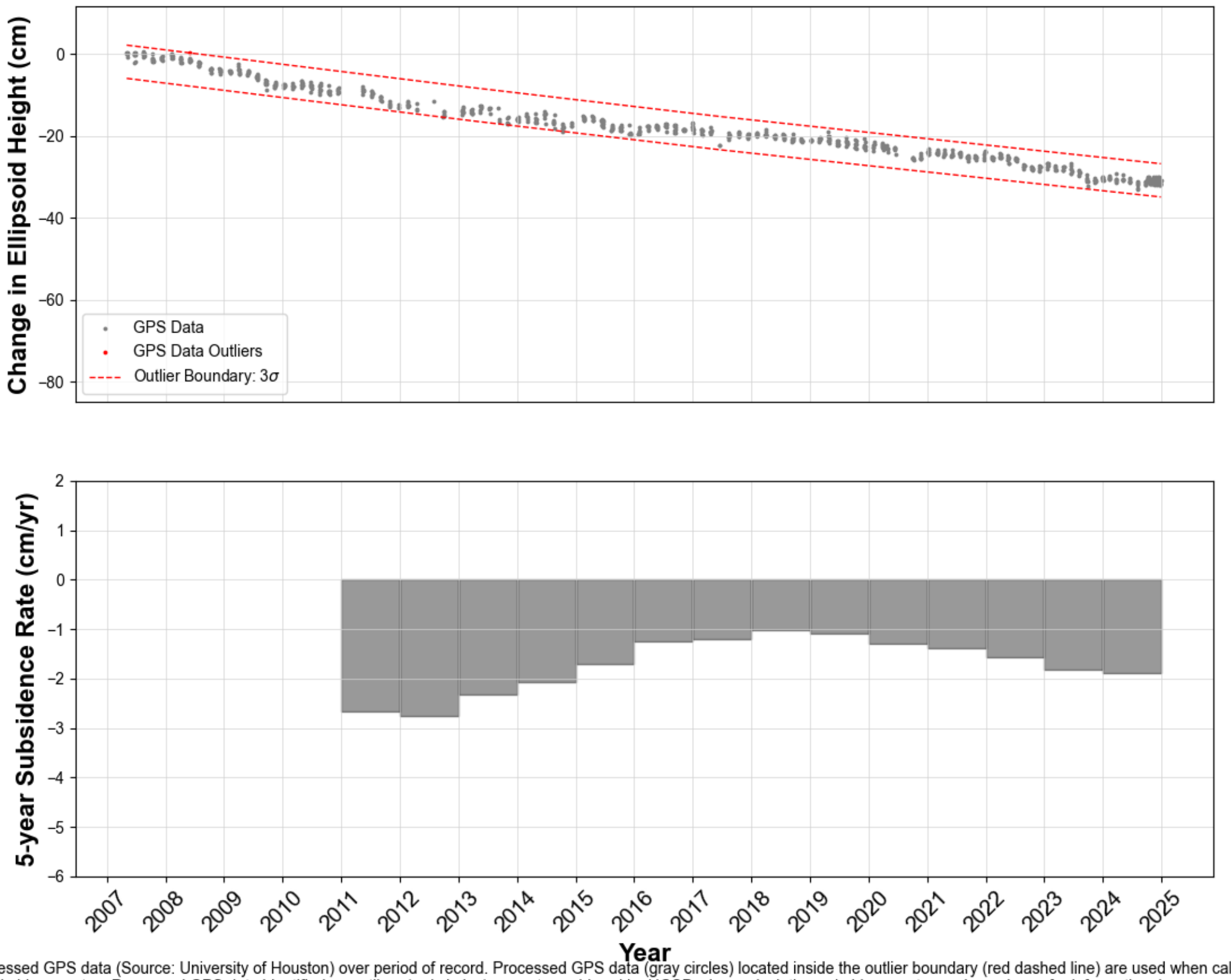


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P047

Spring, TX

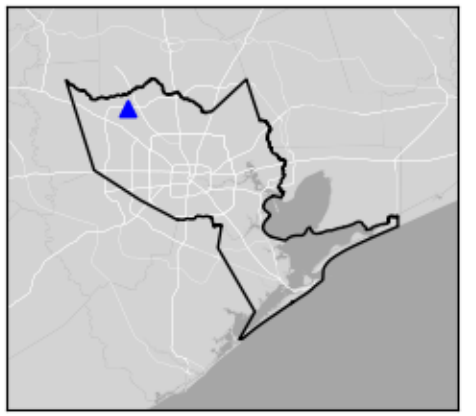


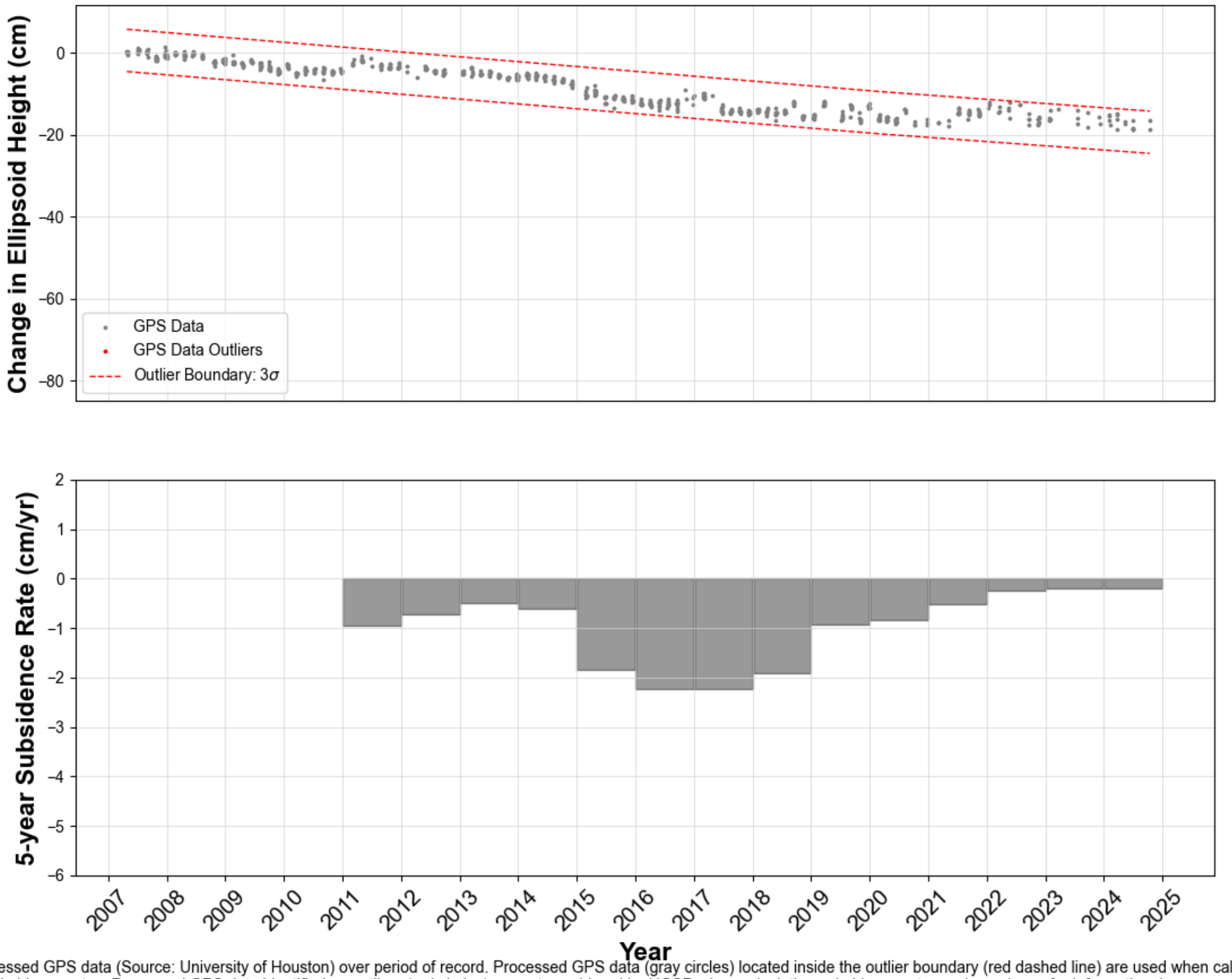


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P048

Cypress, TX

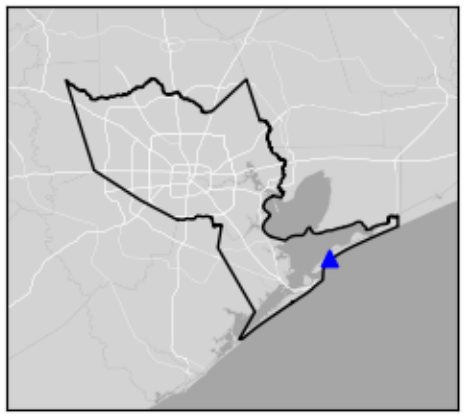


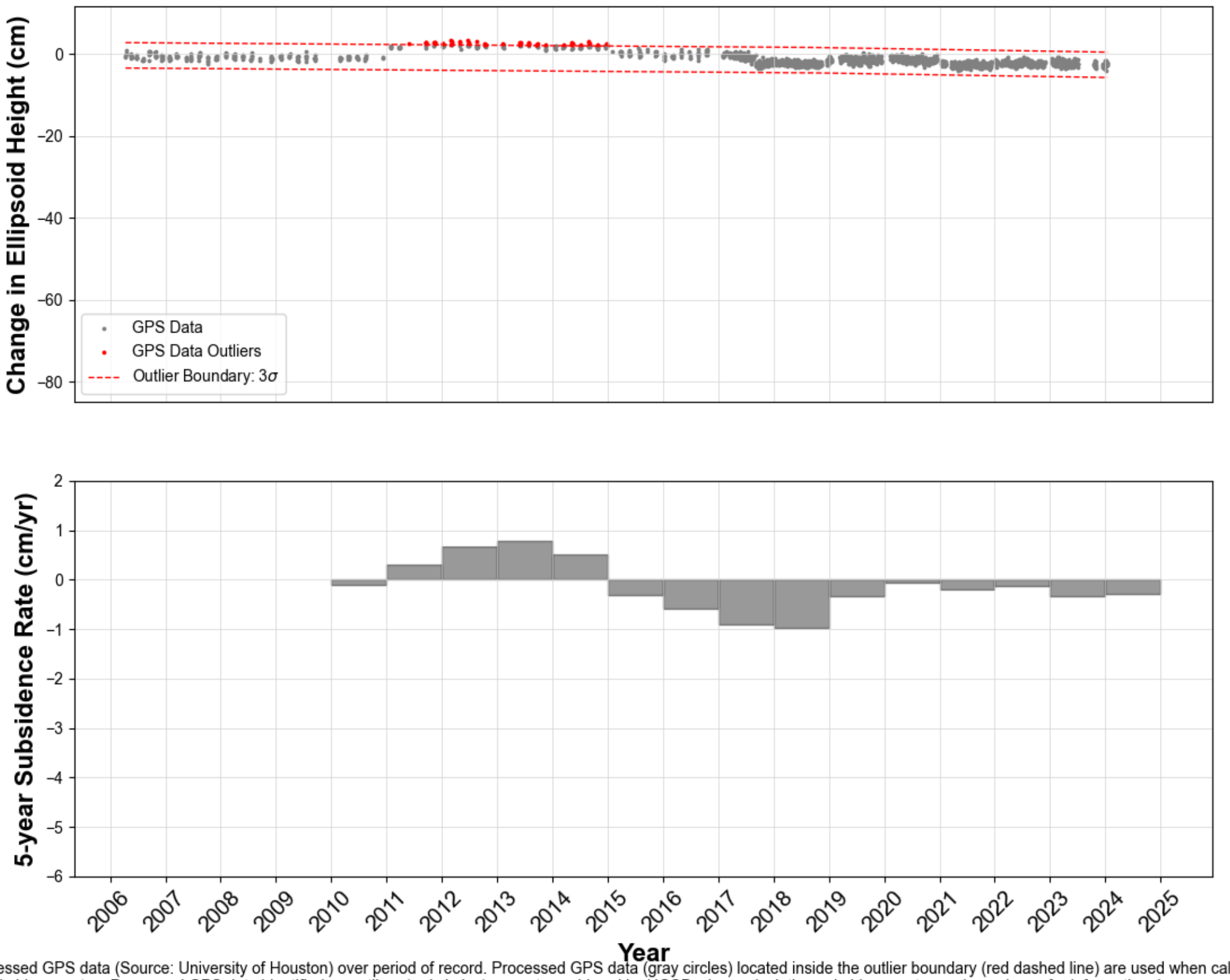


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P049

Bolivar Peninsula, TX

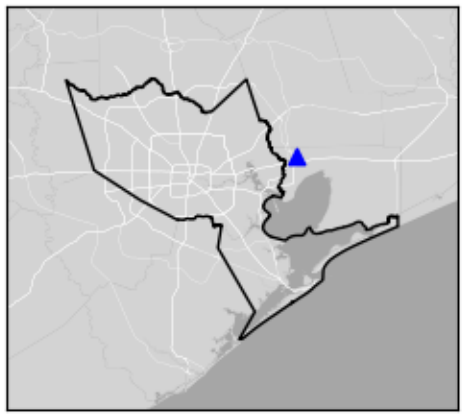


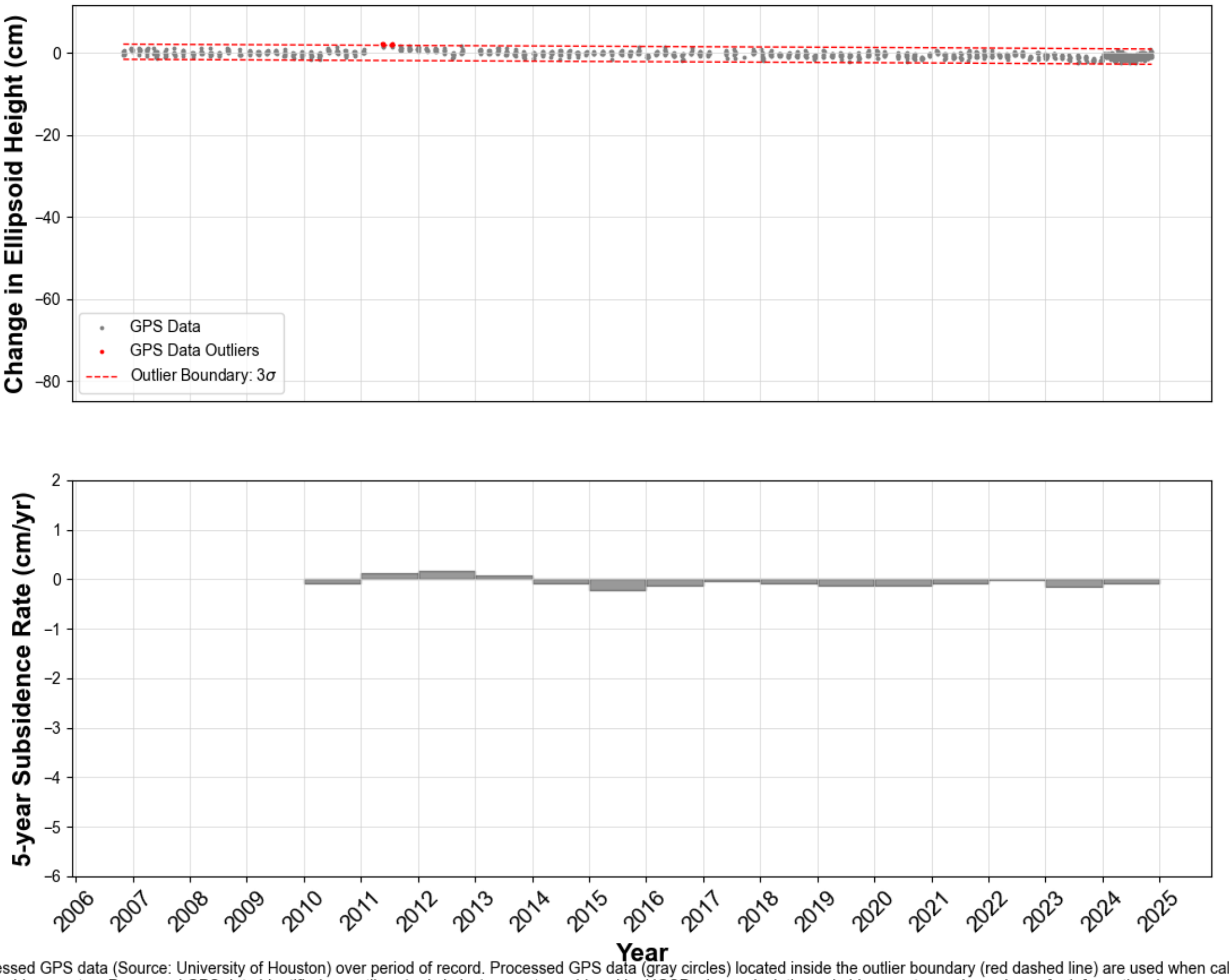


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P050

Mont Belvieu, TX

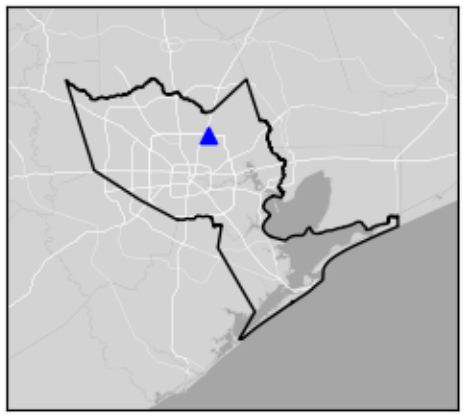


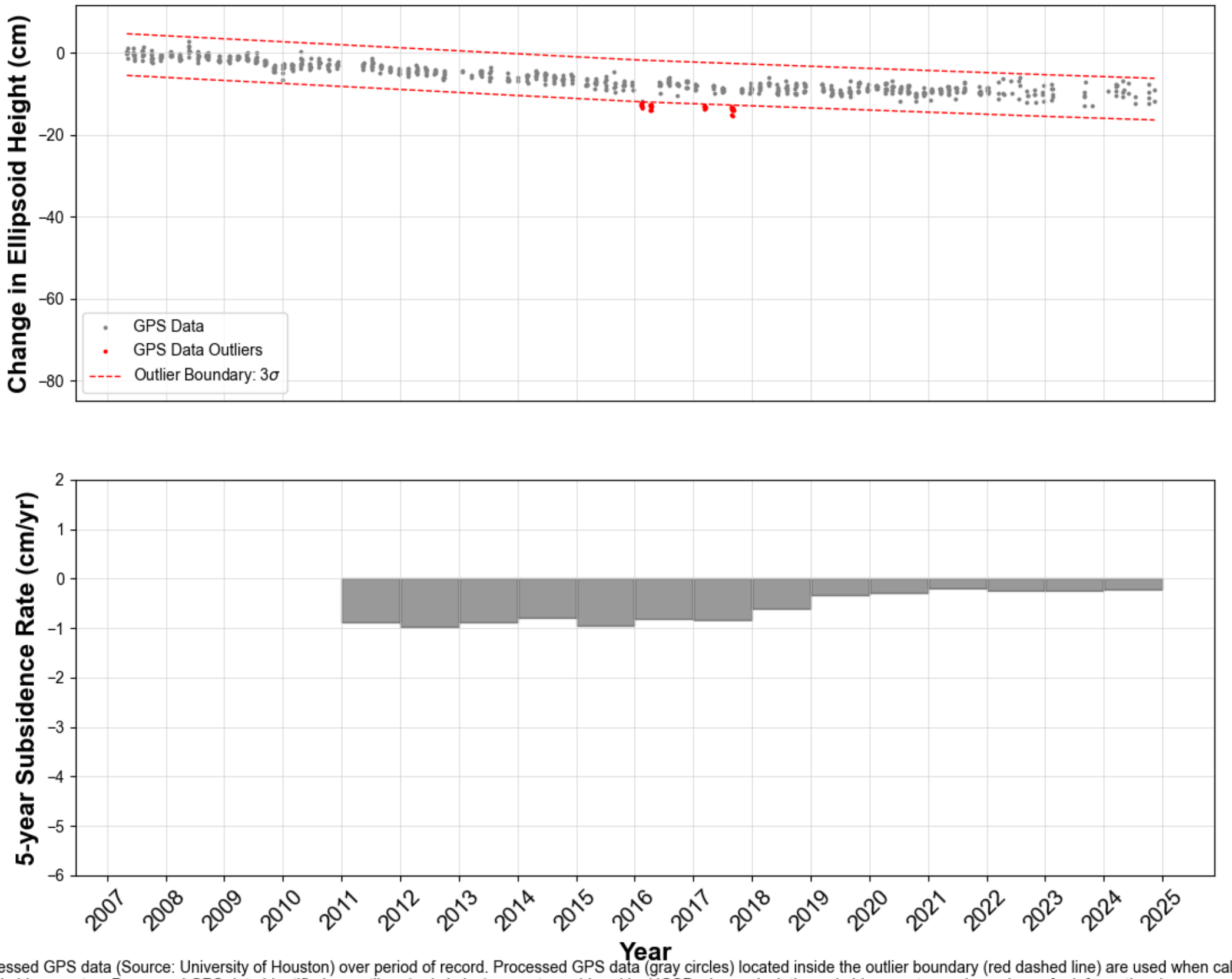


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P051

Humble, TX

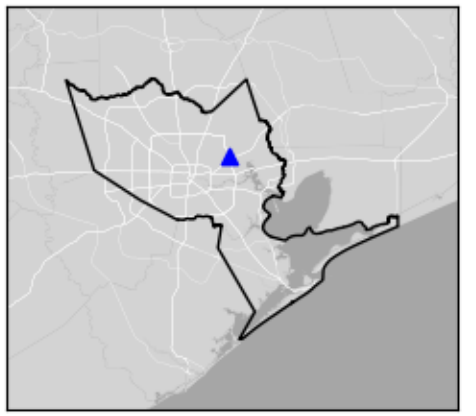


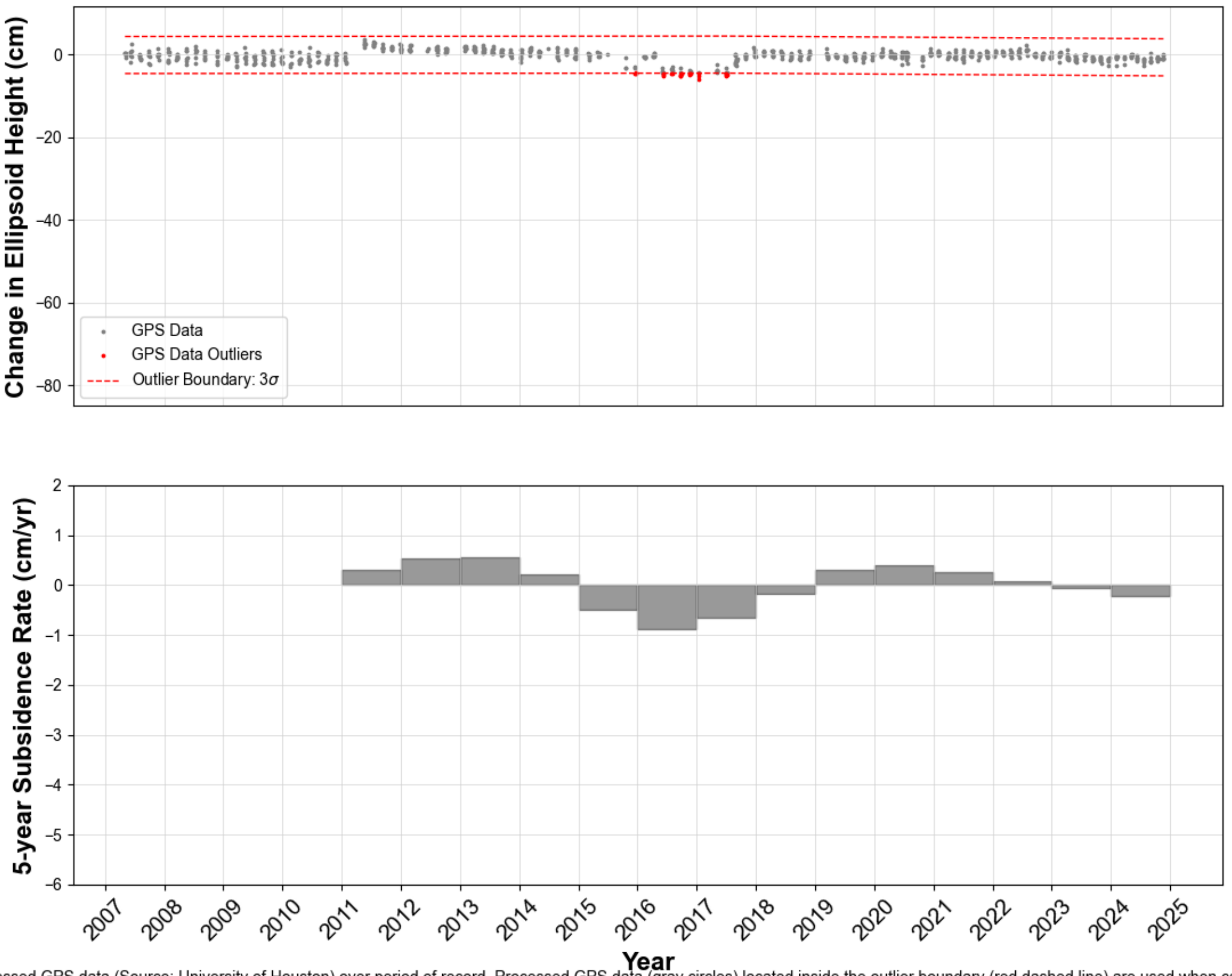


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

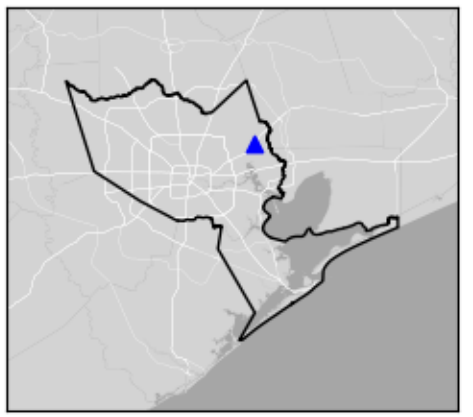
P052

Houston, TX



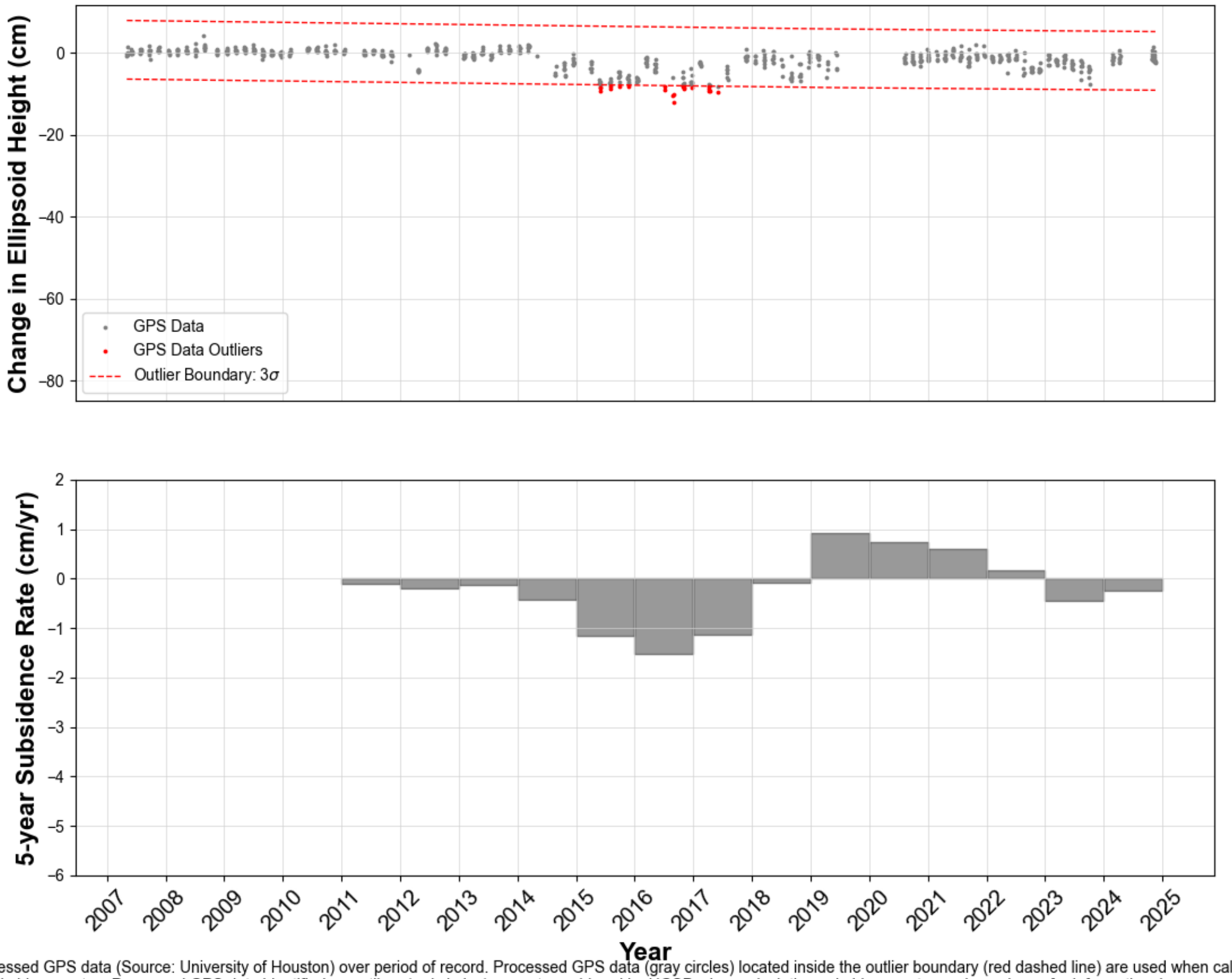


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P053

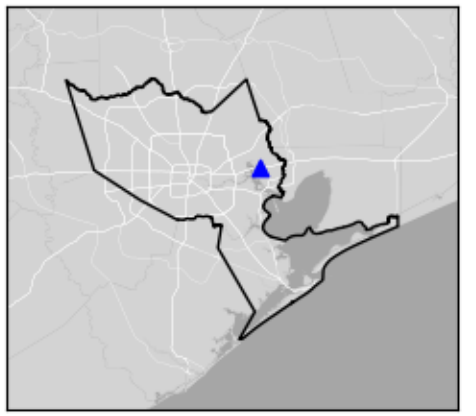
Crosby, TX

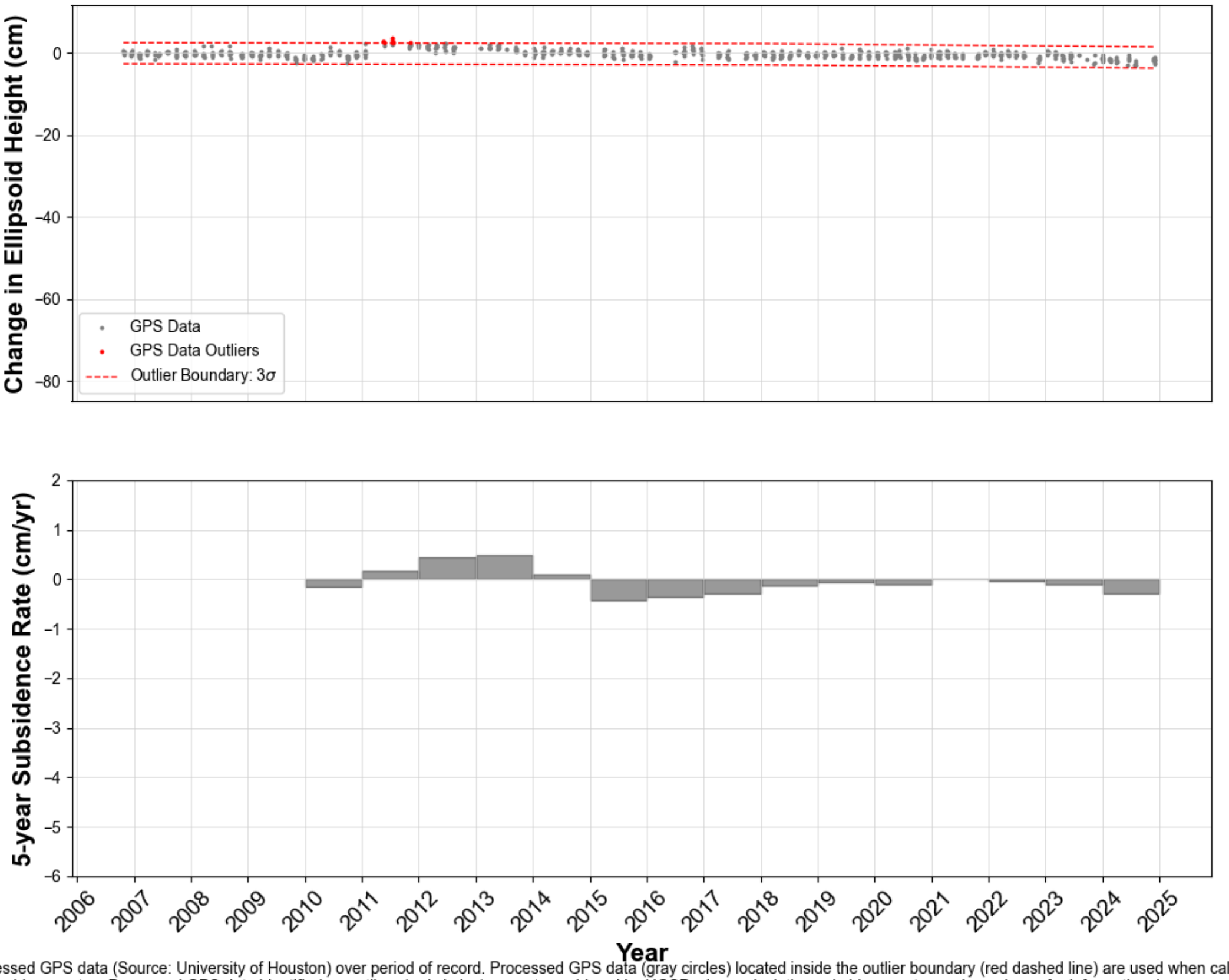


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P054

Baytown, TX

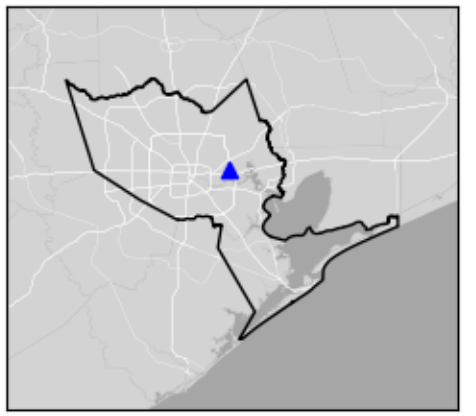


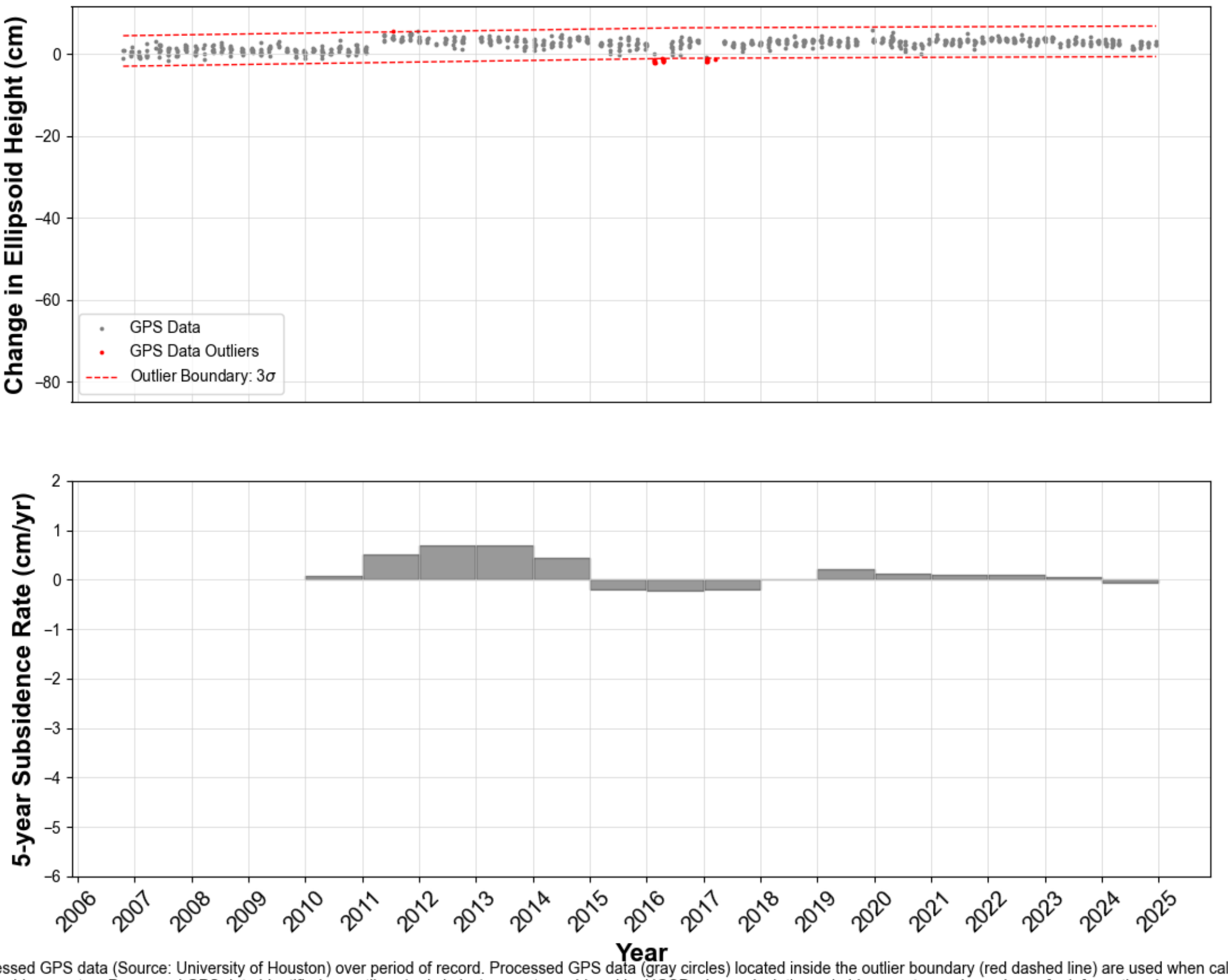


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P055

Houston, TX

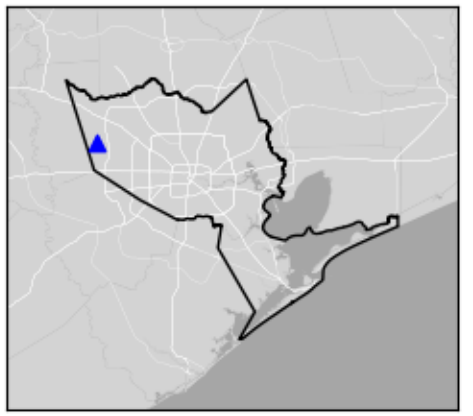


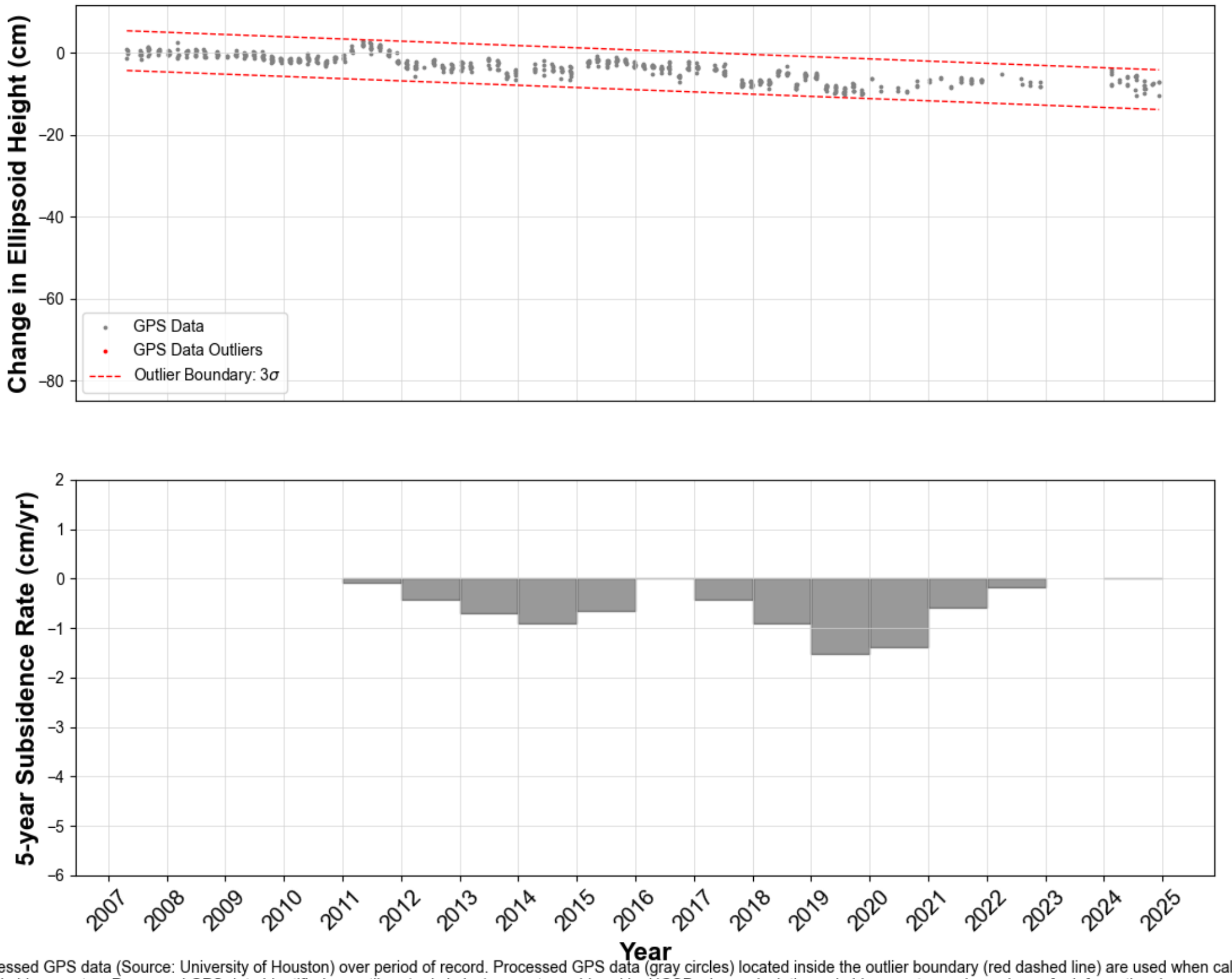


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P056

Katy, TX

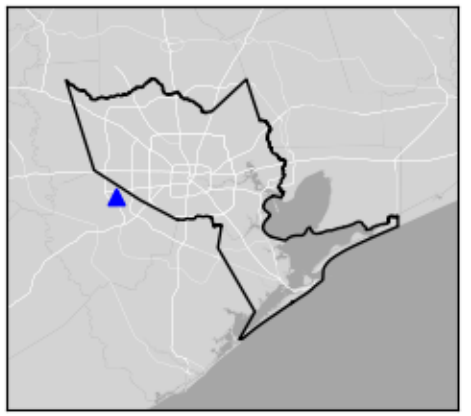


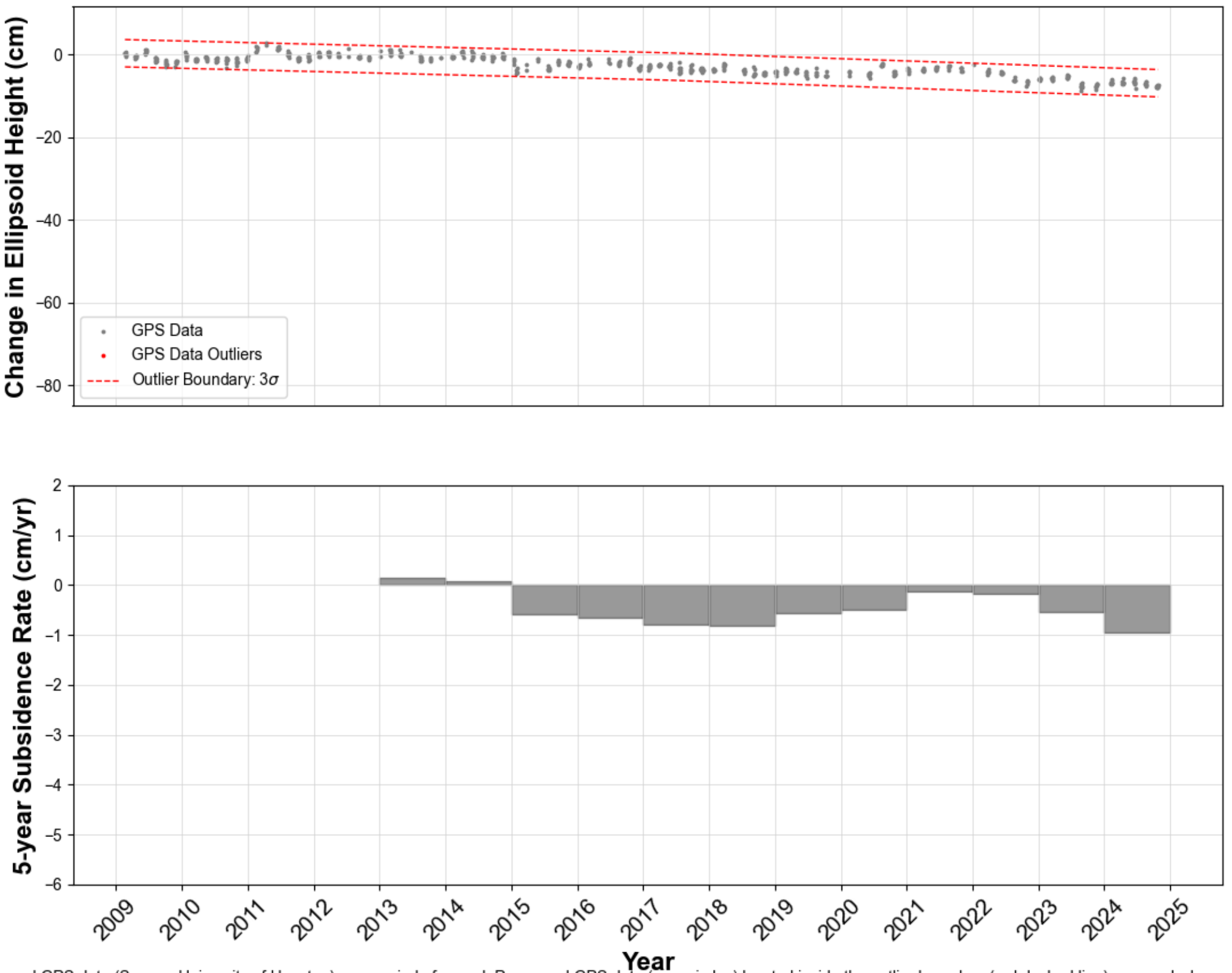


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P057

Richmond, TX

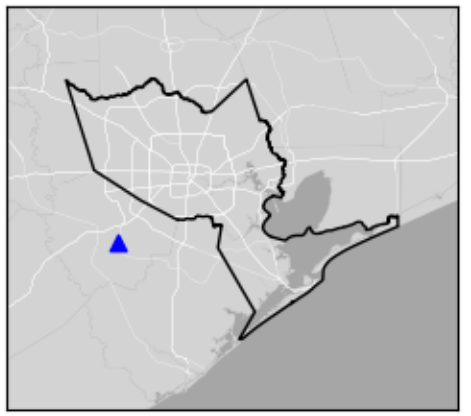


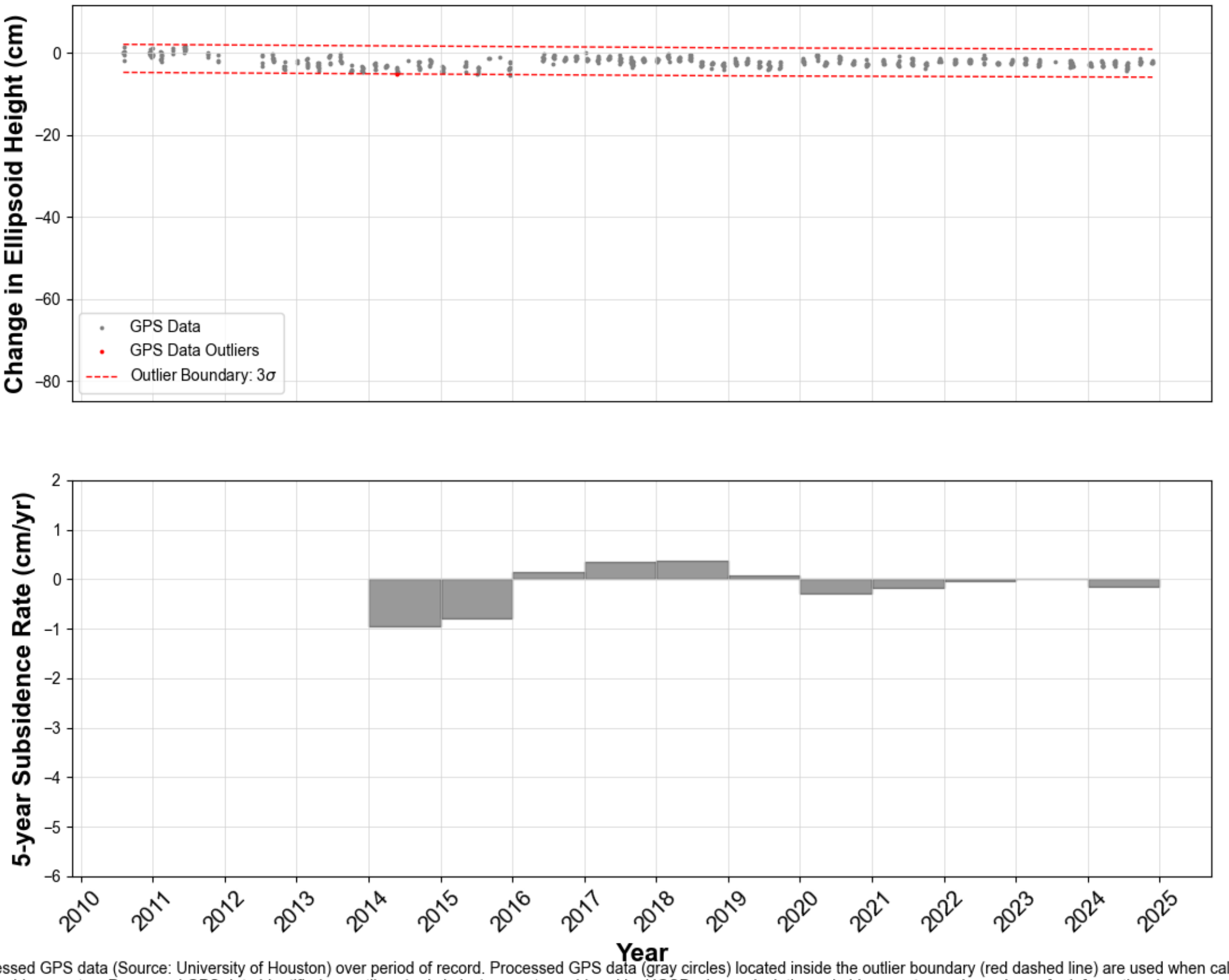


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P058

Richmond, TX

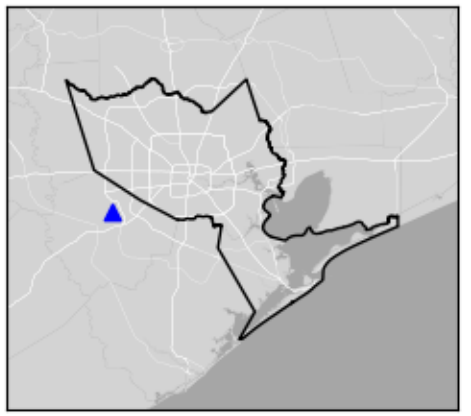


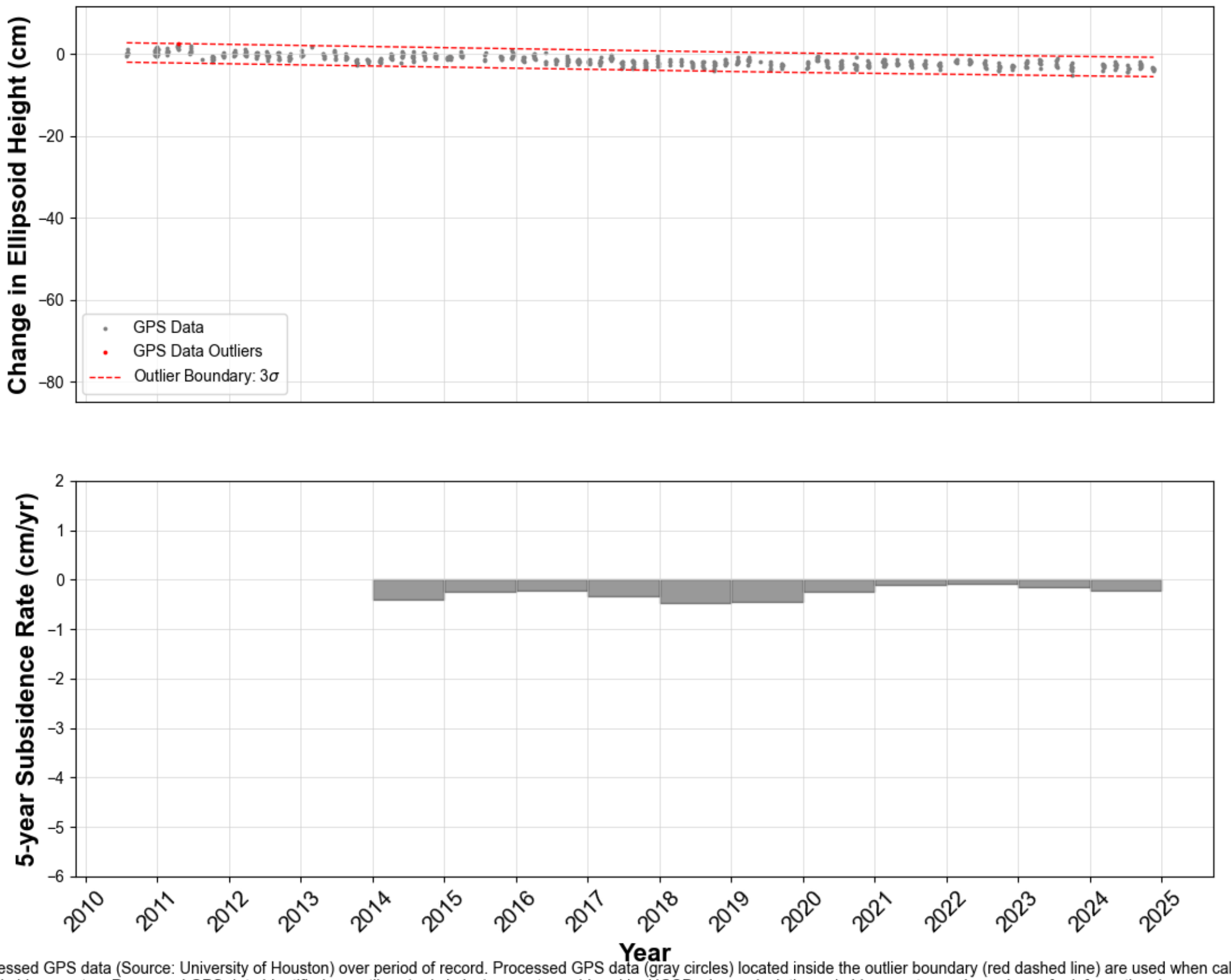


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P059

Richmond, TX

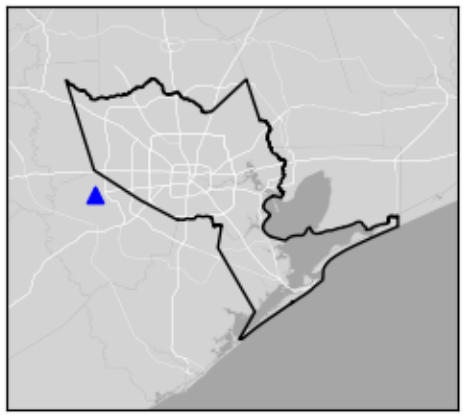


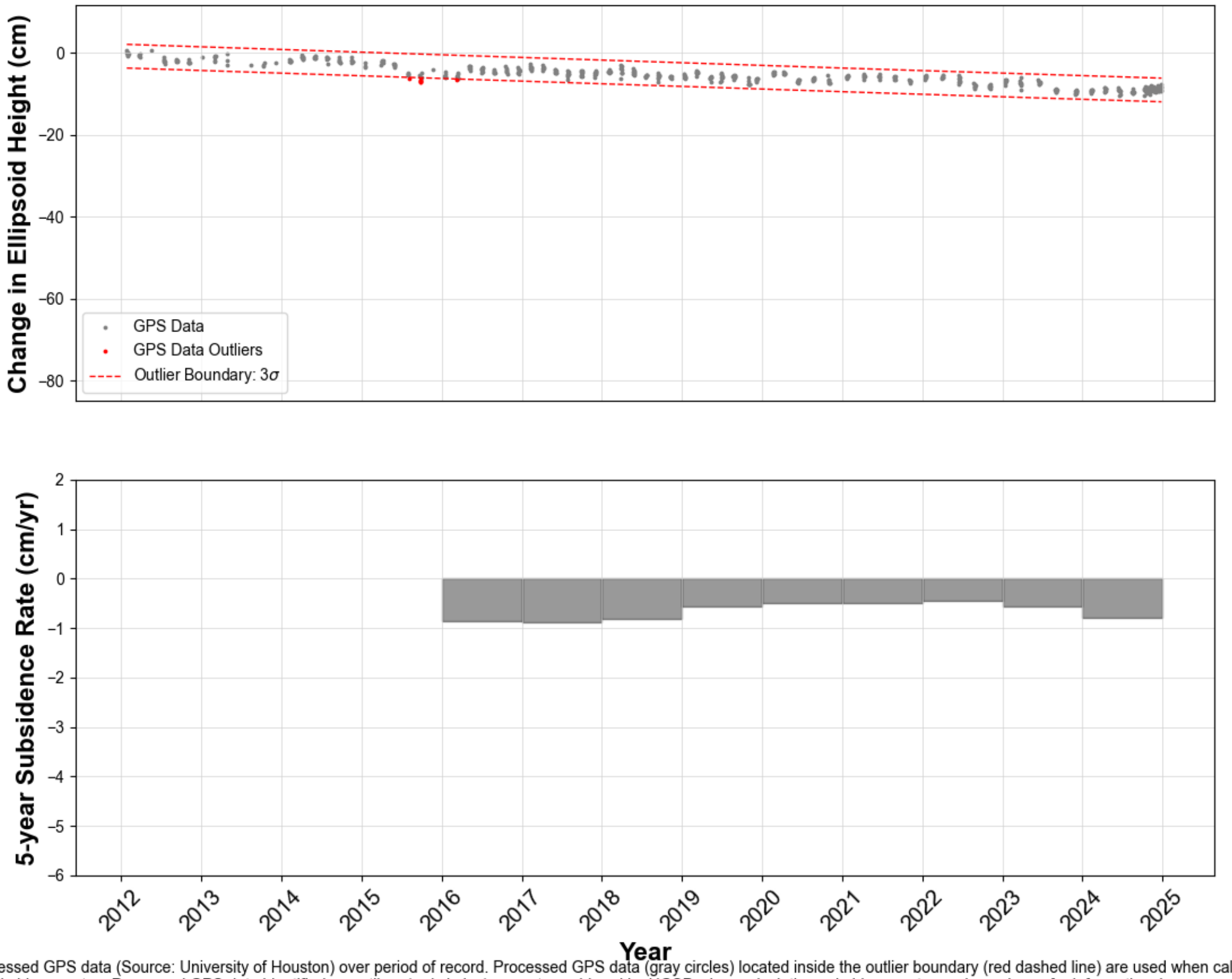


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P060

Richmond, TX

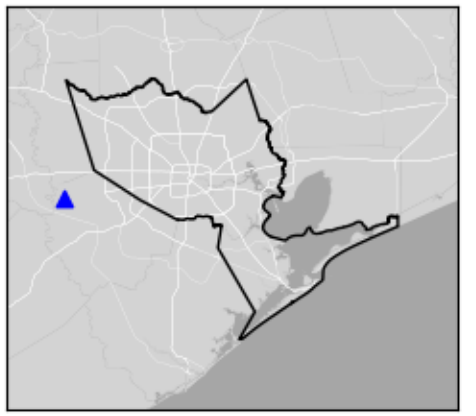


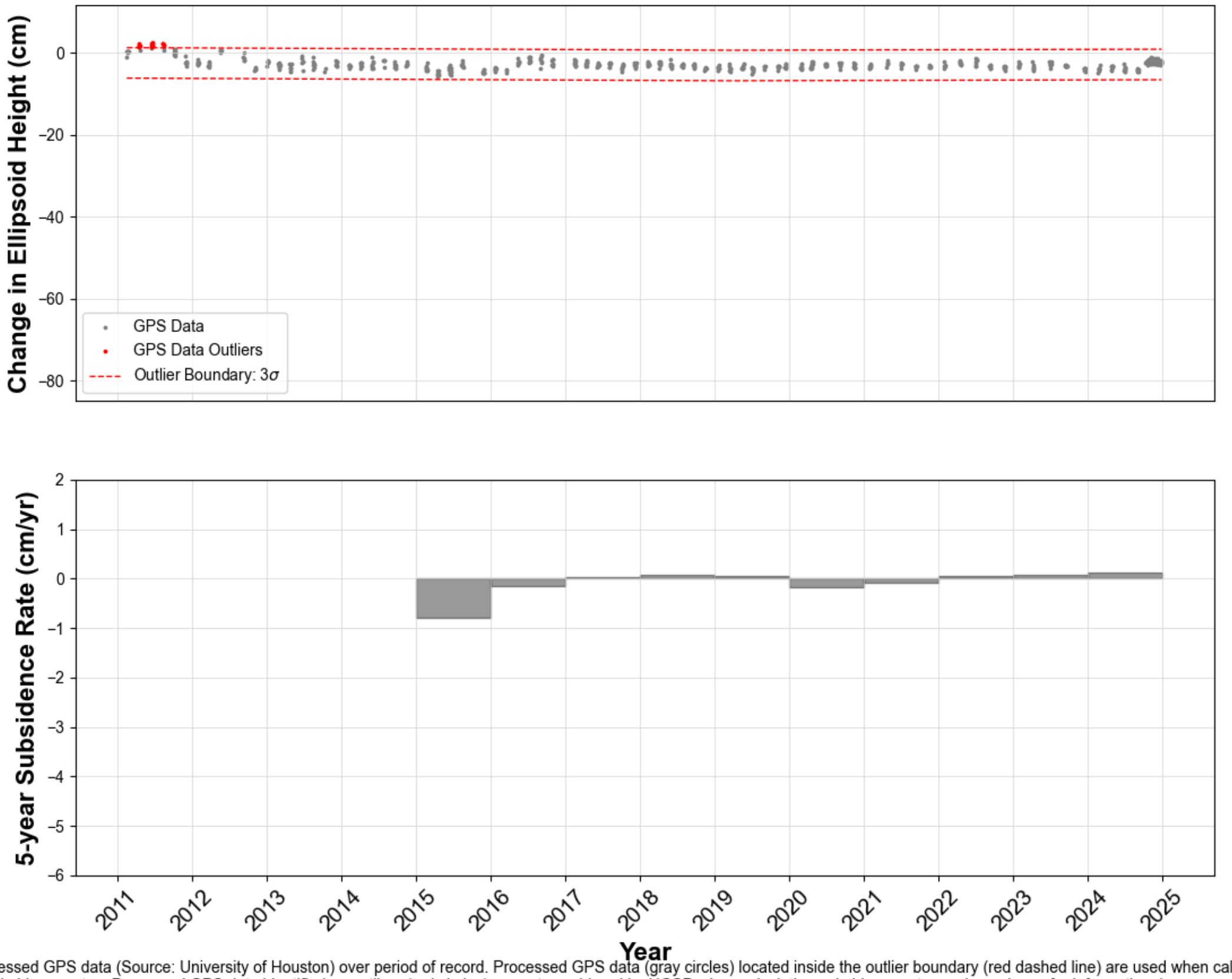


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P061

Simonton, TX

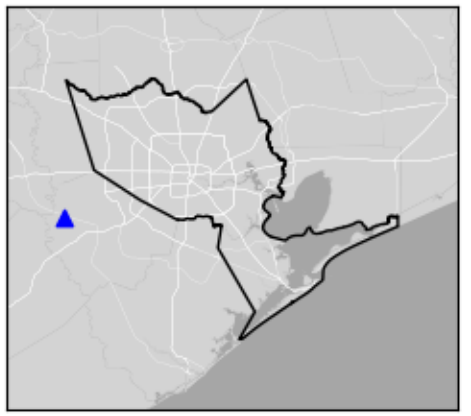


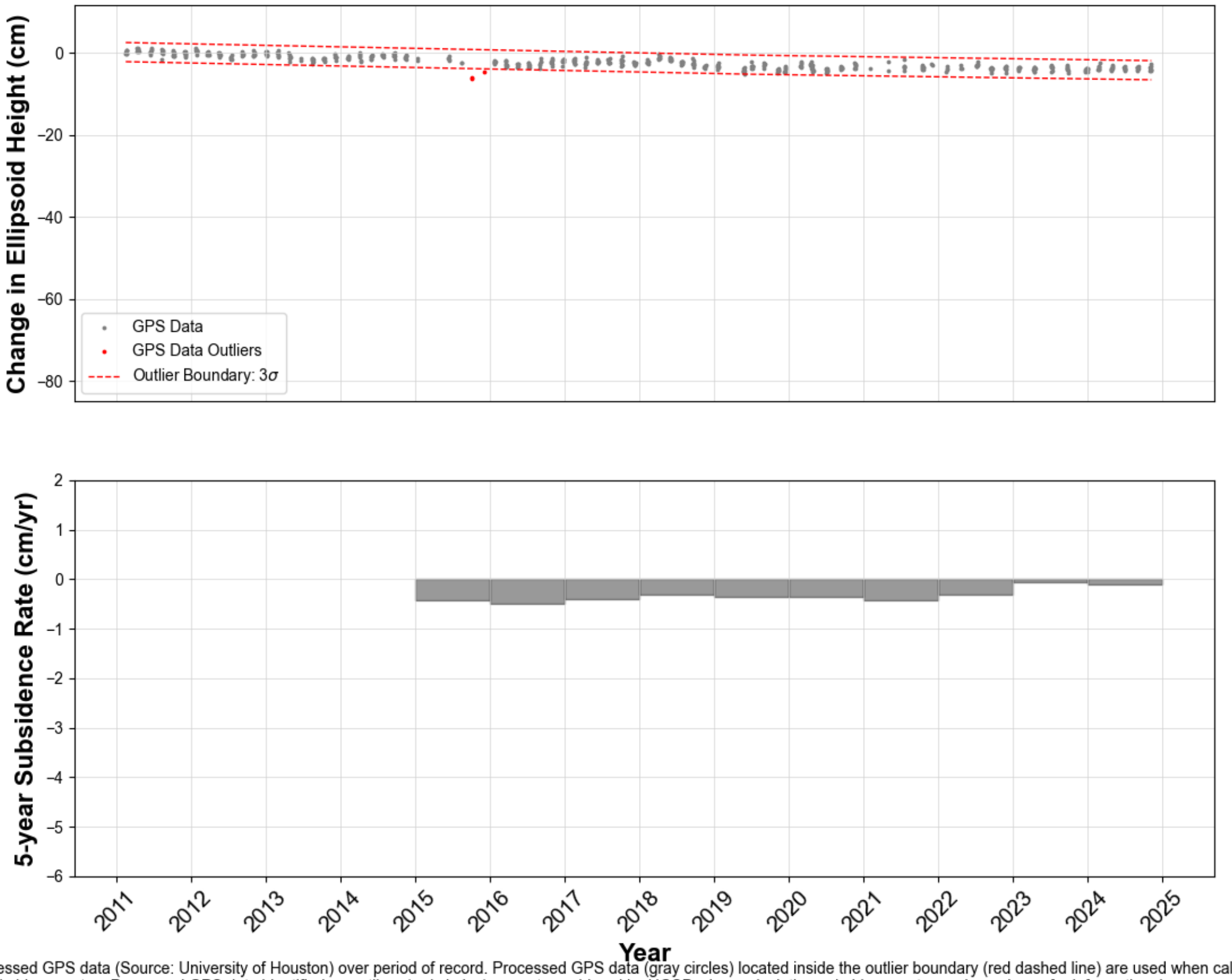


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P062

Rosenberg, TX

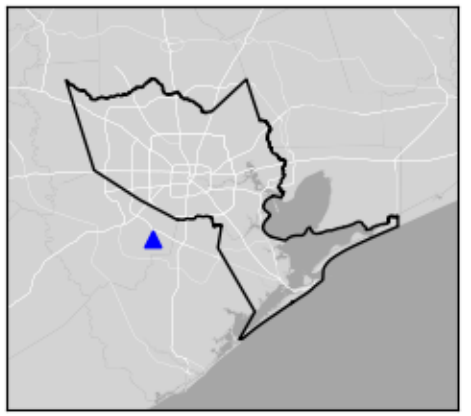


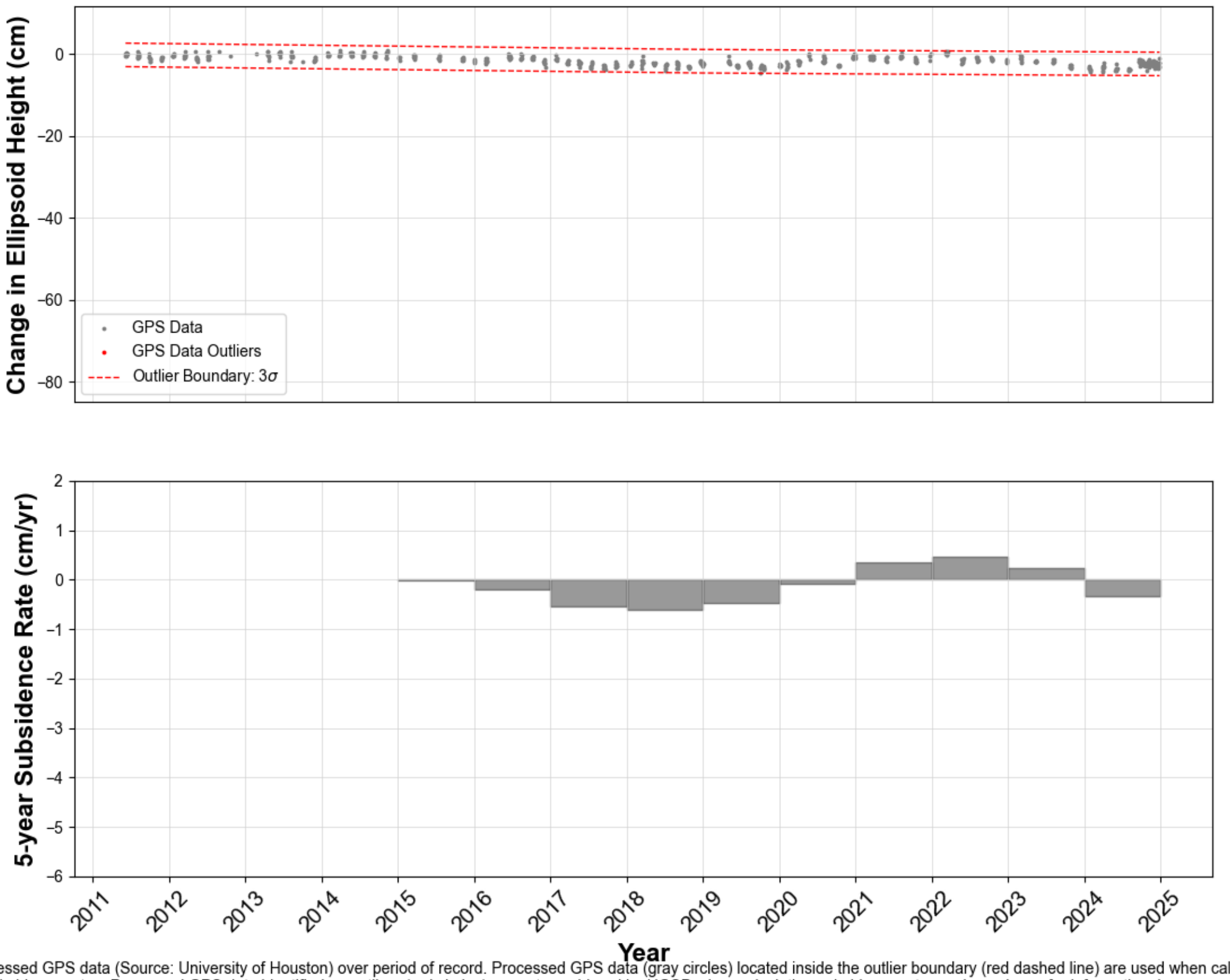


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P063

Missouri City, TX

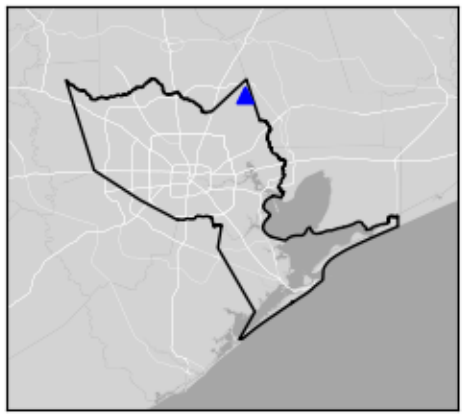


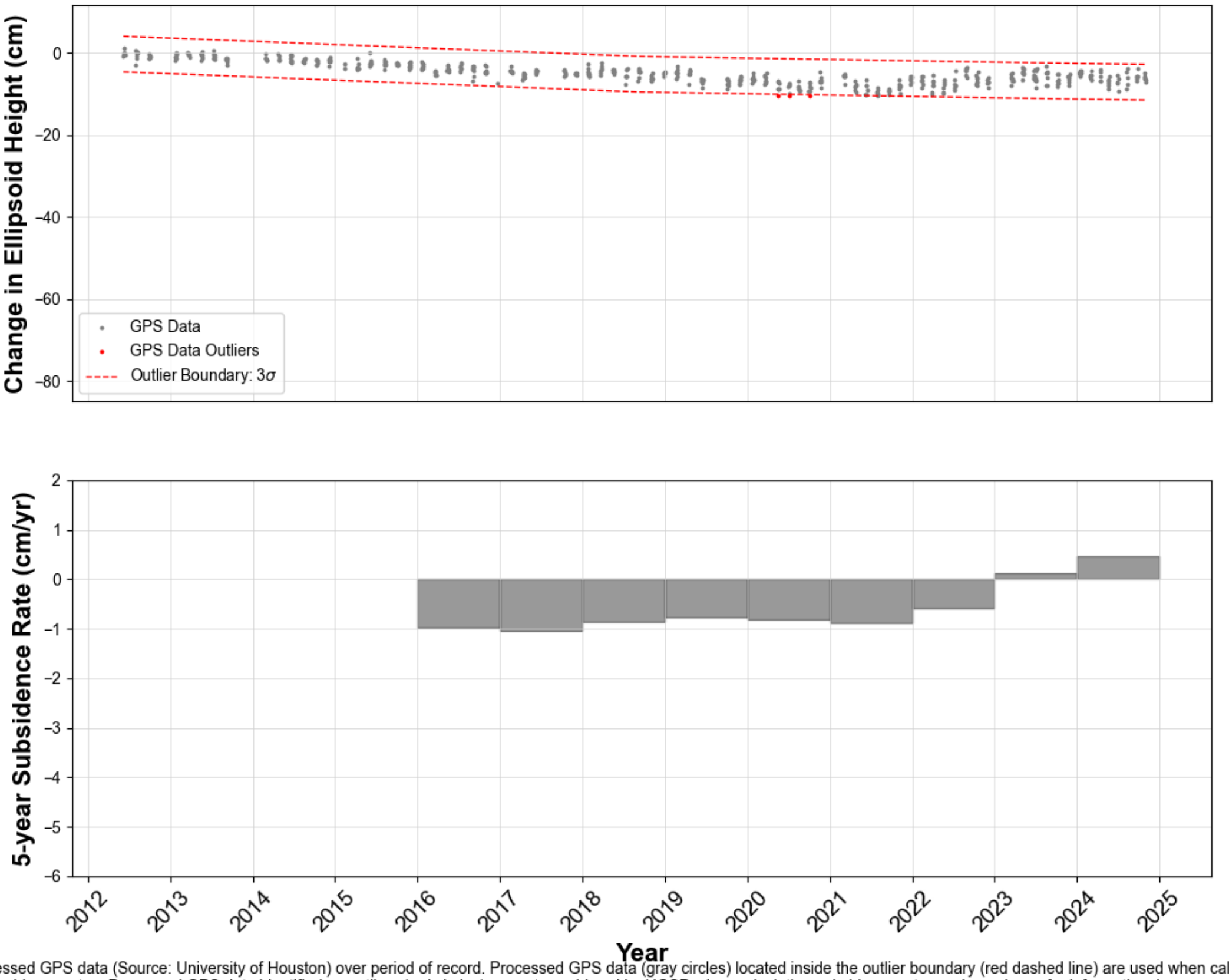


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P065

Huffman, TX

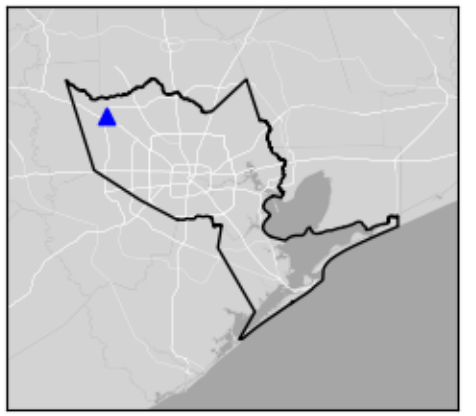


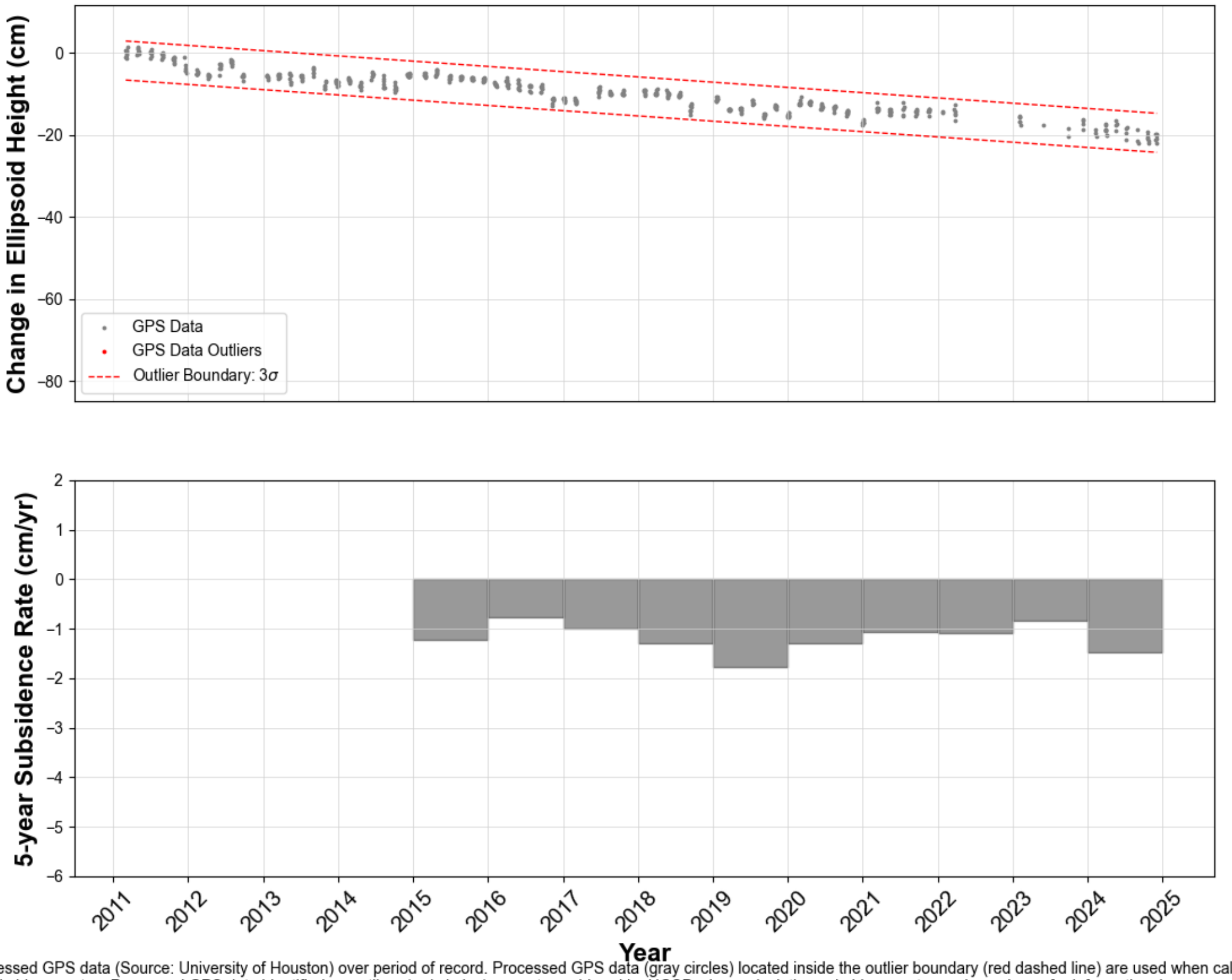


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P066

Cypress, TX

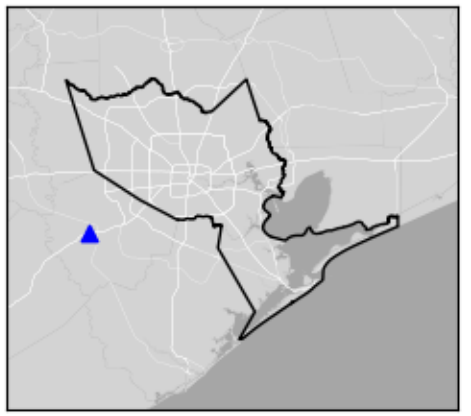


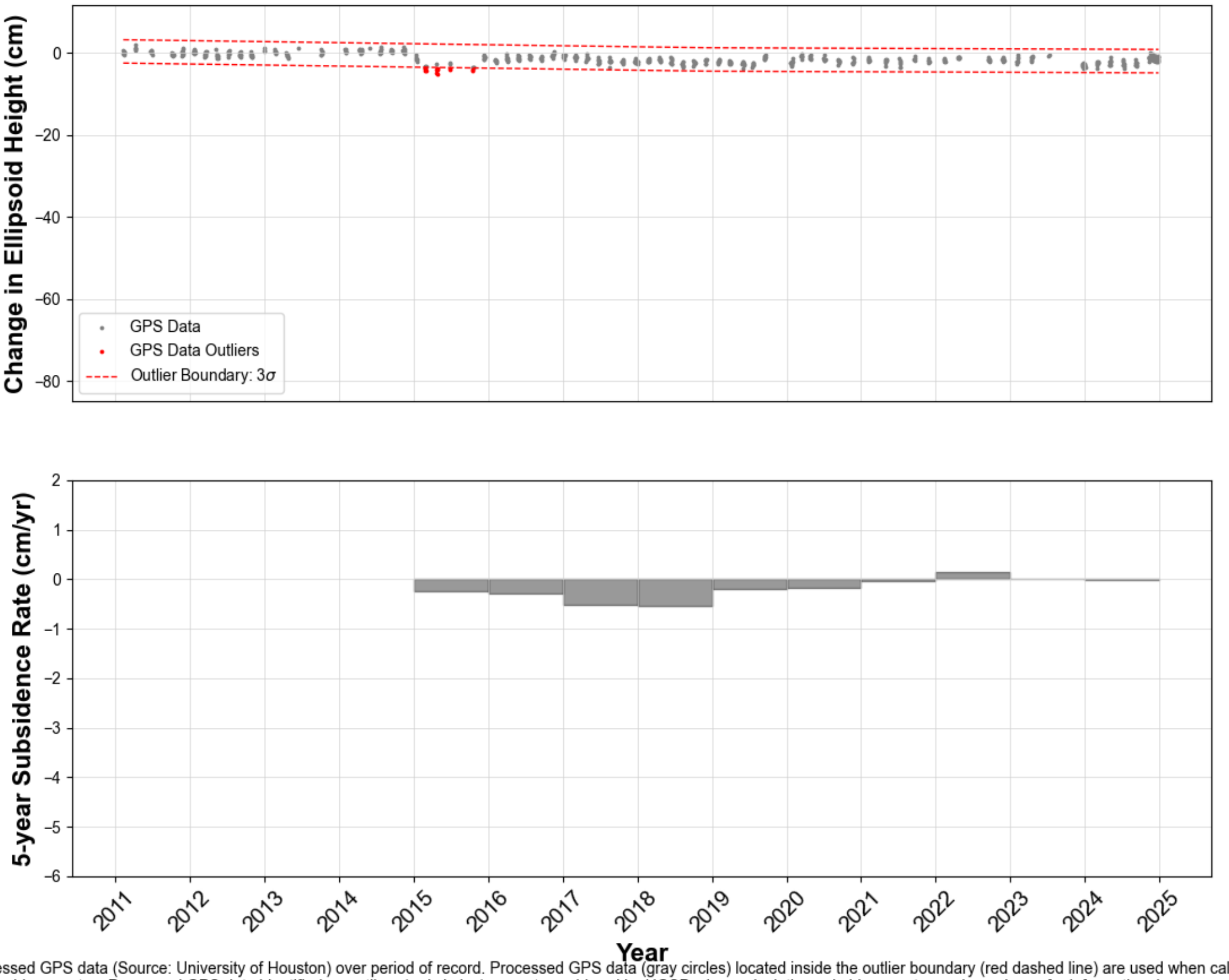


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

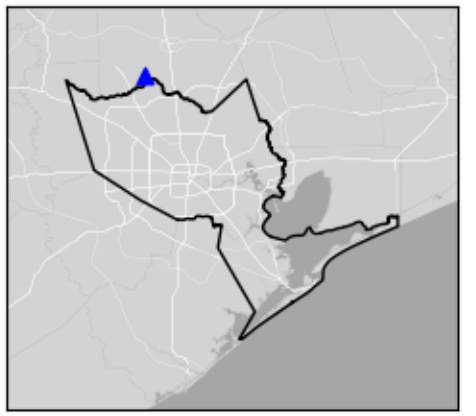
P067

Rosenberg, TX



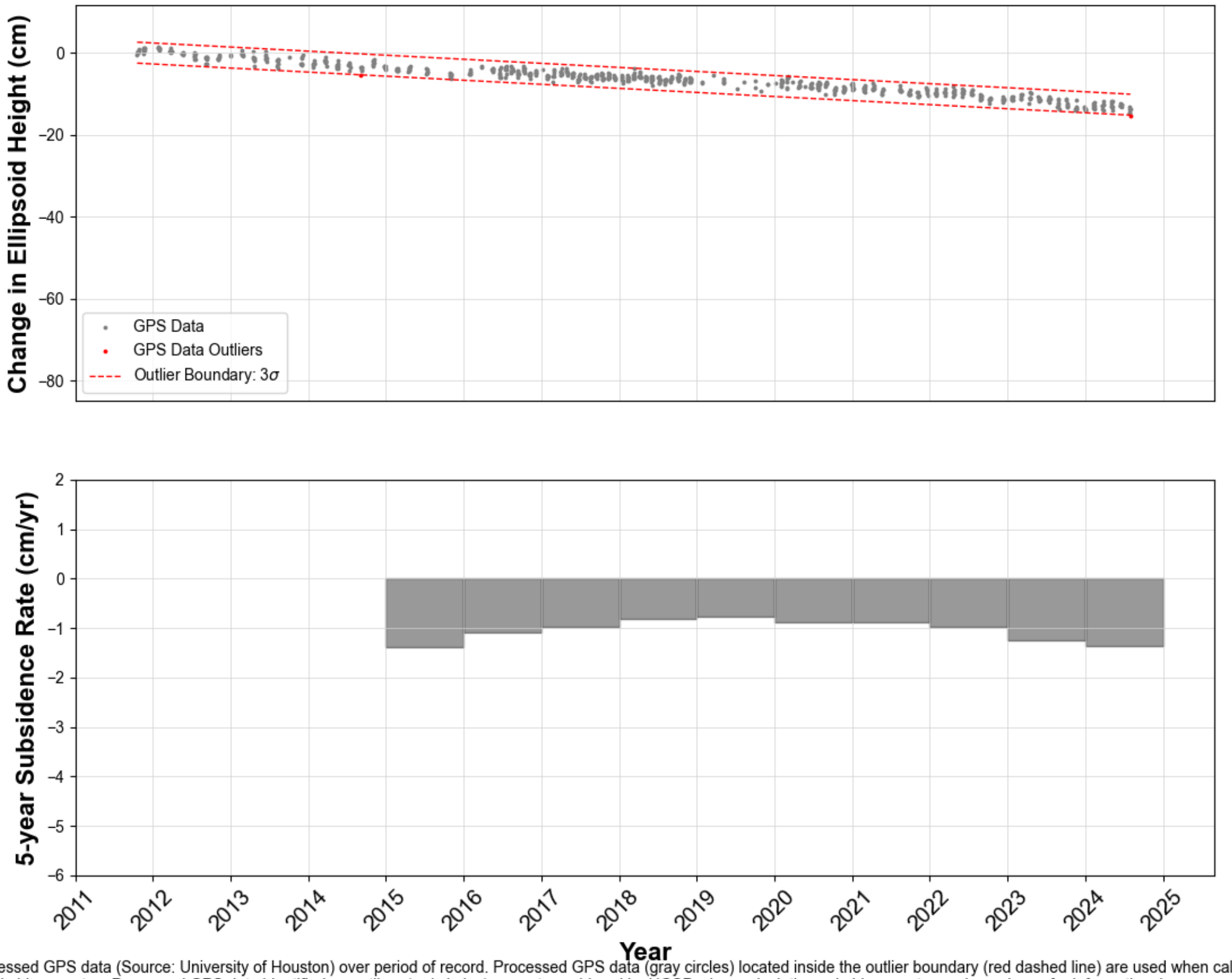


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P068

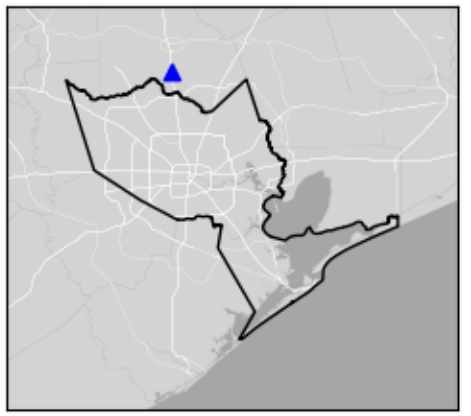
The Woodlands, TX

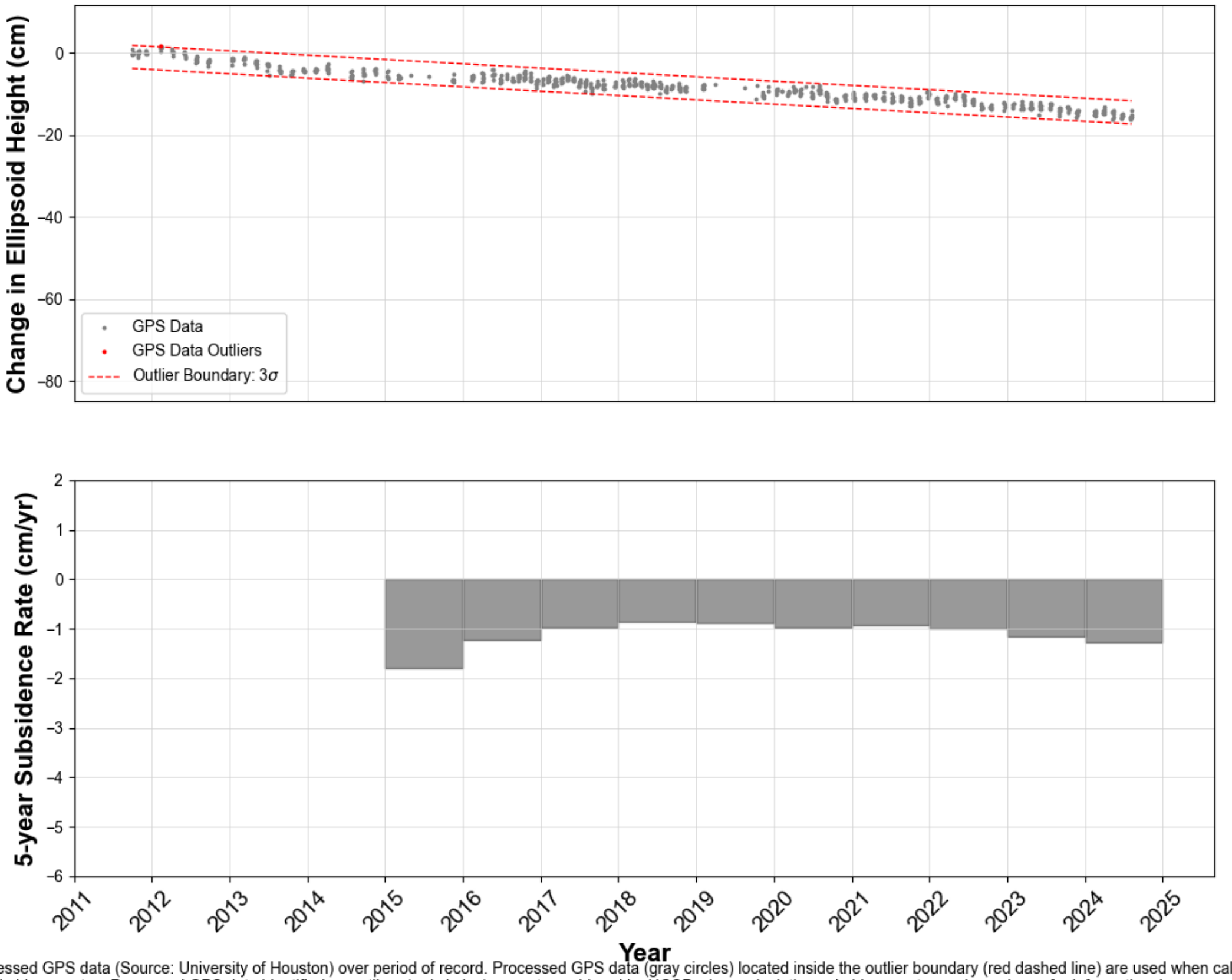


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P069

Conroe, TX

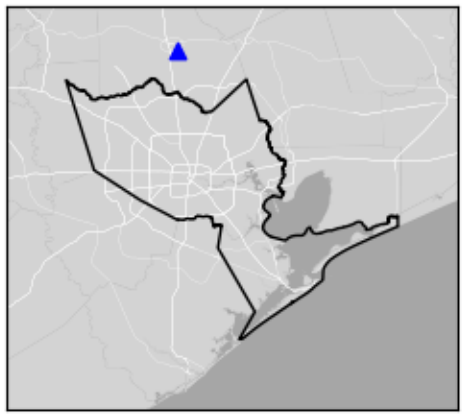


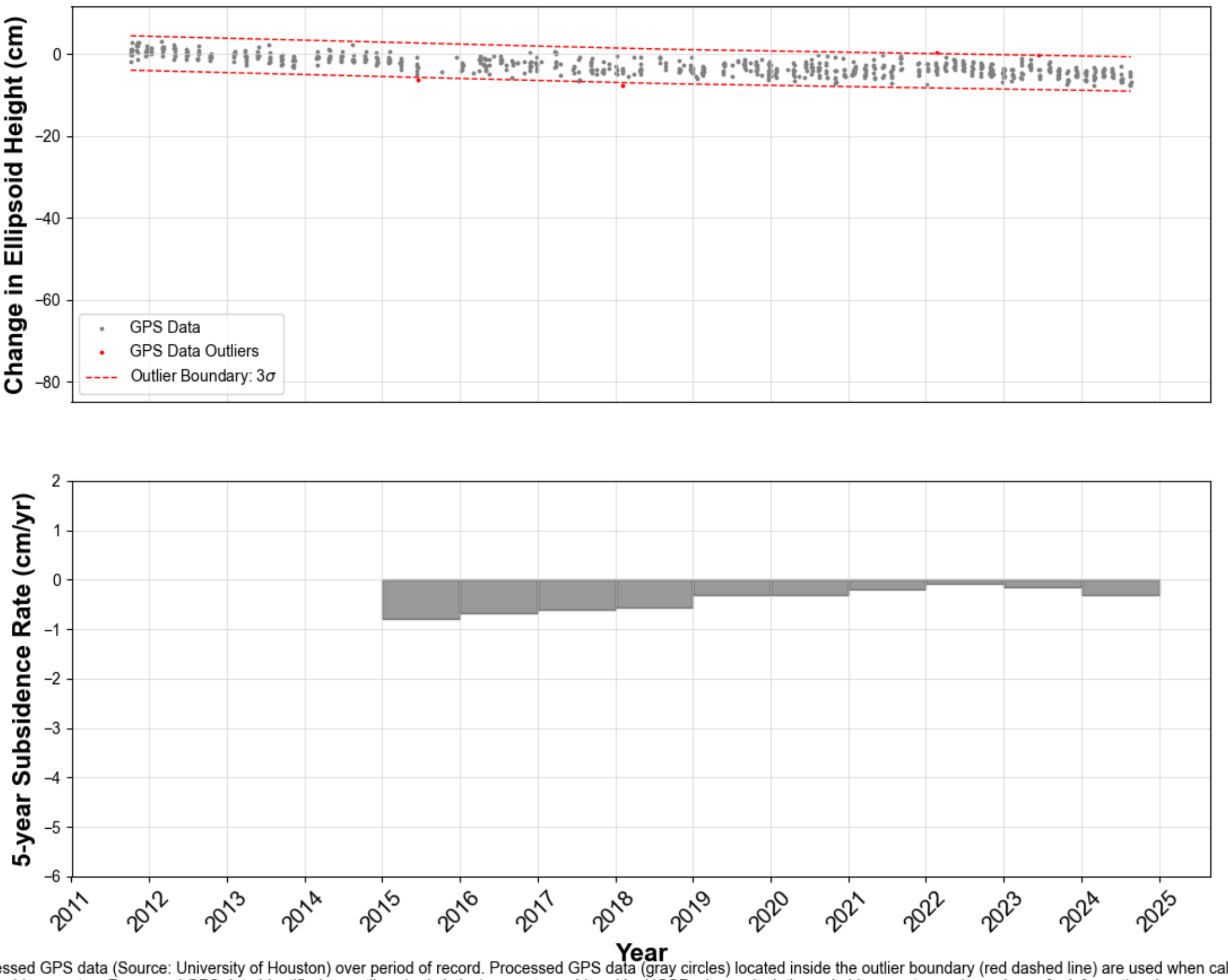


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P070

Conroe, TX

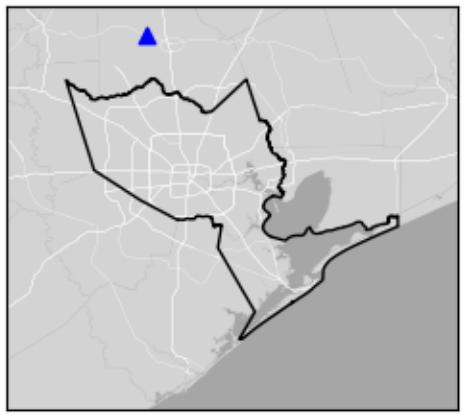


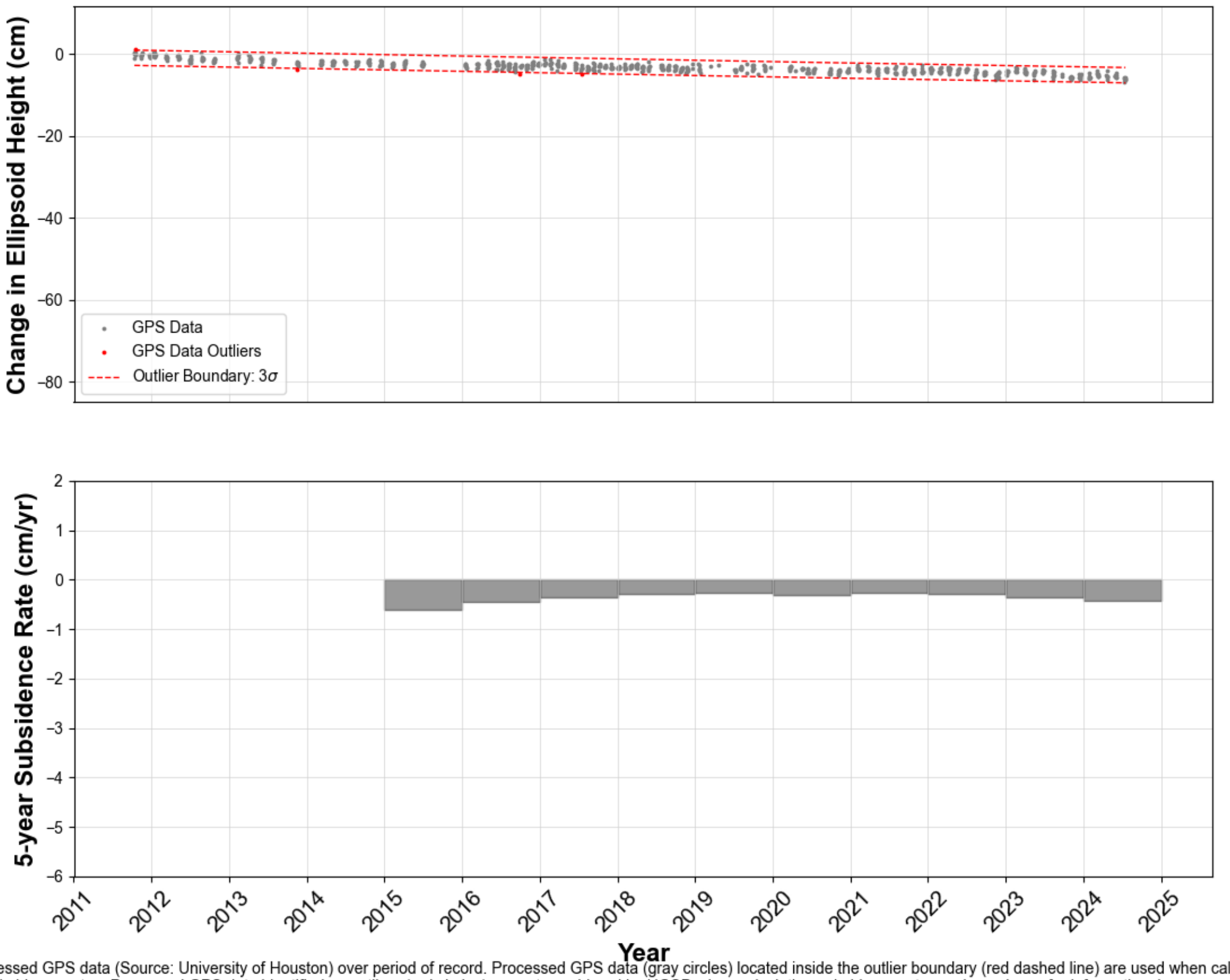


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P071

Conroe, TX

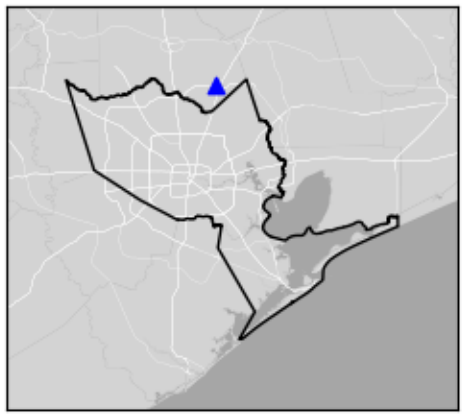


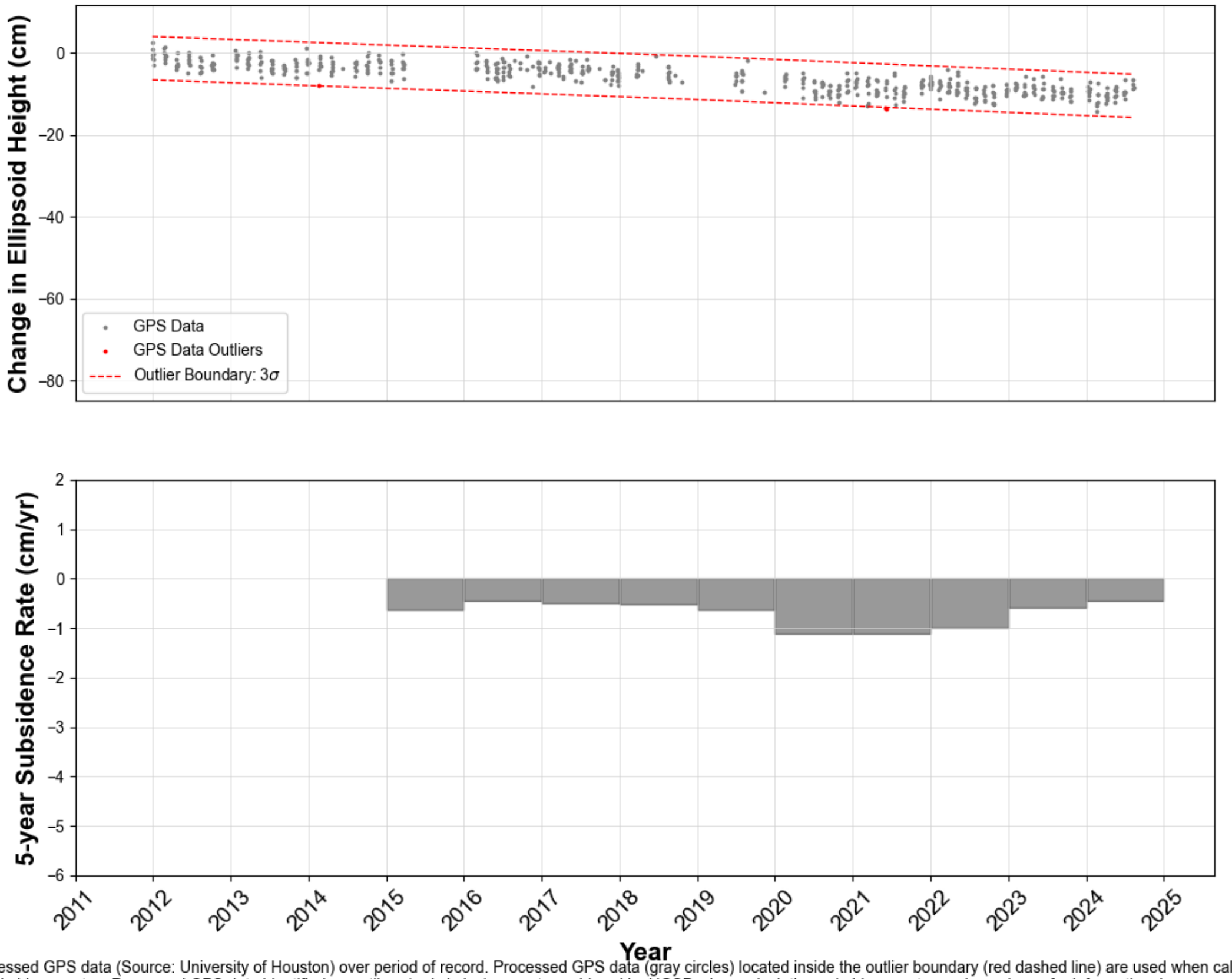


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P072

New Caney, TX

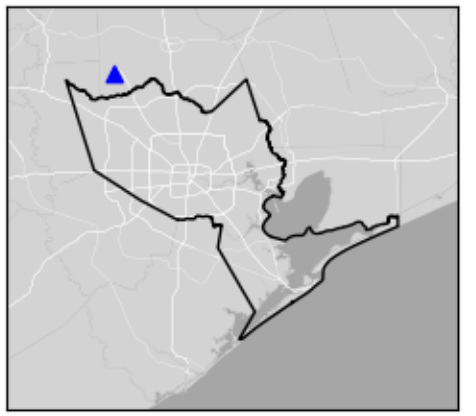


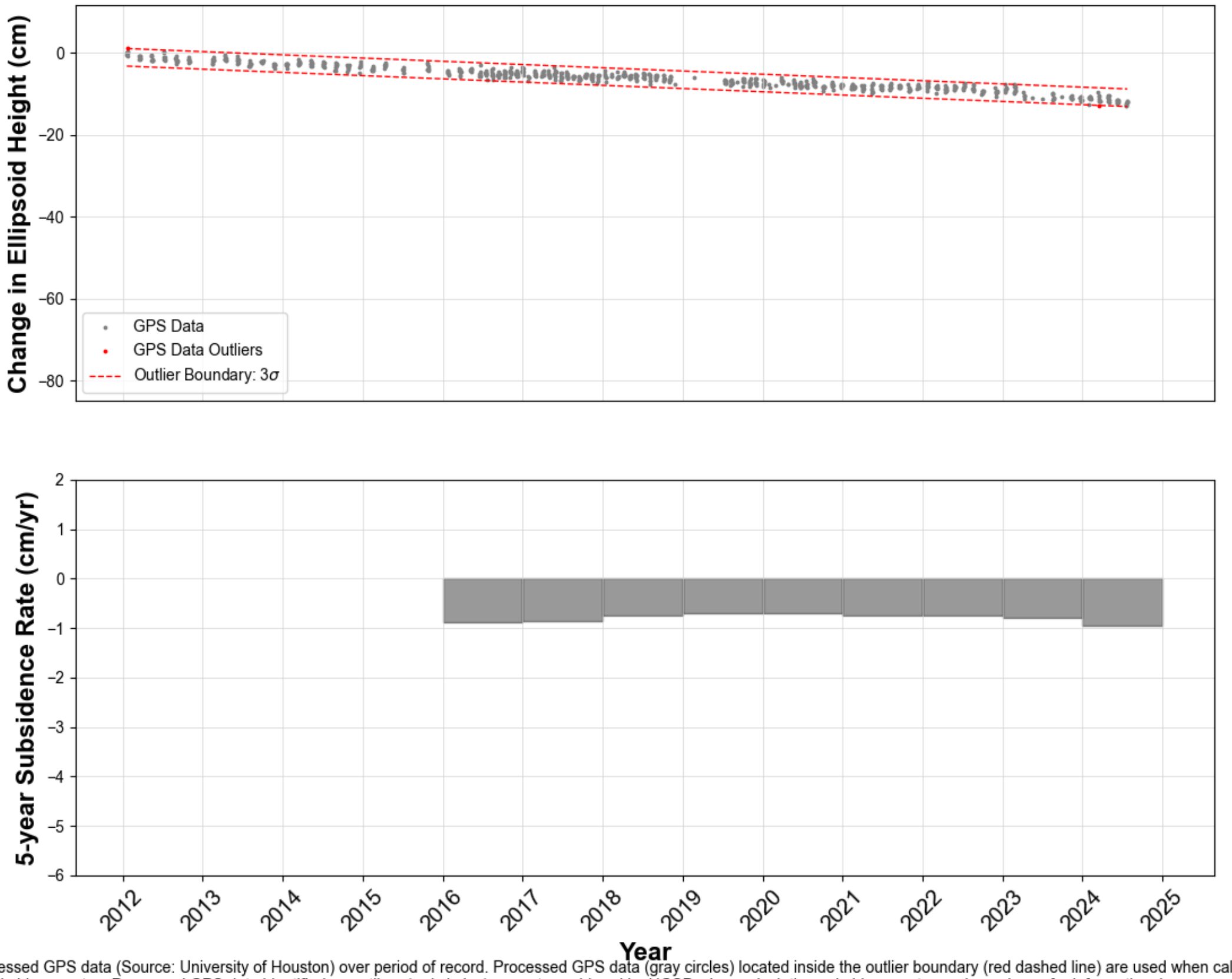


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P073

Magnolia, TX

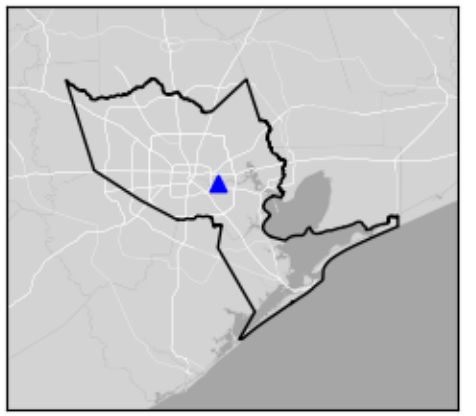


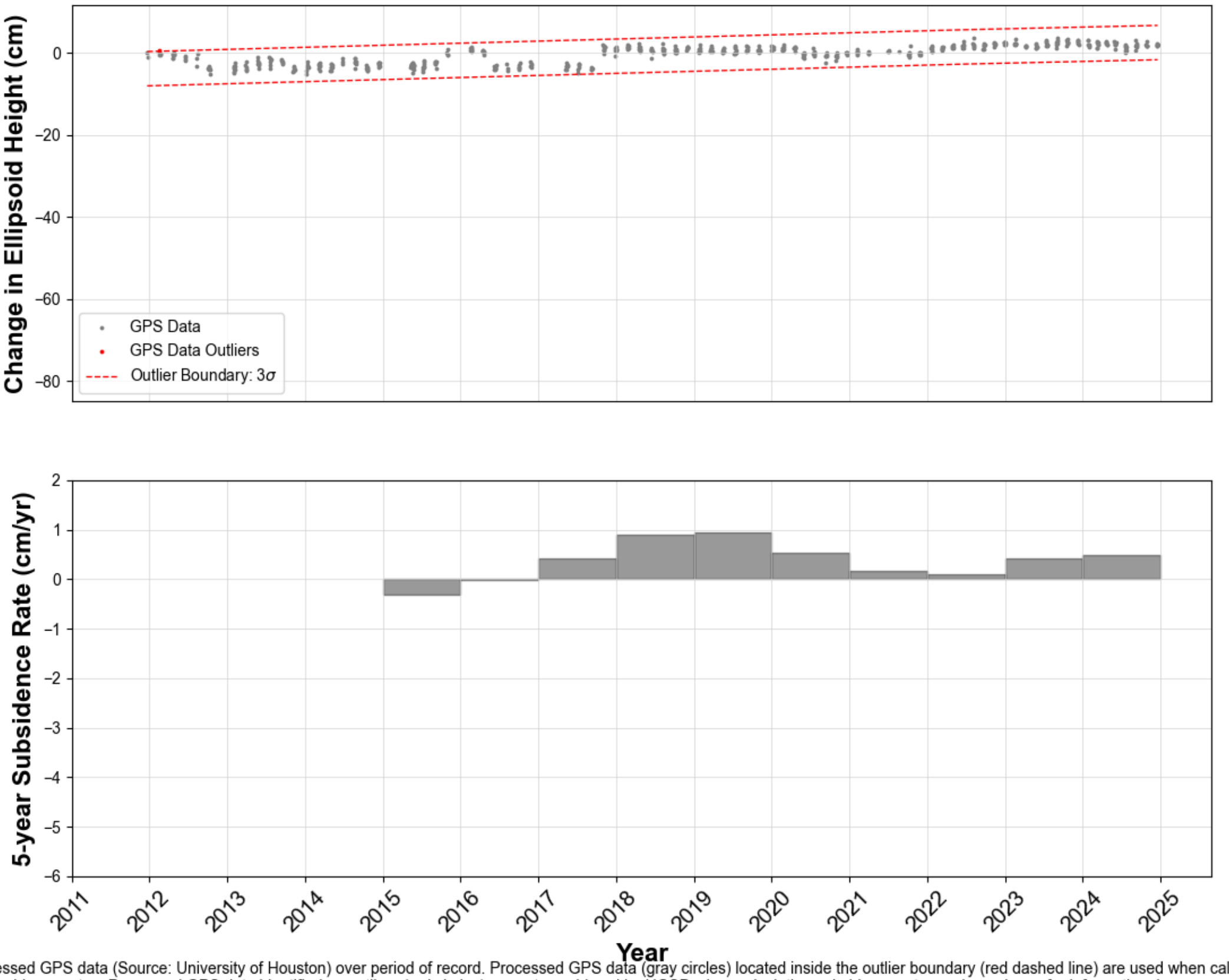


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P074

Galena Park, TX

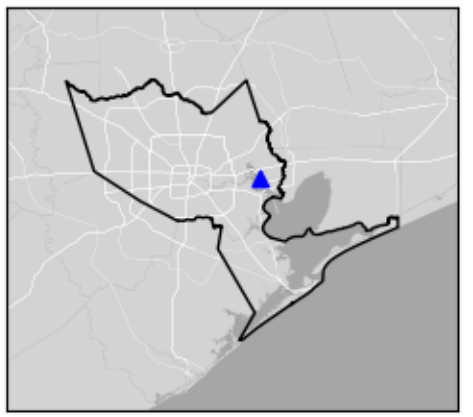


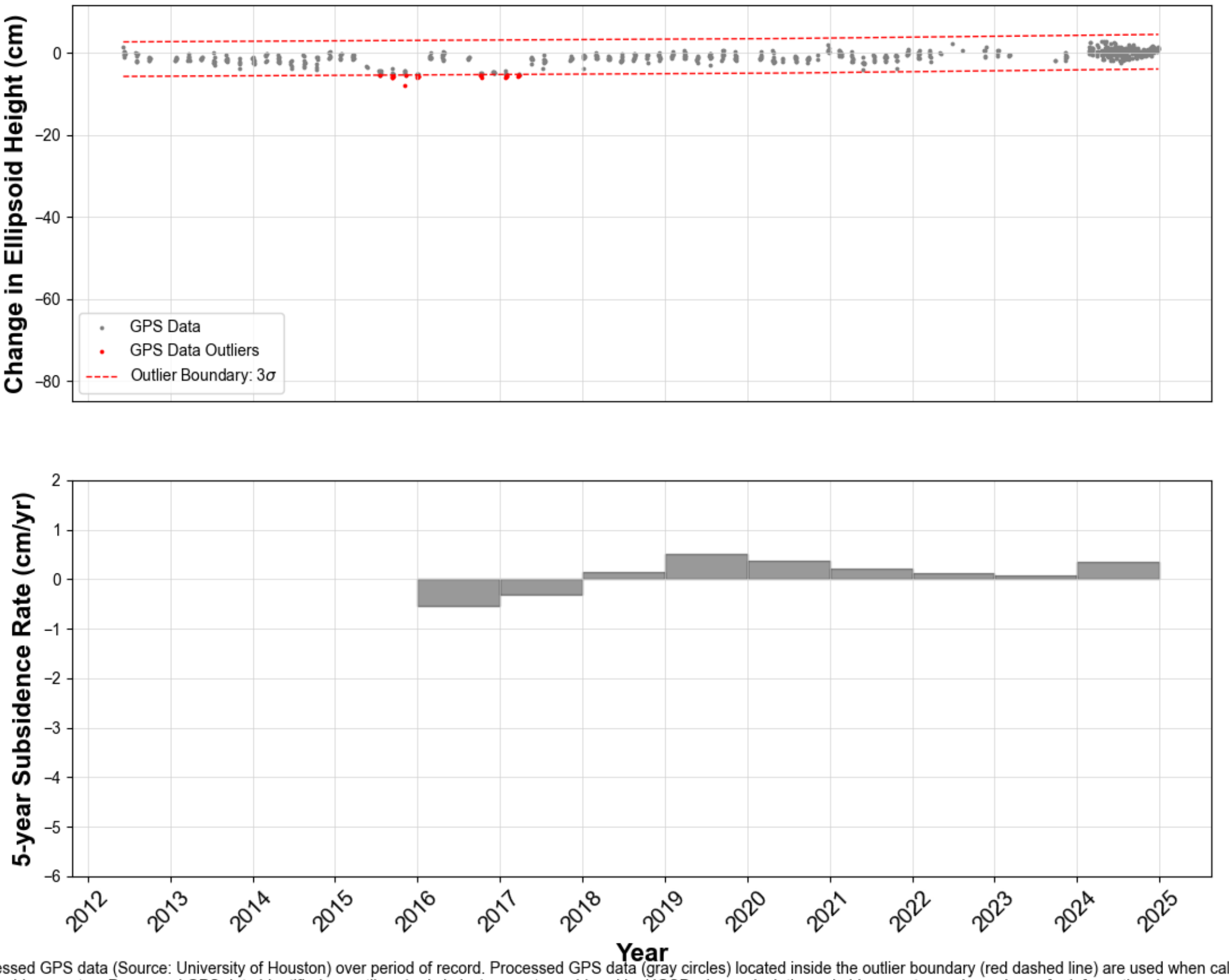


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P075

Baytown, TX

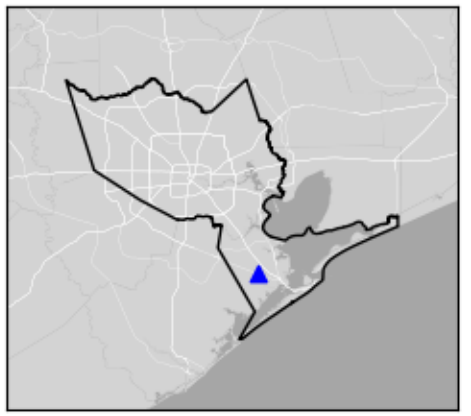


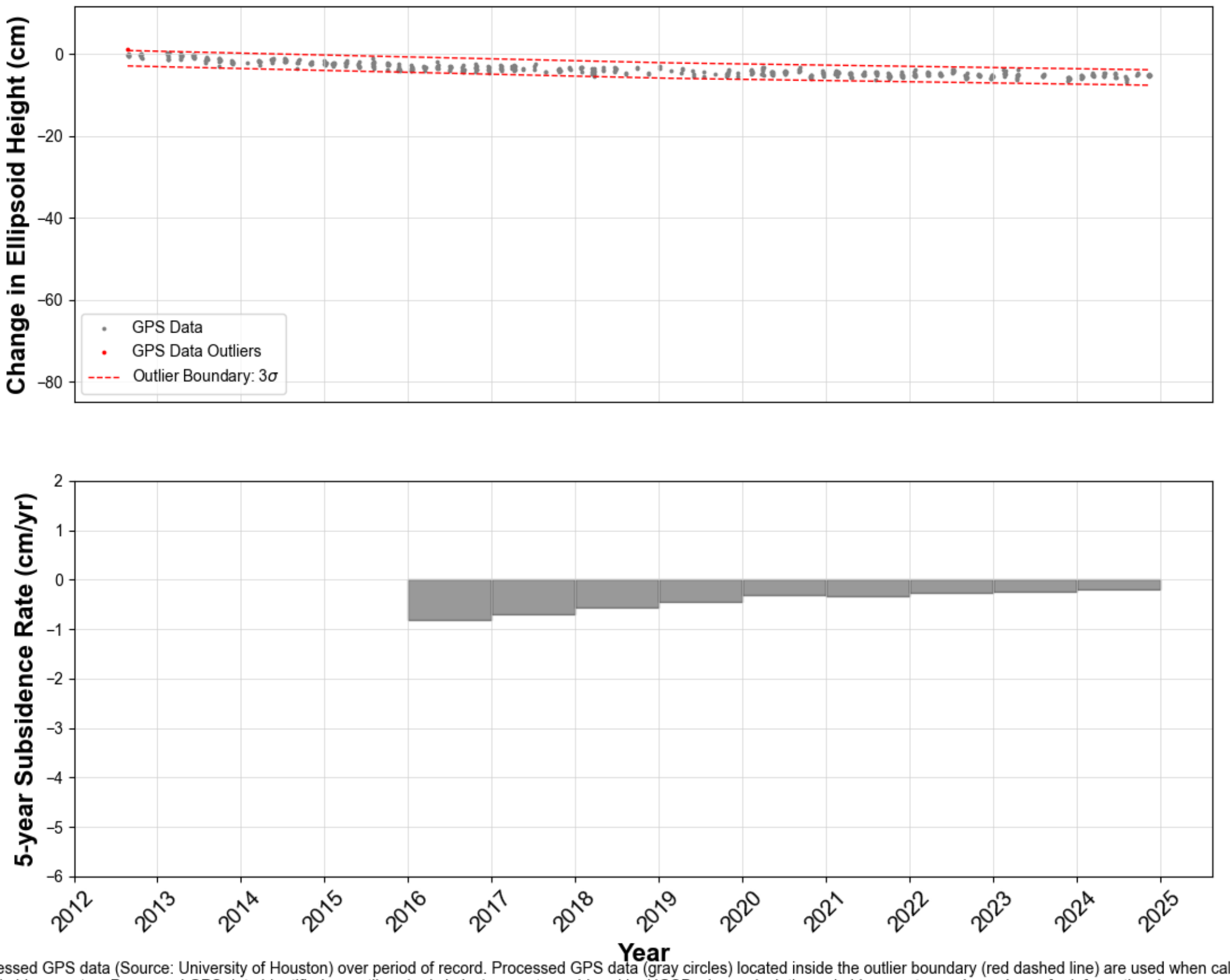


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P076

Hitchcock, TX

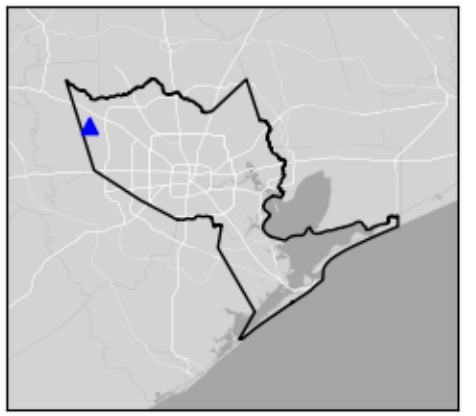


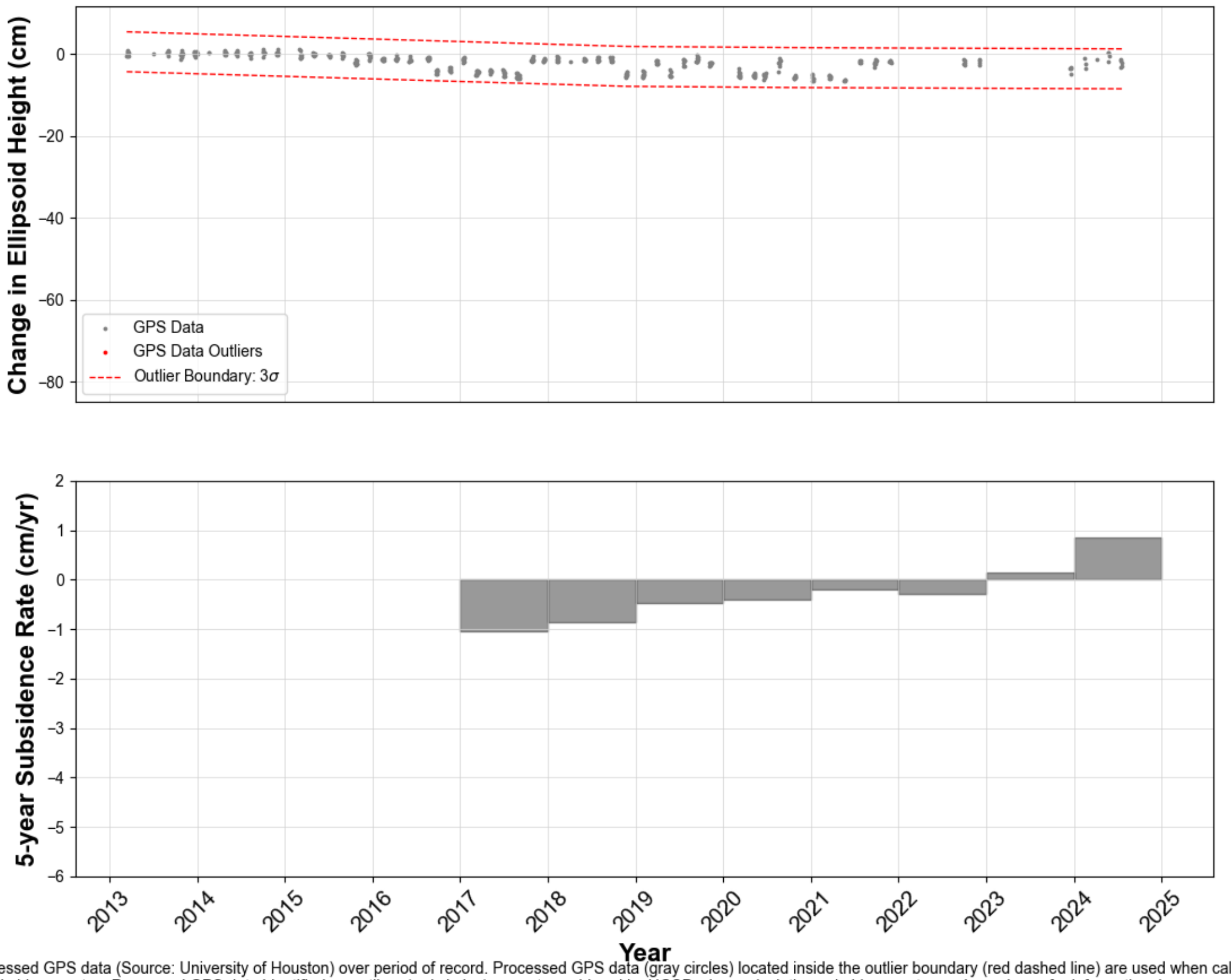


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P077

Hockley, TX

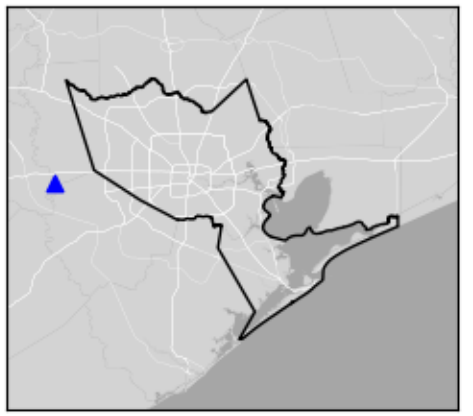


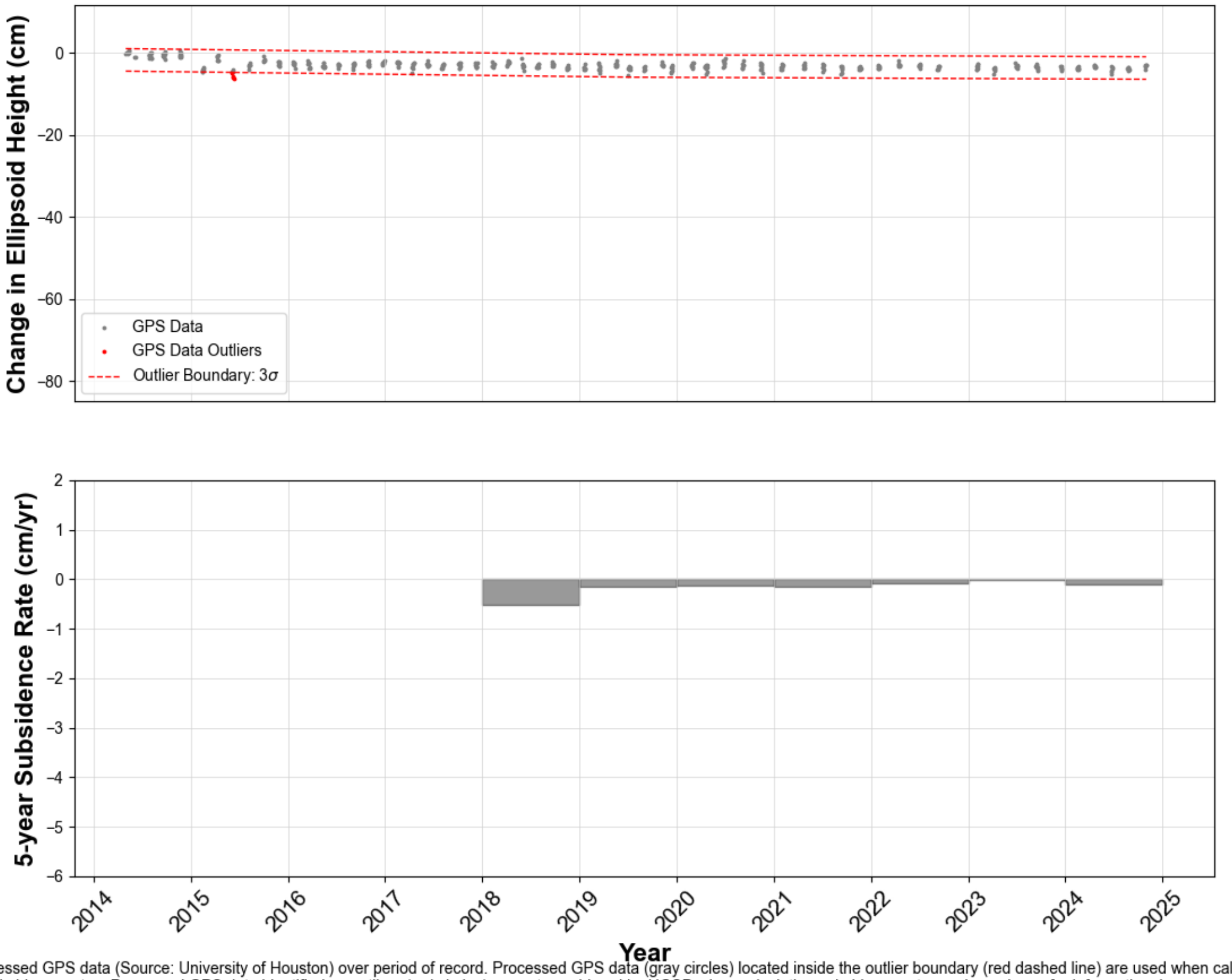


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P078

Brazos Country, TX

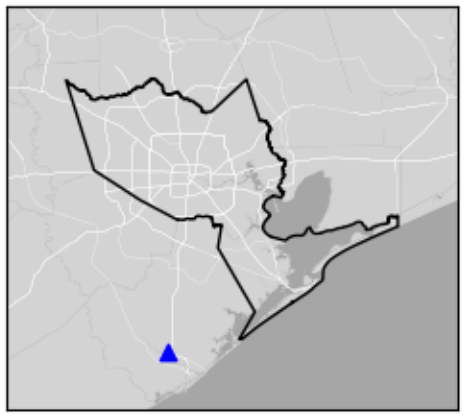


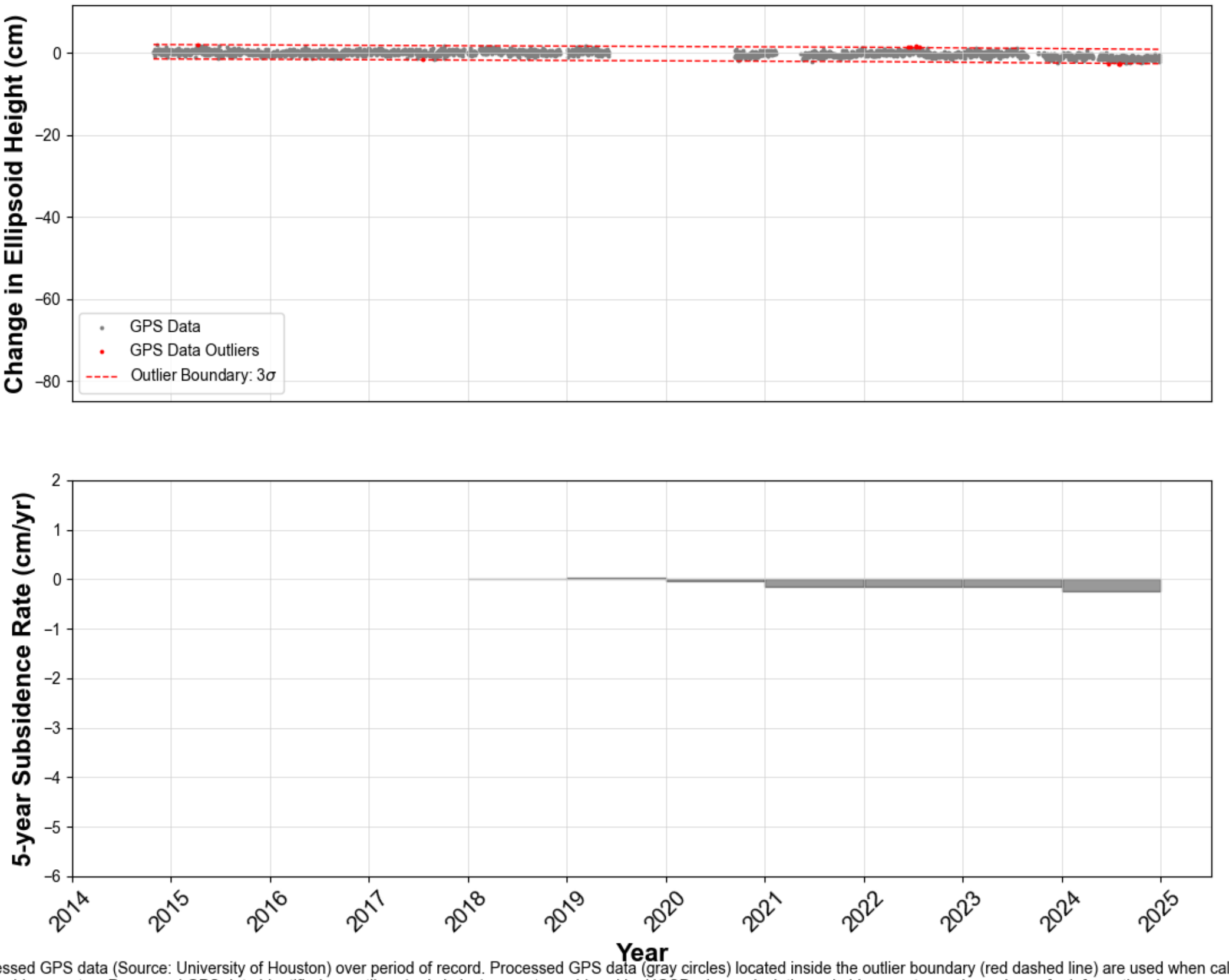


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P079

Lake Jackson, TX

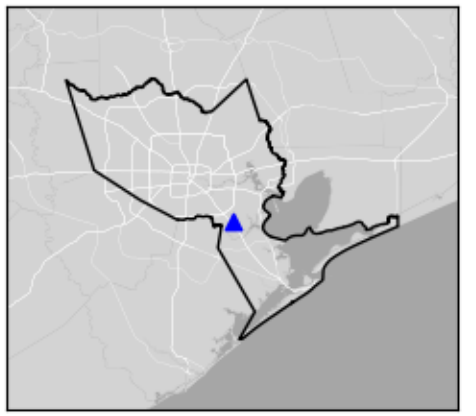


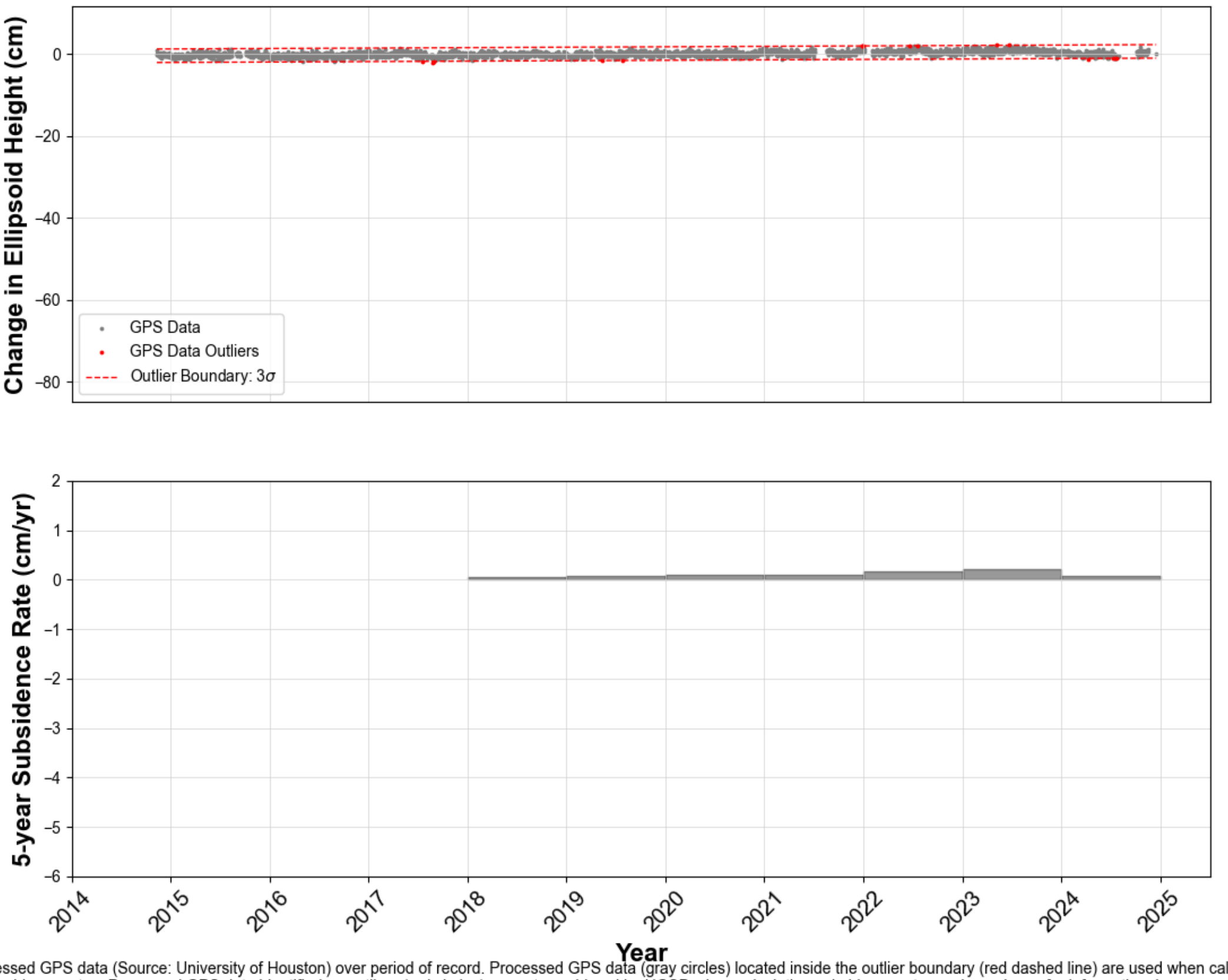


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P080

Houston, TX

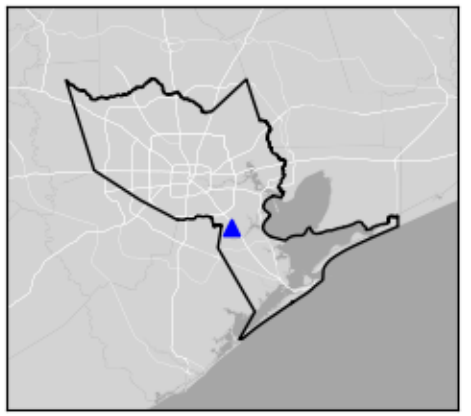


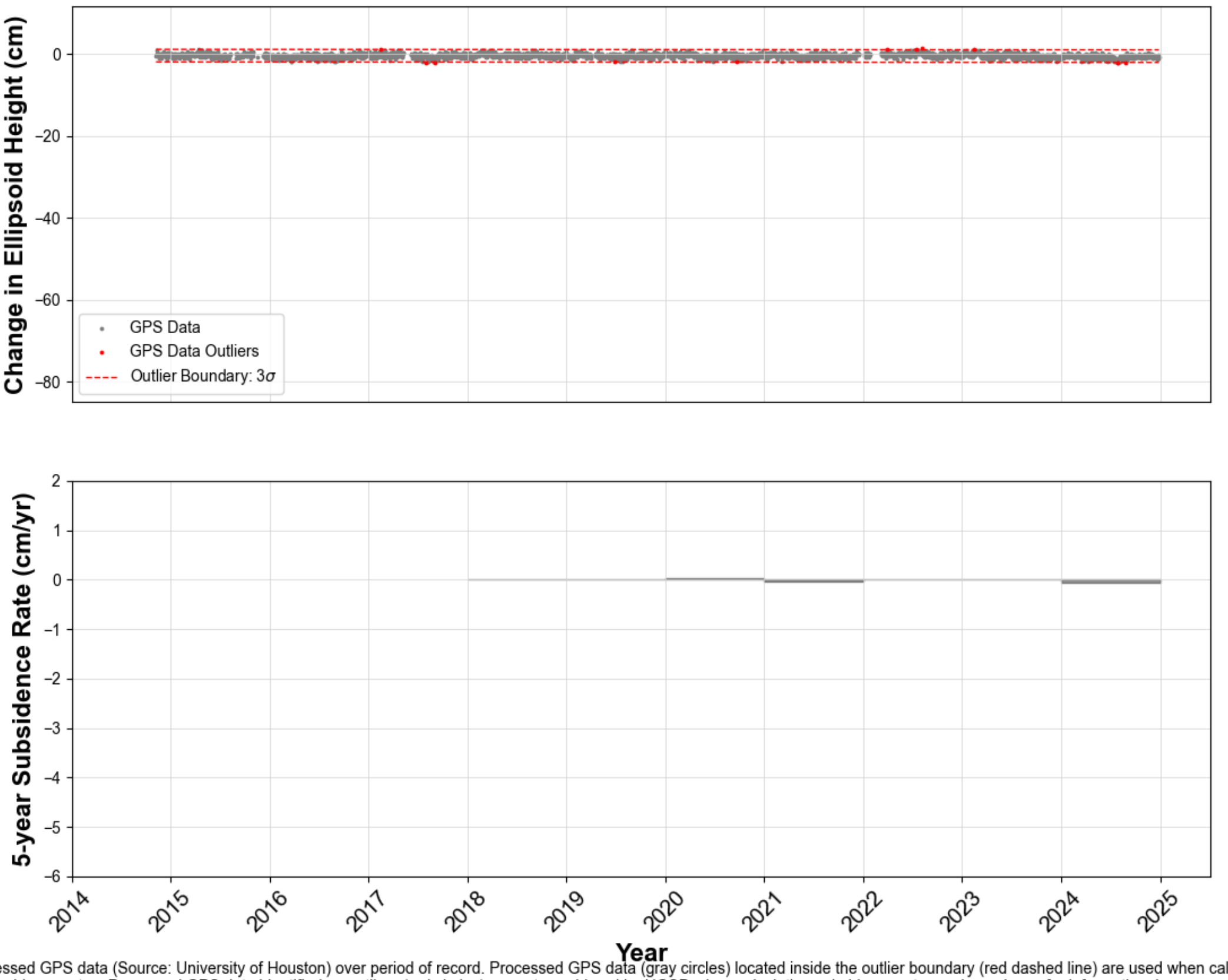


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P081

Houston, TX

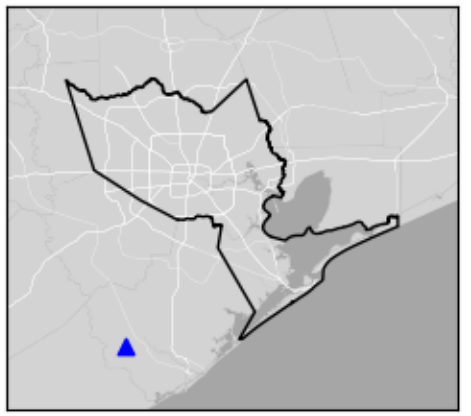


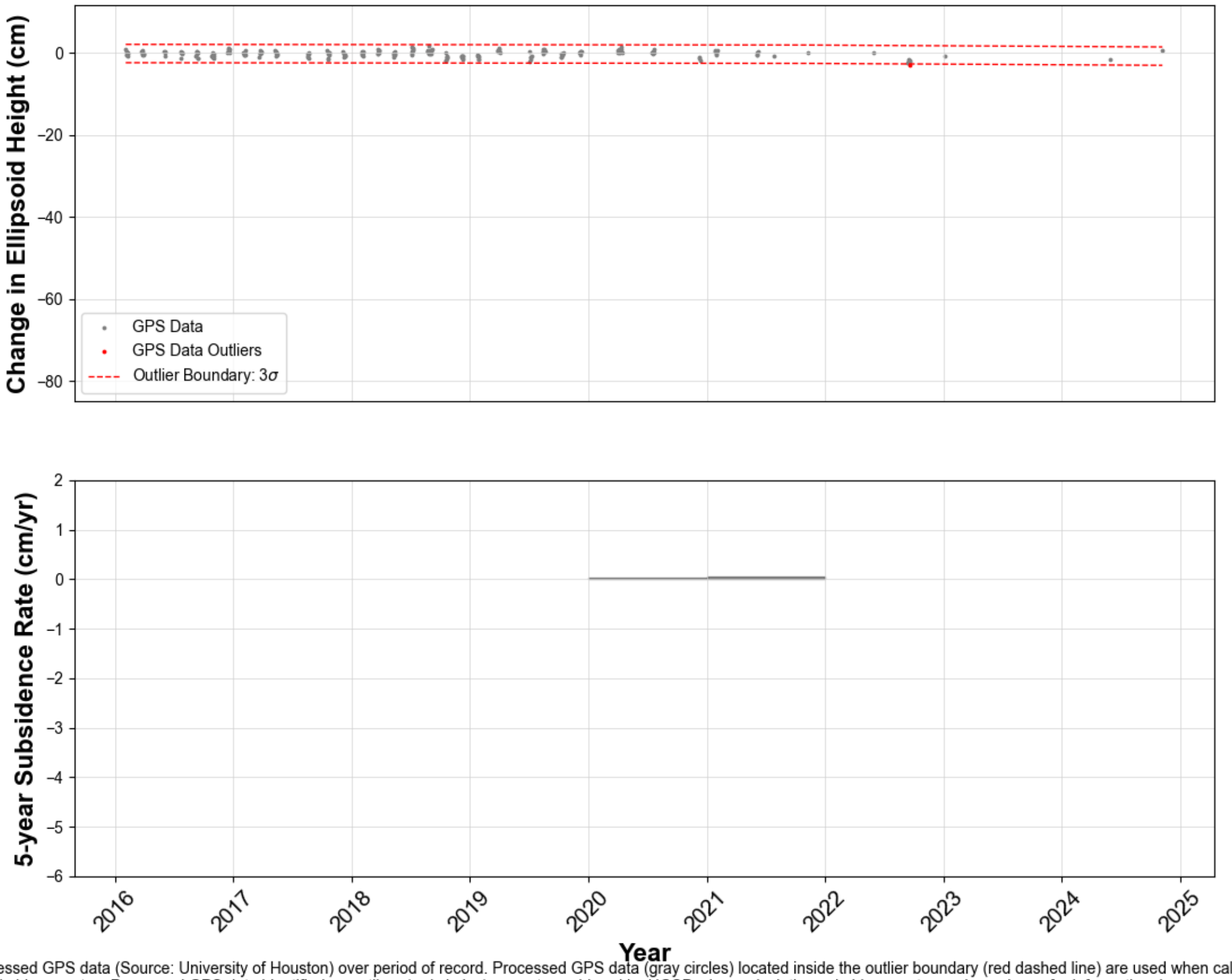


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P087

Sweeny, TX

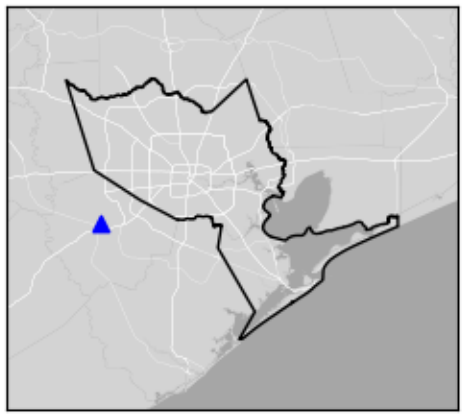


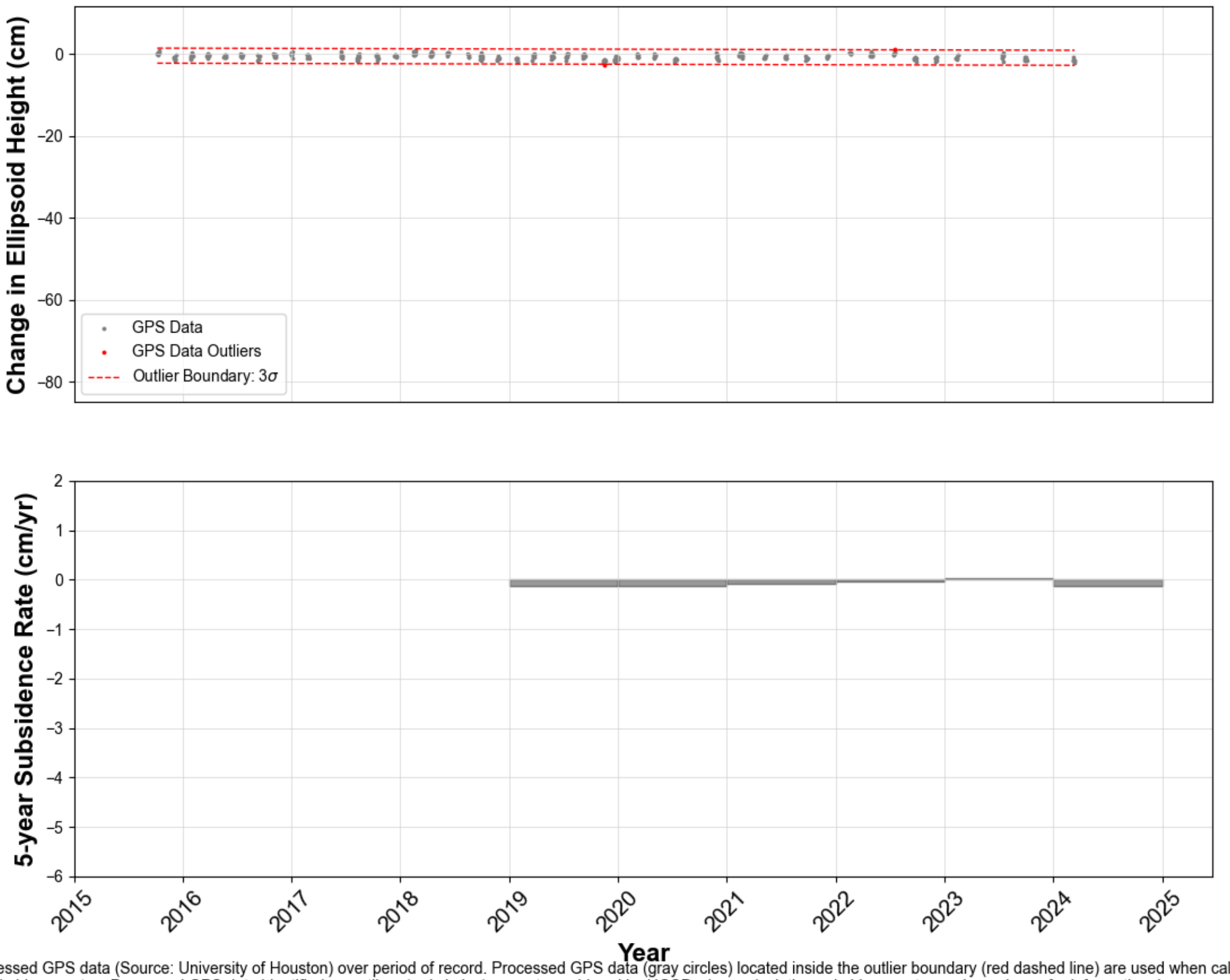


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P089

Rosenberg, TX

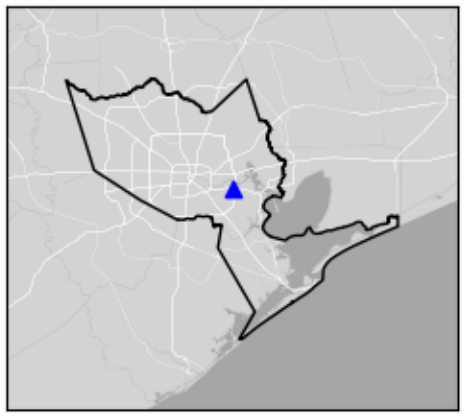


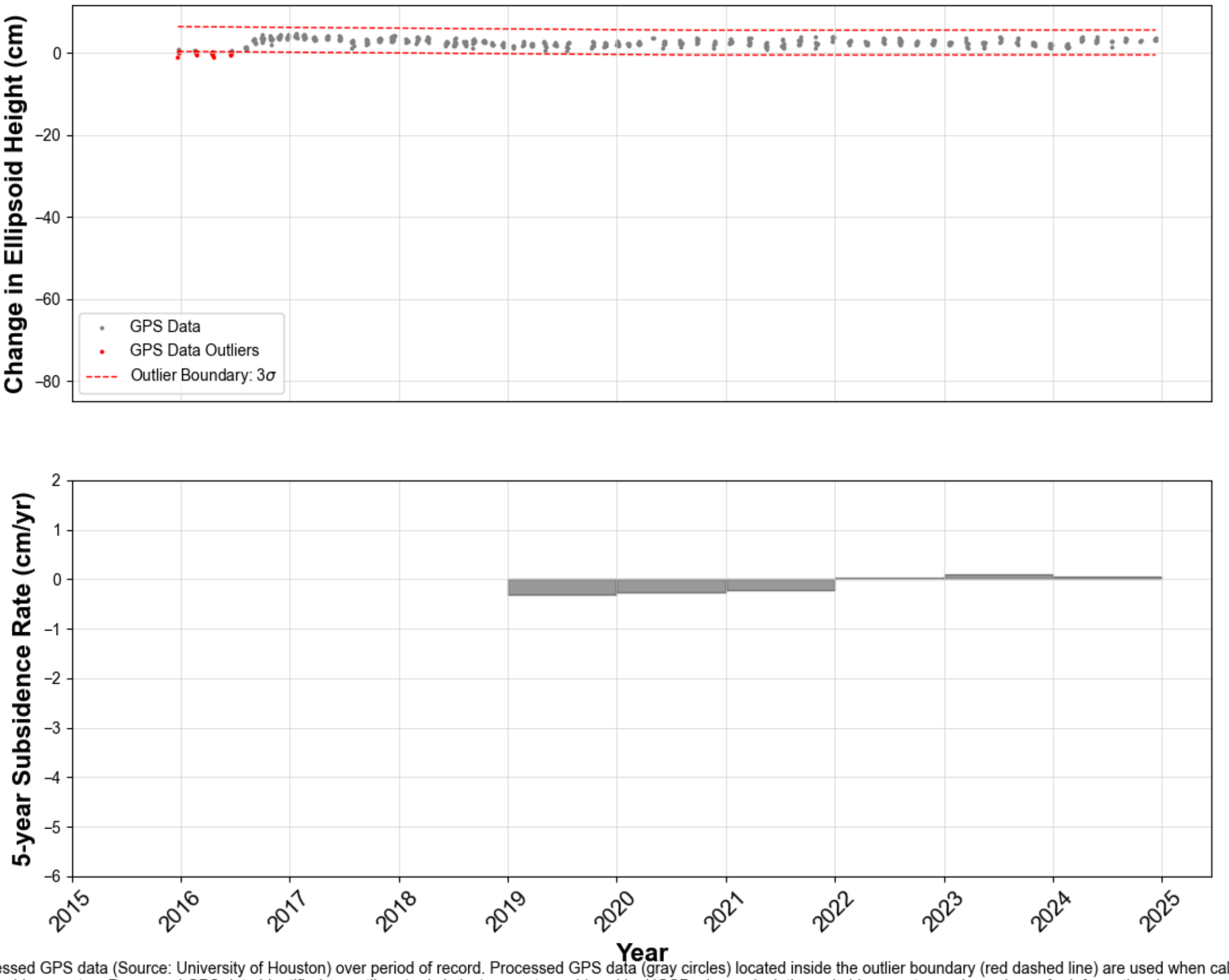


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P090

Pasadena, TX

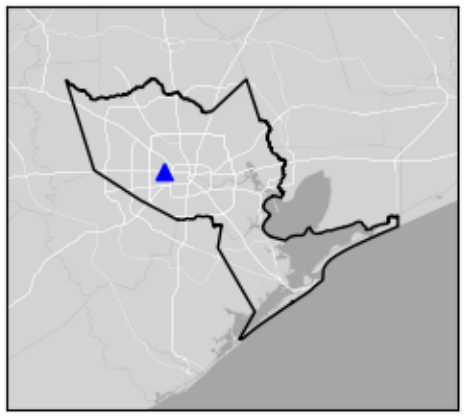


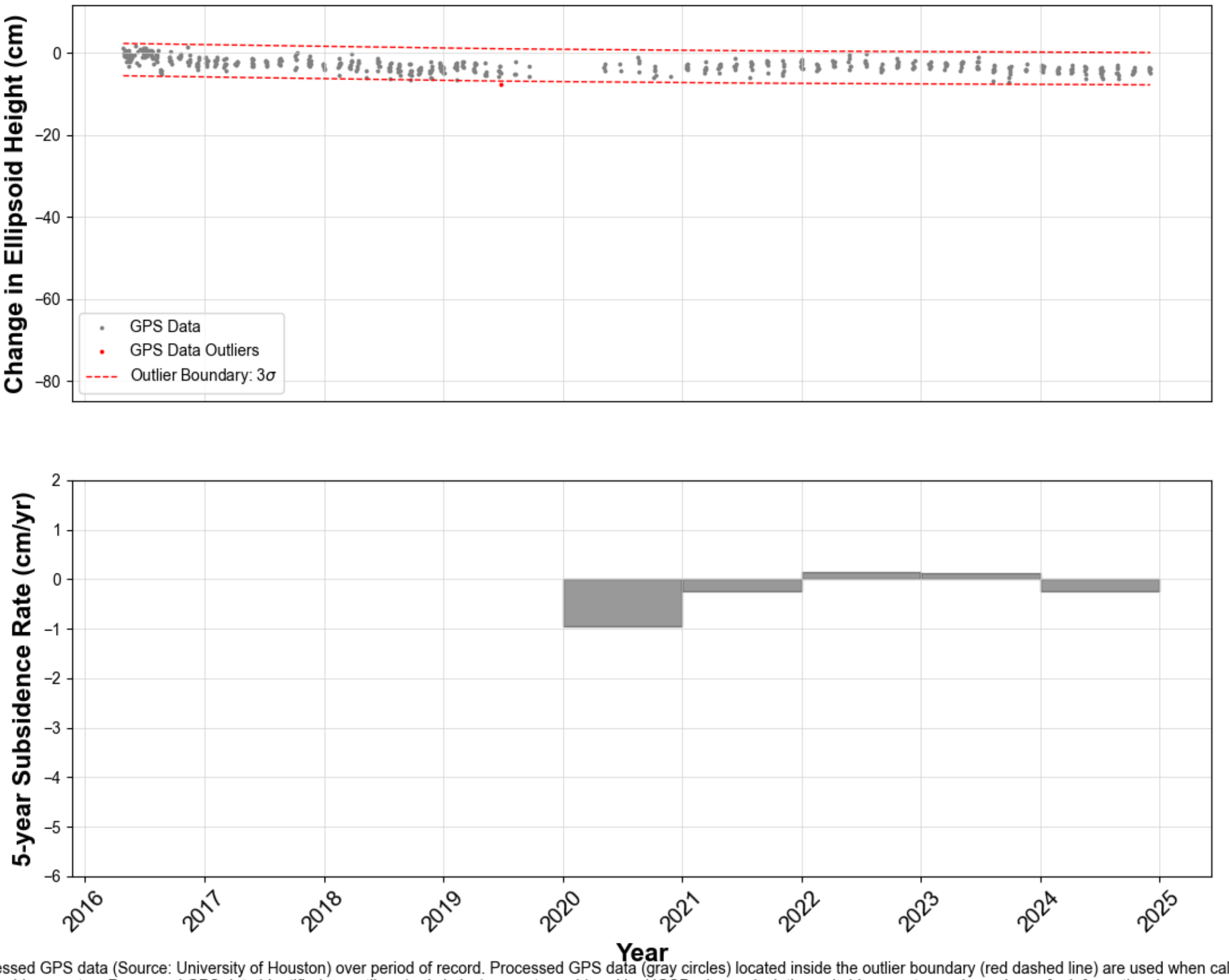


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P091

Houston, TX

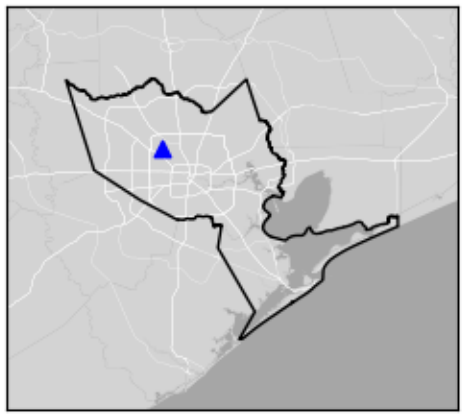


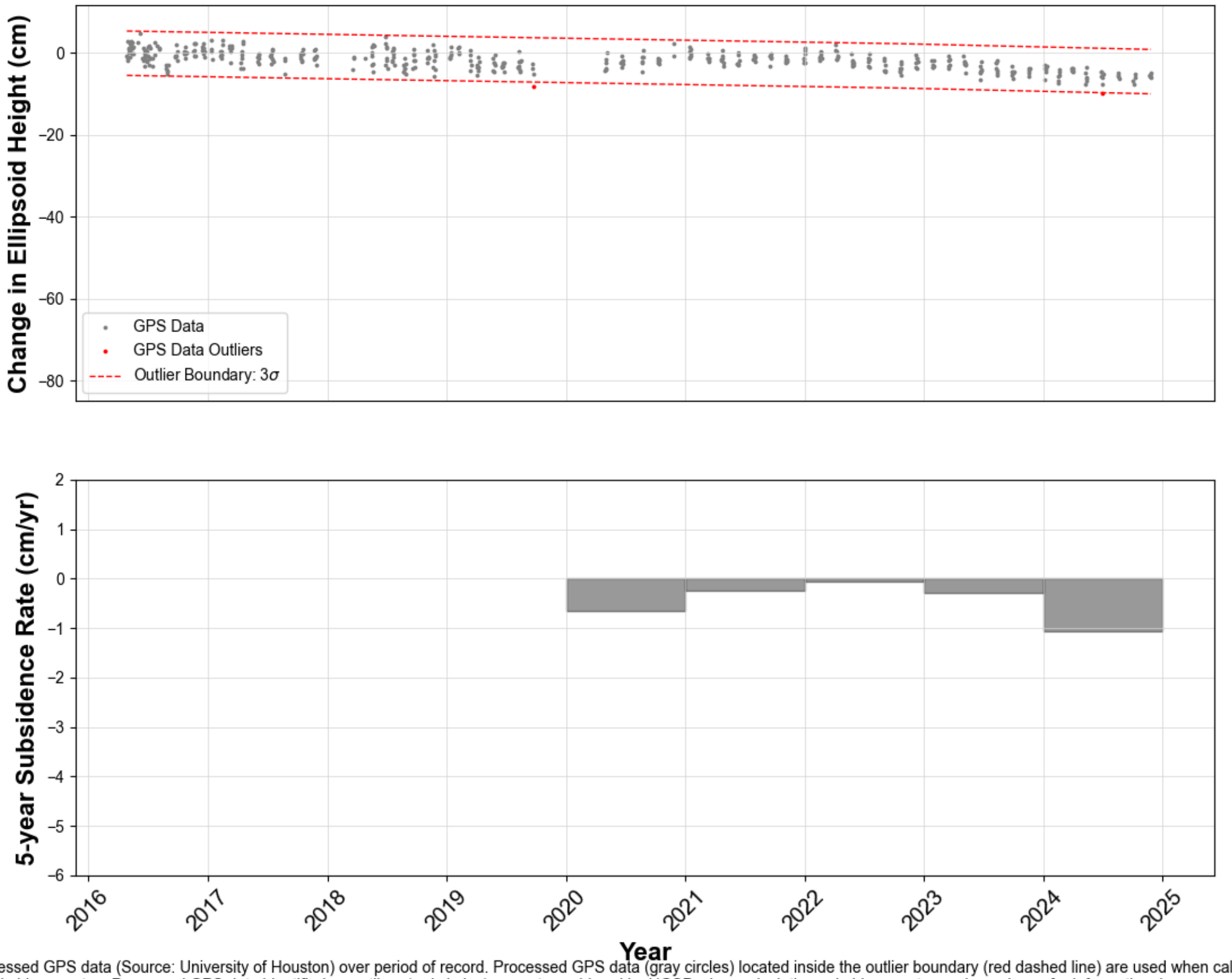


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P092

Houston, TX

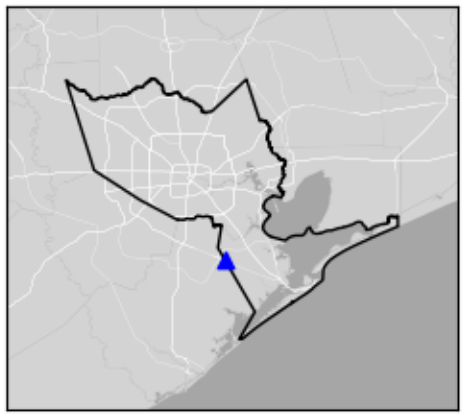


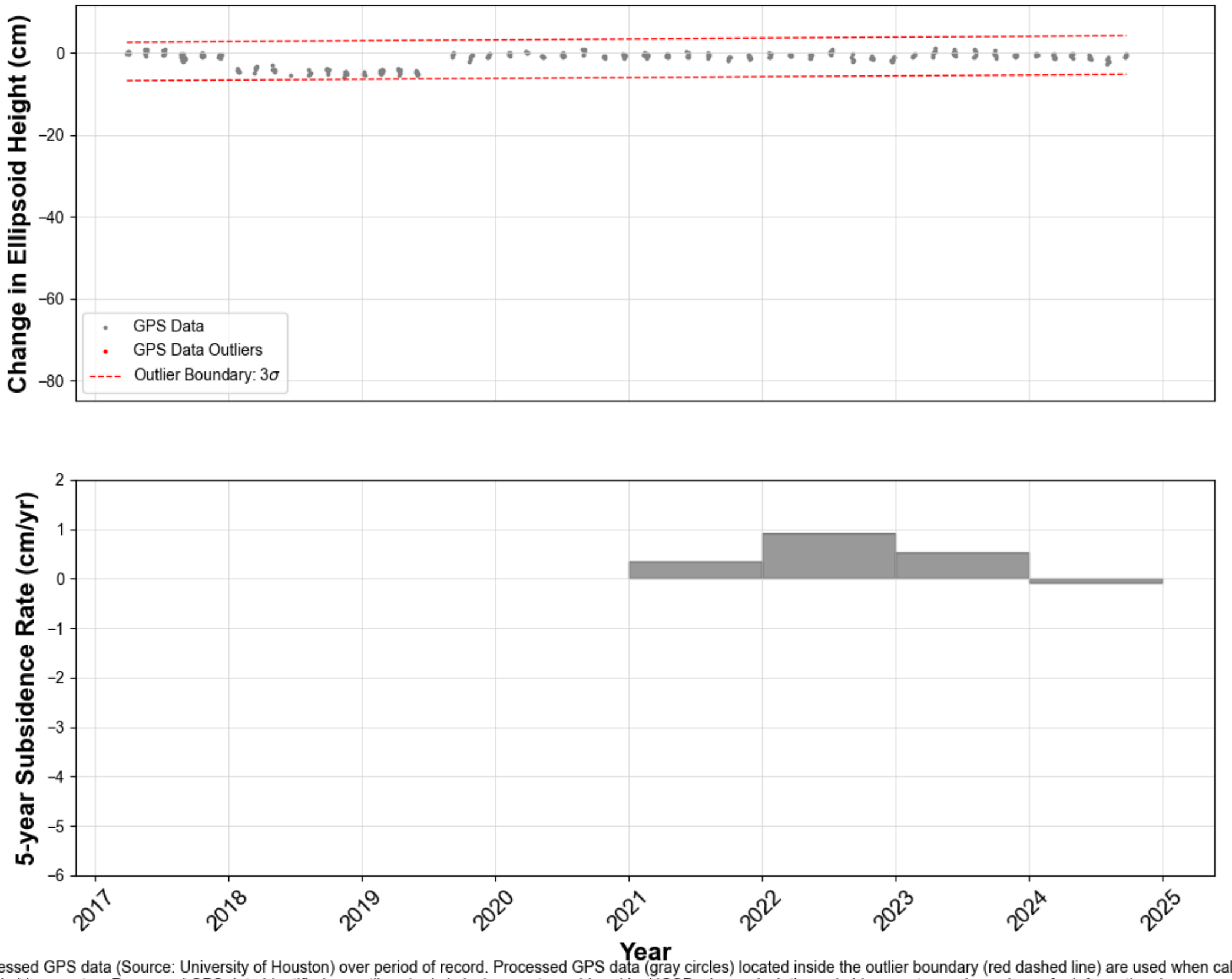


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P093

Alvin, TX

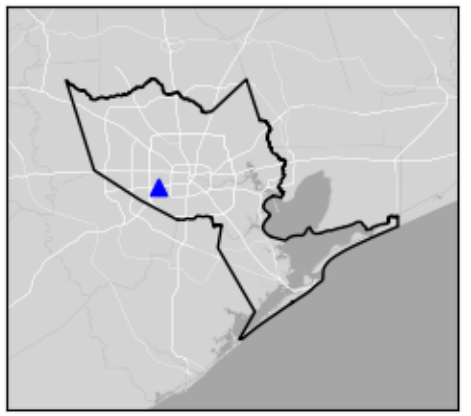


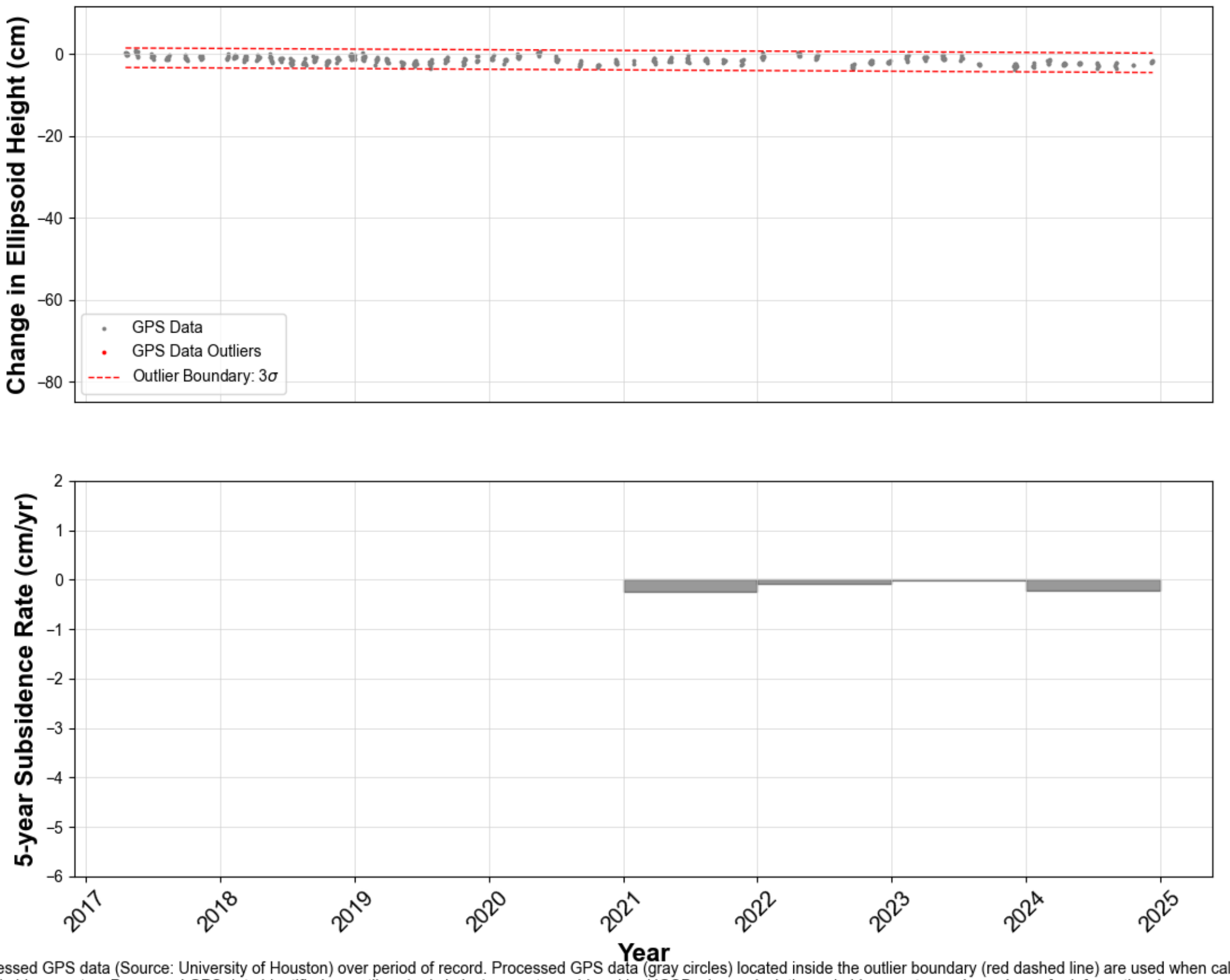


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P094

Houston, TX

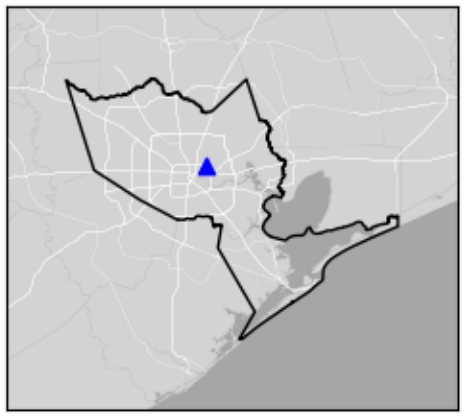


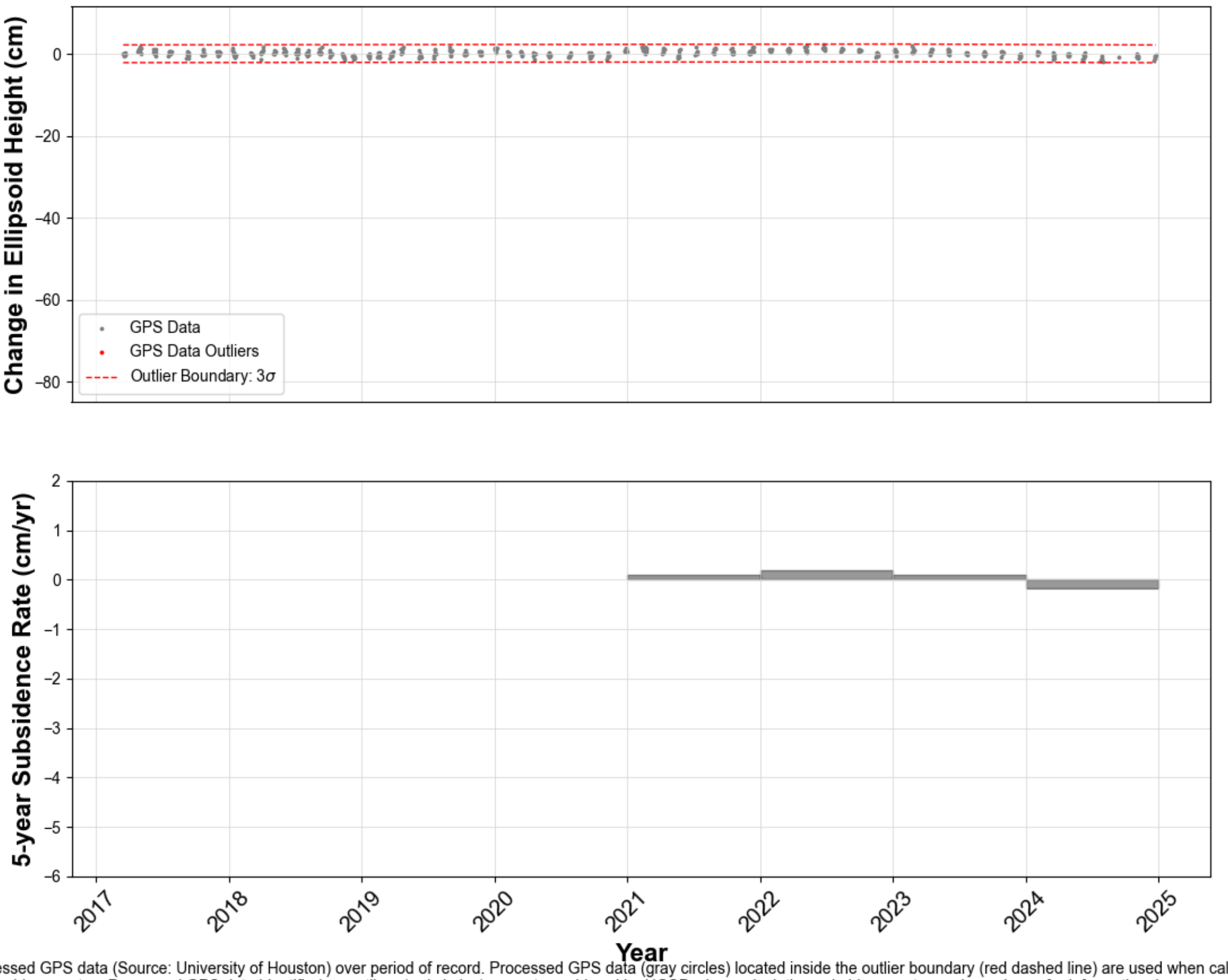


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P095

Houston, TX

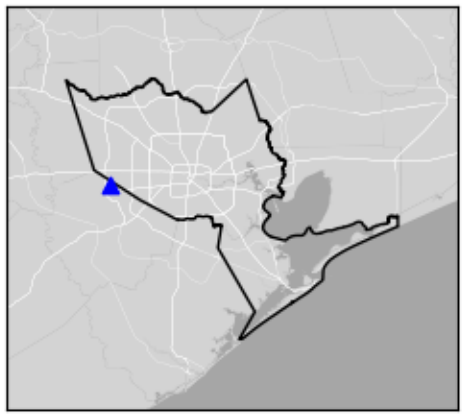


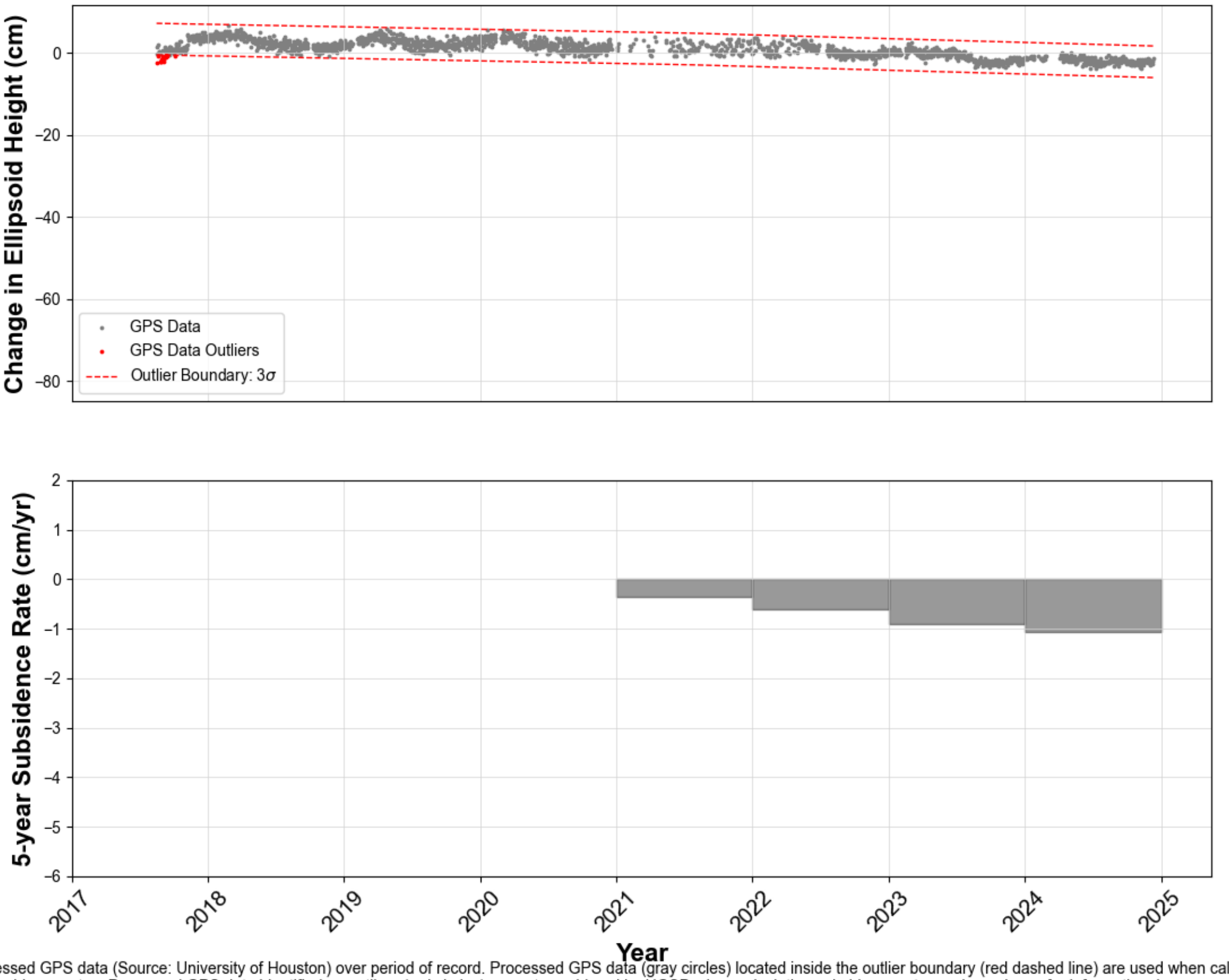


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P096

Katy, TX

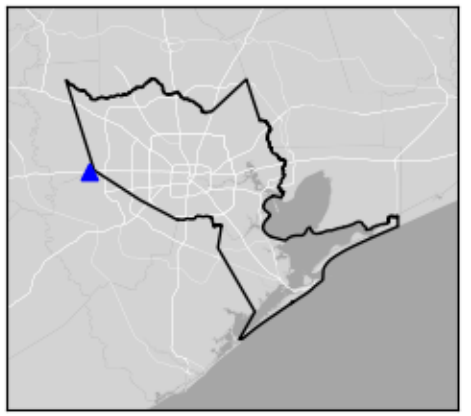


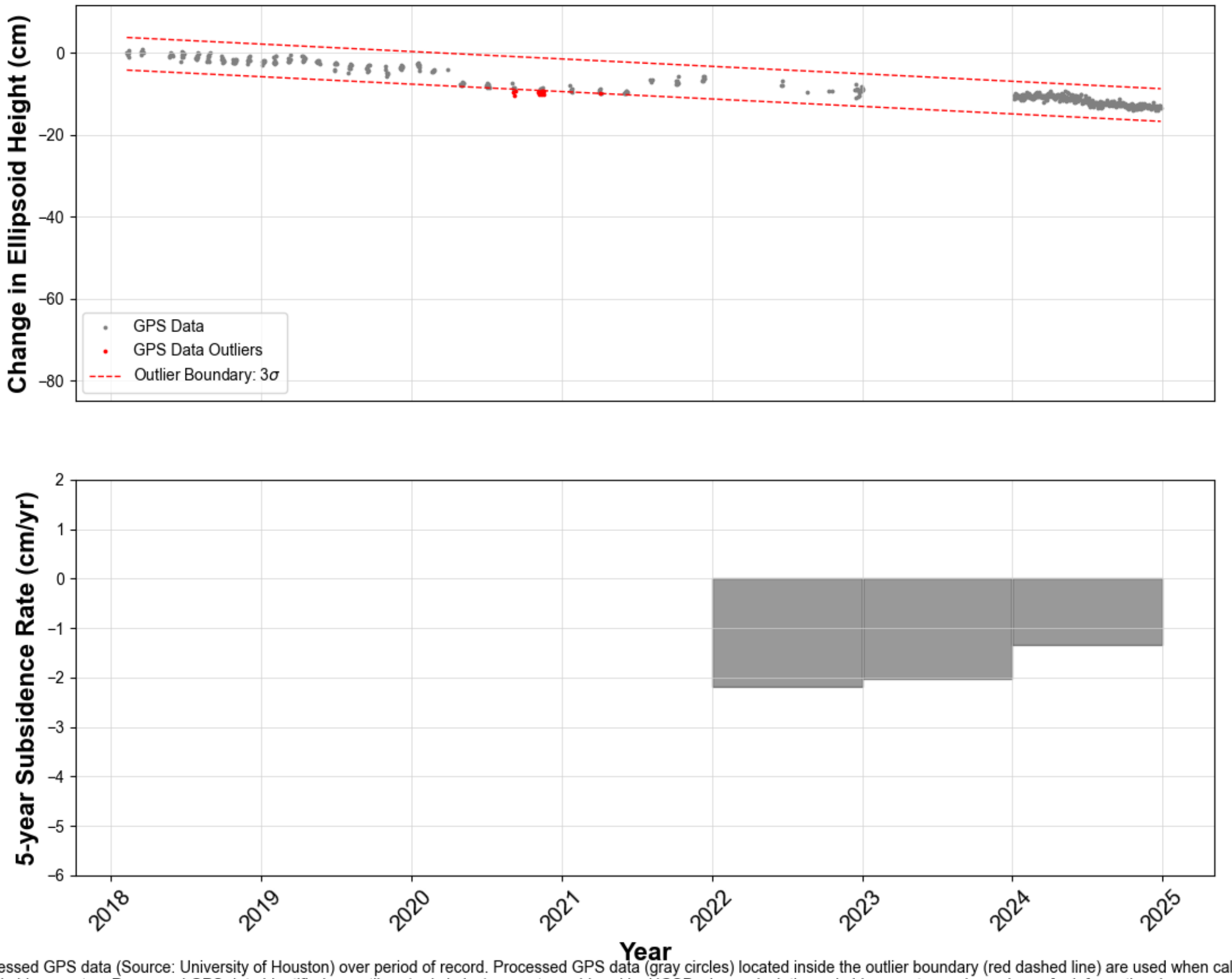


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P097

Katy, TX

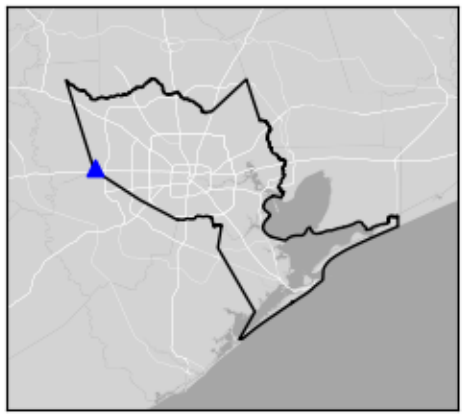


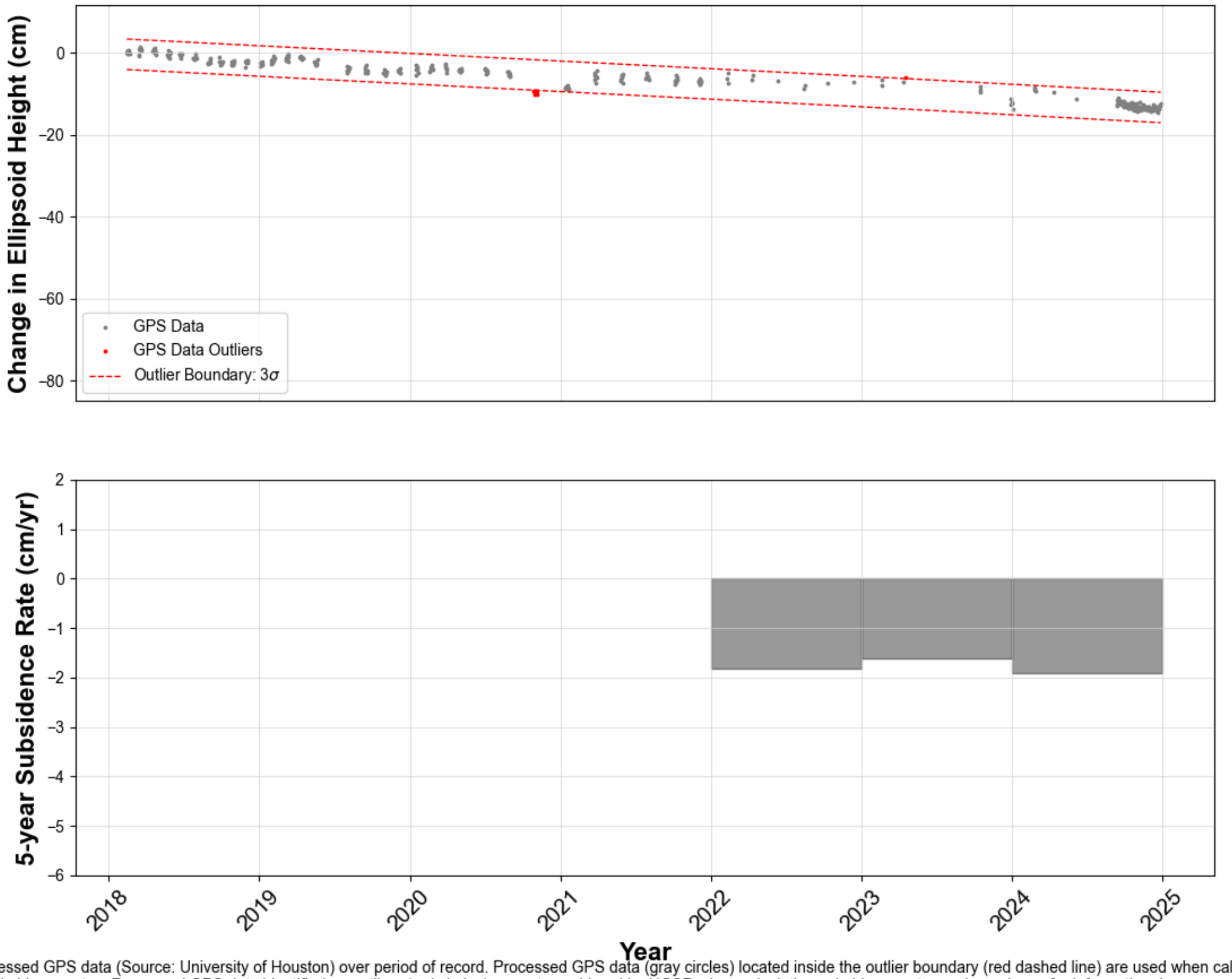


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

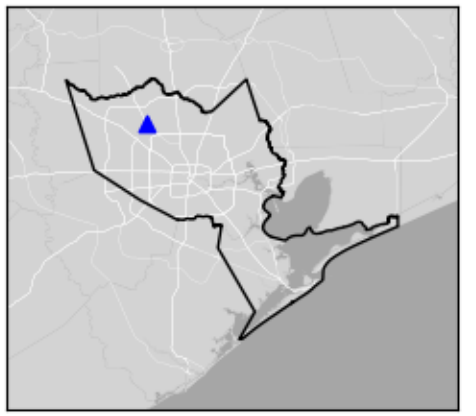
P098

Katy, TX



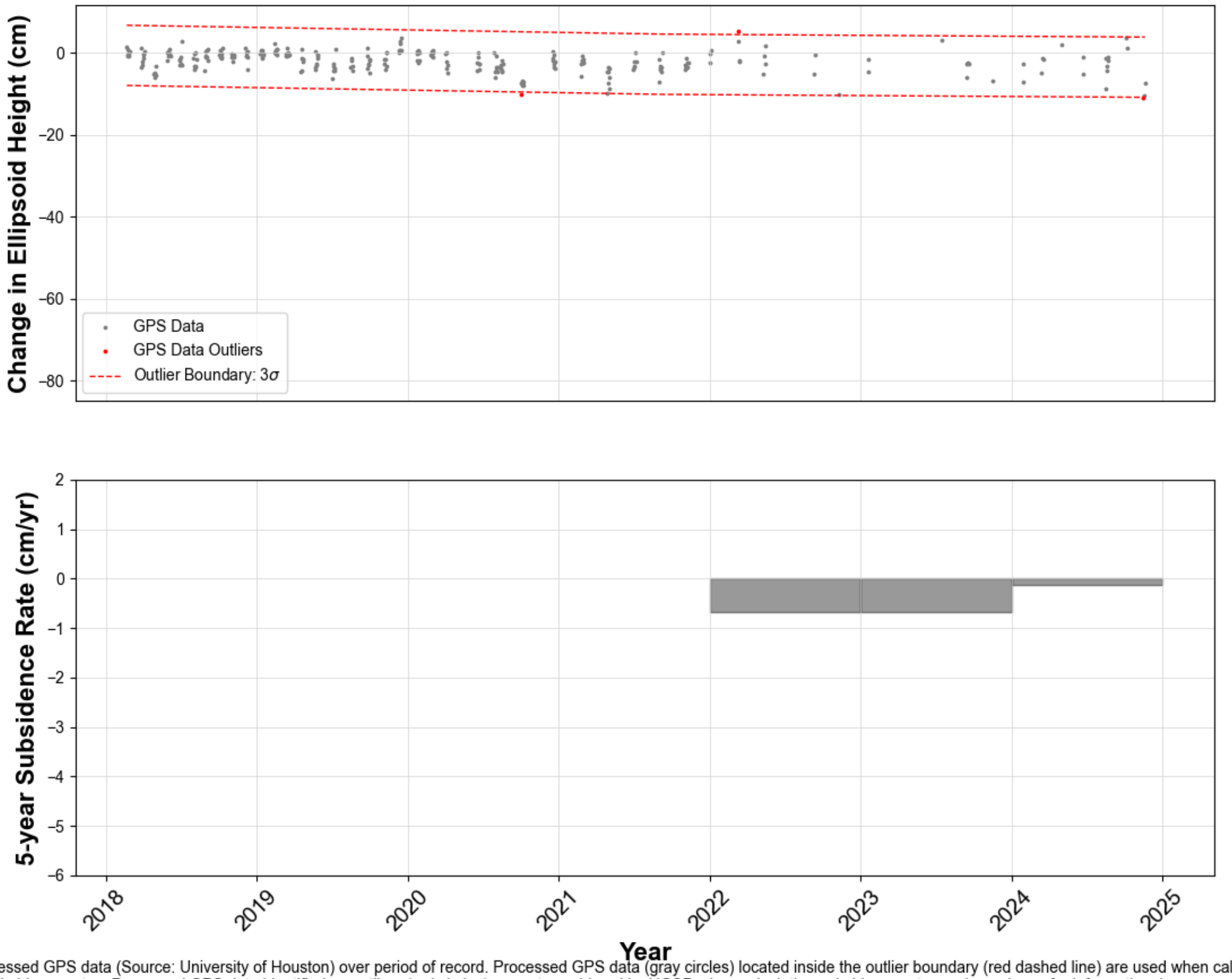


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.



P099

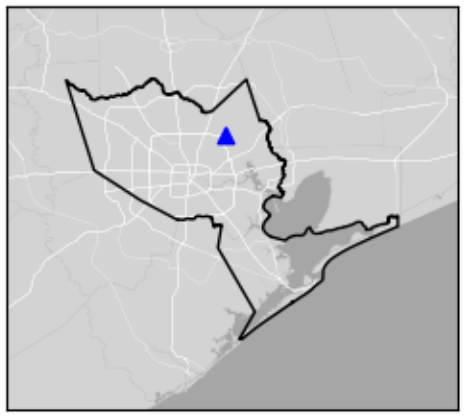
Houston, TX

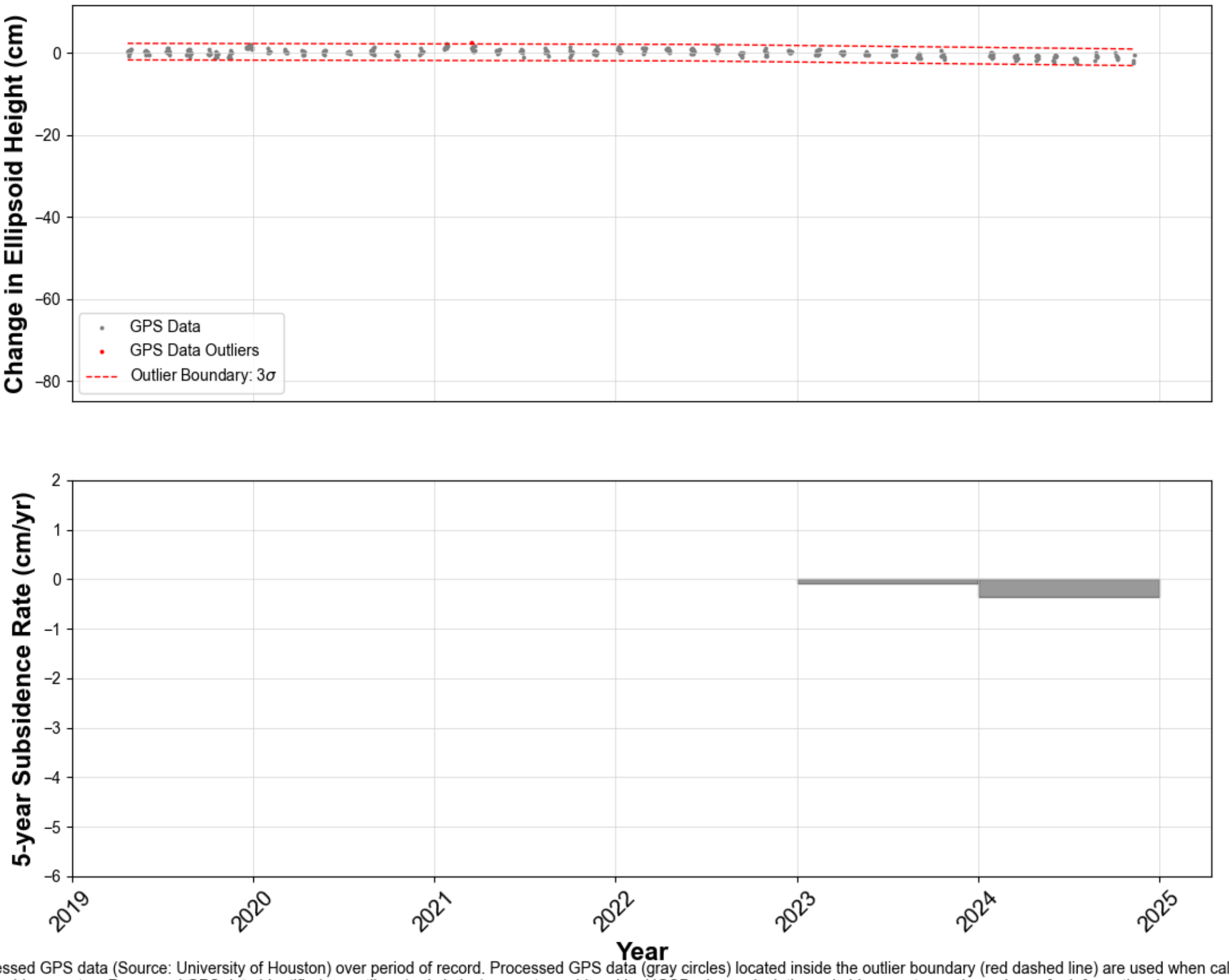


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P100

Atascocita, TX

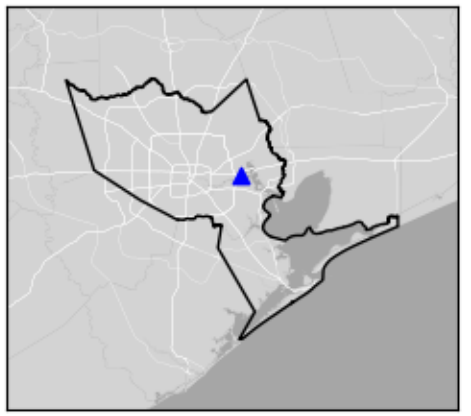


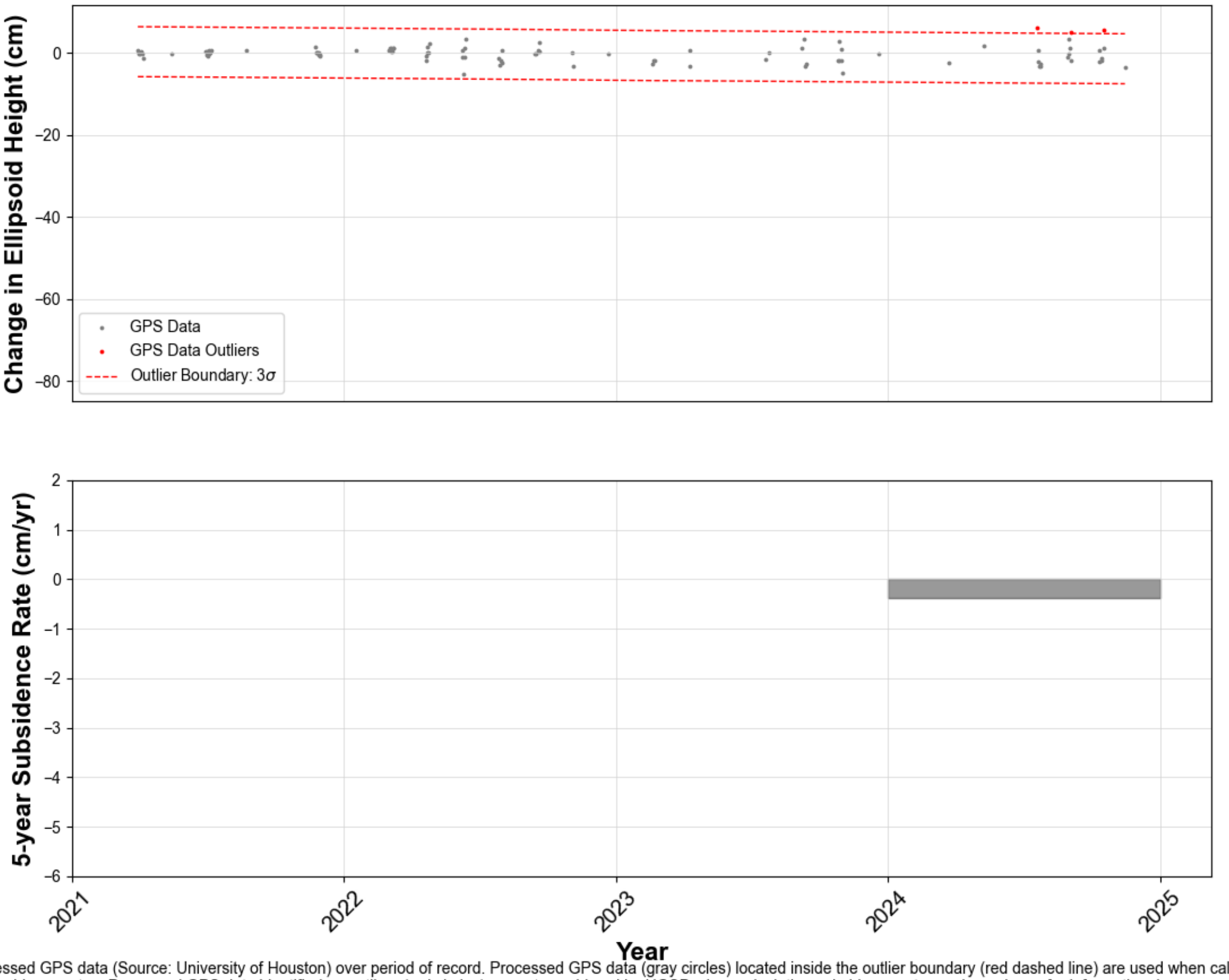


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P108

Channelview, TX

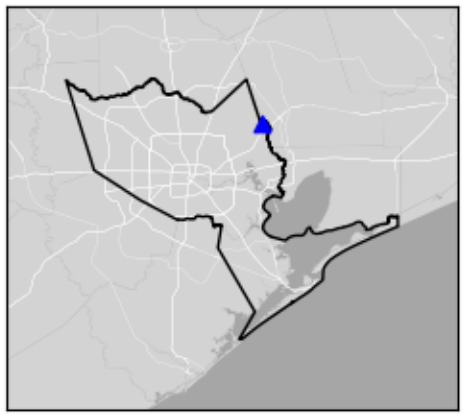


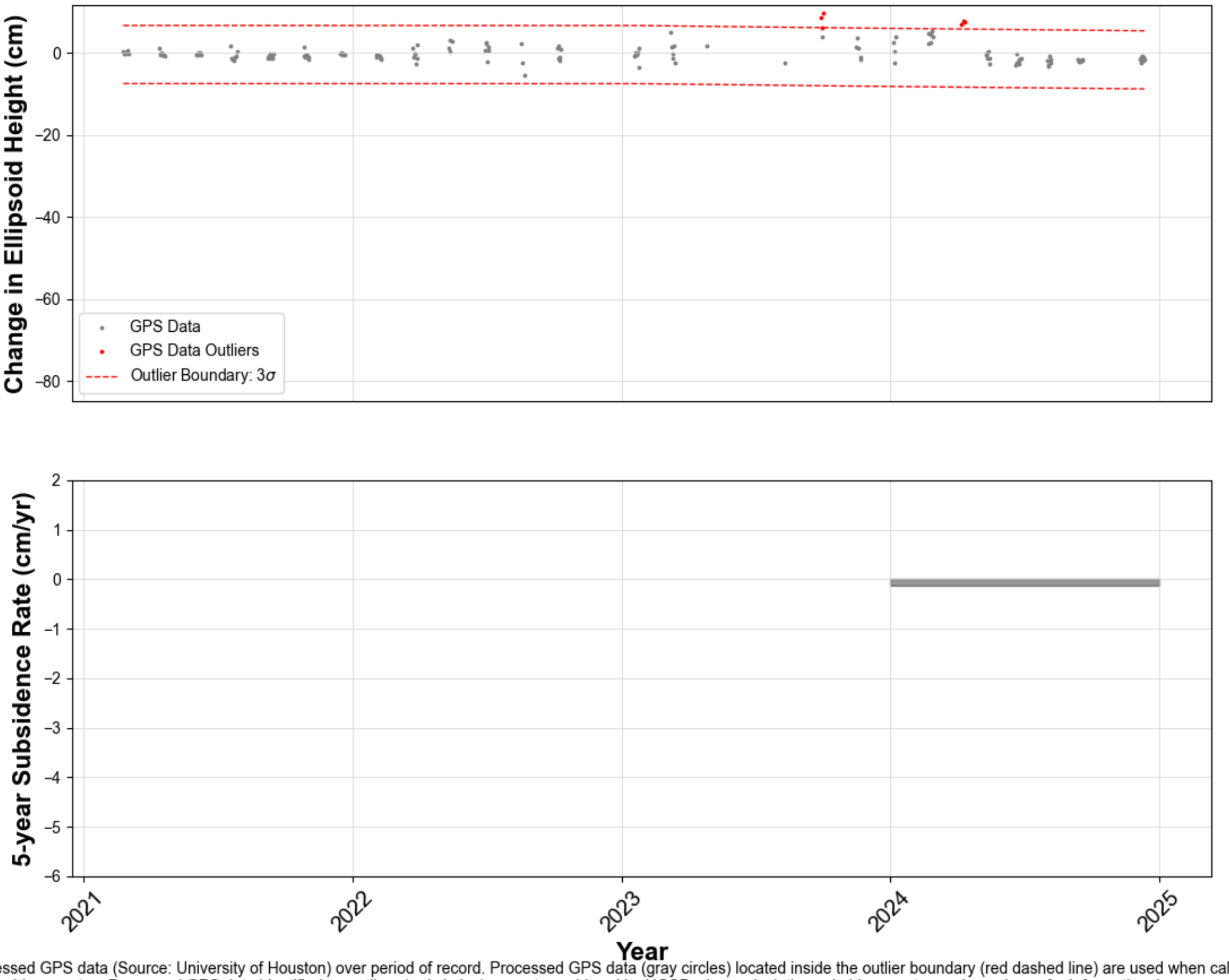


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P109

Crosby, TX

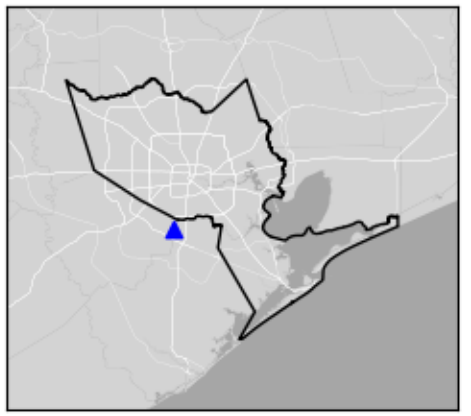


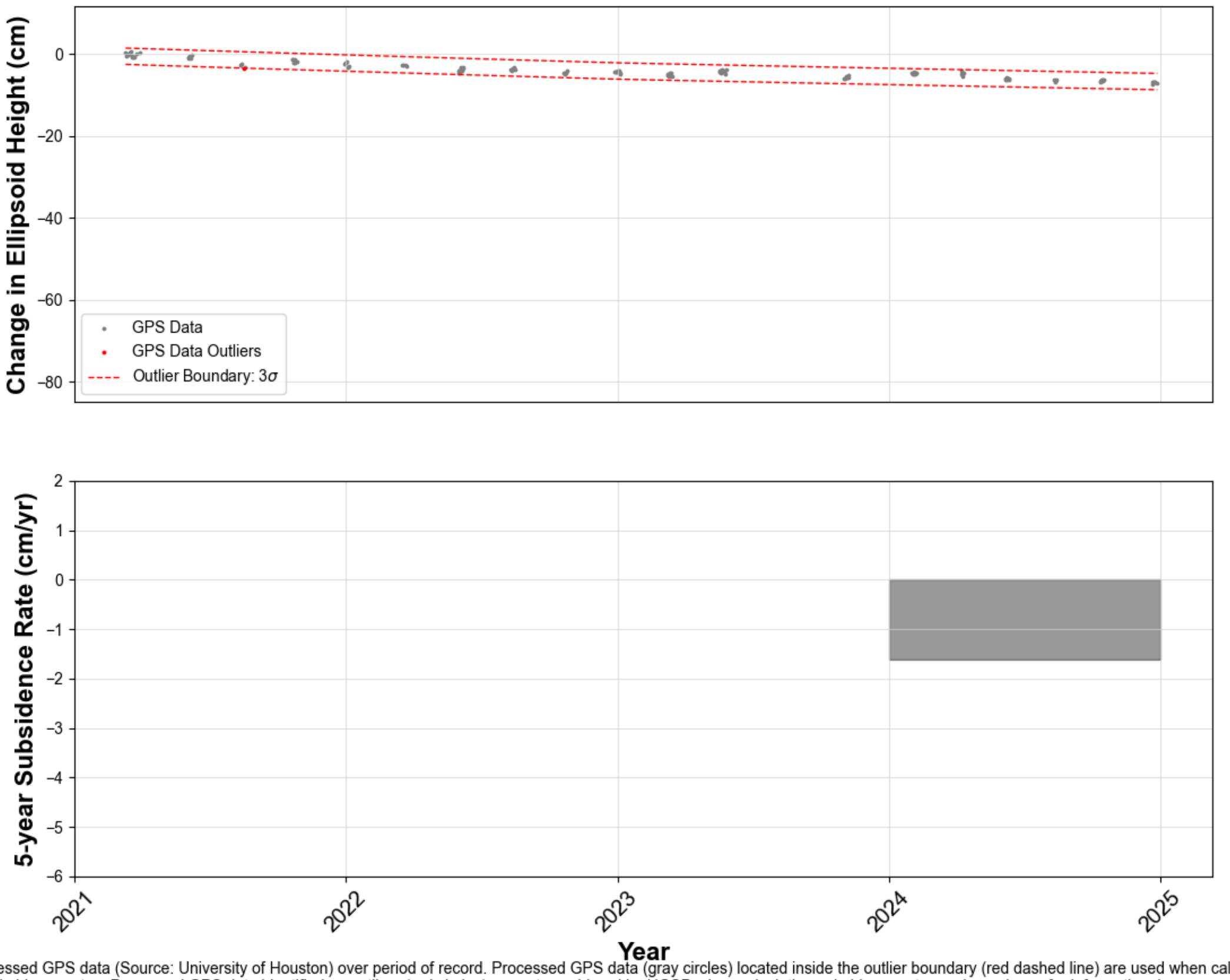


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P110

Fresno, TX

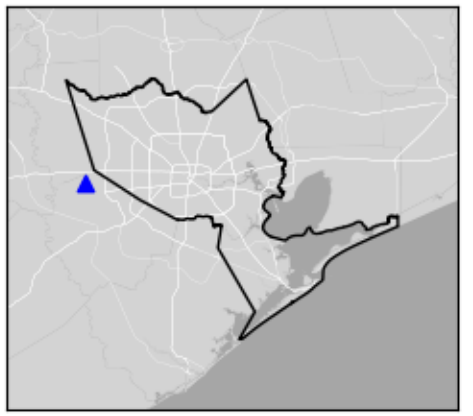


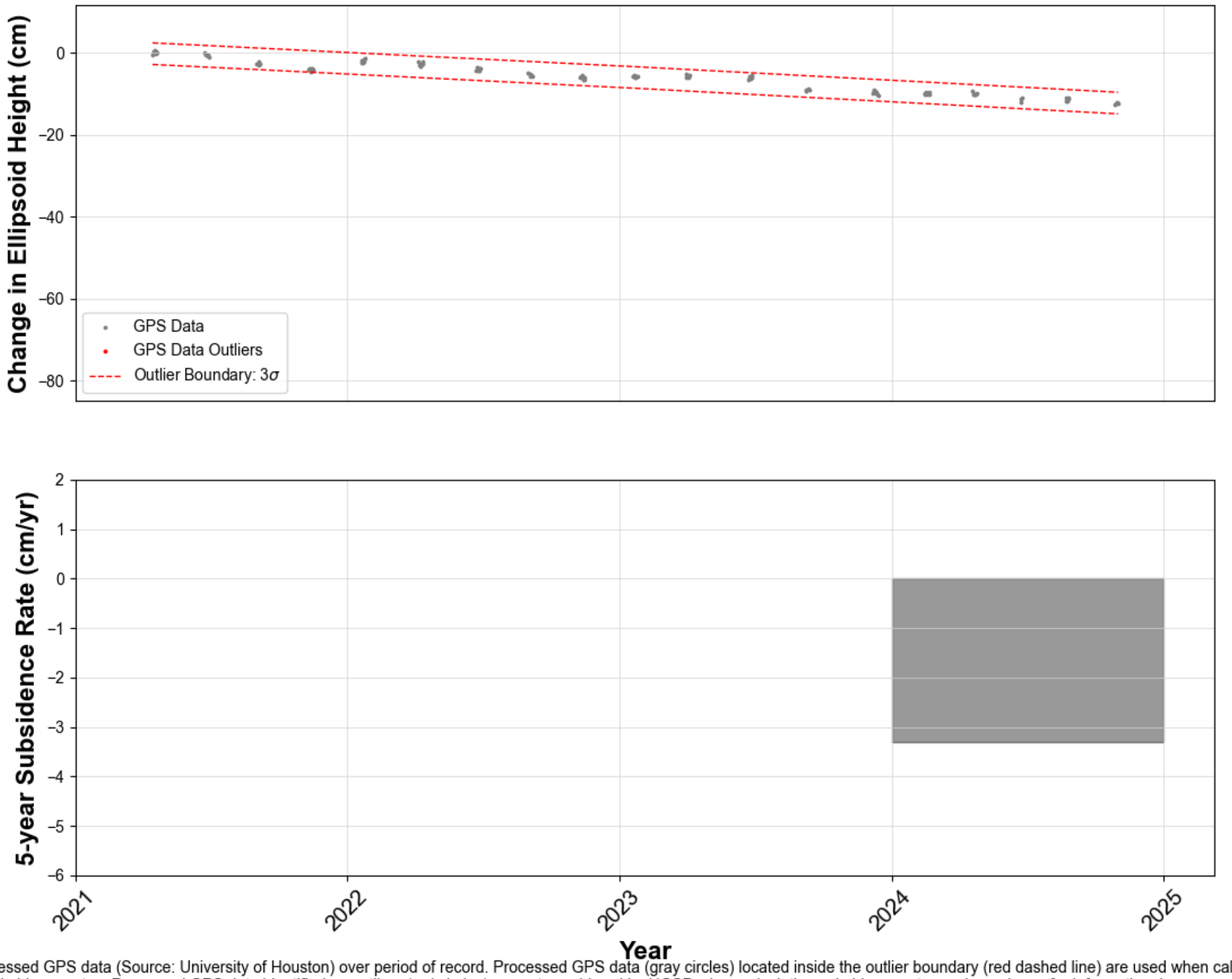


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P111

Katy, TX

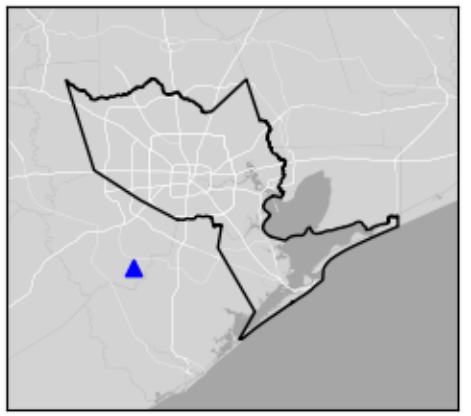


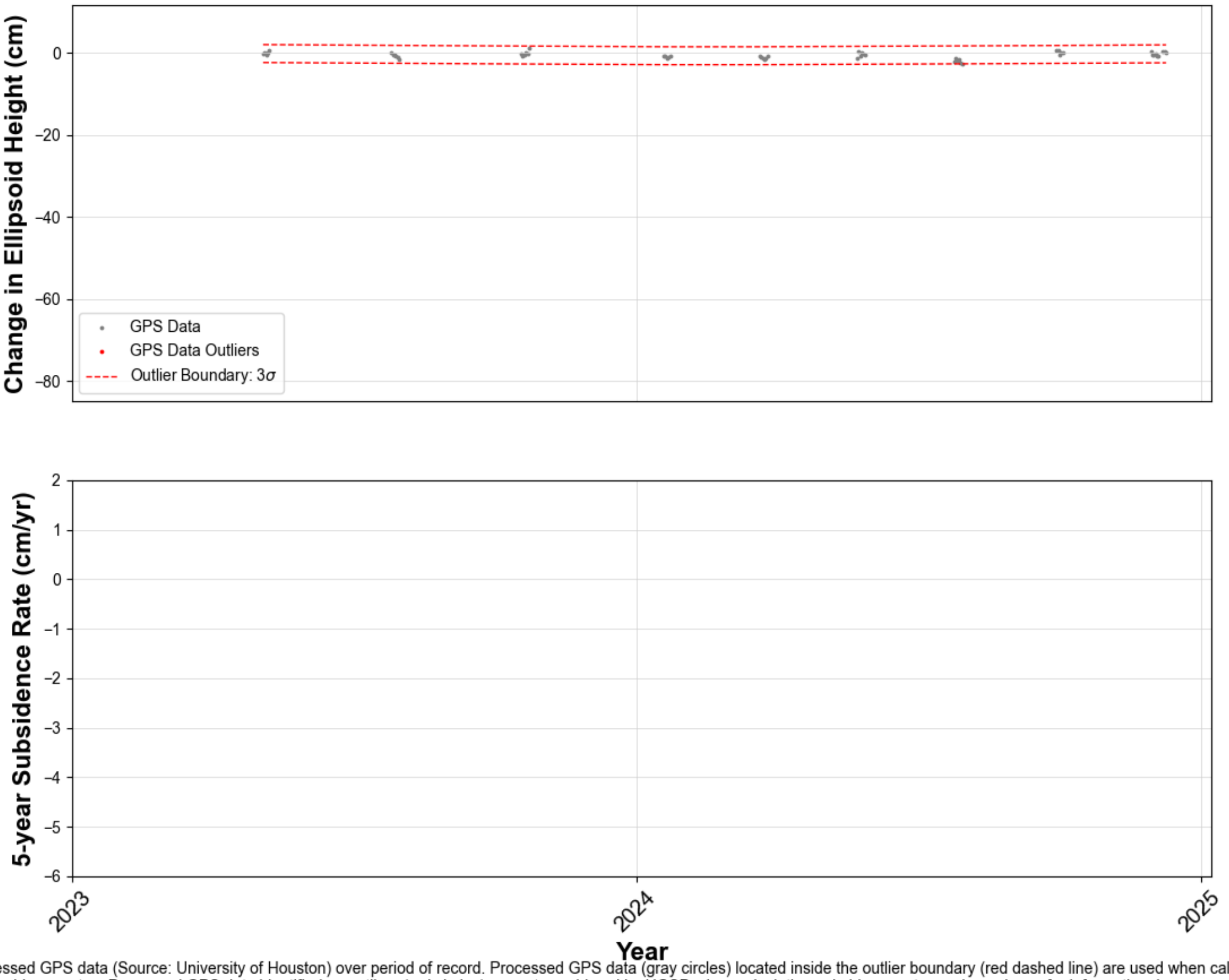


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P113

Needville, TX

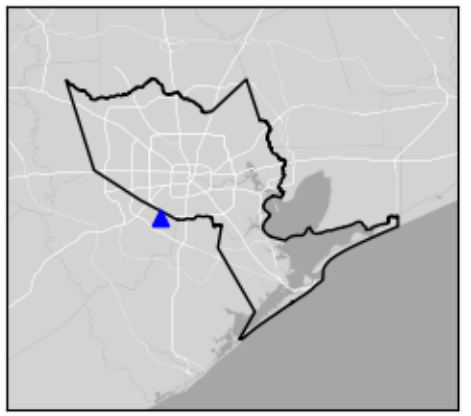


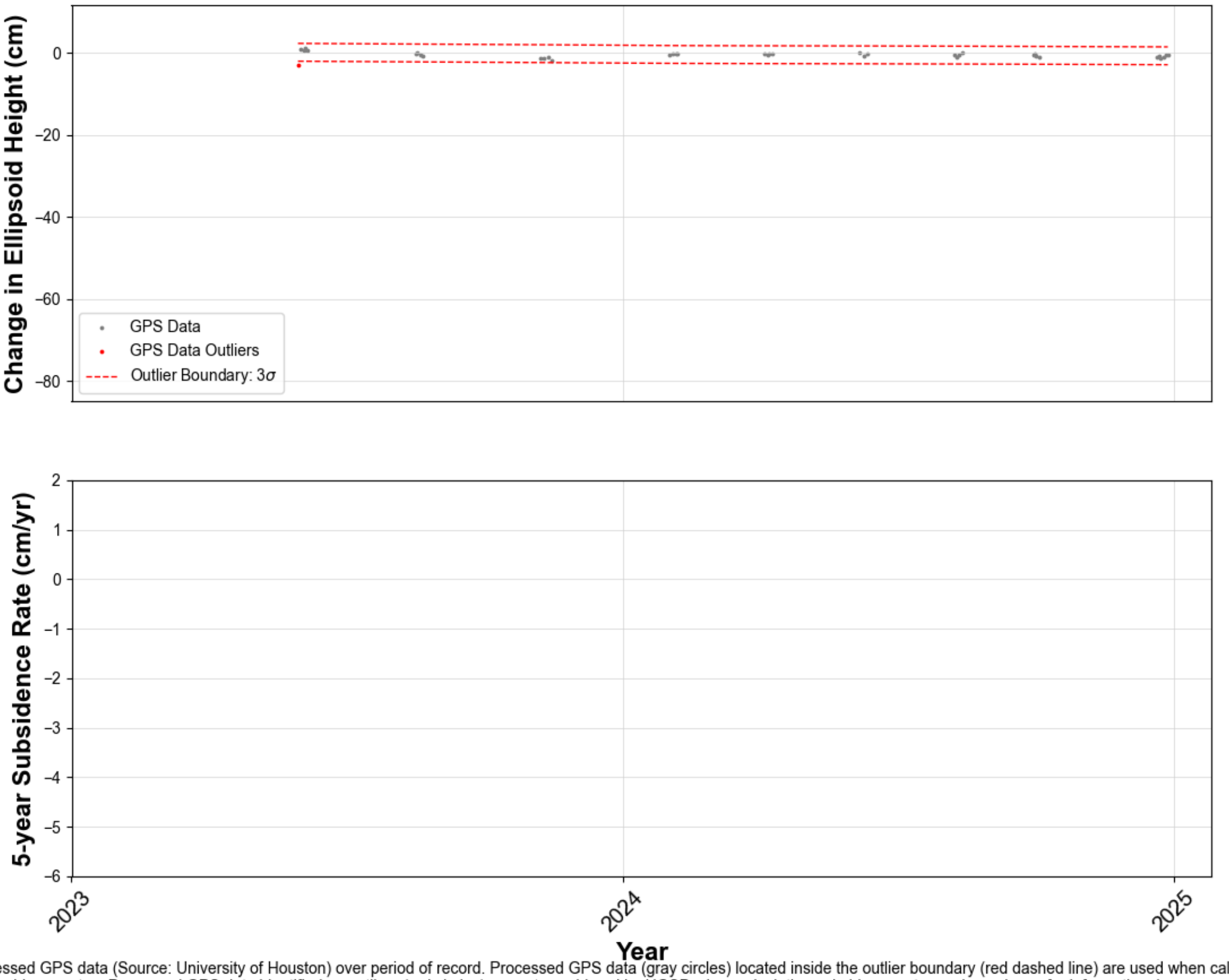


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P114

Missouri City, TX

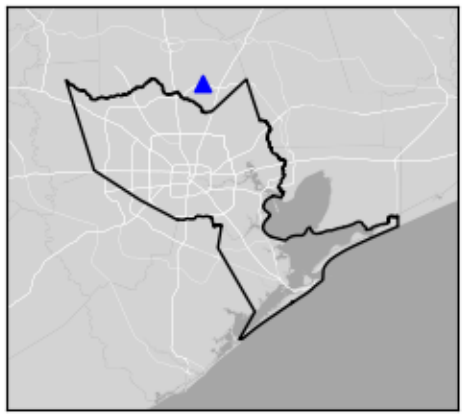




Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

P115

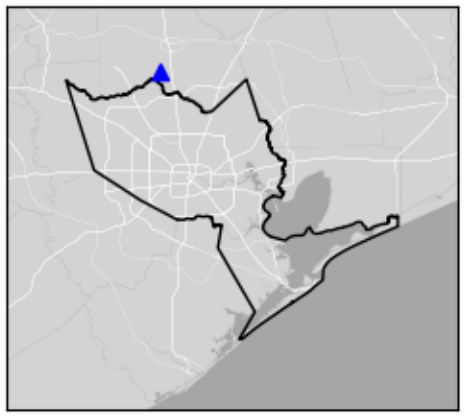
Porter, TX

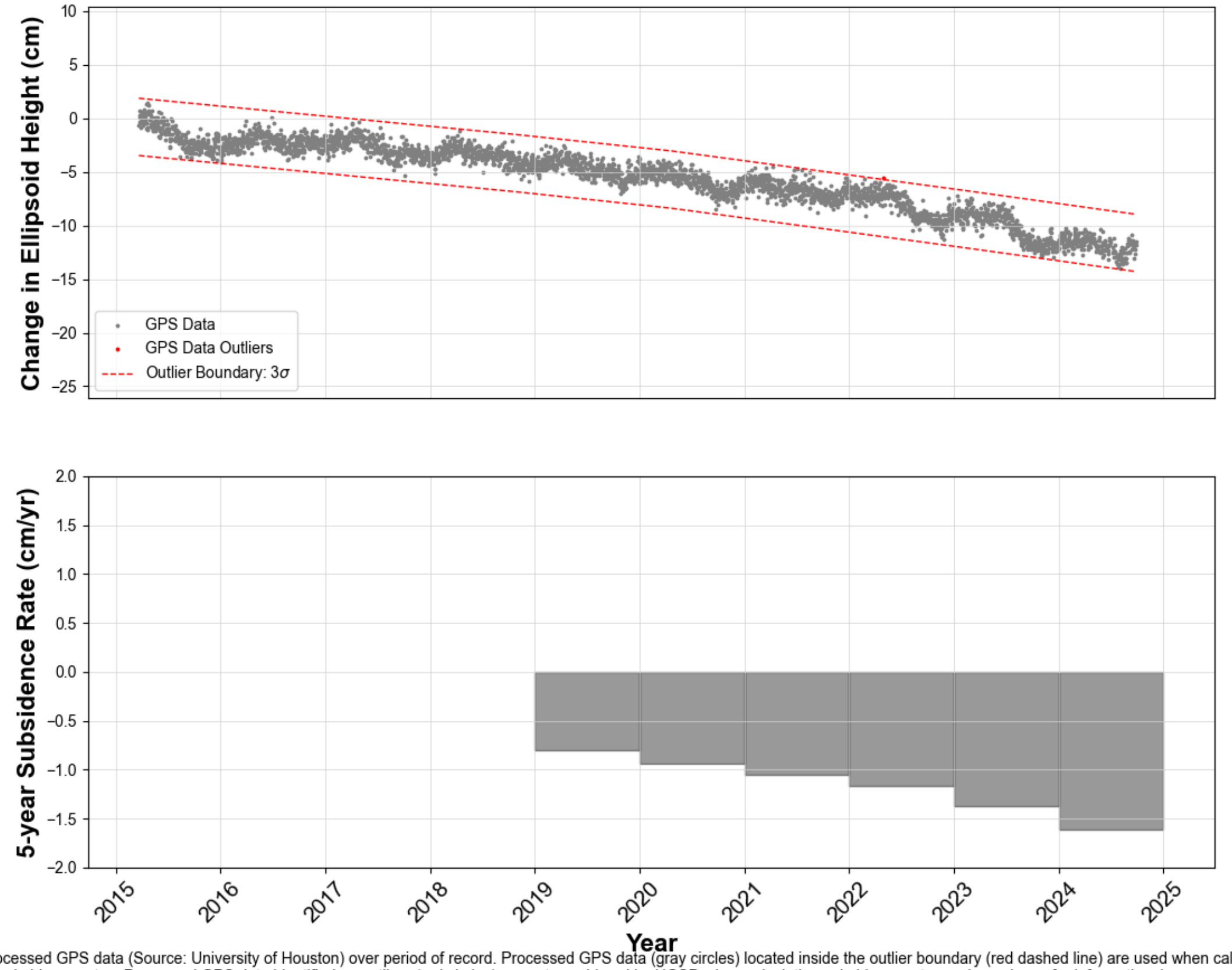


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

PWES

Spring, TX

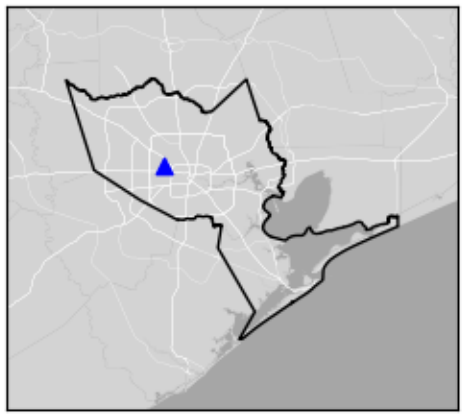


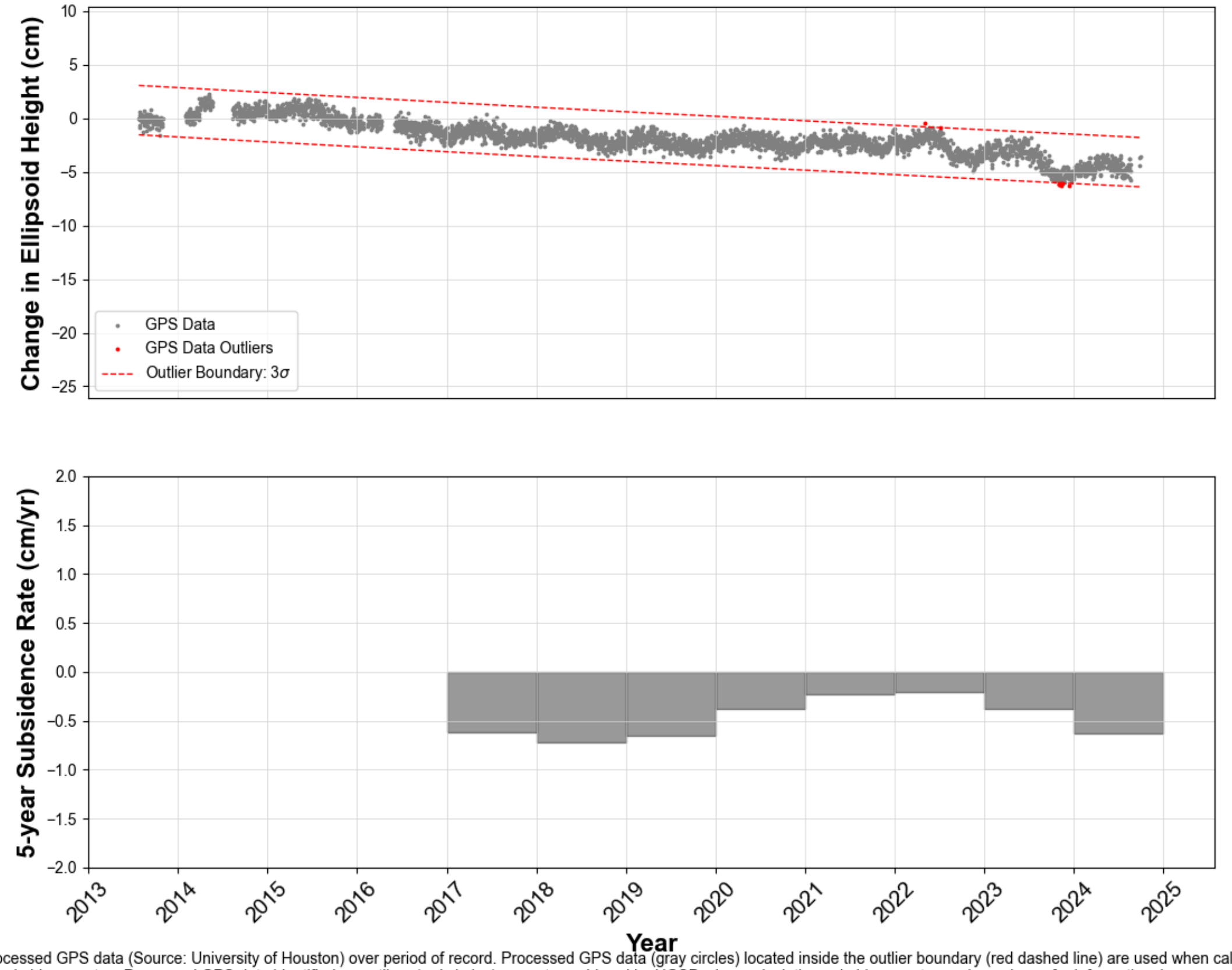


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

RDCT

Houston, TX

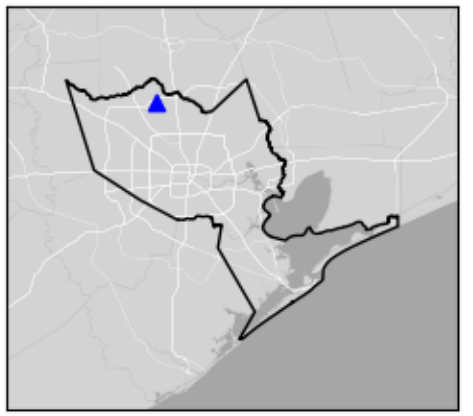


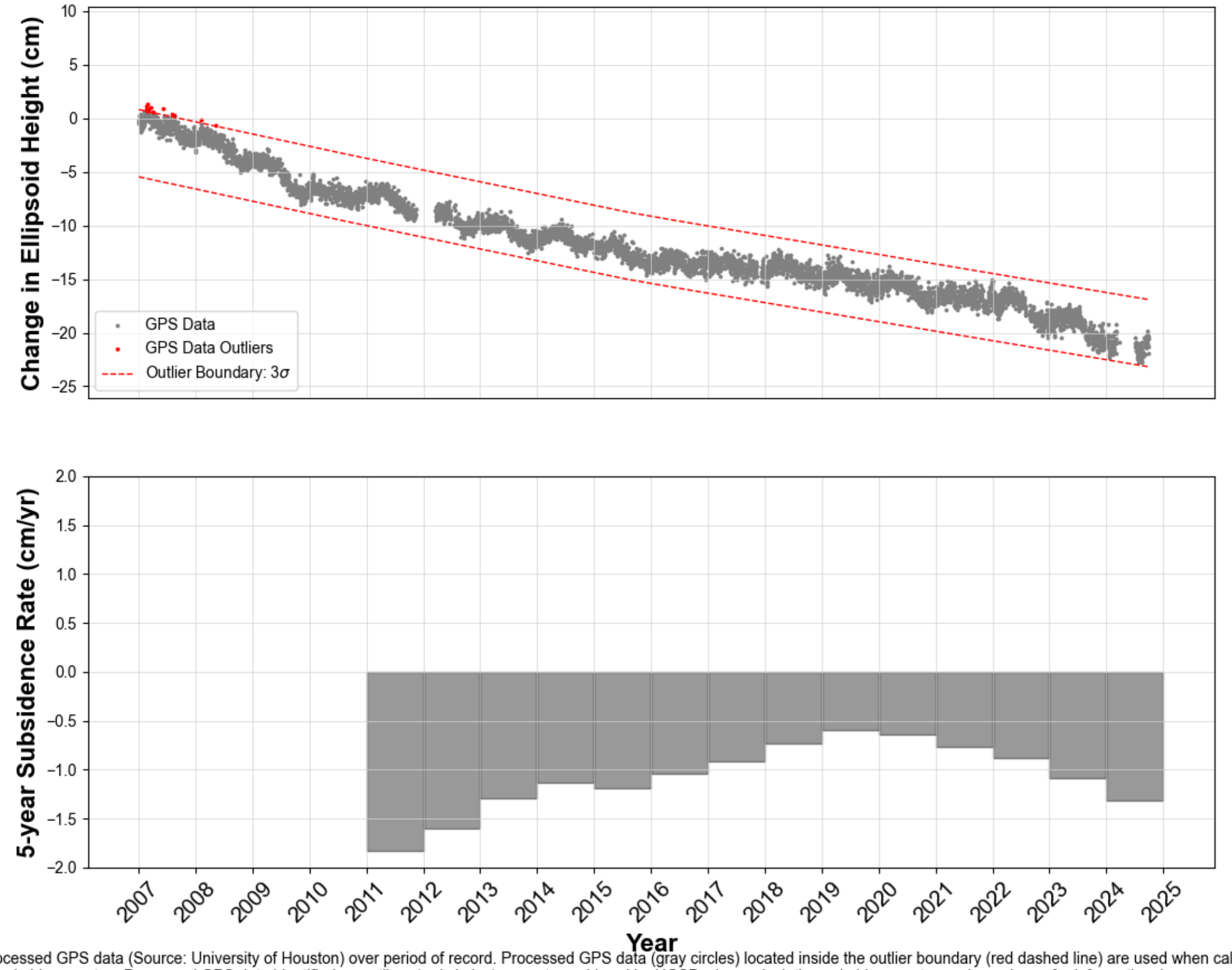


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

ROD1

Spring, TX

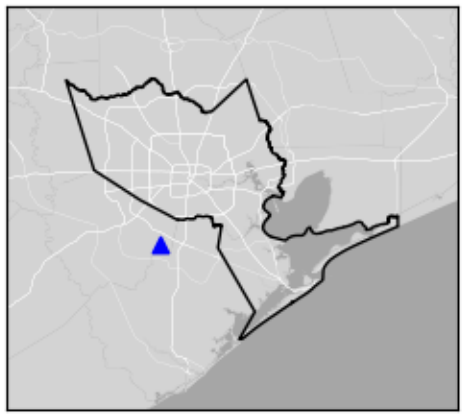


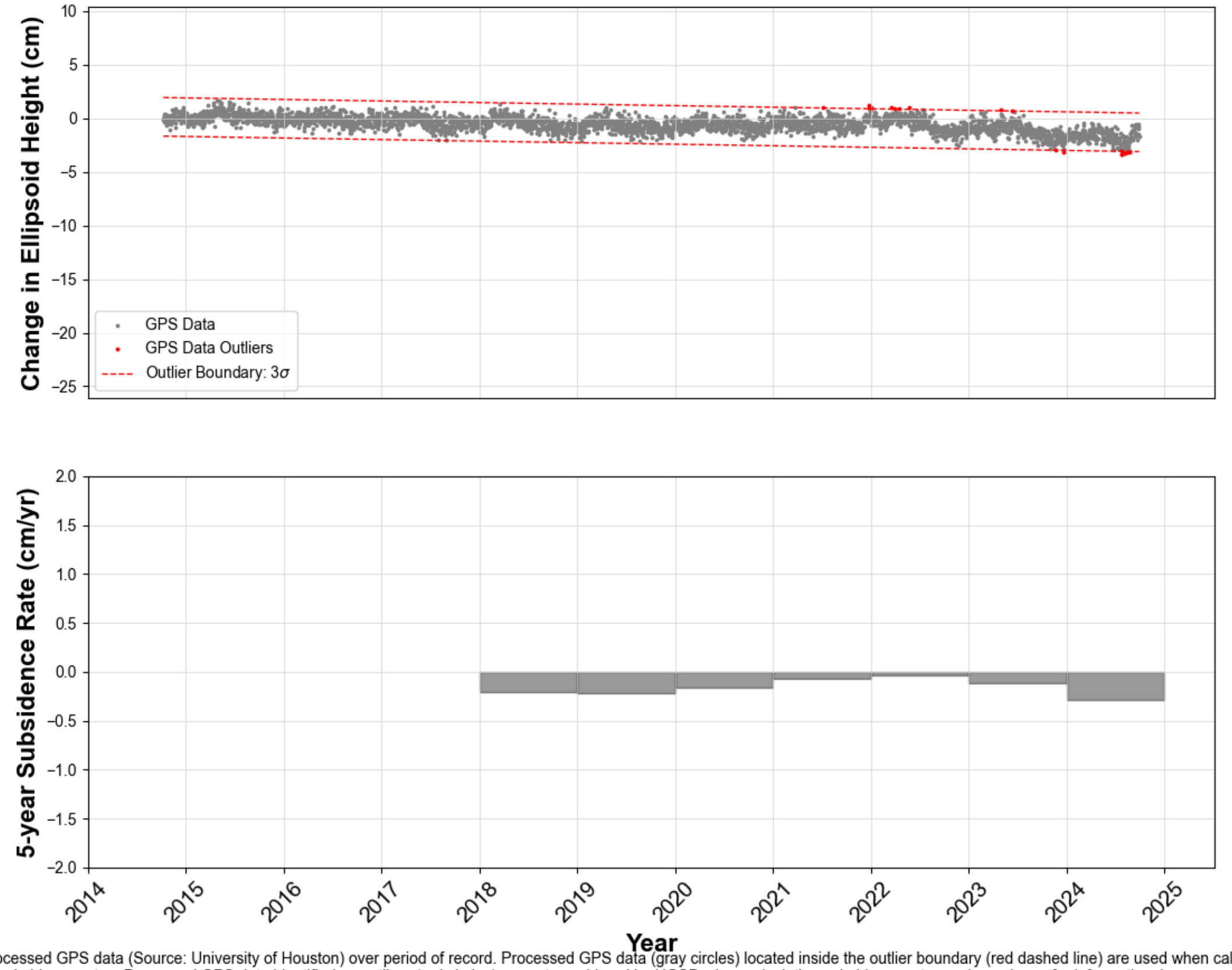


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

RPFB

Sienna, TX

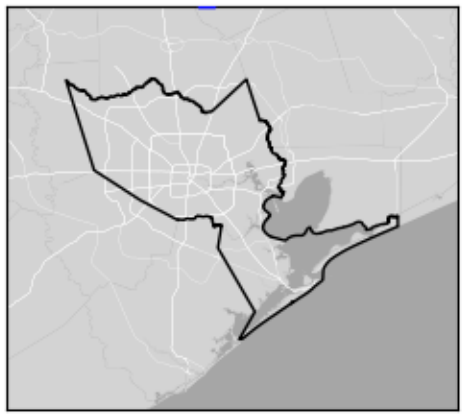


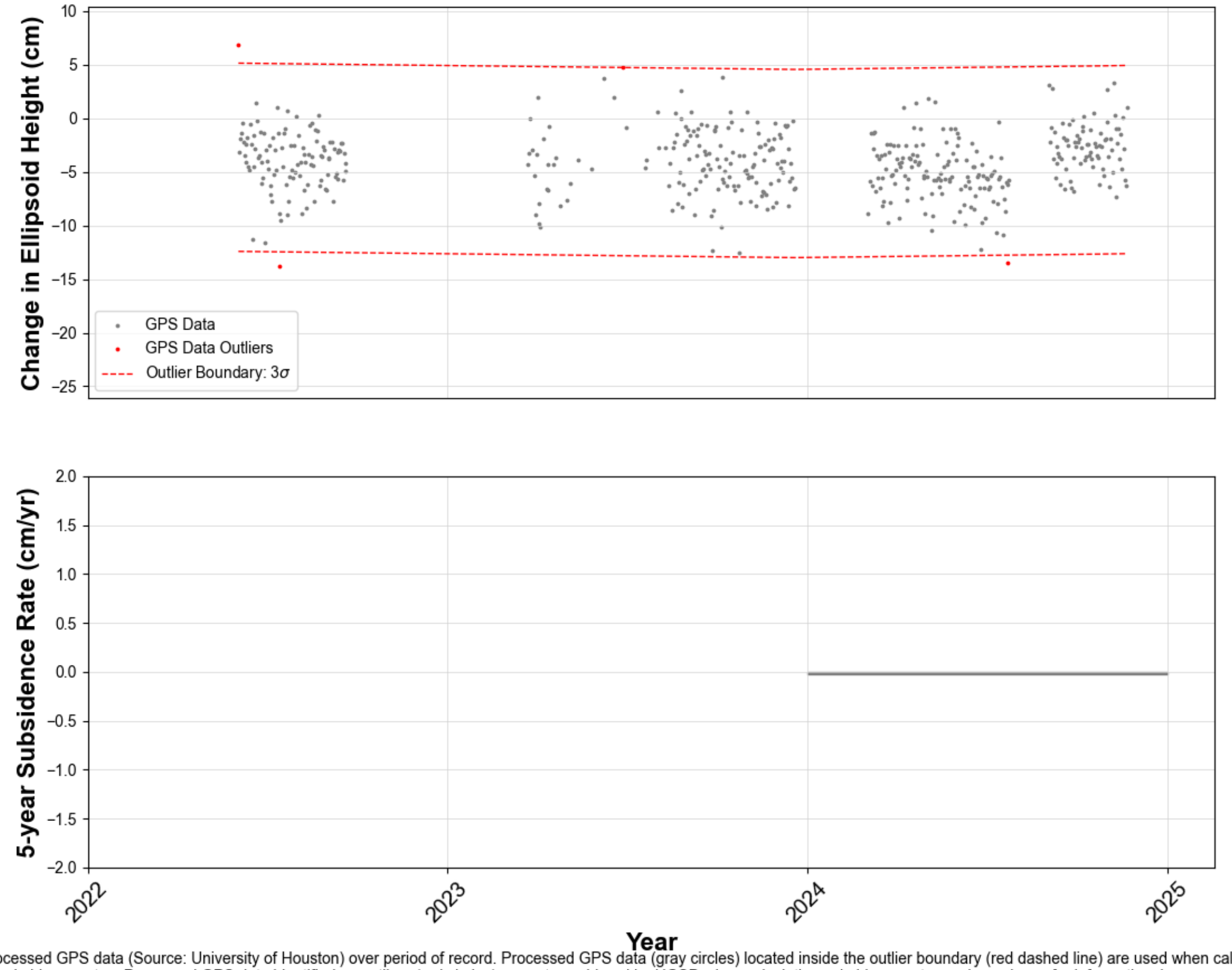


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

SANJ

Willis, TX

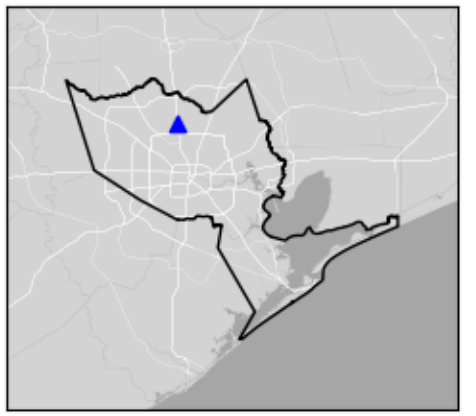


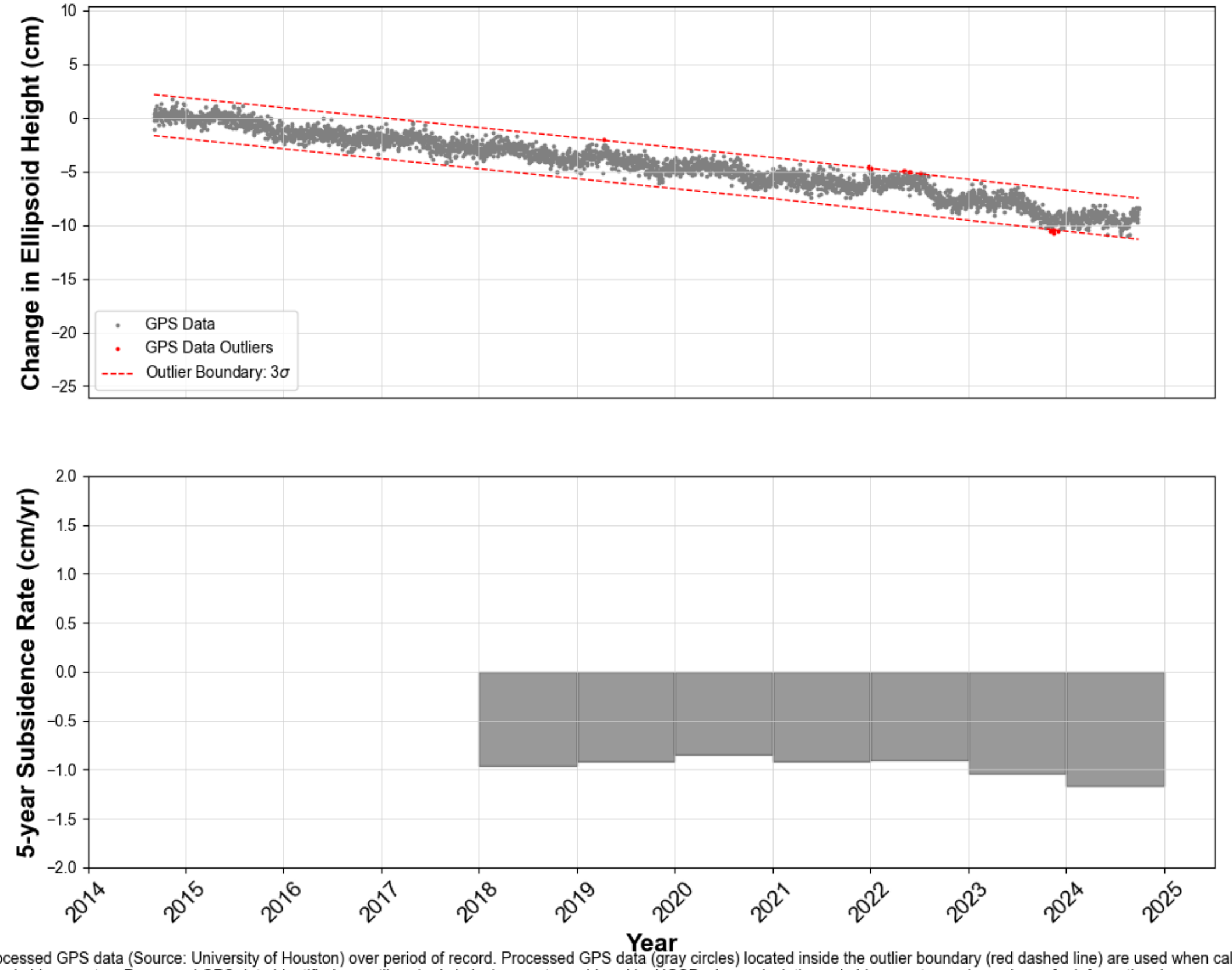


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

SESG

Houston, TX

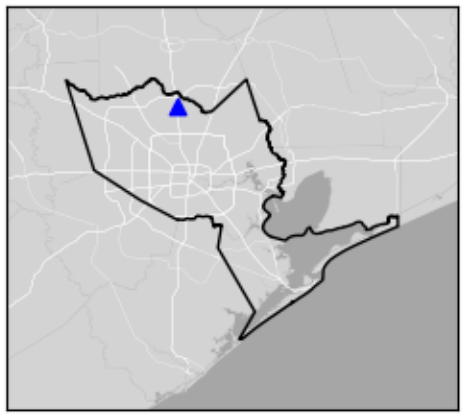


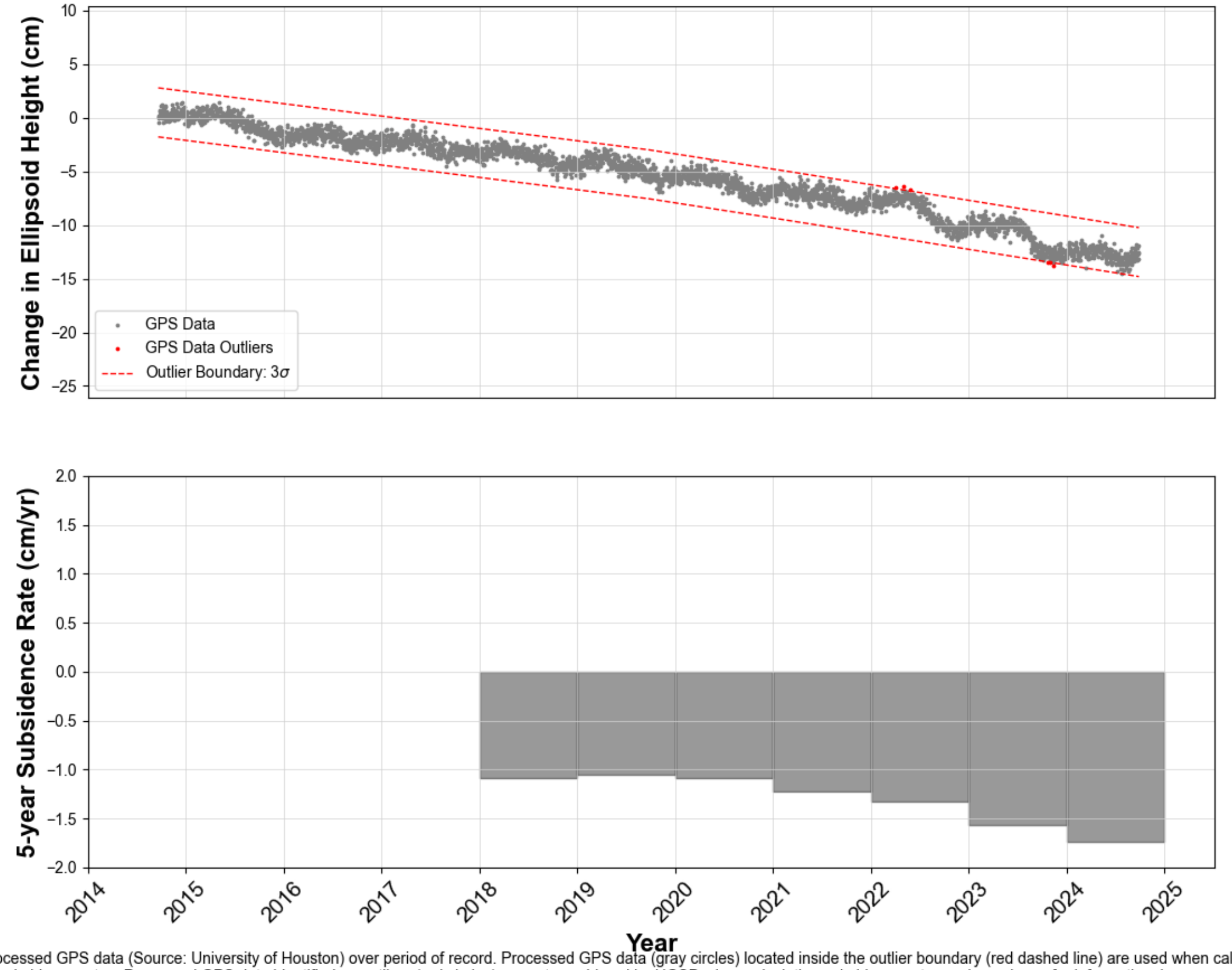


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

SHSG

Spring, TX

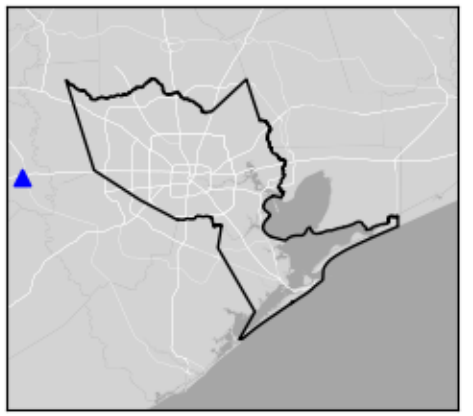


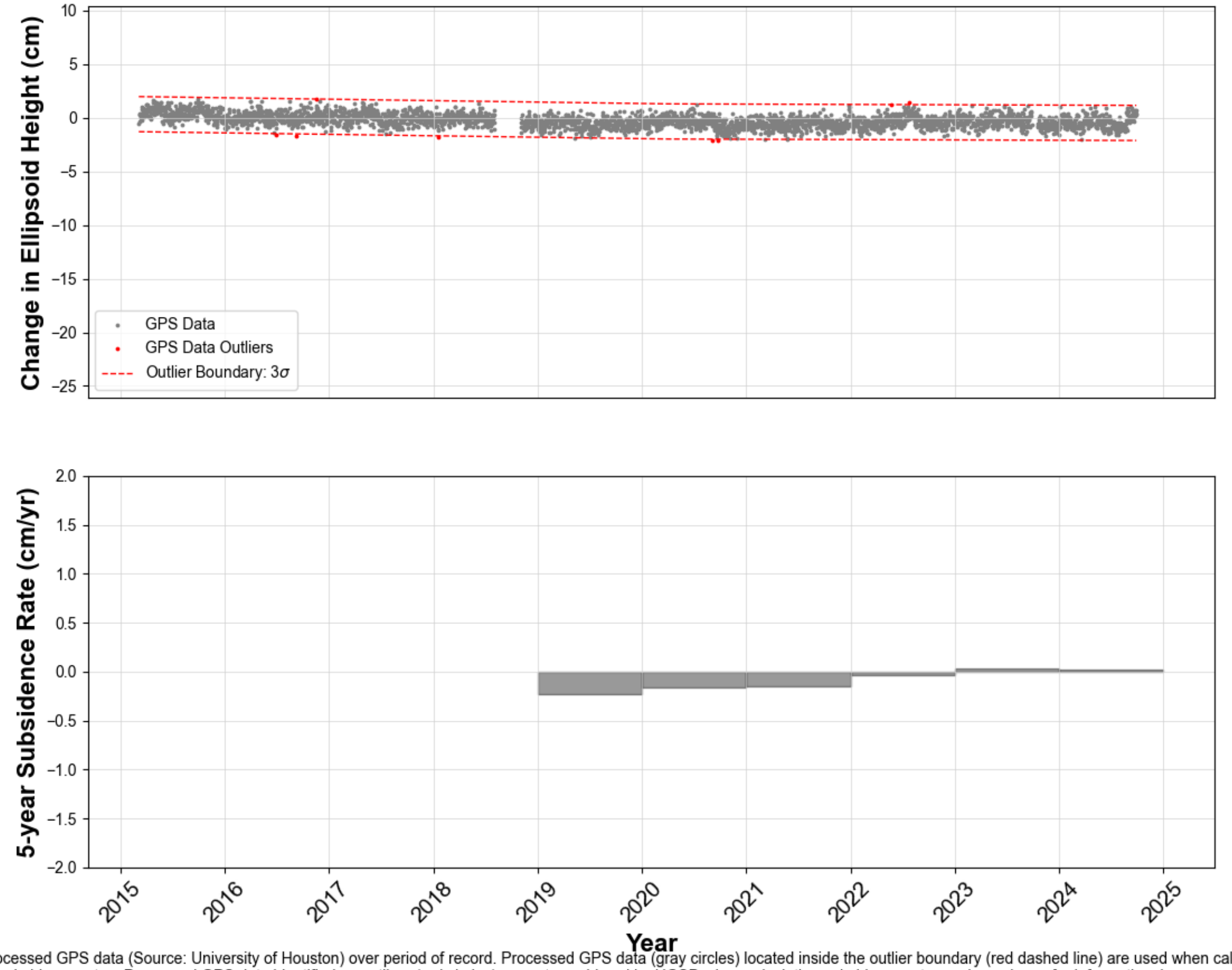


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

SISD

Sealy, TX





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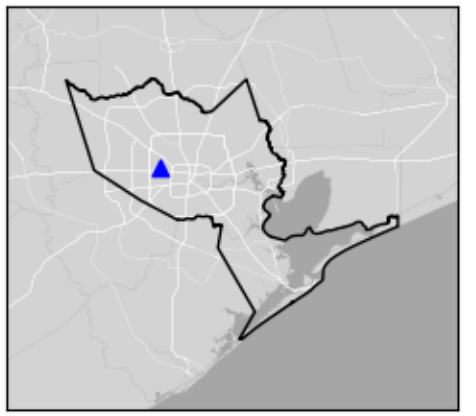
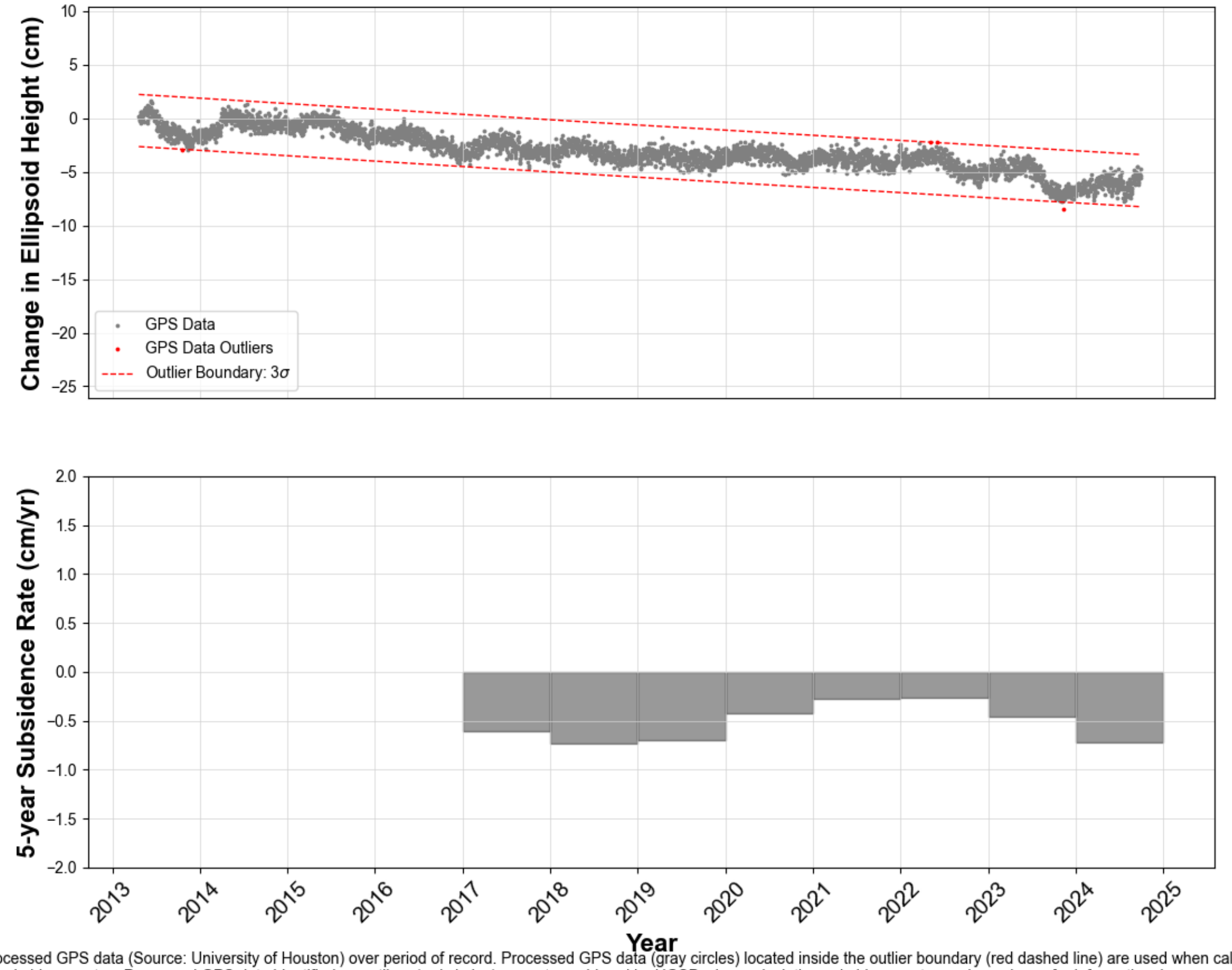
SPBH

Houston, TX





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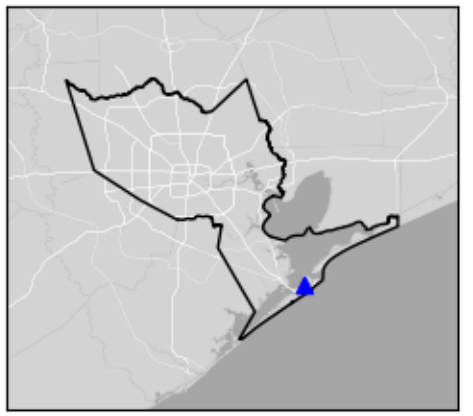
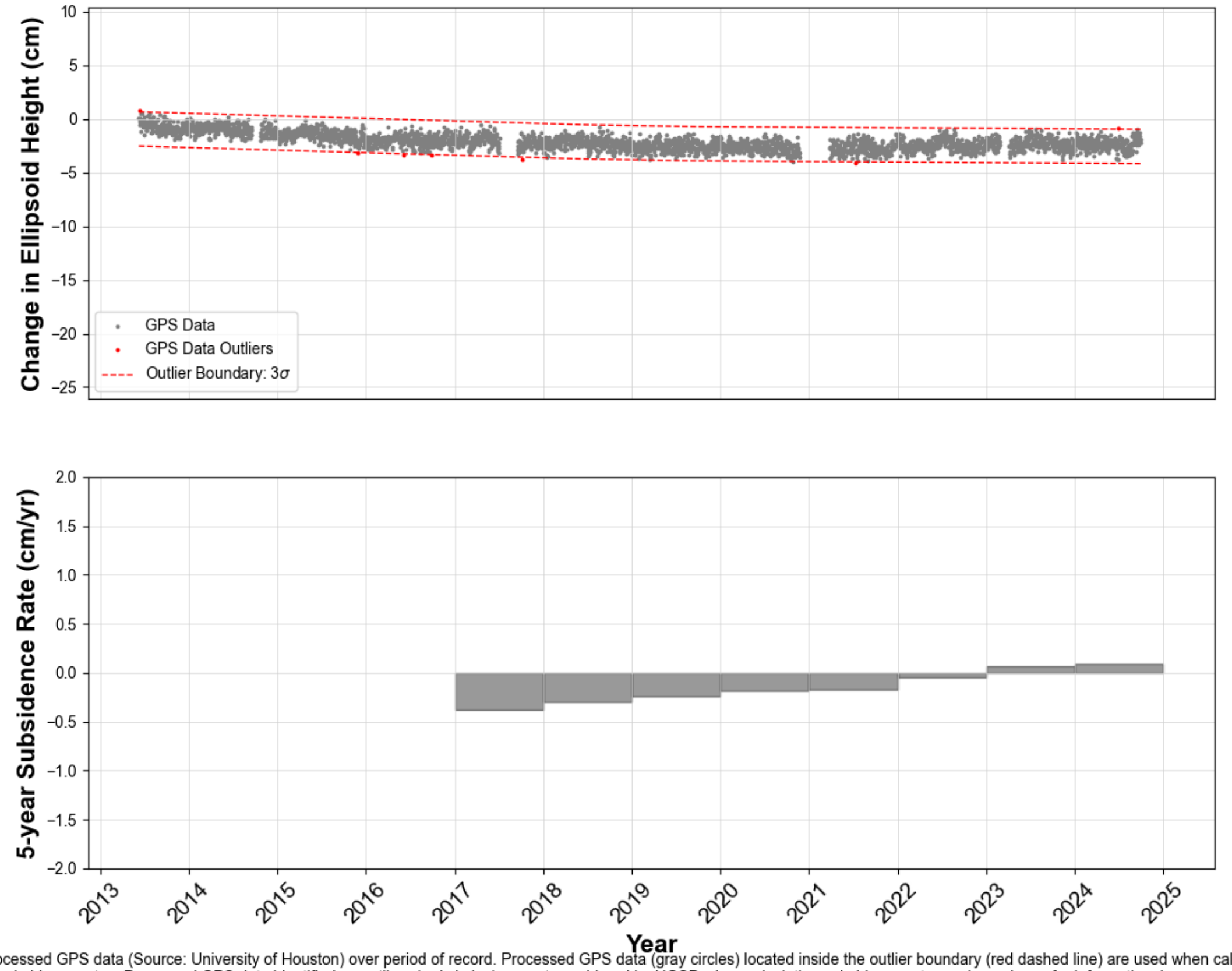
TDAM

Galveston, TX





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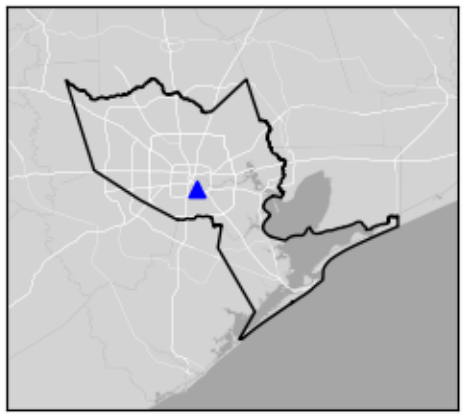
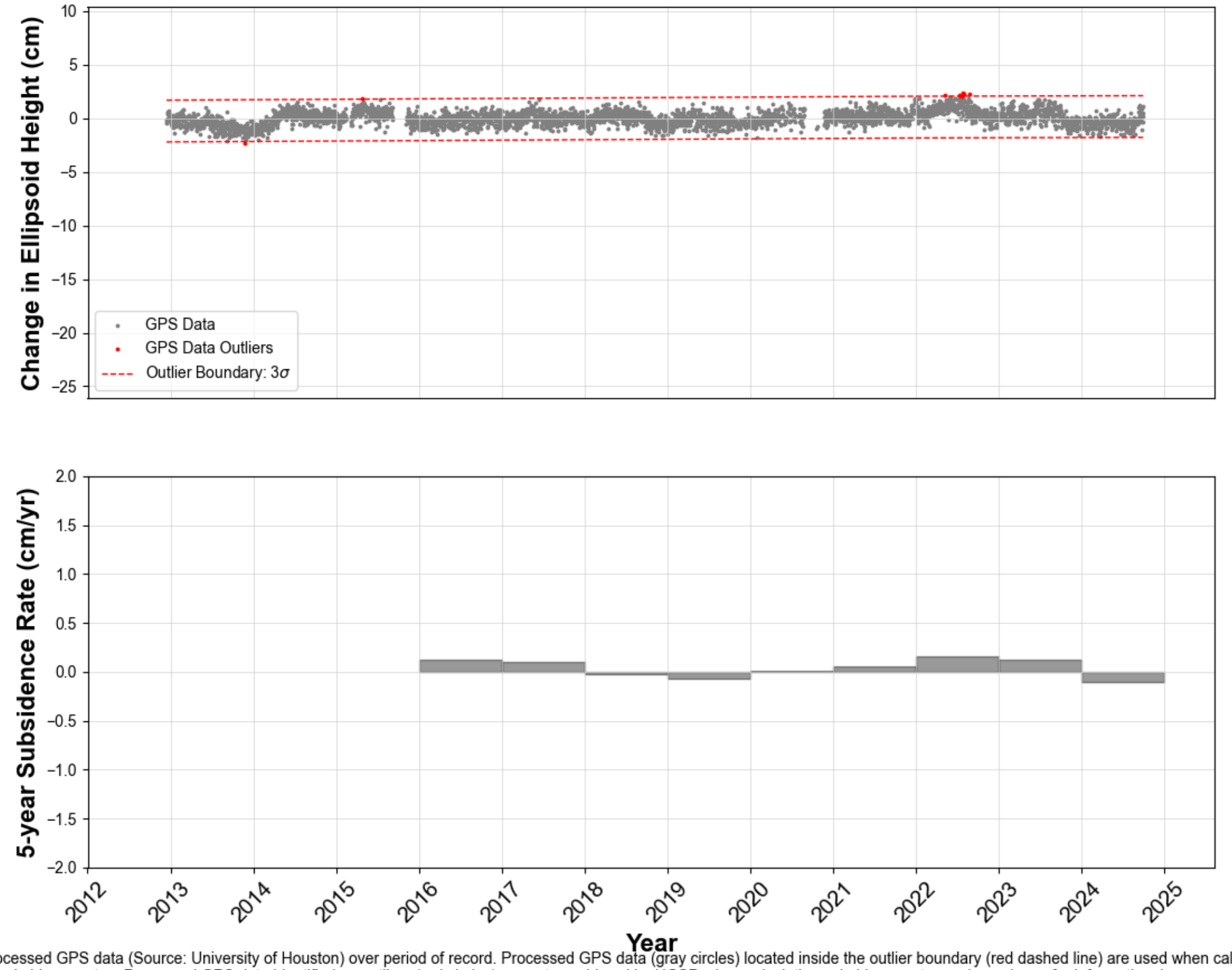
THSU

Houston, TX





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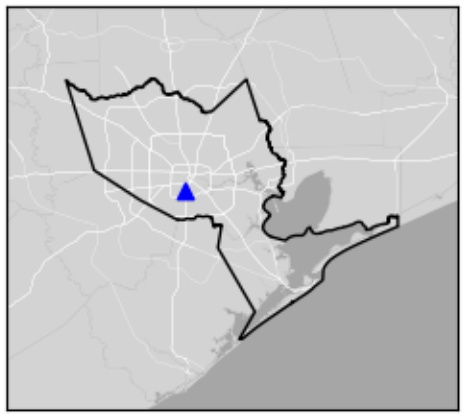
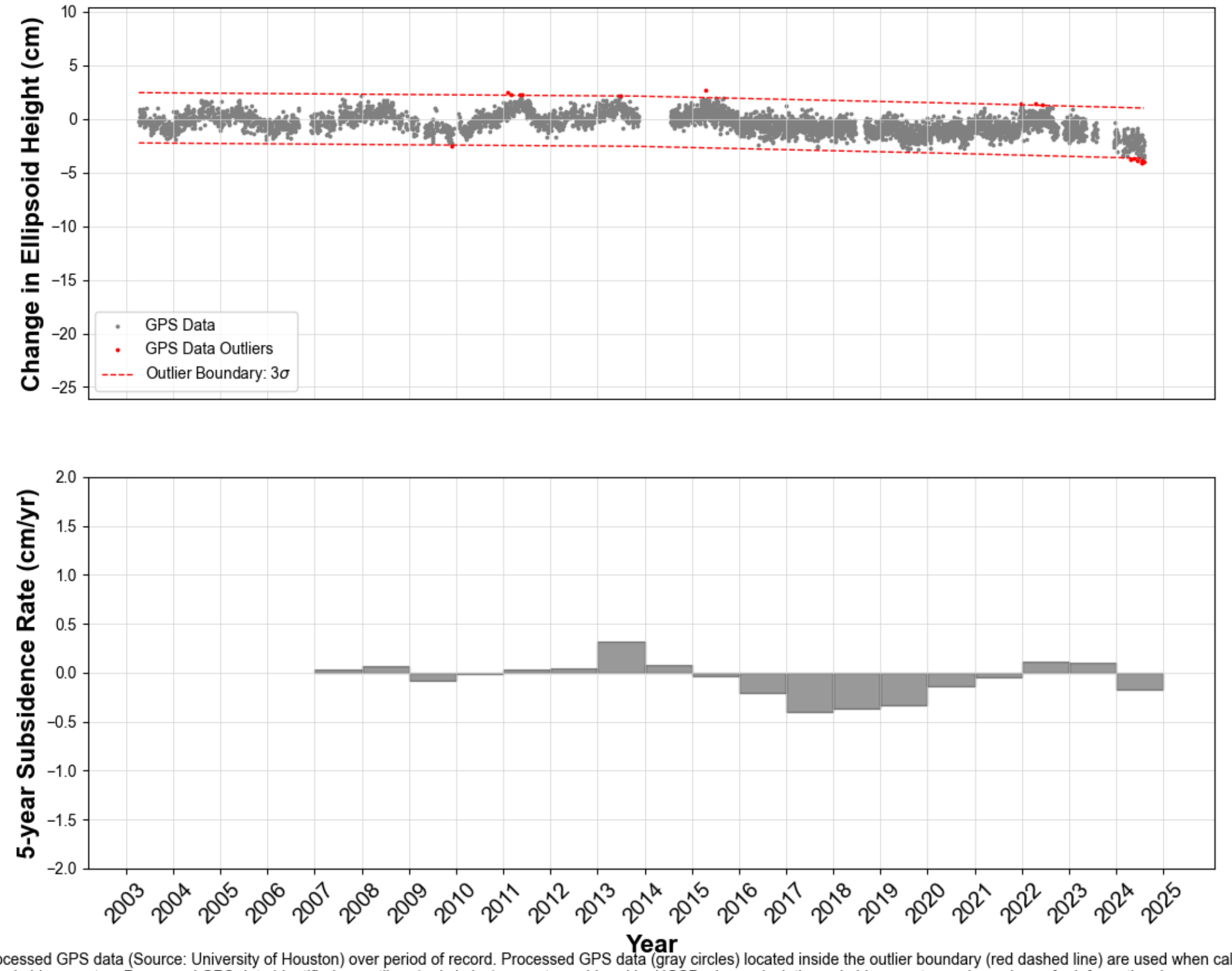
TMCC

Houston, TX





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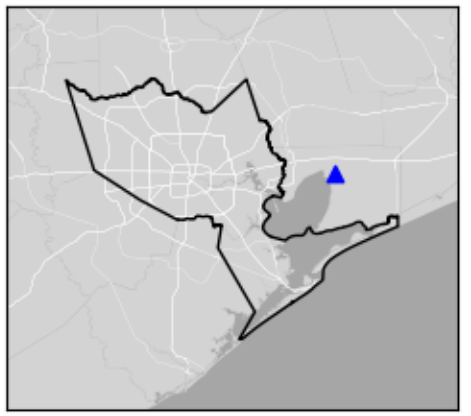
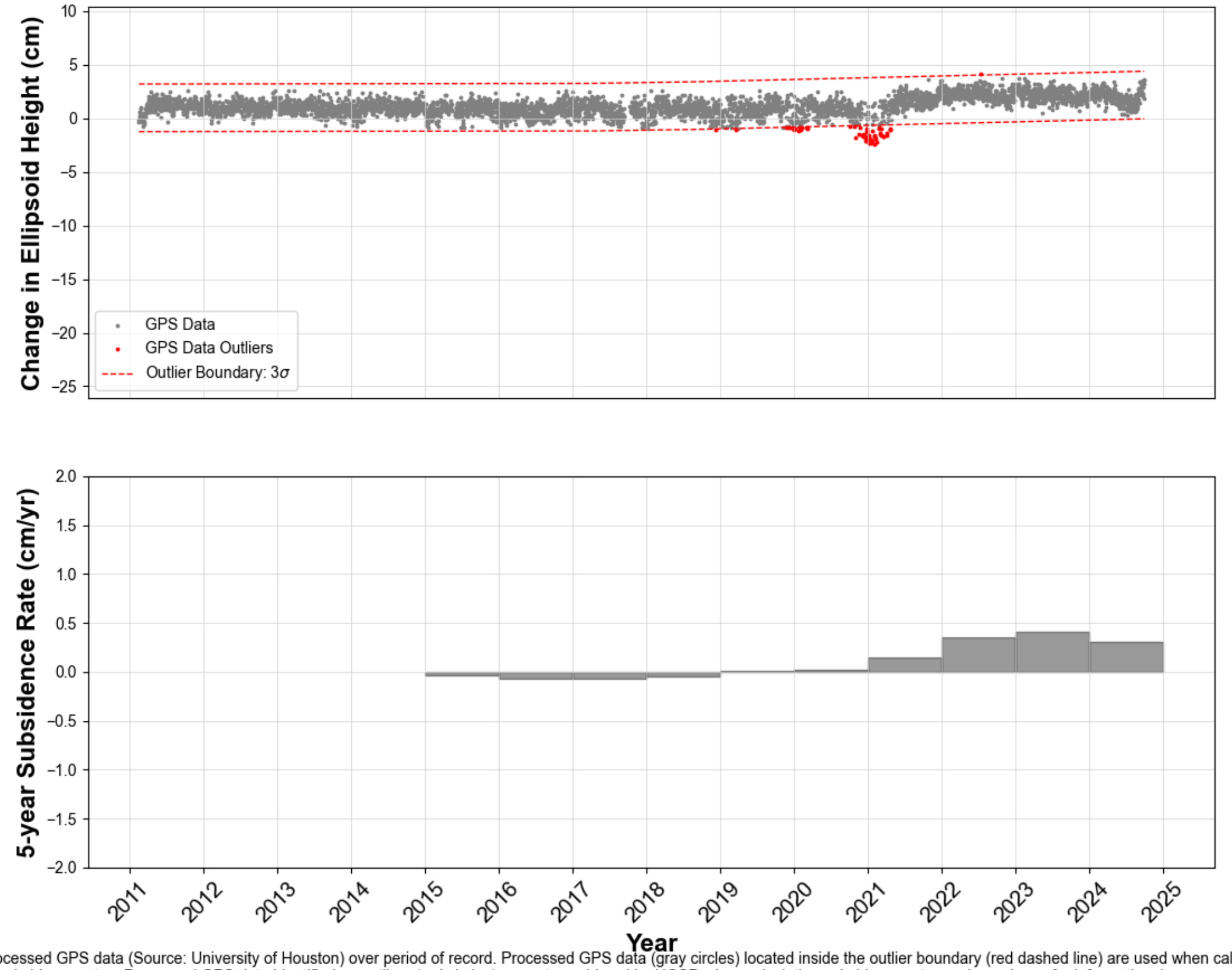
TXAC

Anahuac, TX

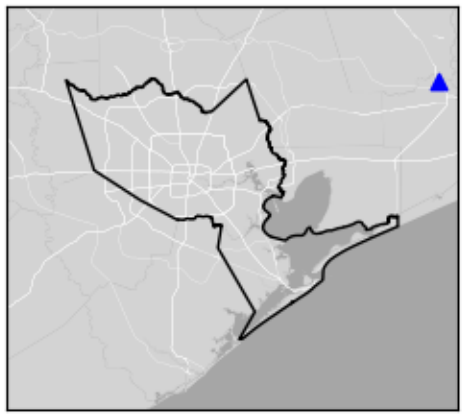


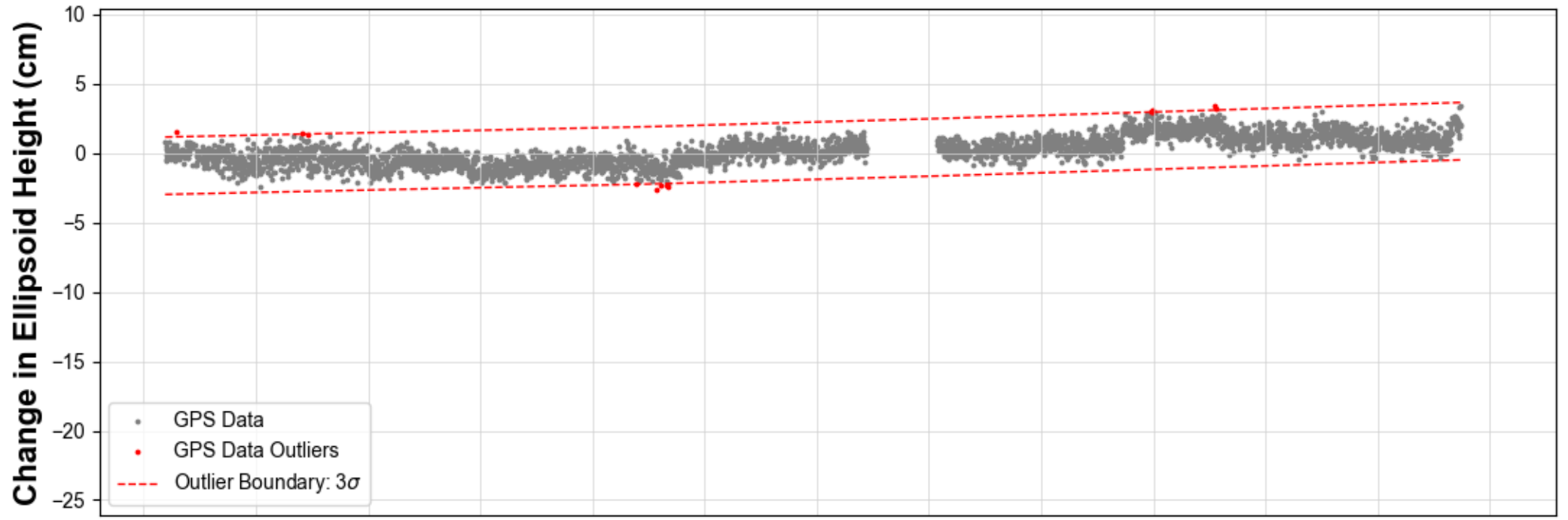


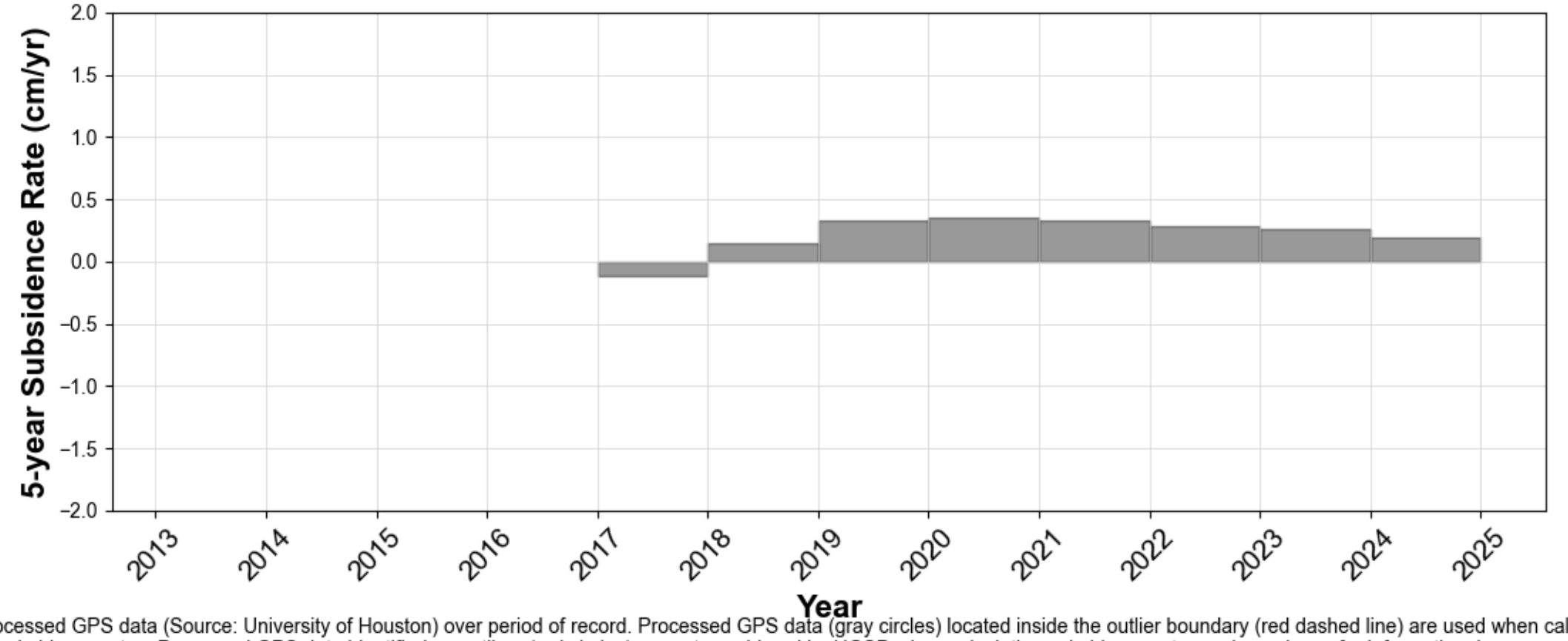
Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXB1

Beaumont, TX







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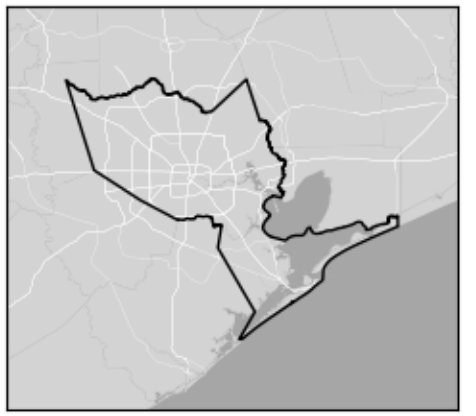
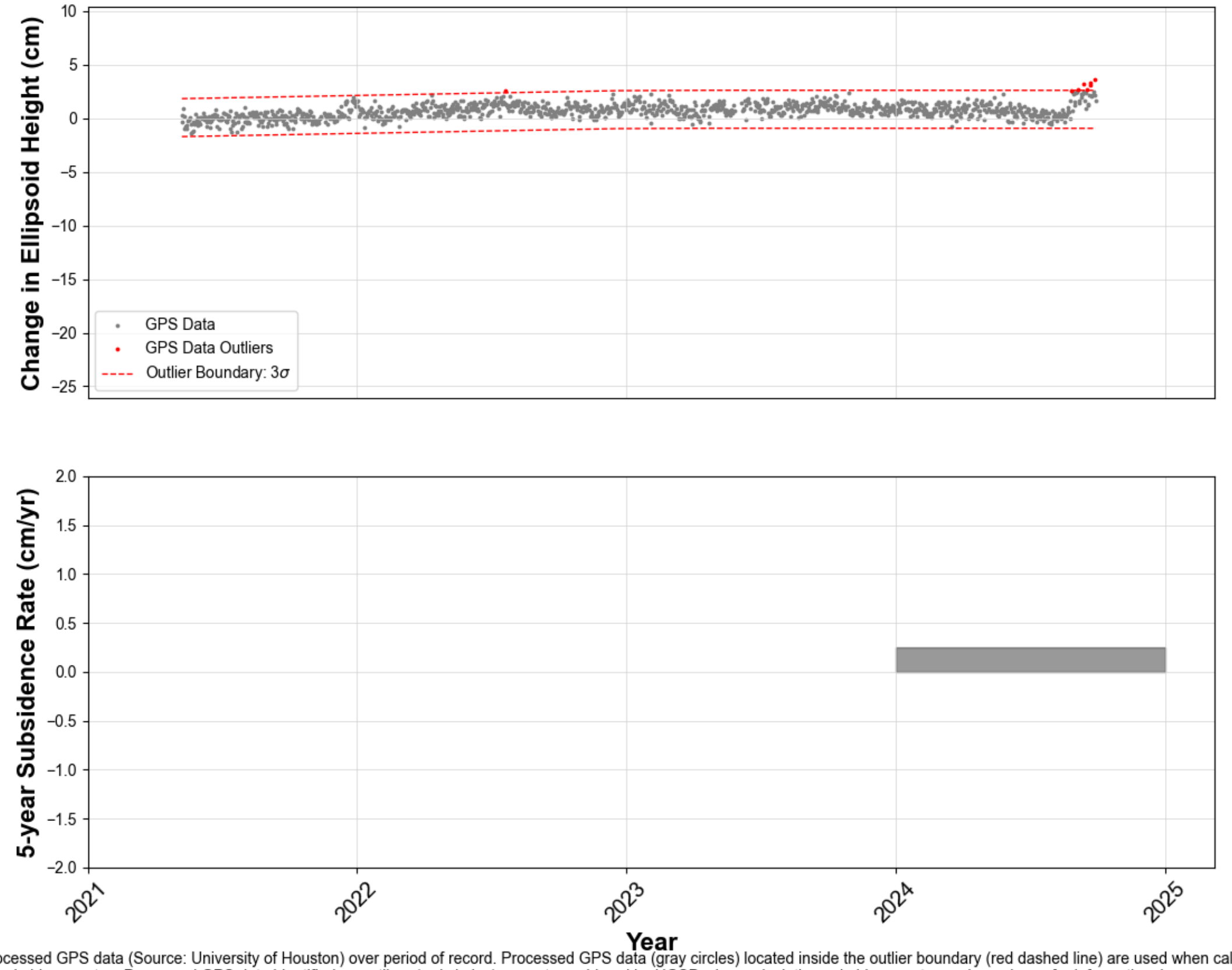
TXB7

Buffalo, TX





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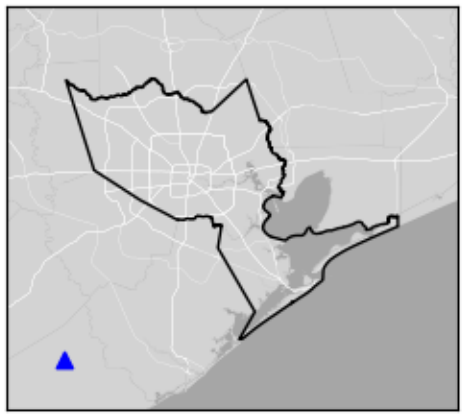
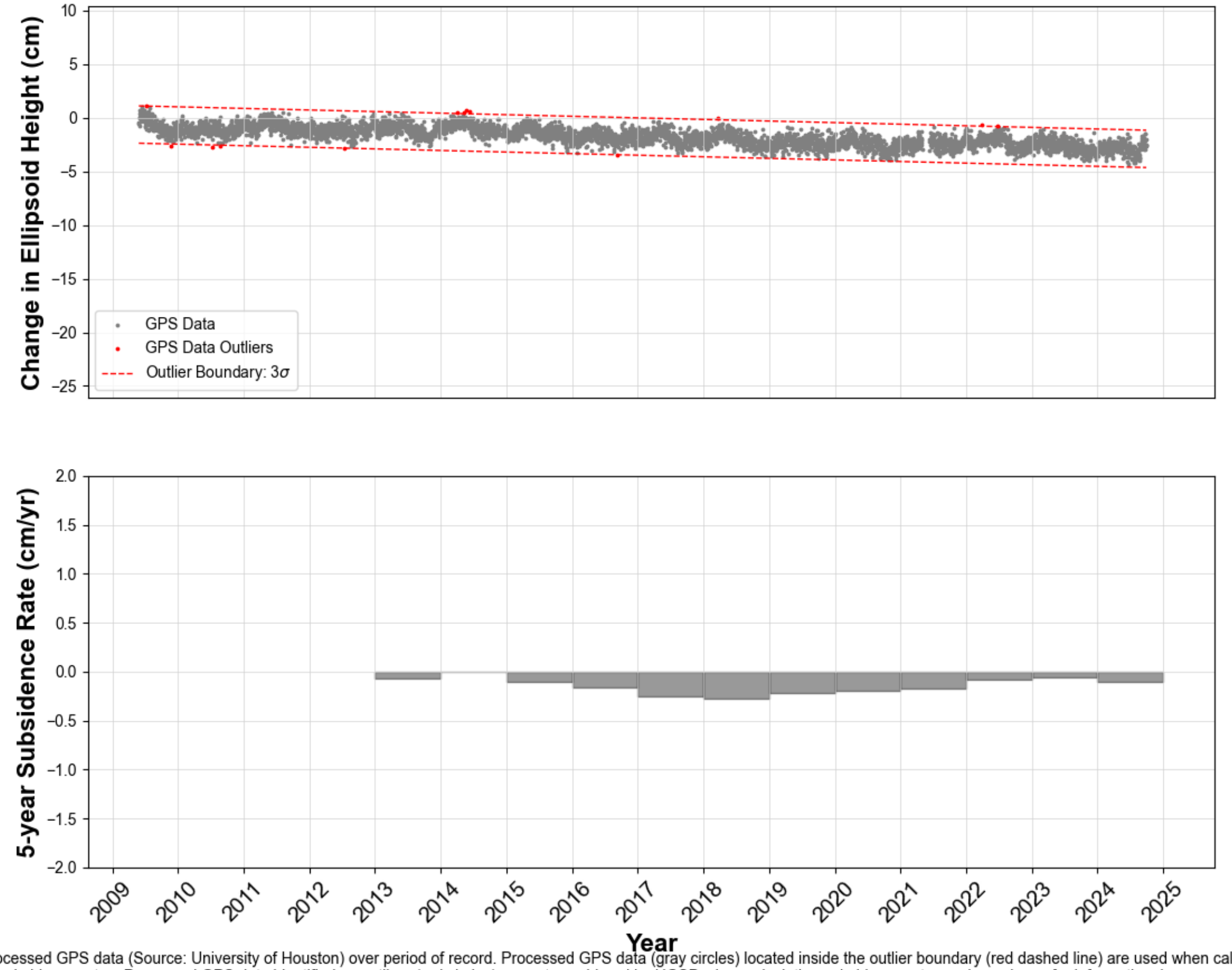
TXBC

Bay City, TX





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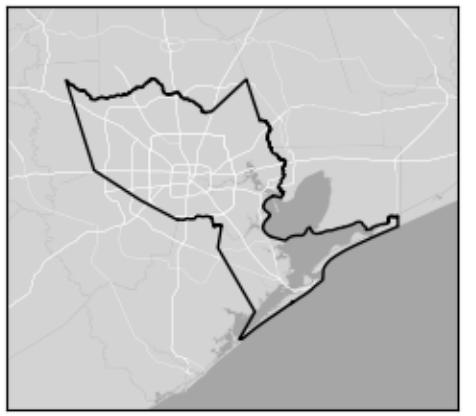
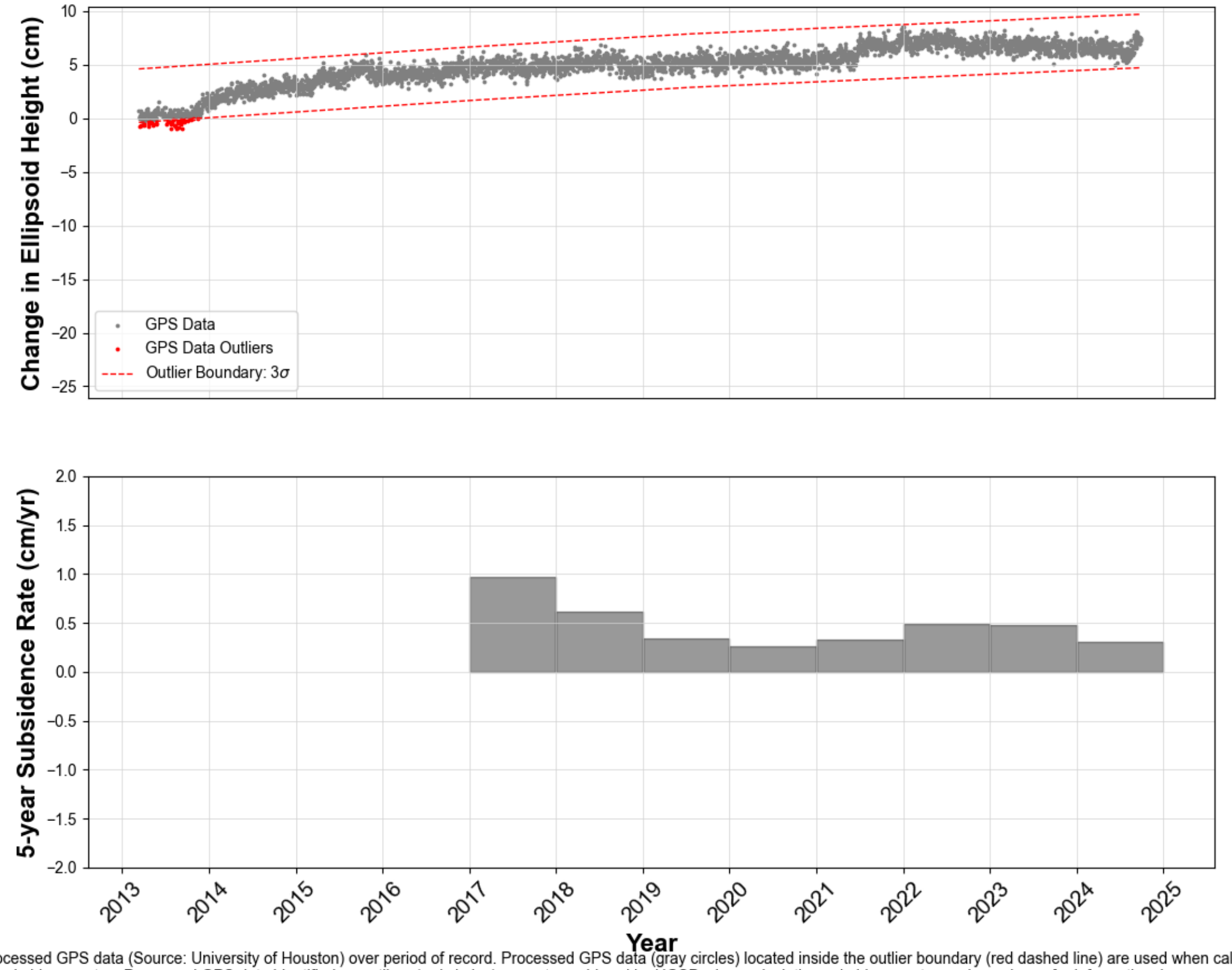
TXBX

Bryan, TX





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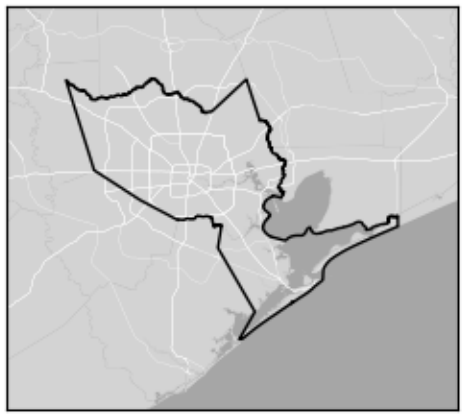
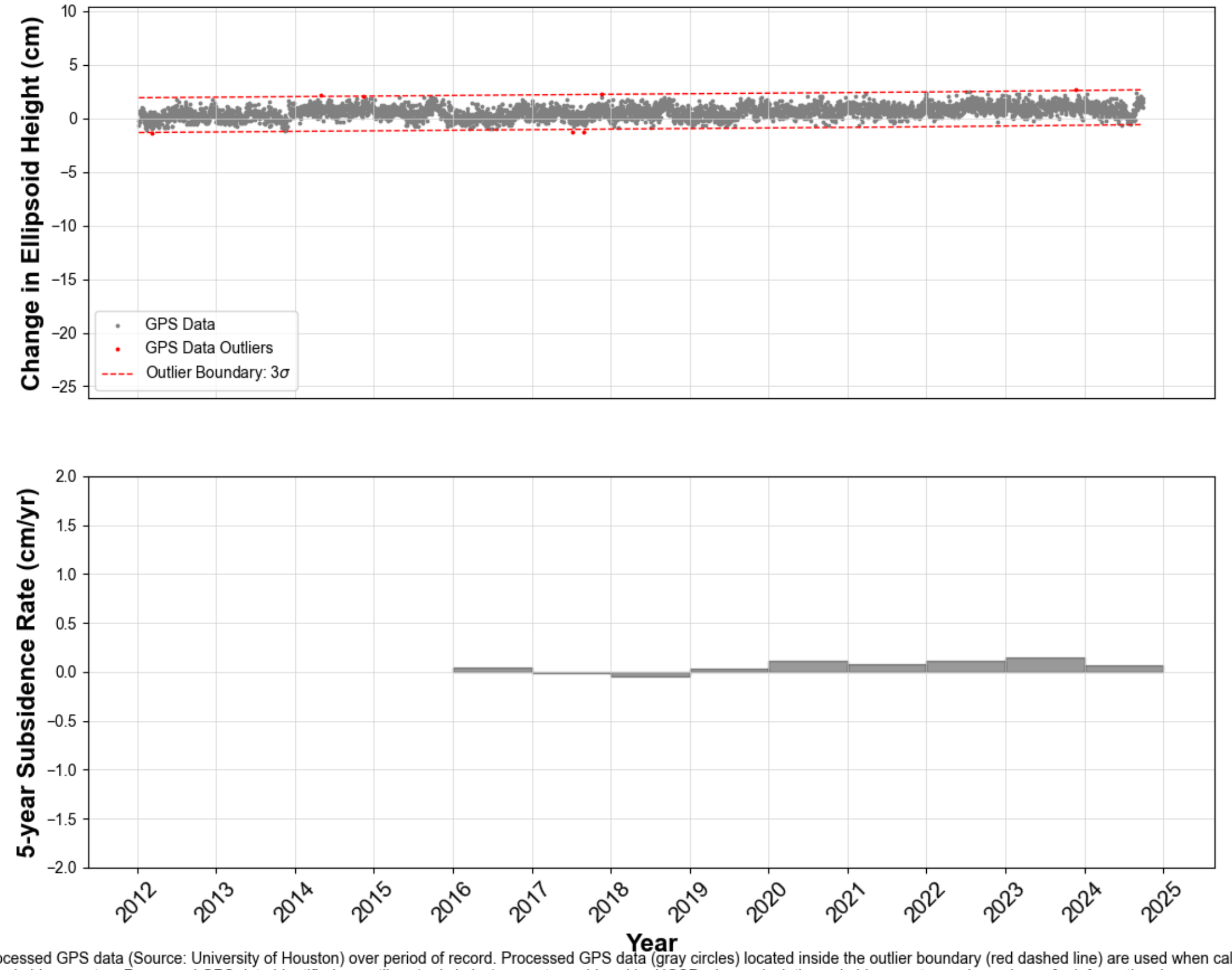
TXCK

Crockett, TX





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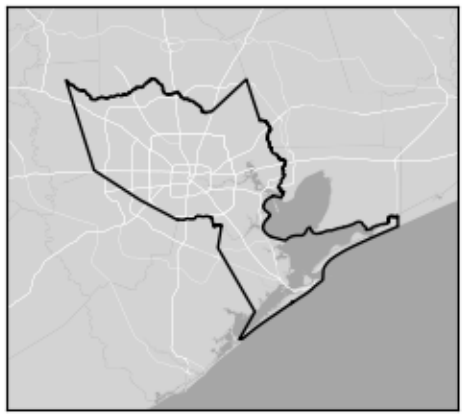
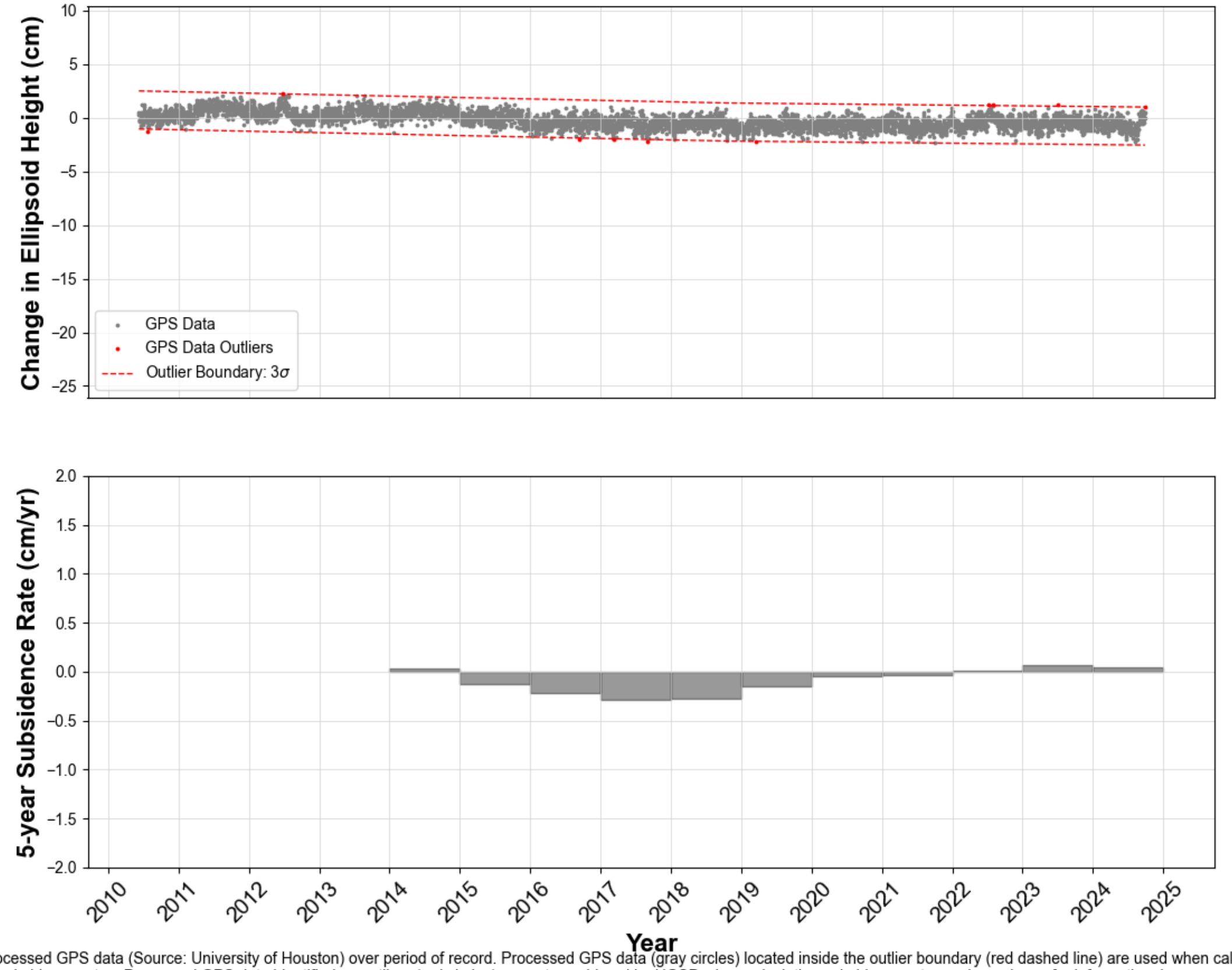
TXCM

Glidden, TX

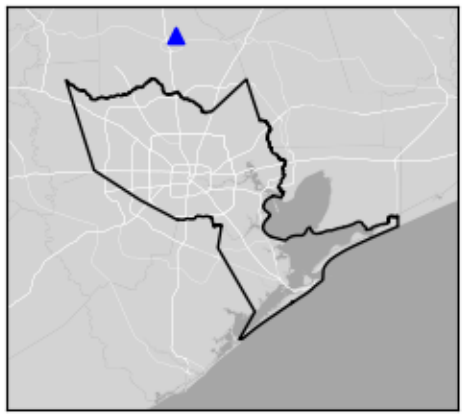


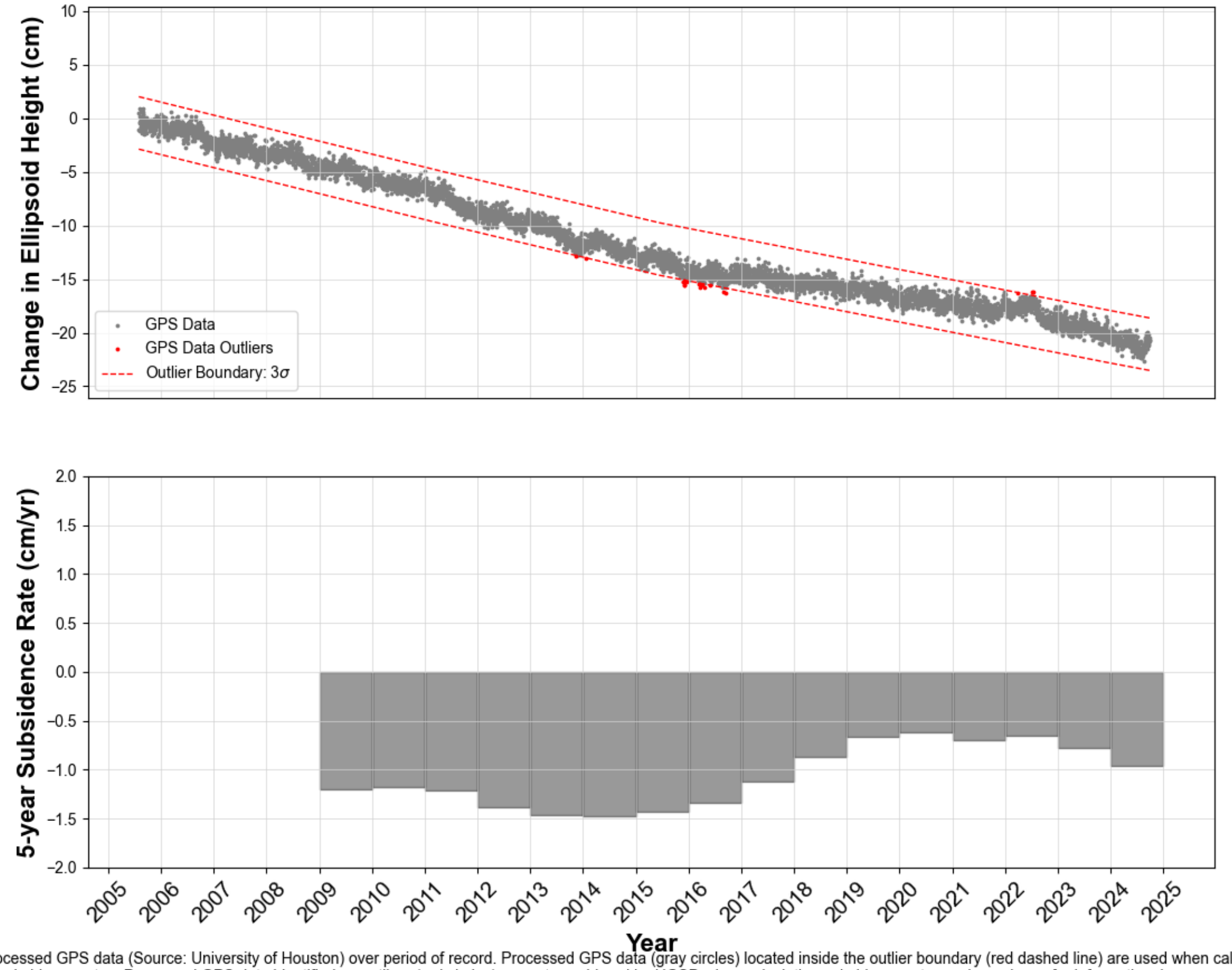


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXCN

Conroe, TX

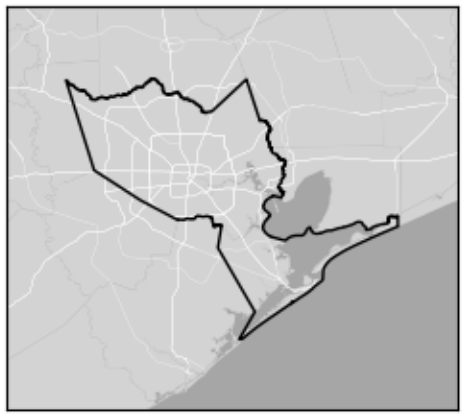


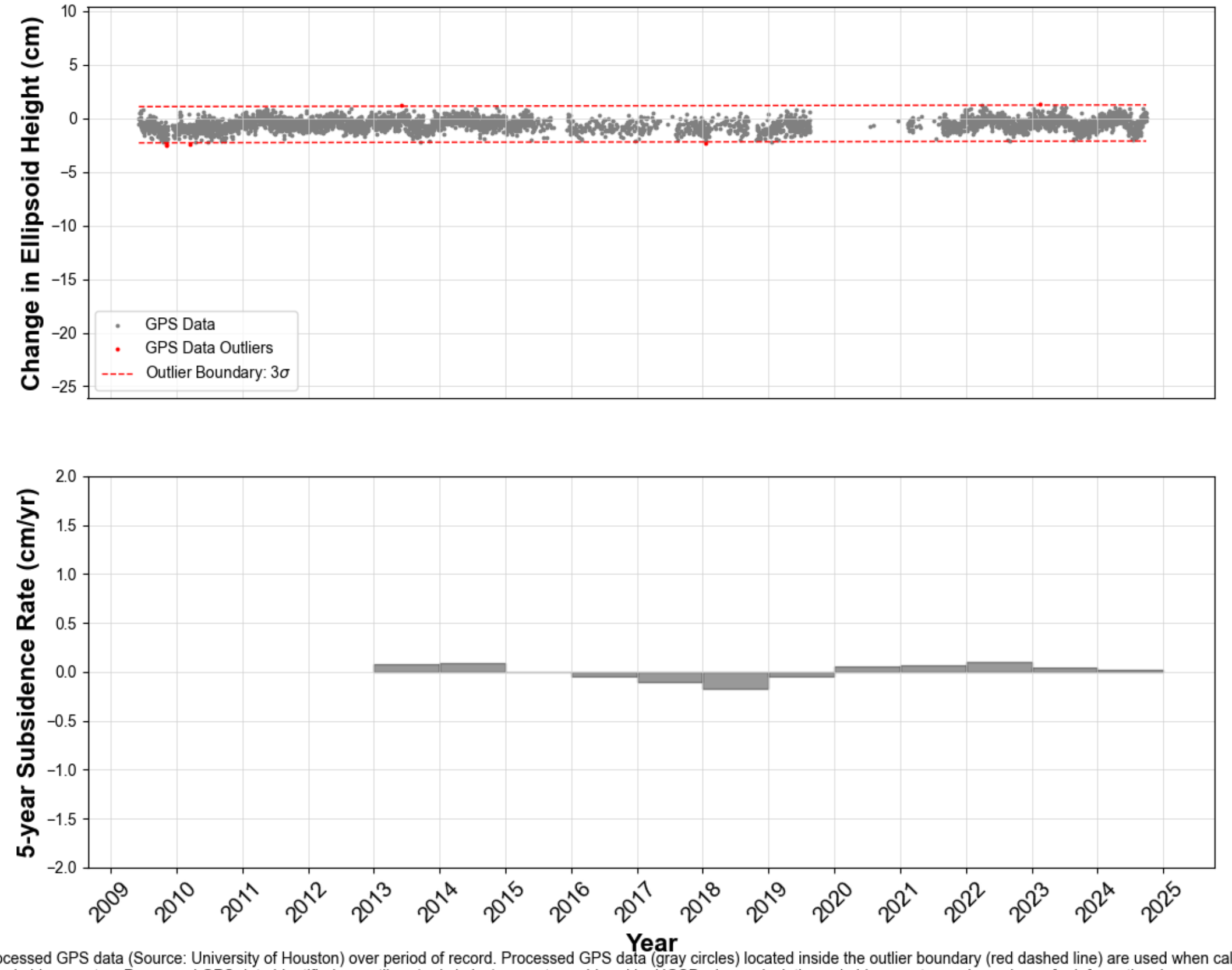


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXED

Edna, TX

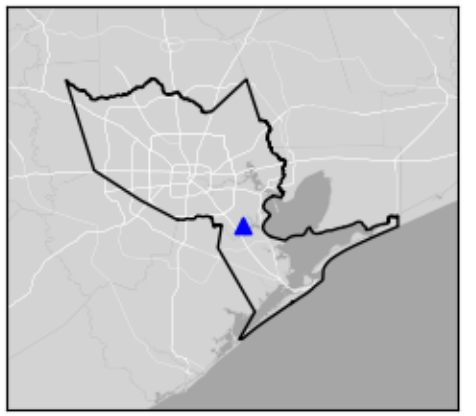


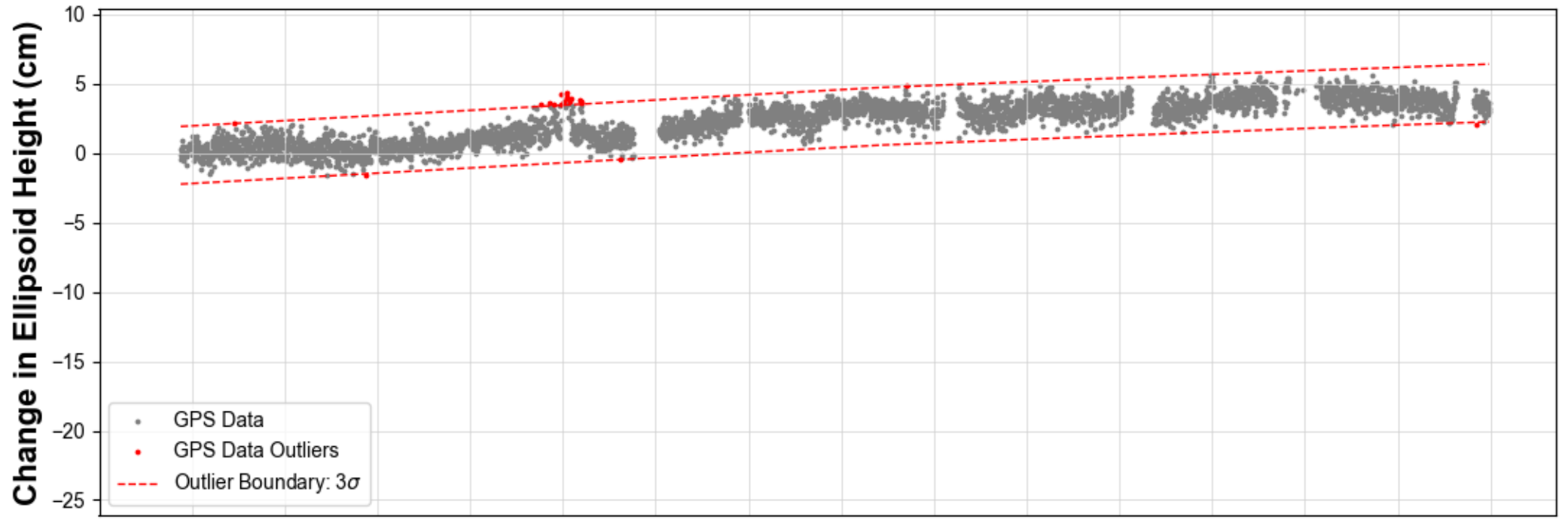


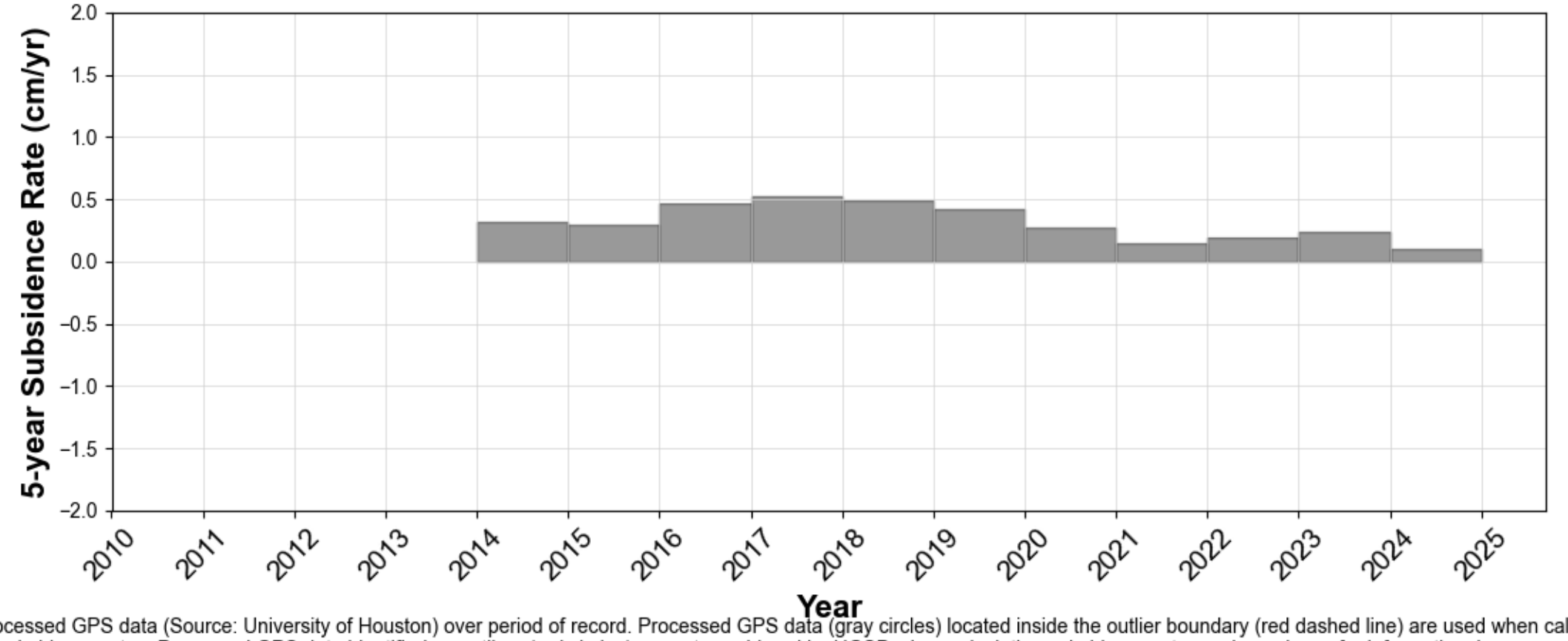
Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXEX

Houston, TX



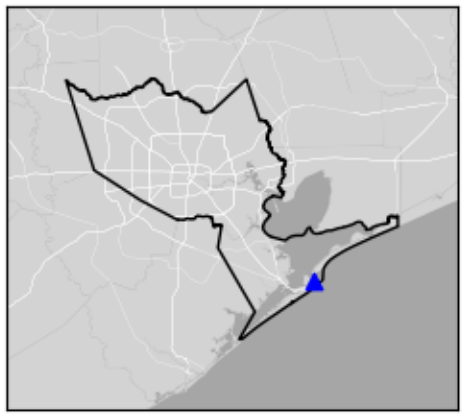


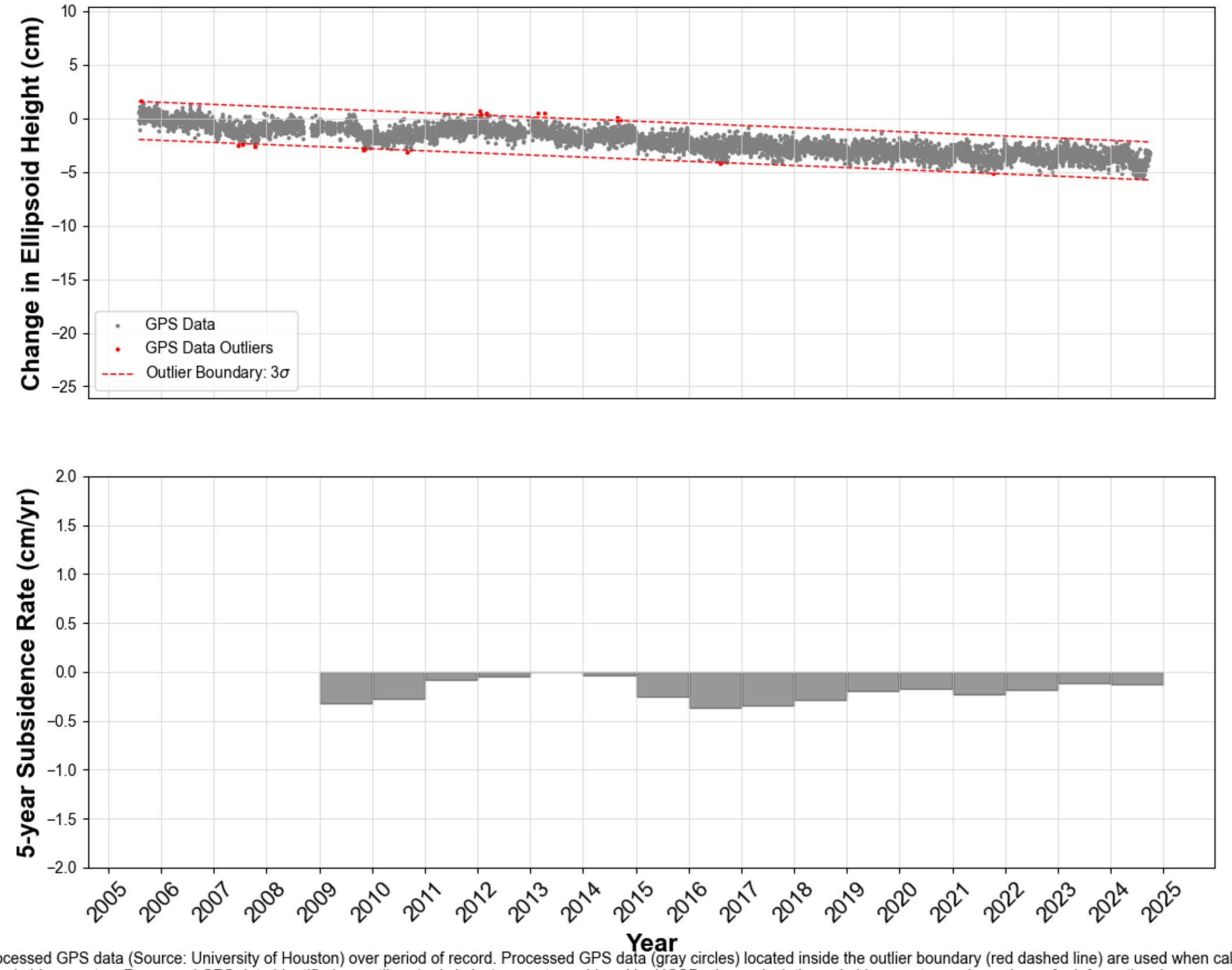


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXGA

Galveston, TX





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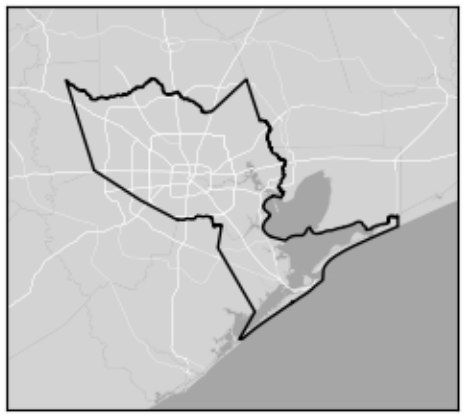
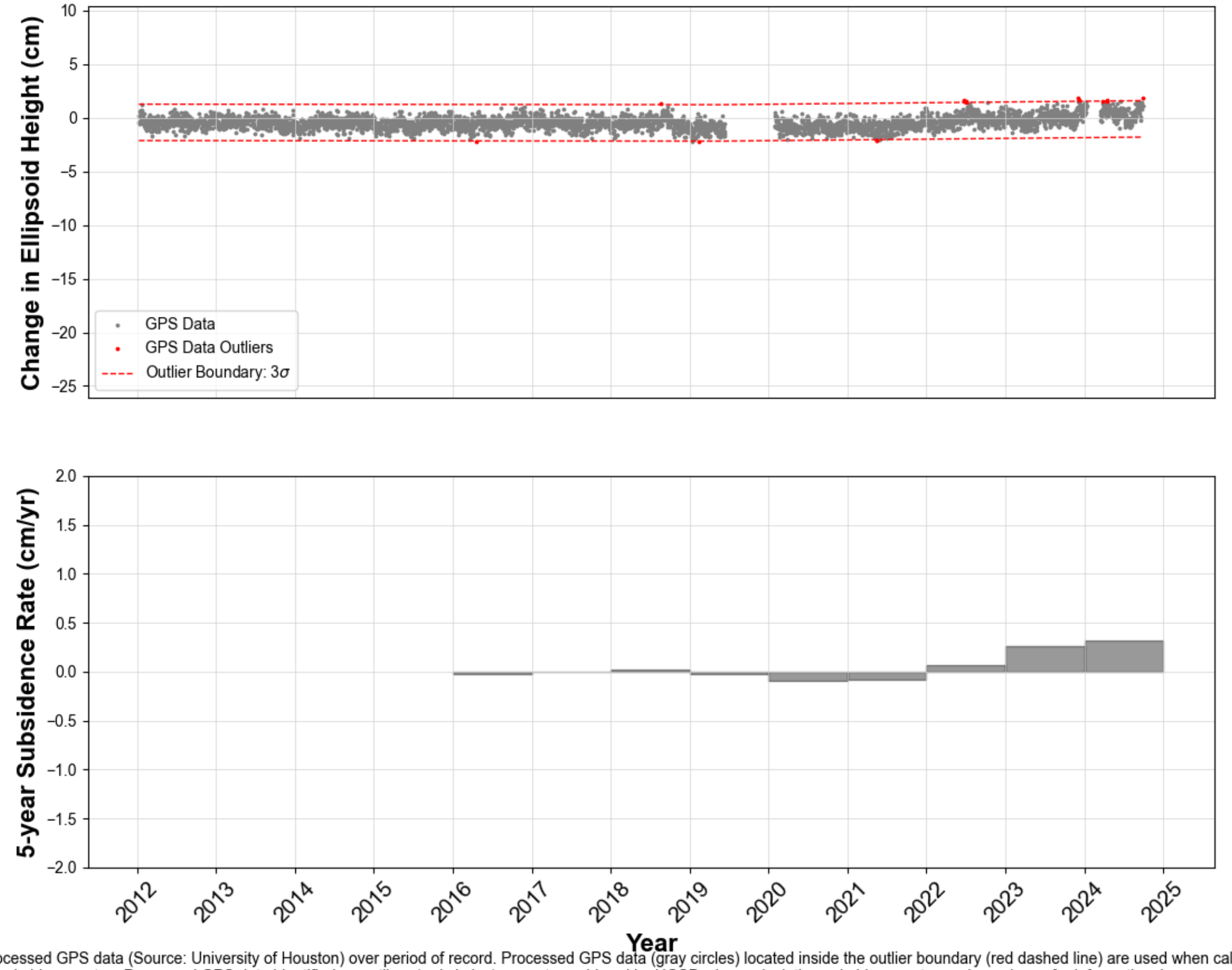
TXGN

Groveton, TX





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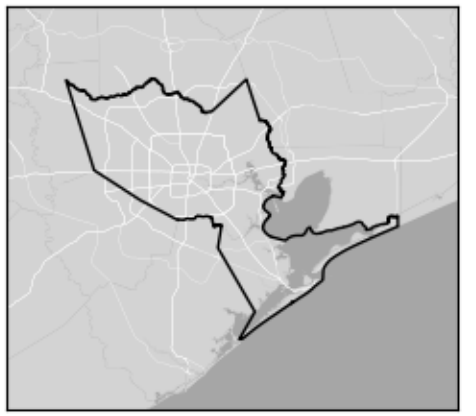
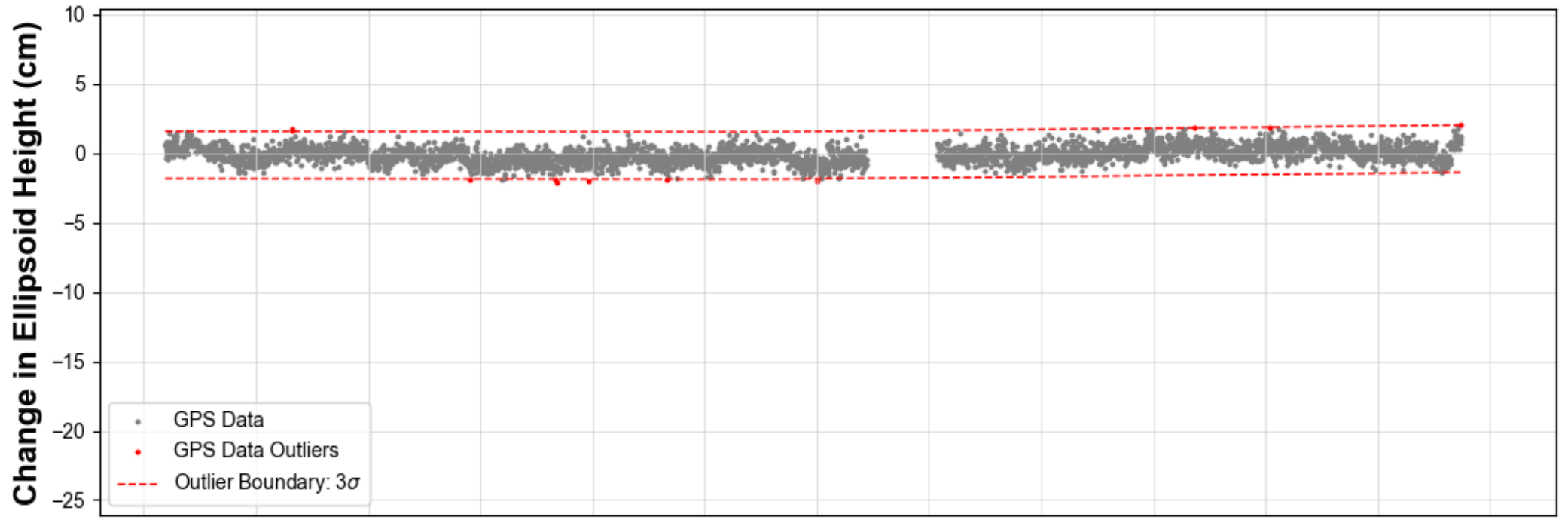
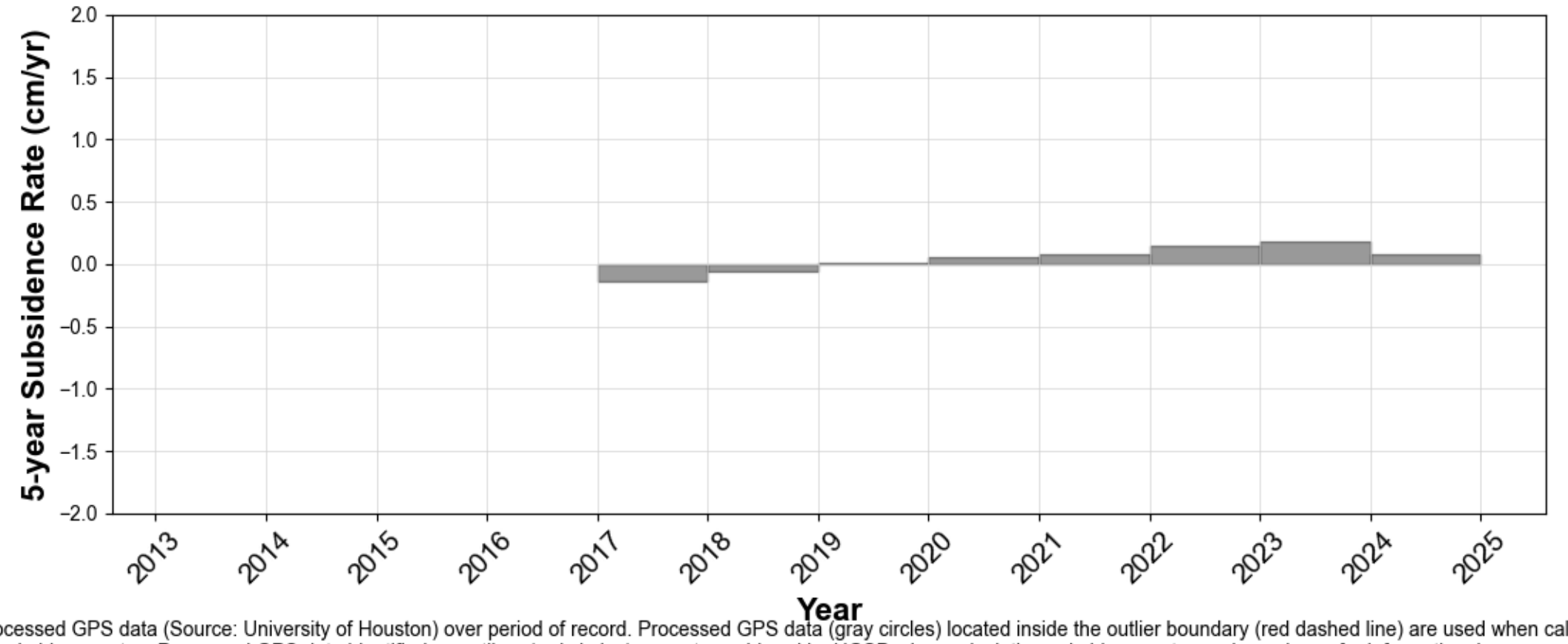
TXH1

Hearne, TX







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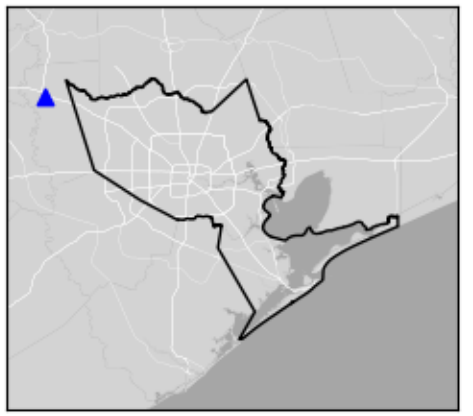
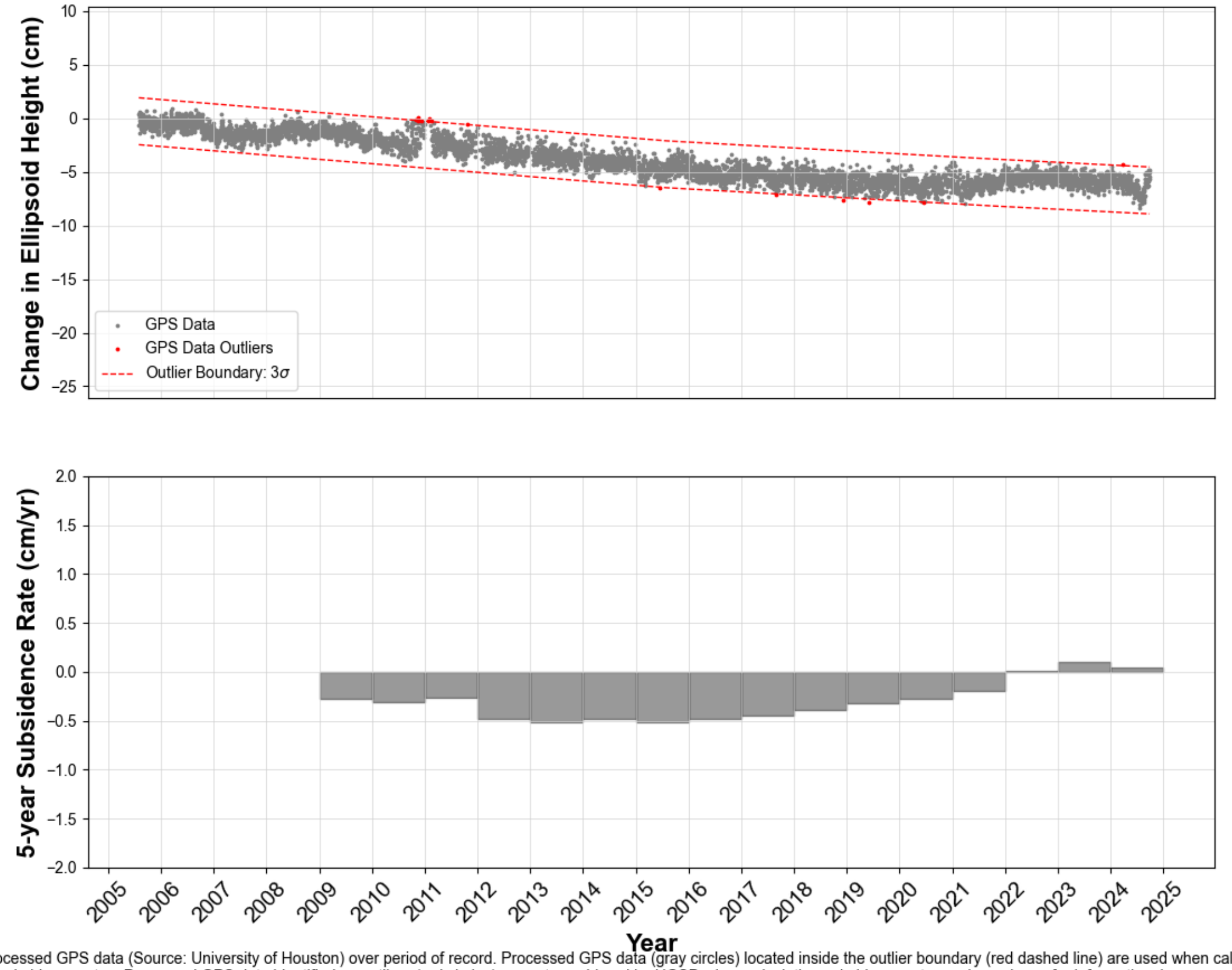
TXHE

Hempstead, TX





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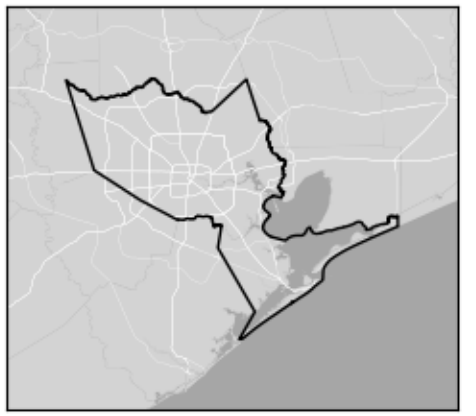
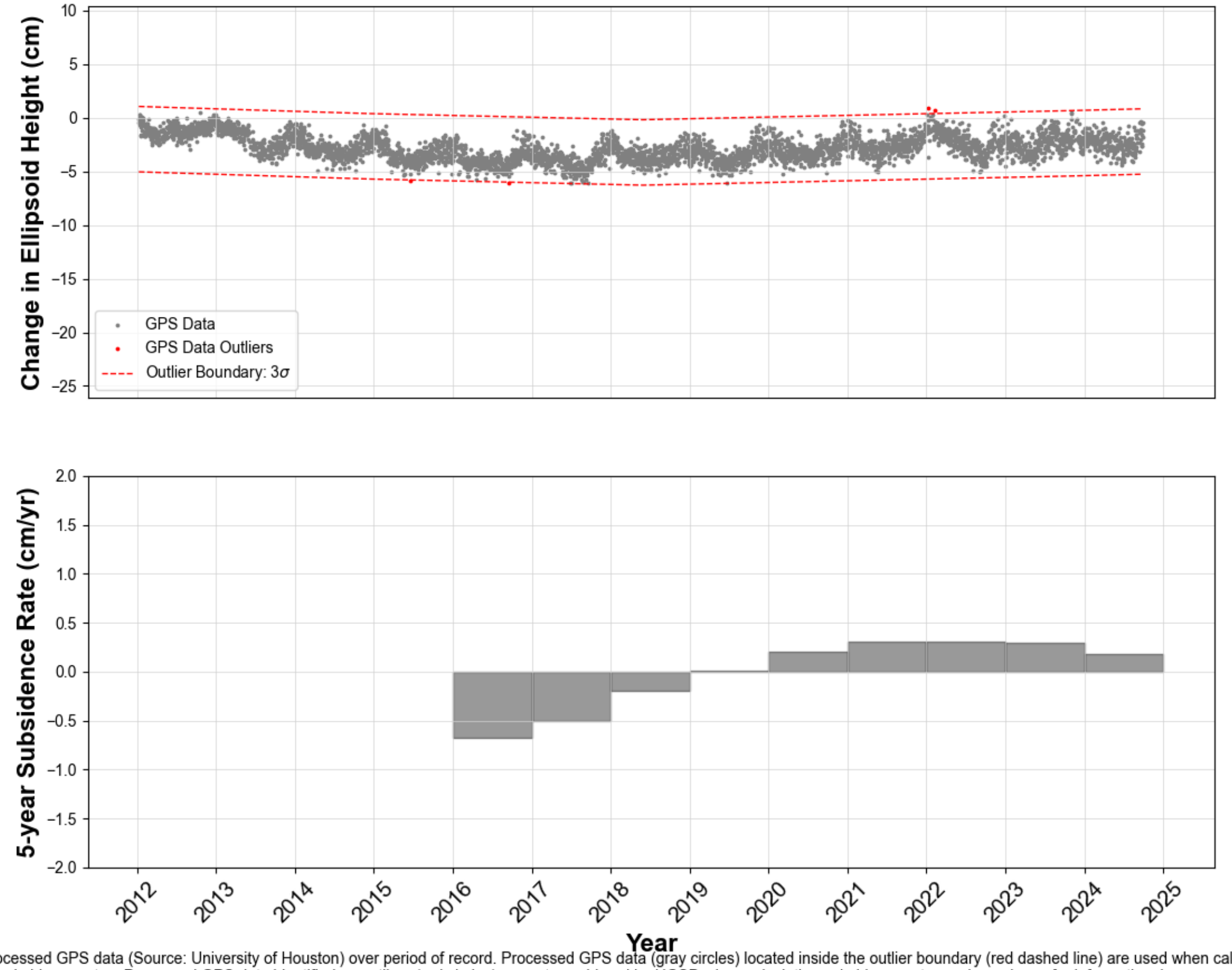
TXHP

Hemphill, TX

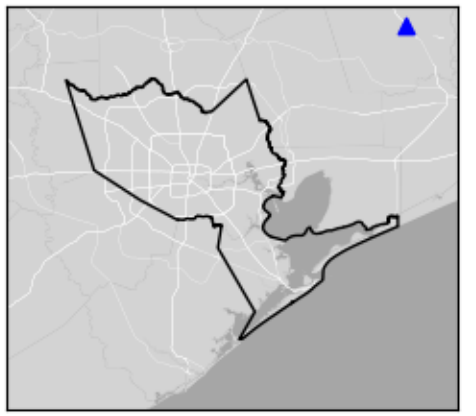


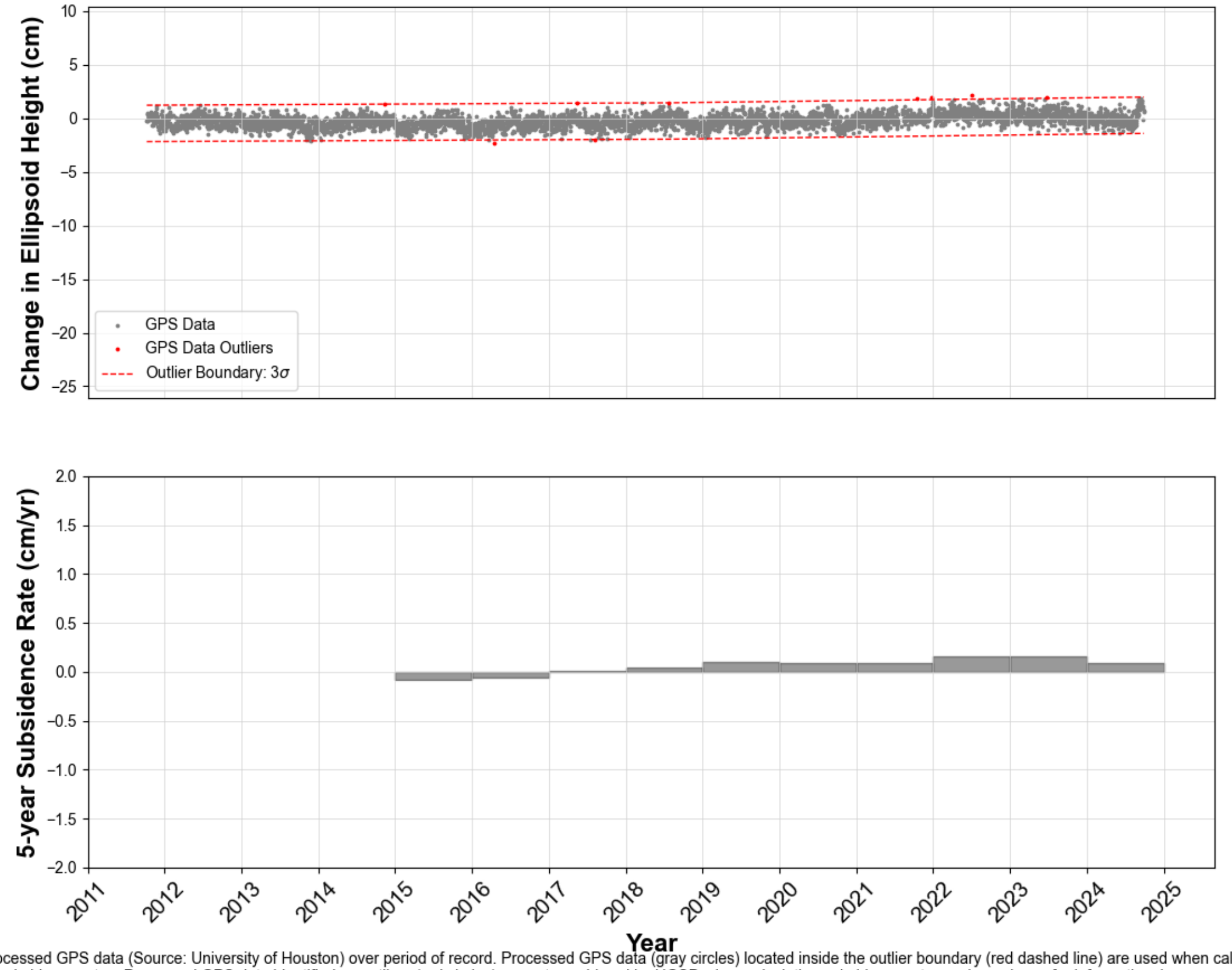


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXKO

Kountze, TX

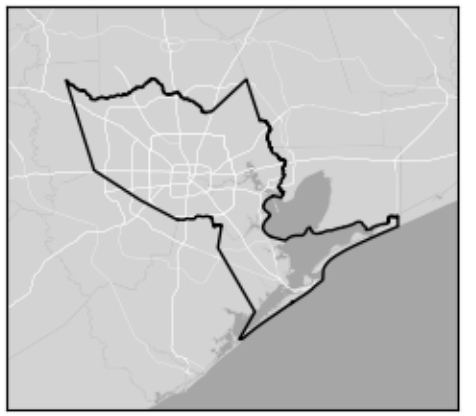


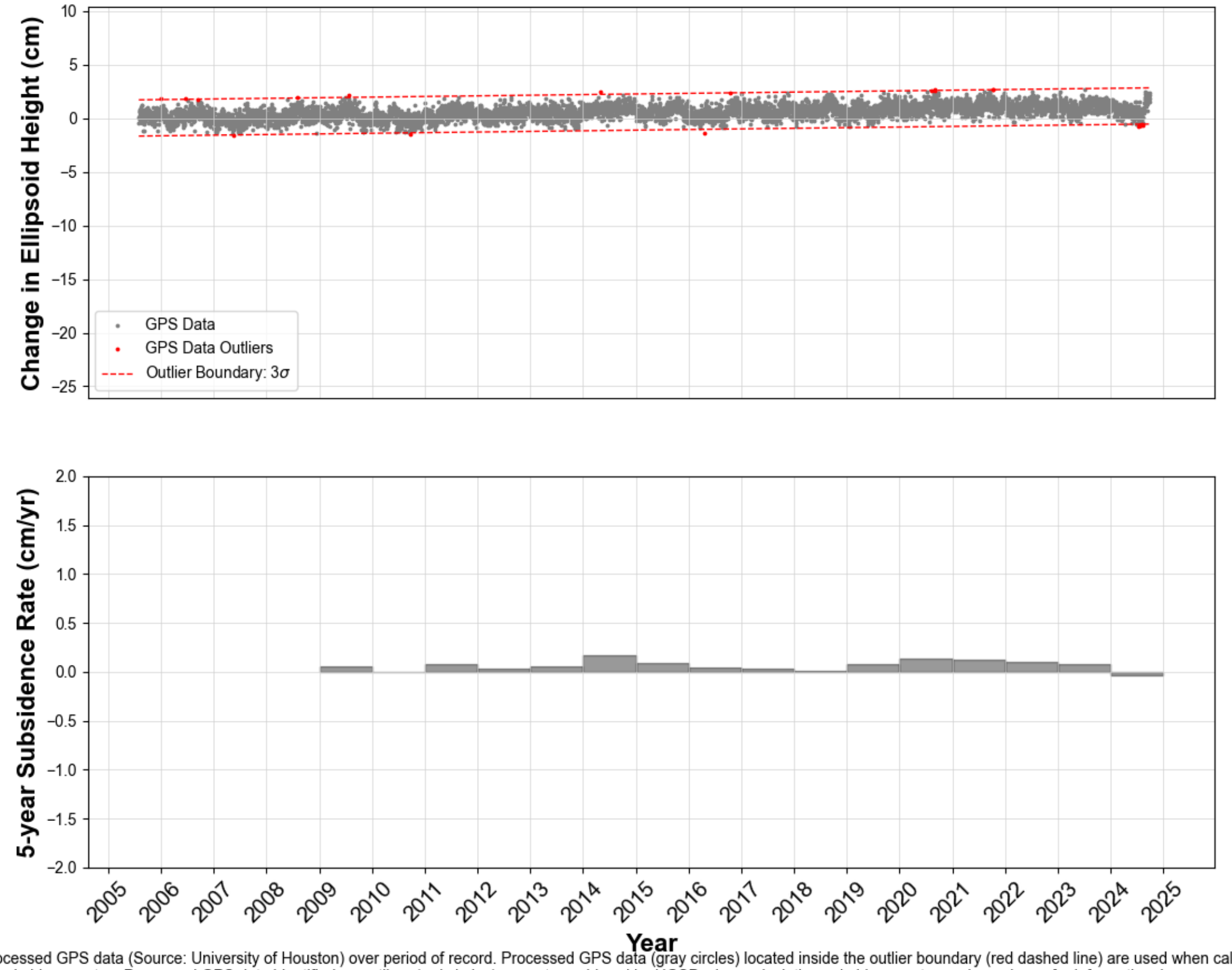


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXLF

Lufkin, TX

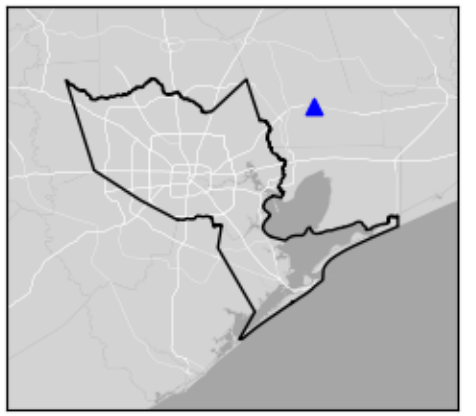


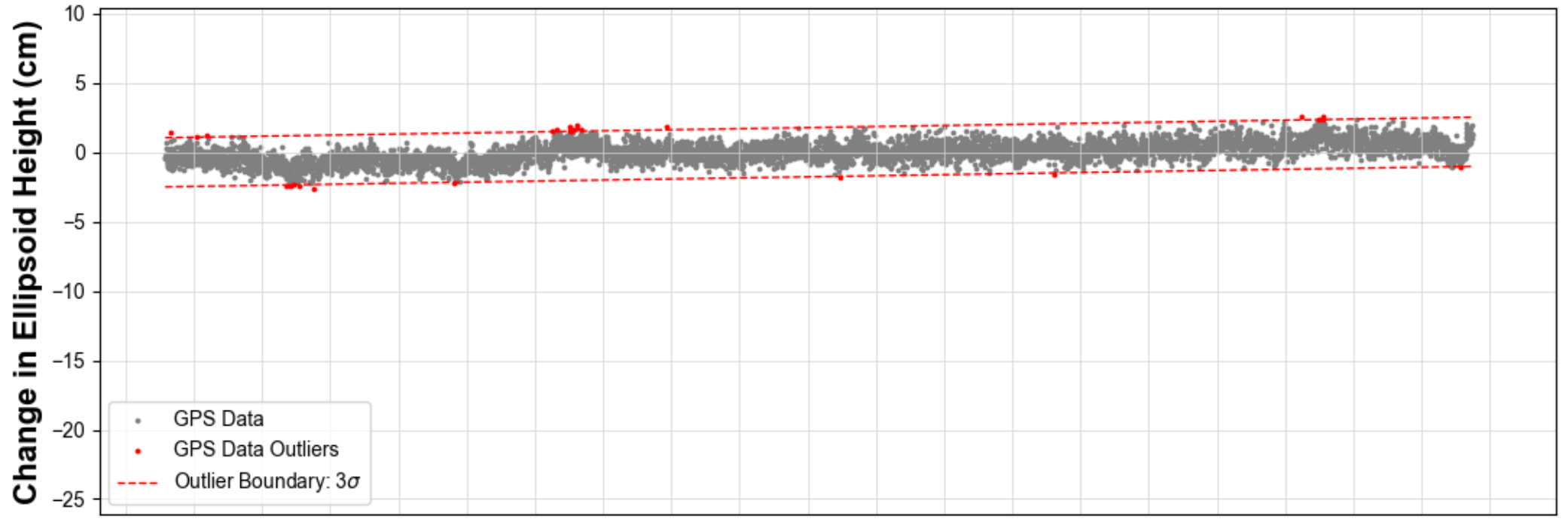


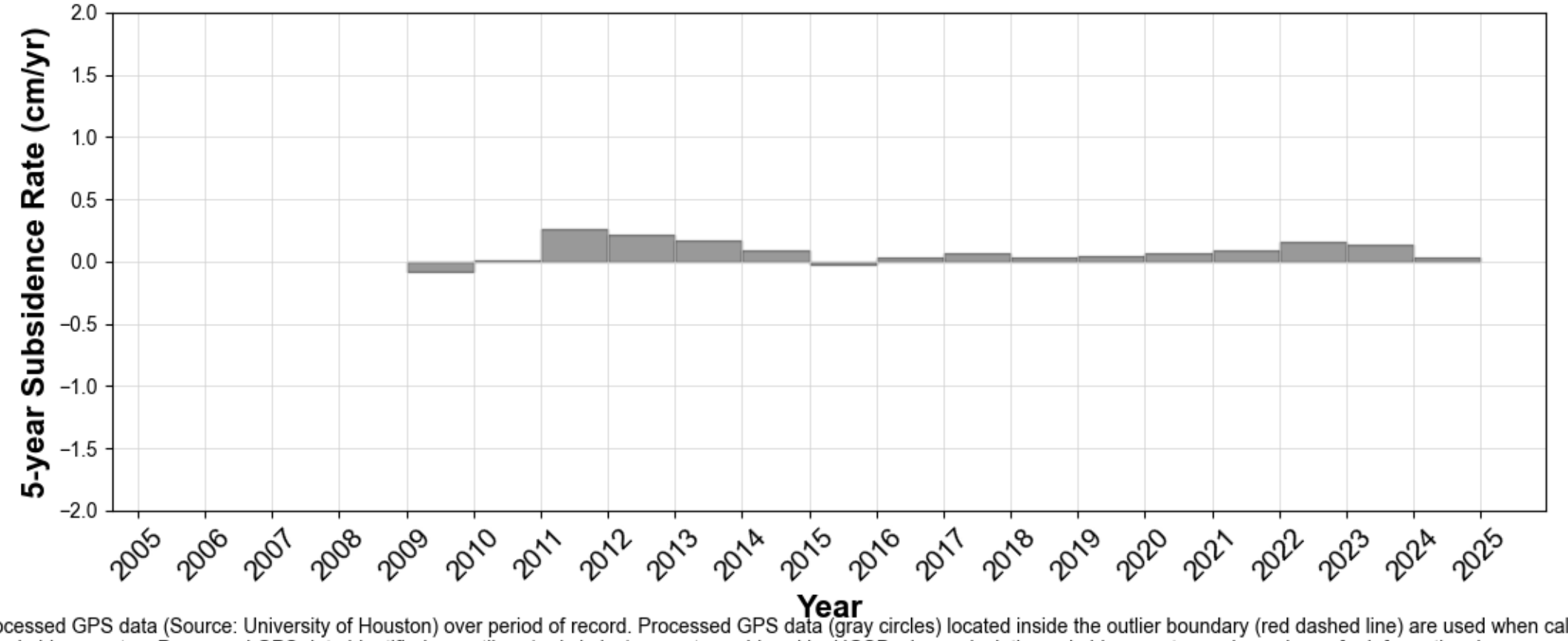
Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXLI

Dayton, TX



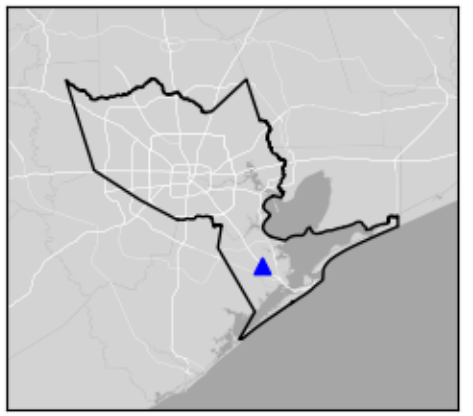


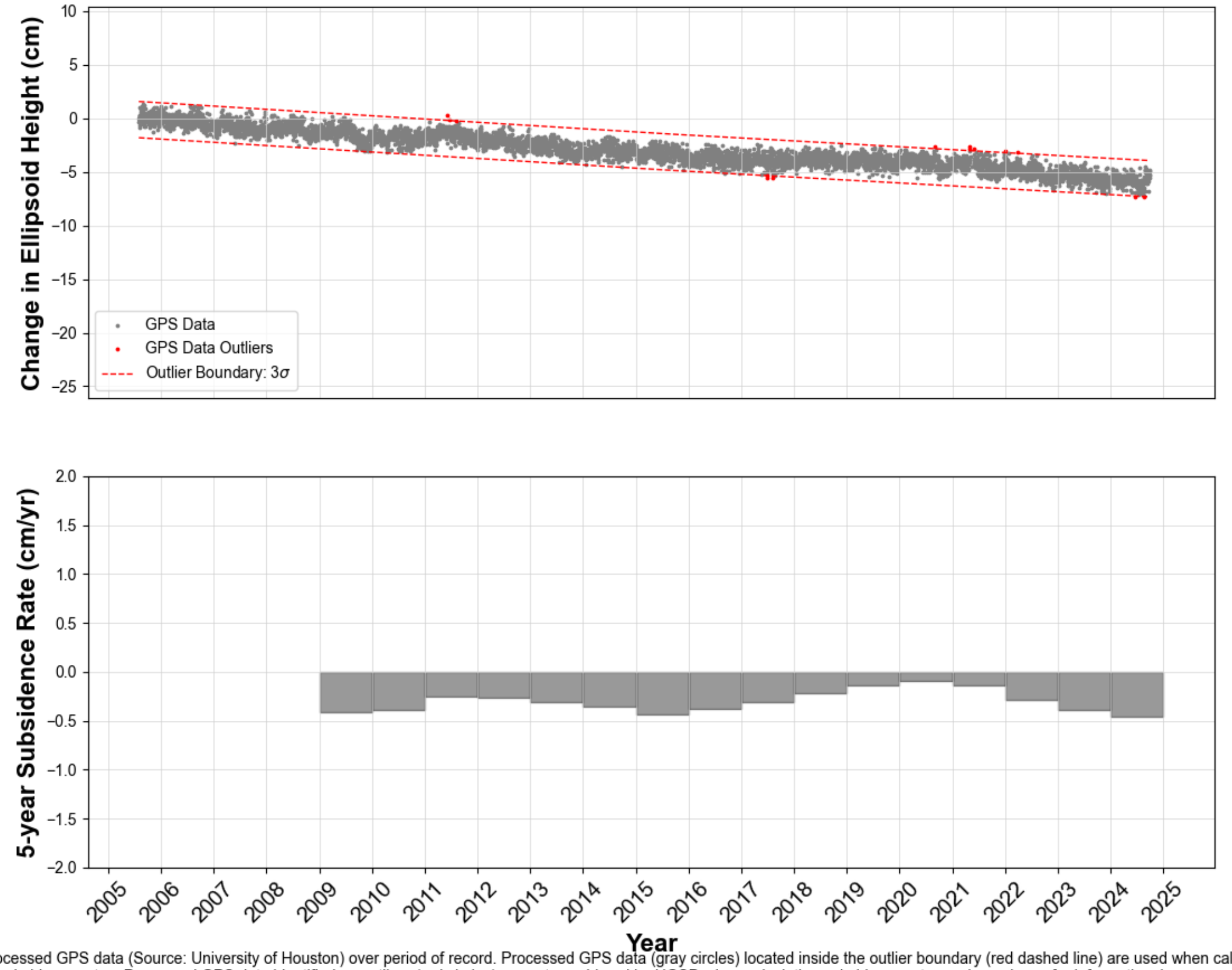


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXLM

La Marque, TX

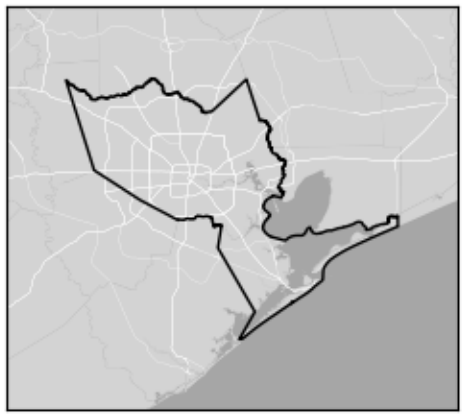


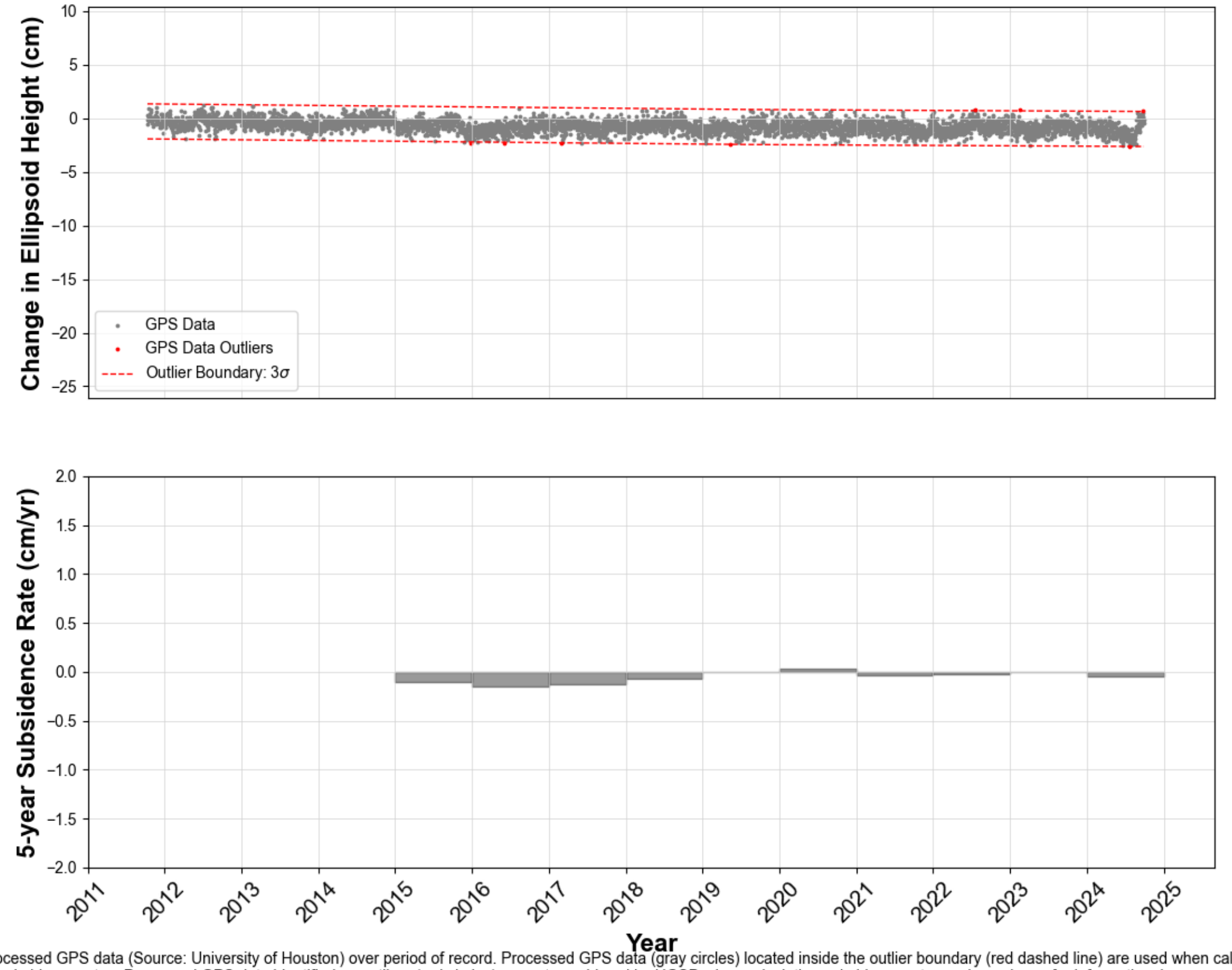


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXLV

Livingston, TX





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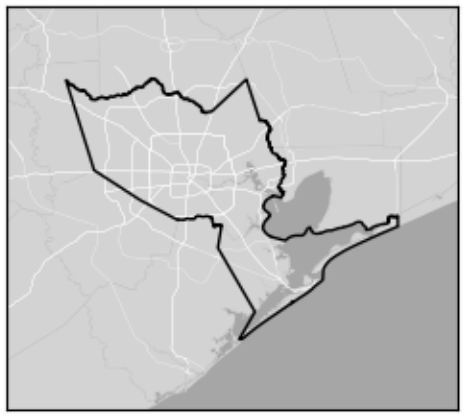
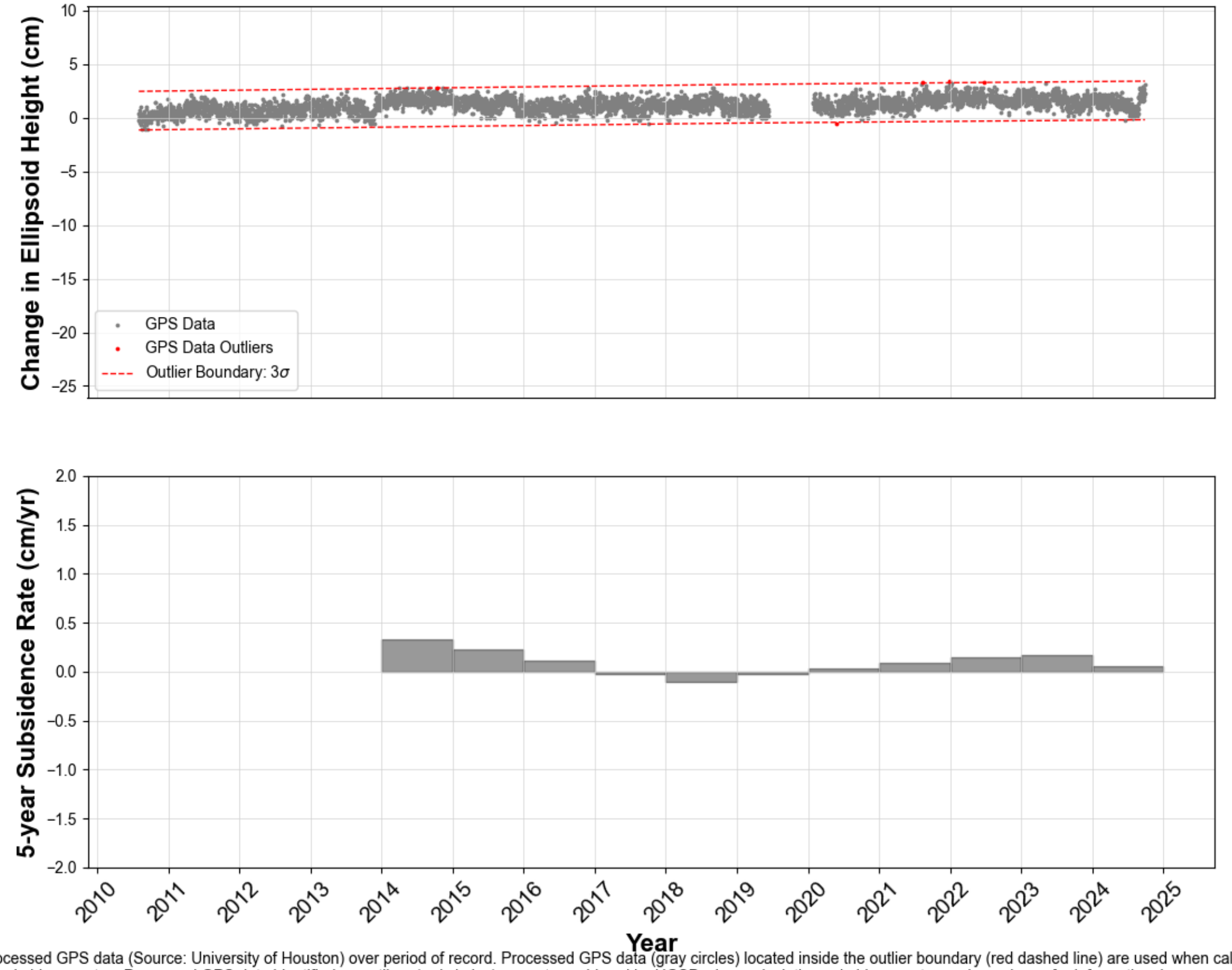
TXMD

Madisonville, TX

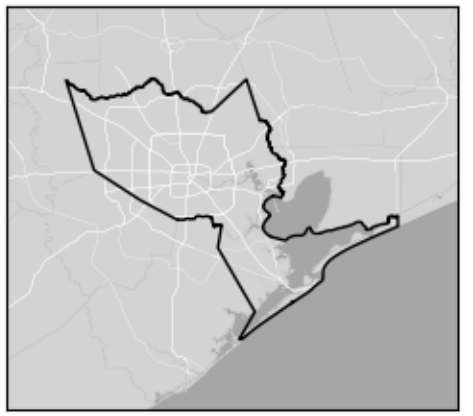


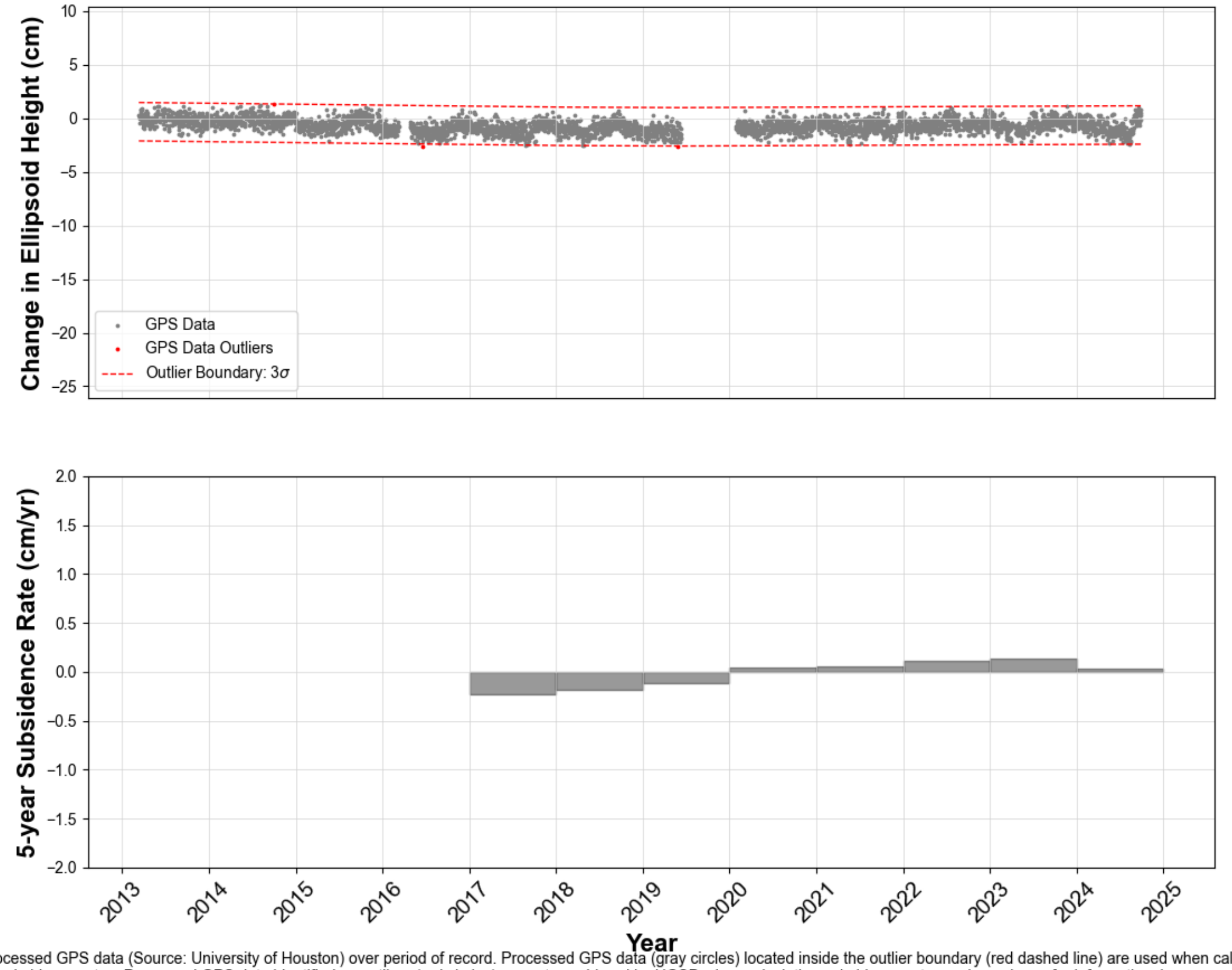


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXNE

Newton, TX

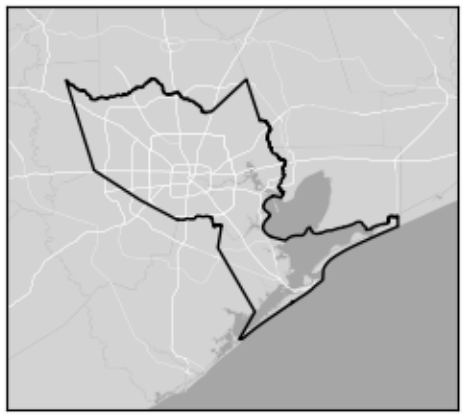


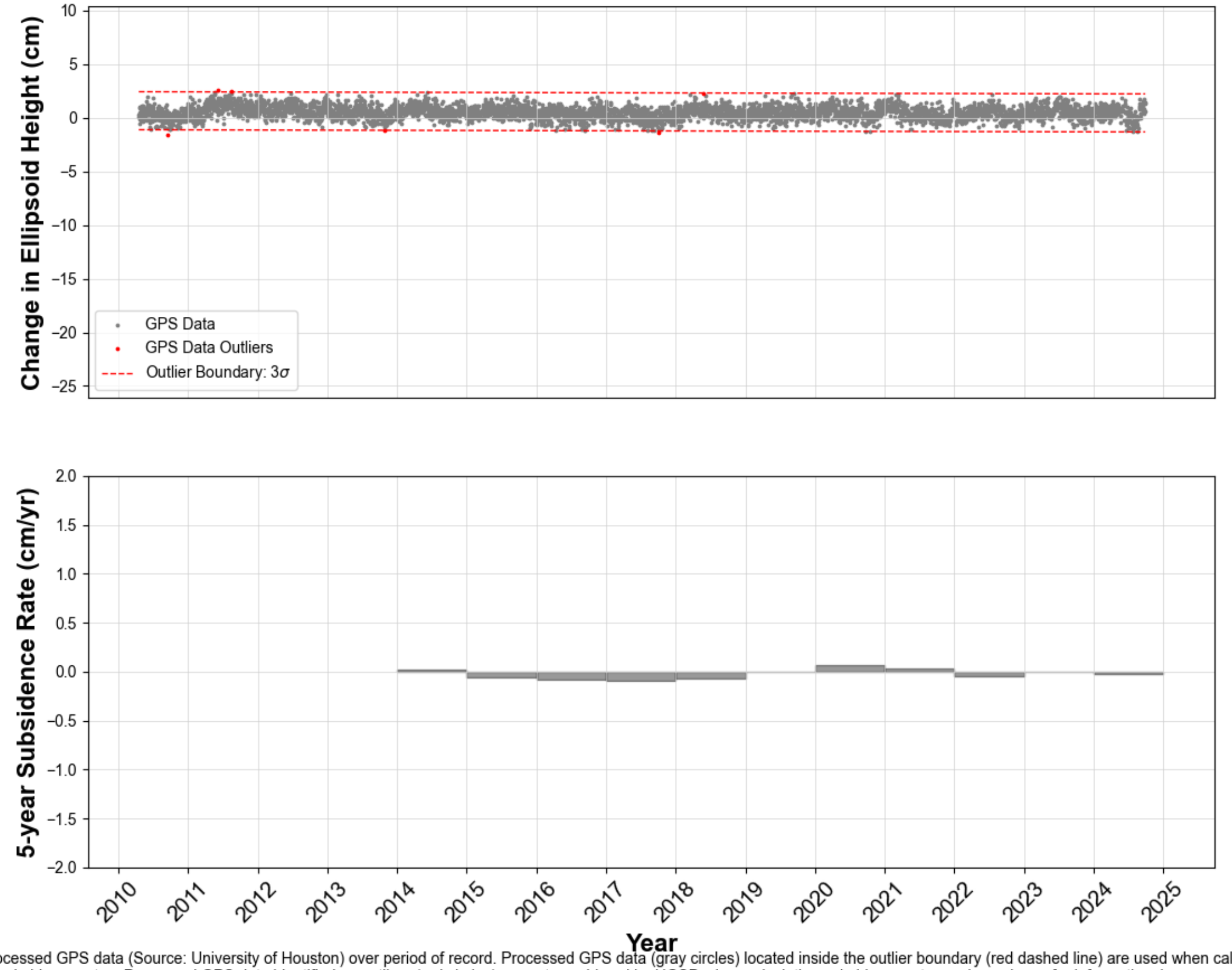


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXPV

Port Lavaca, TX

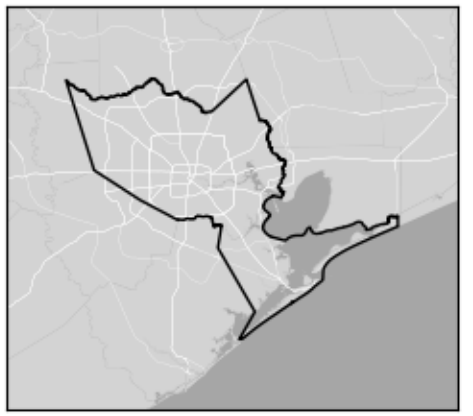


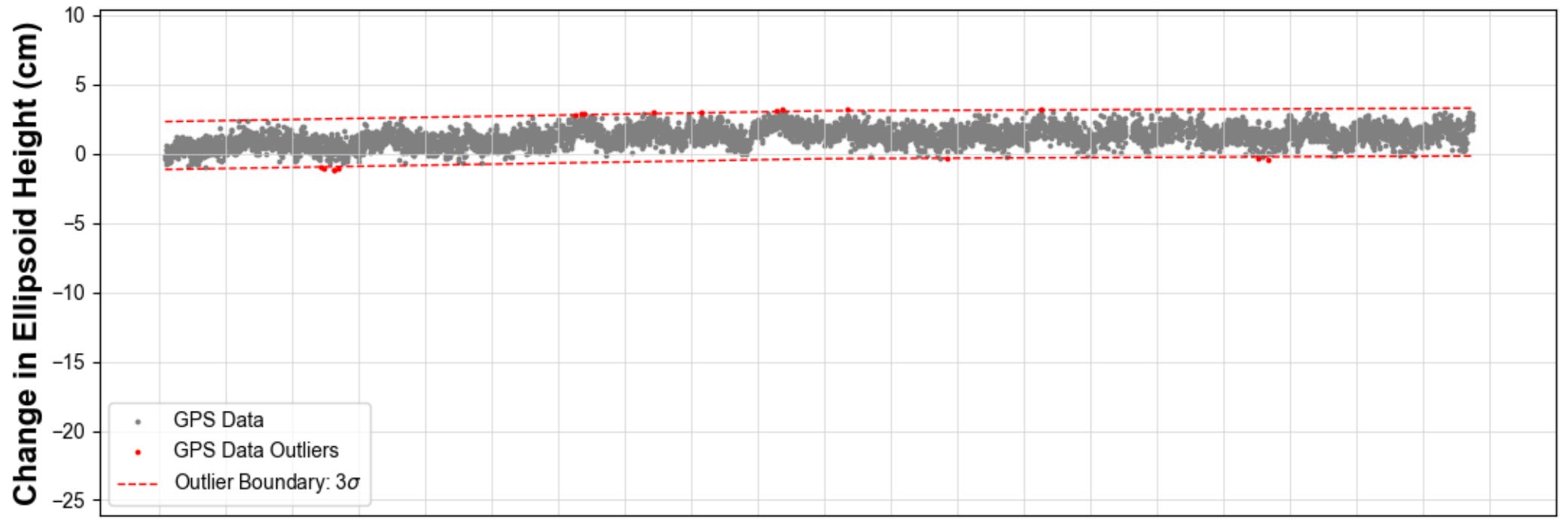


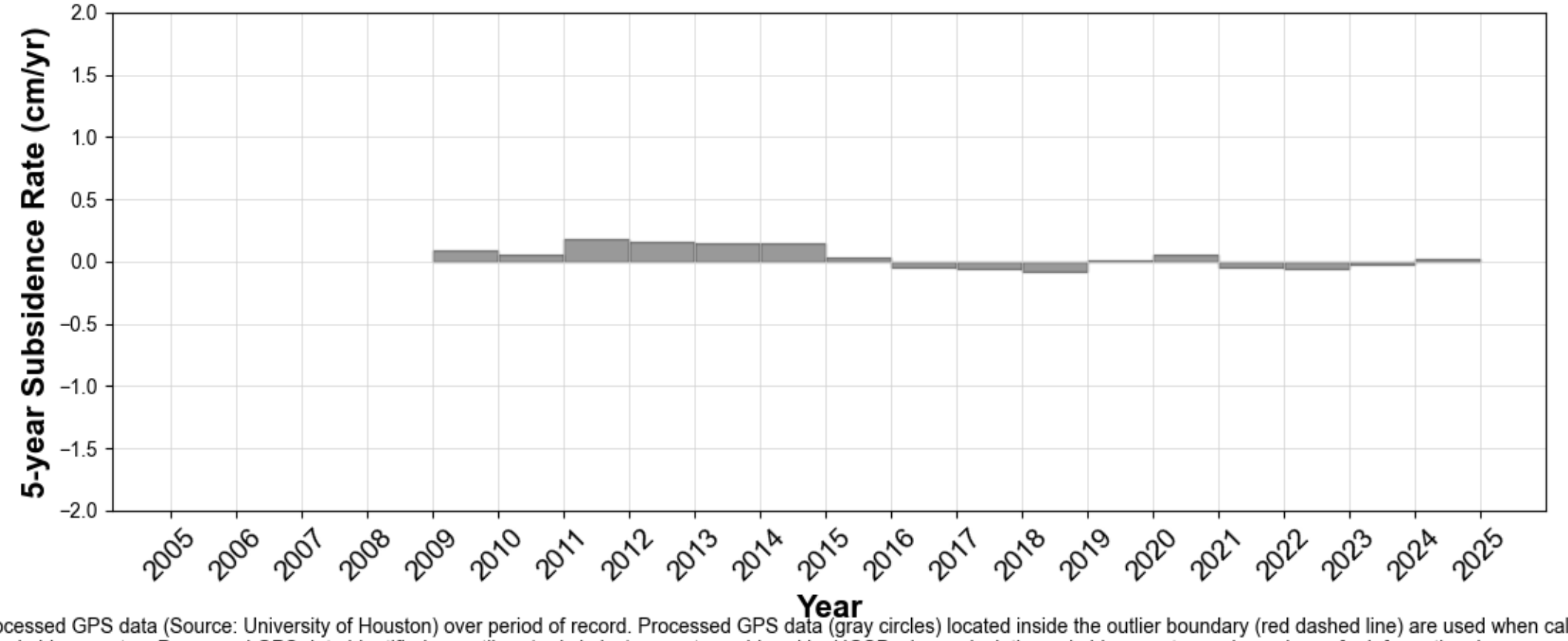
Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

TXVA

Victoria, TX







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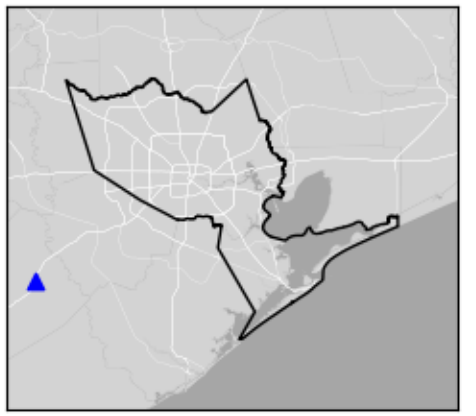
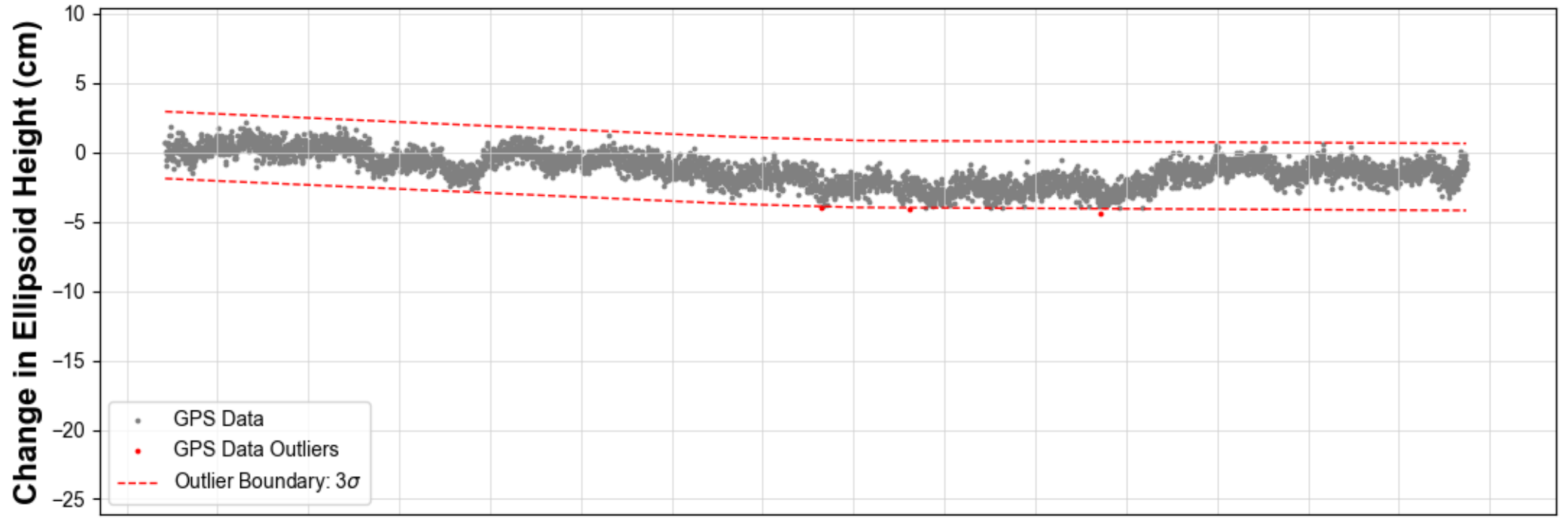
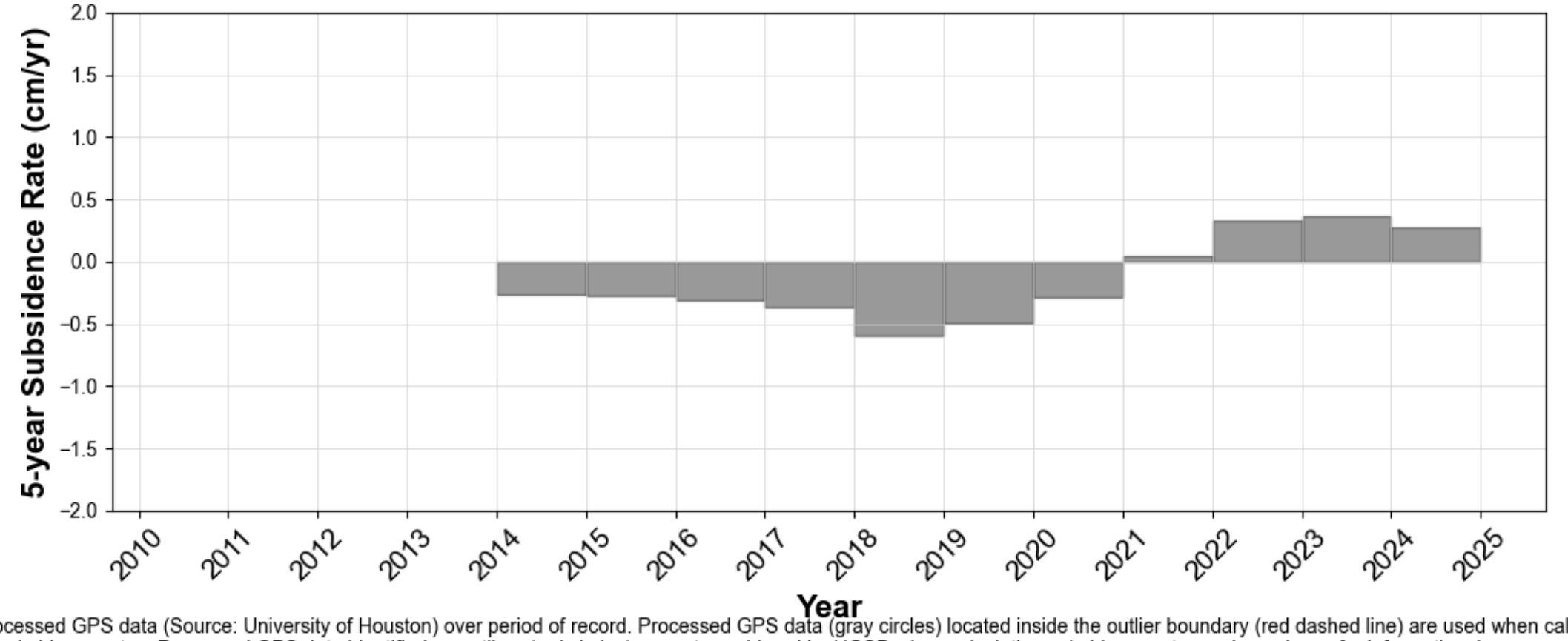
TXWH

Wharton, TX







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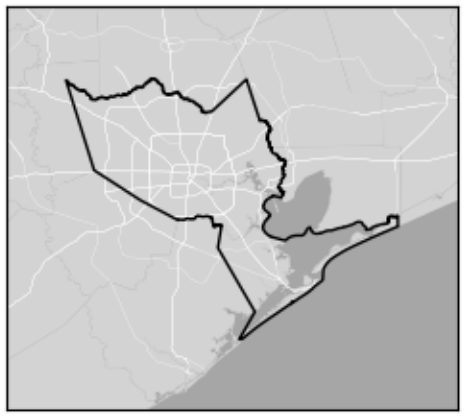
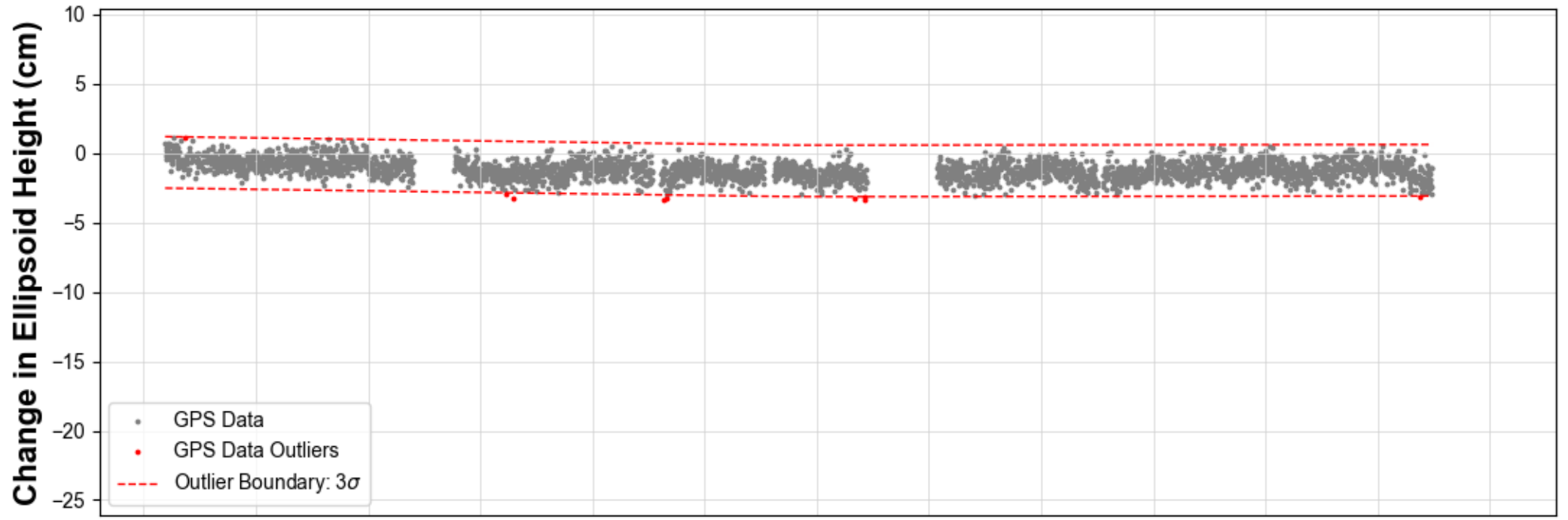
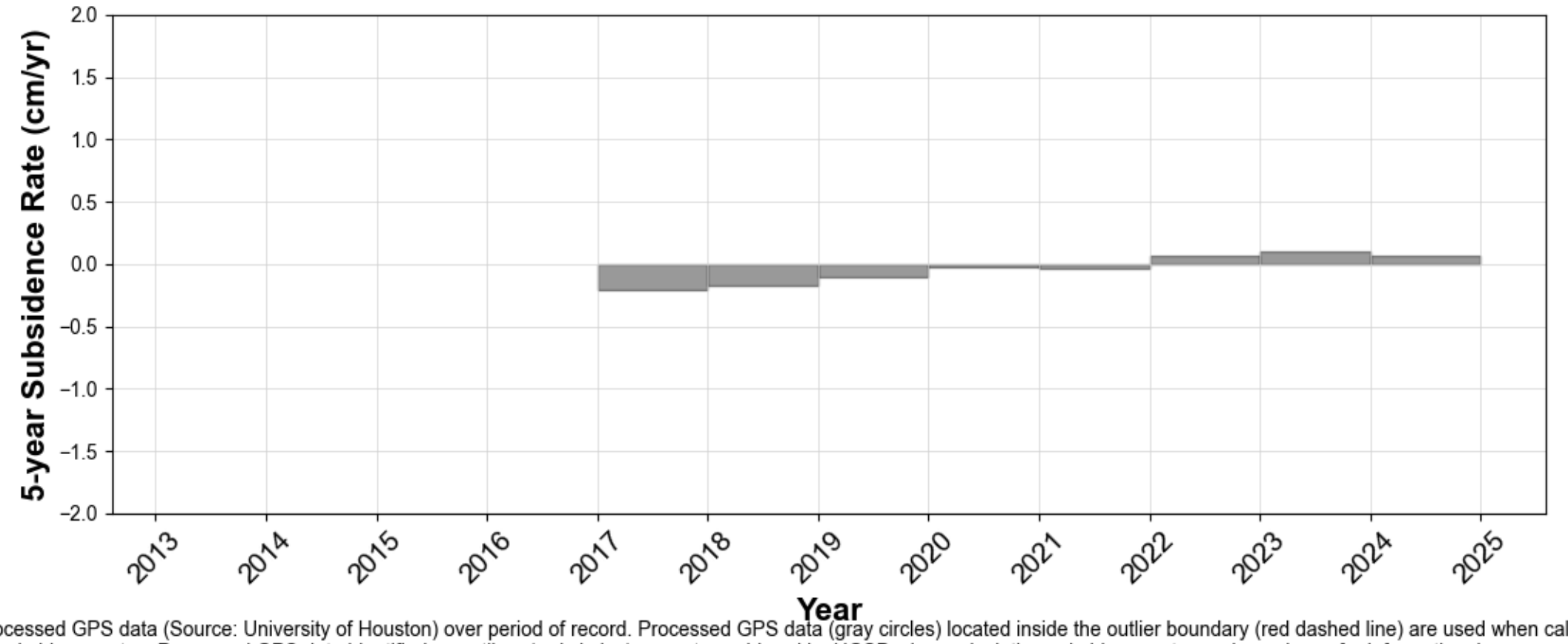
TXWO

Woodville, TX







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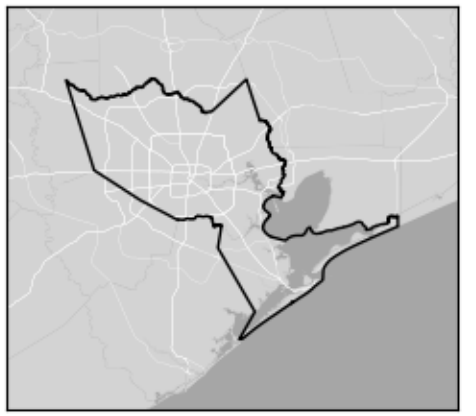
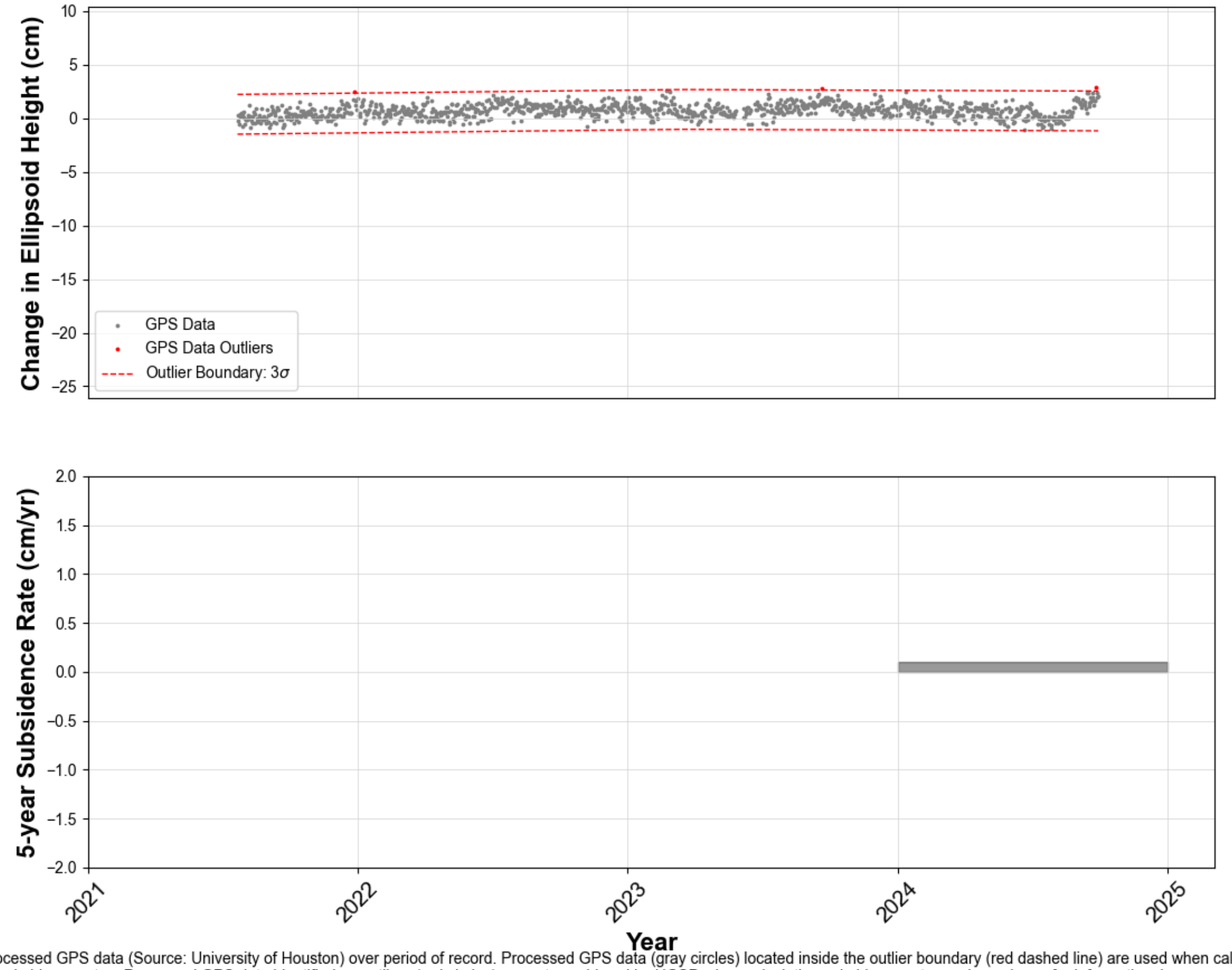
TXXR

Rusk, TX





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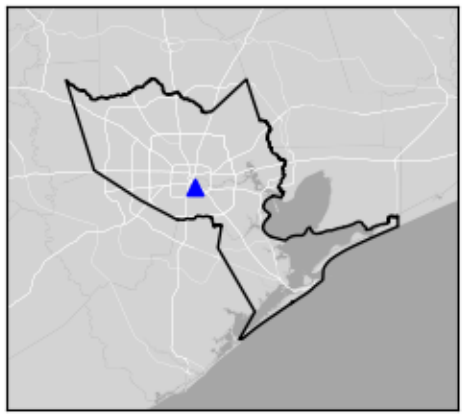
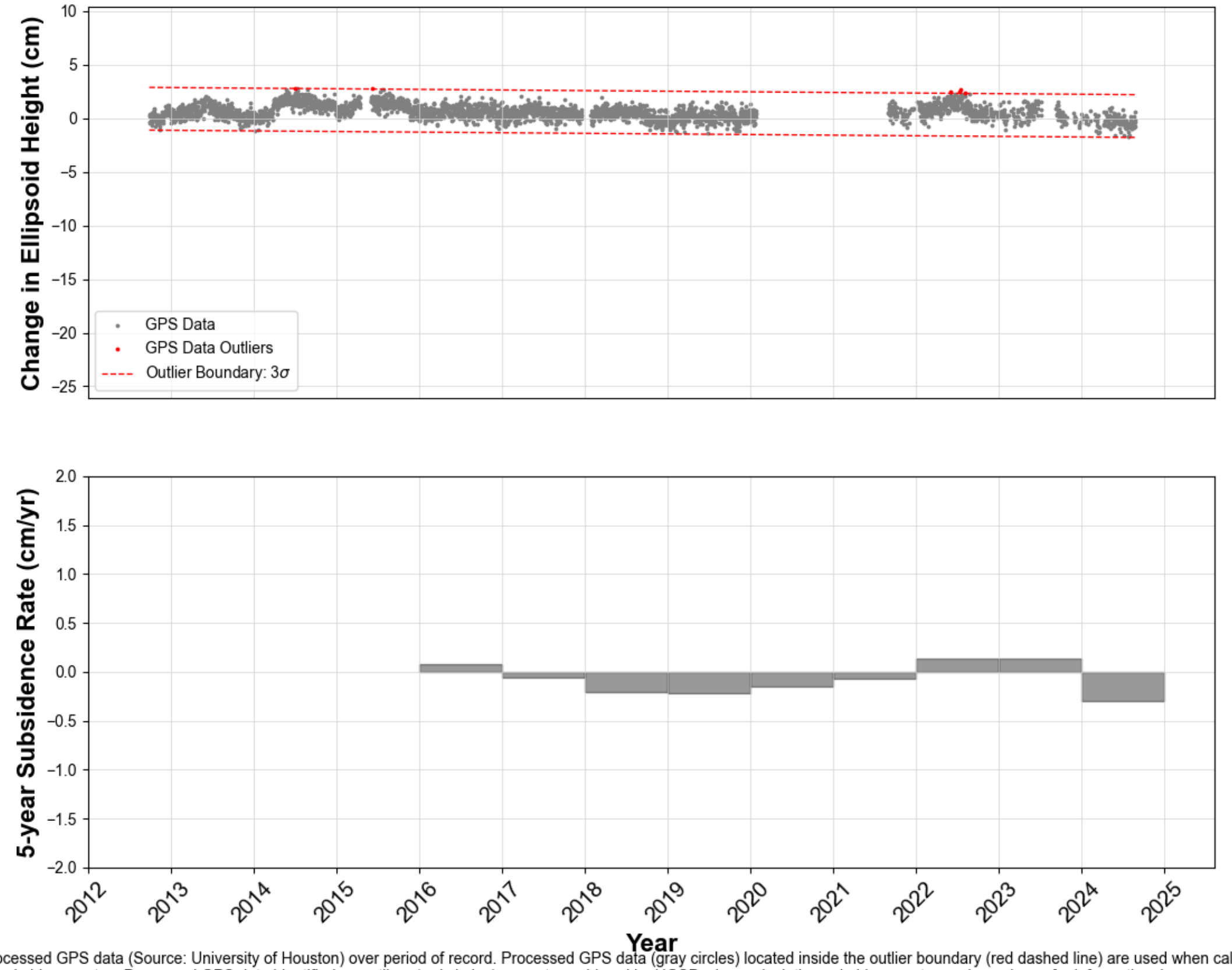
UH01

Houston, TX

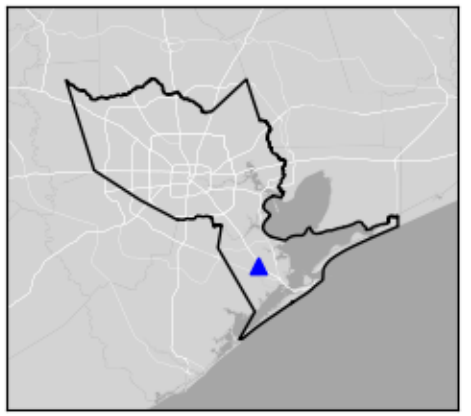


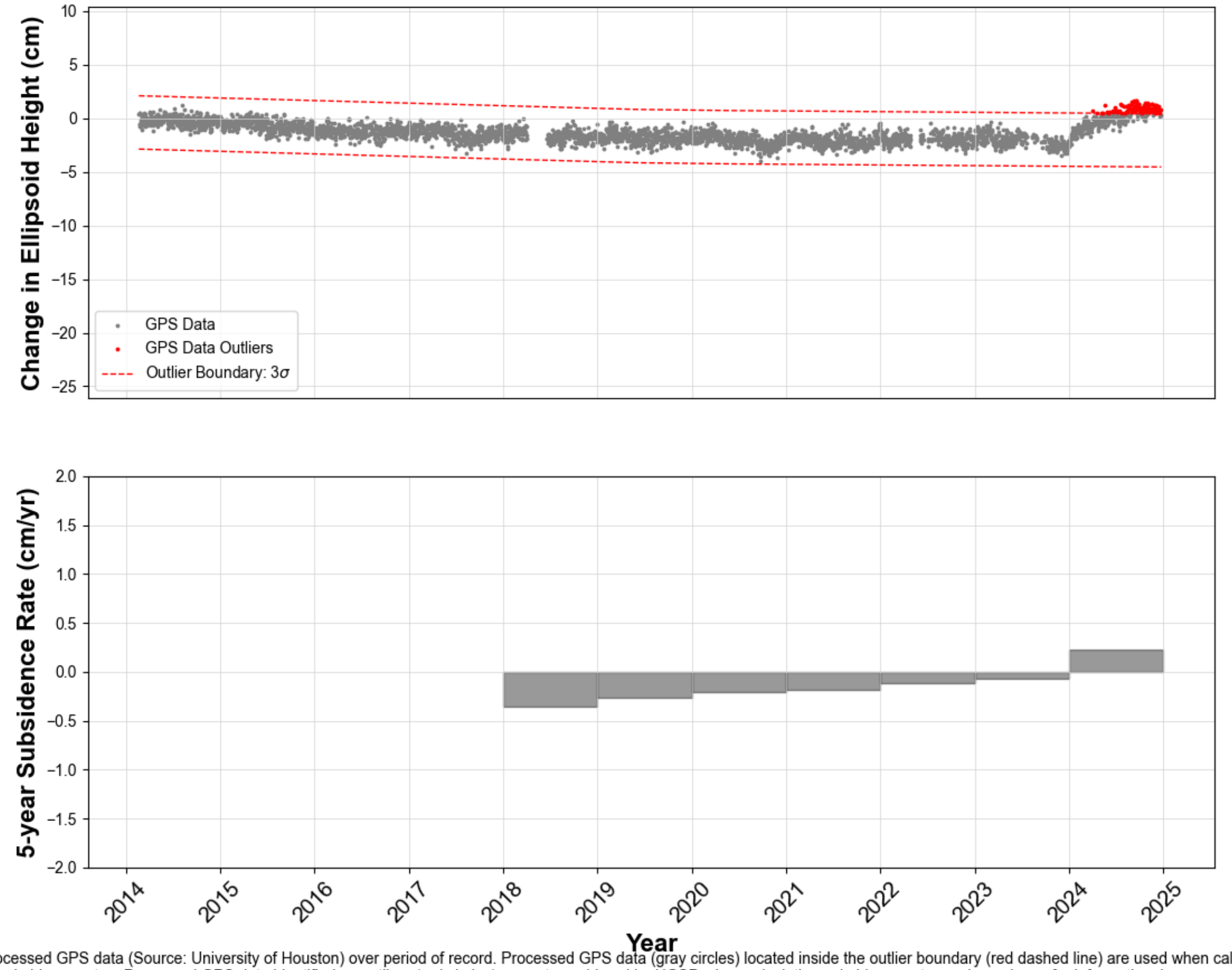


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHC1

La Marque, TX

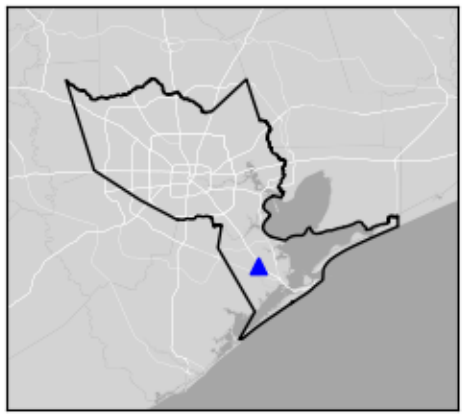


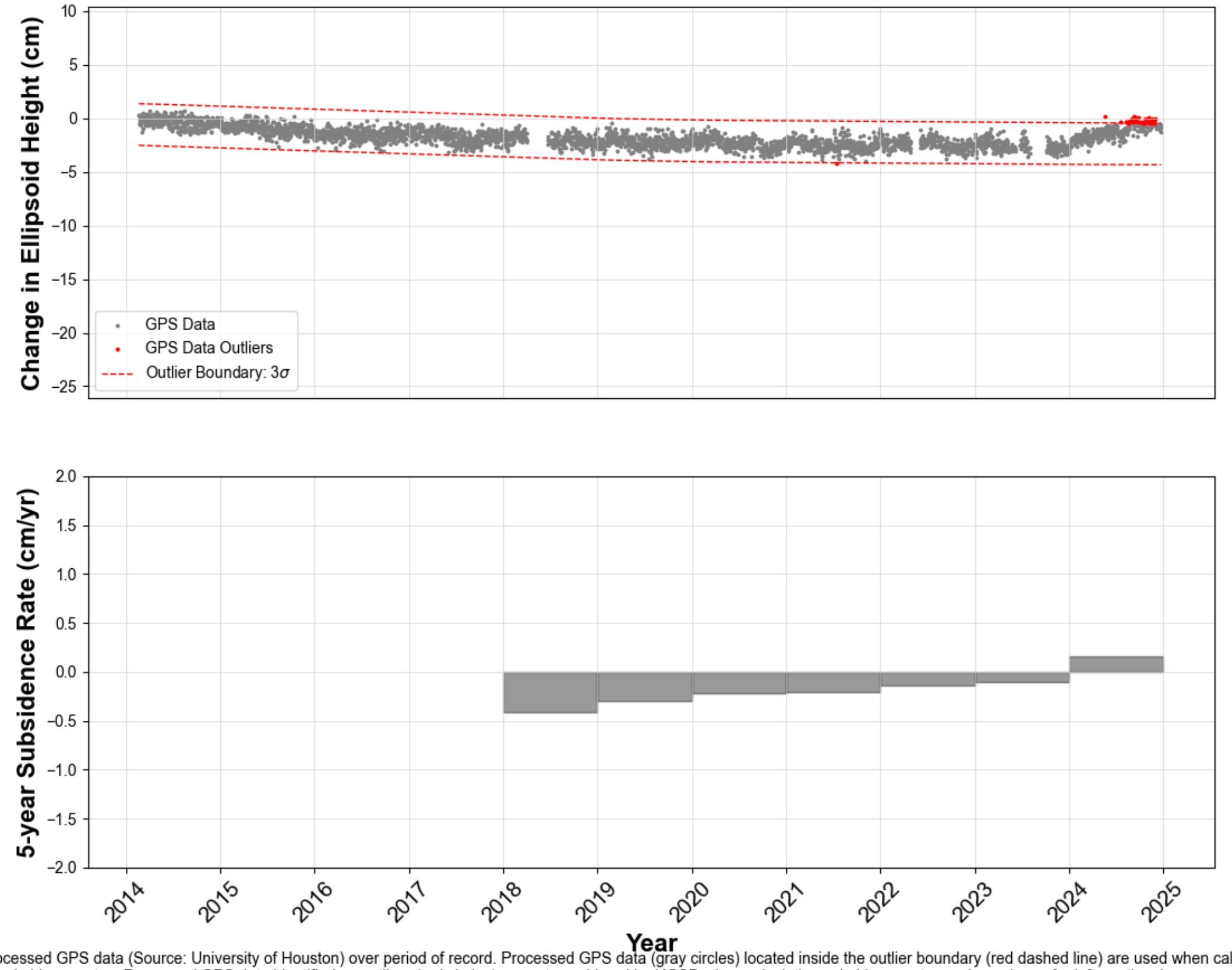


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHC2

La Marque, TX

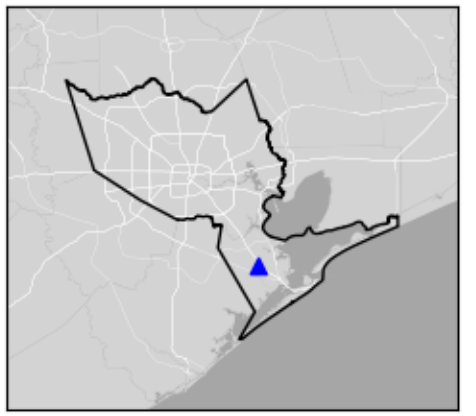


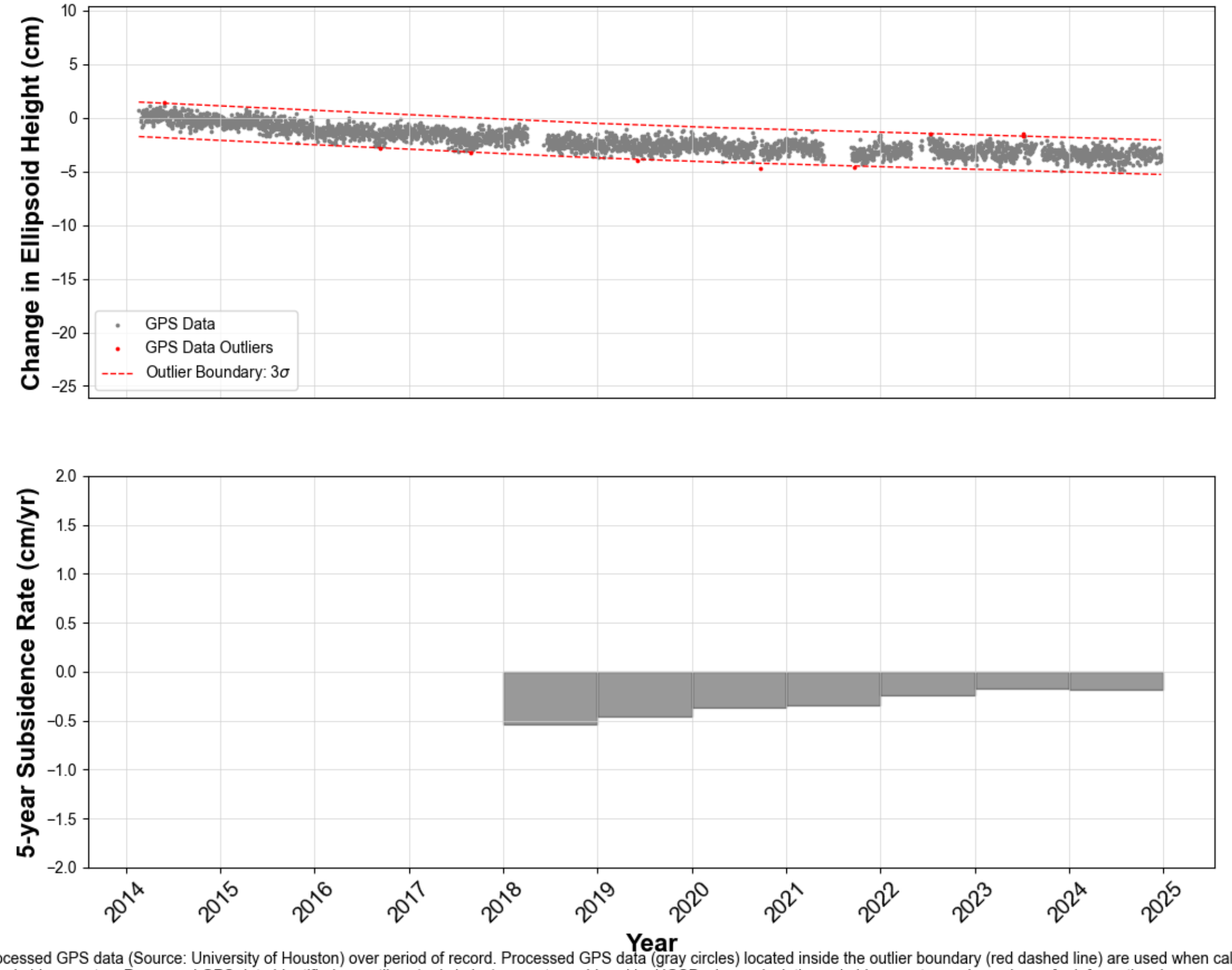


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHC3

La Marque, TX

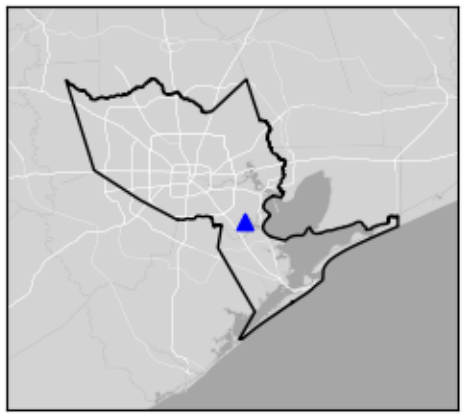


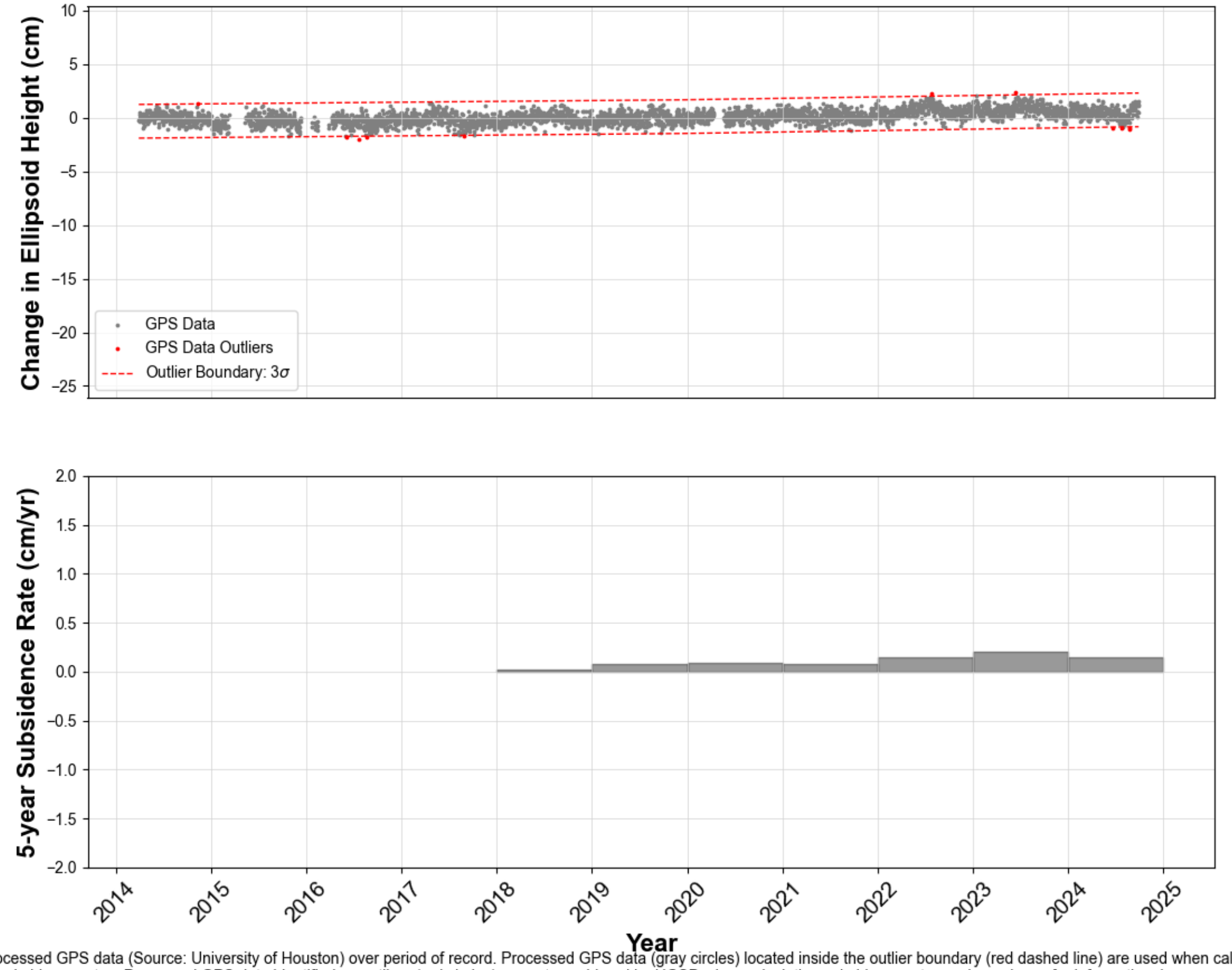


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHCL

Houston, TX

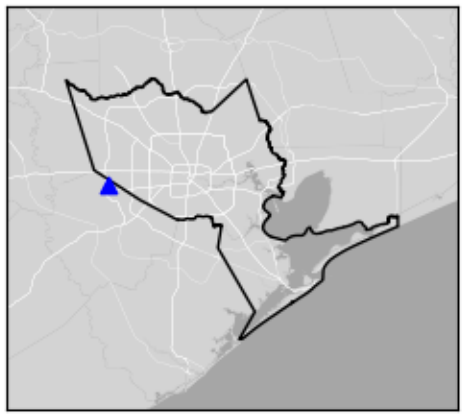


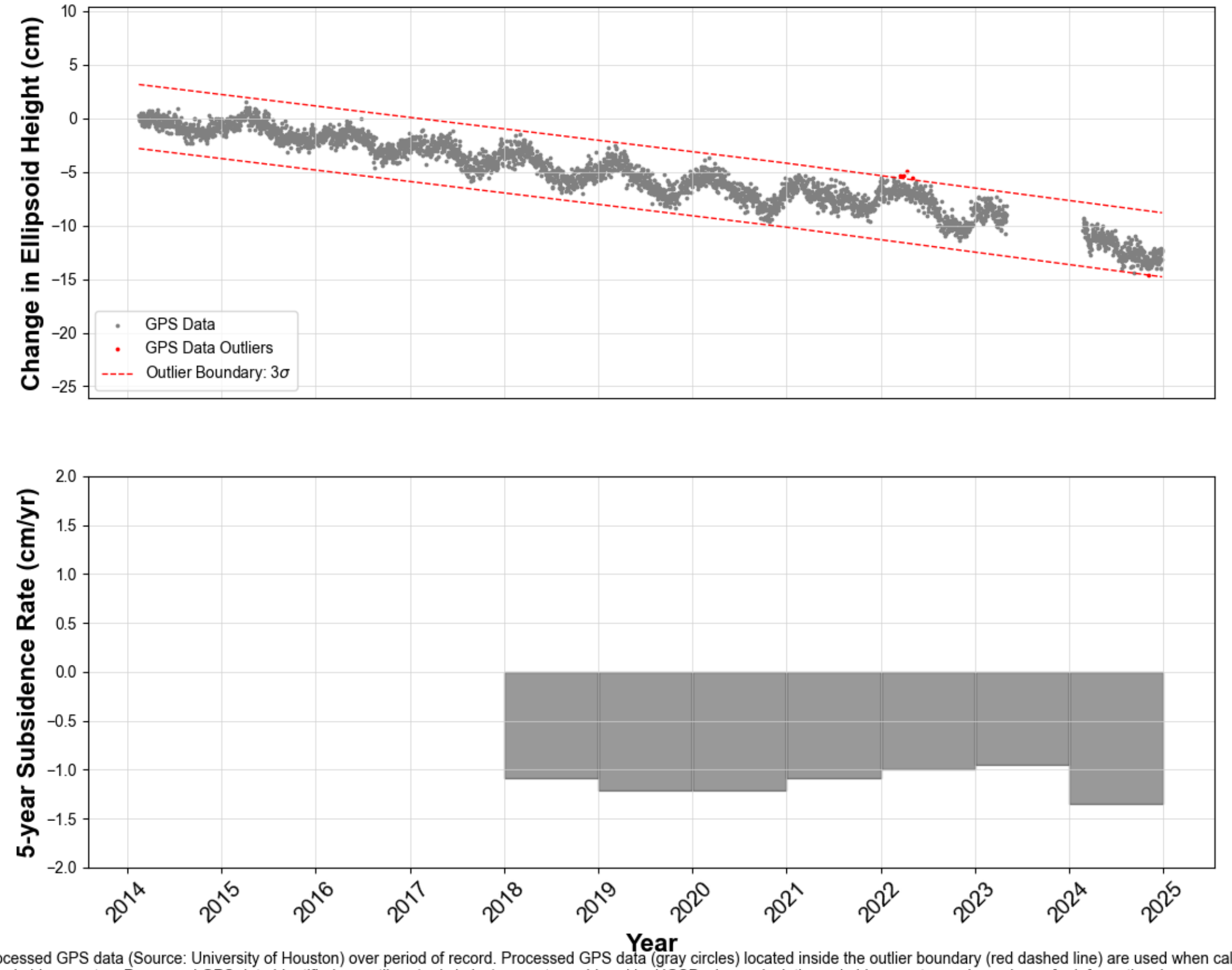


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHCR

Katy, TX

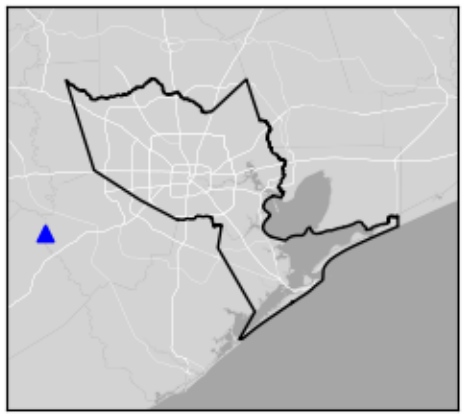


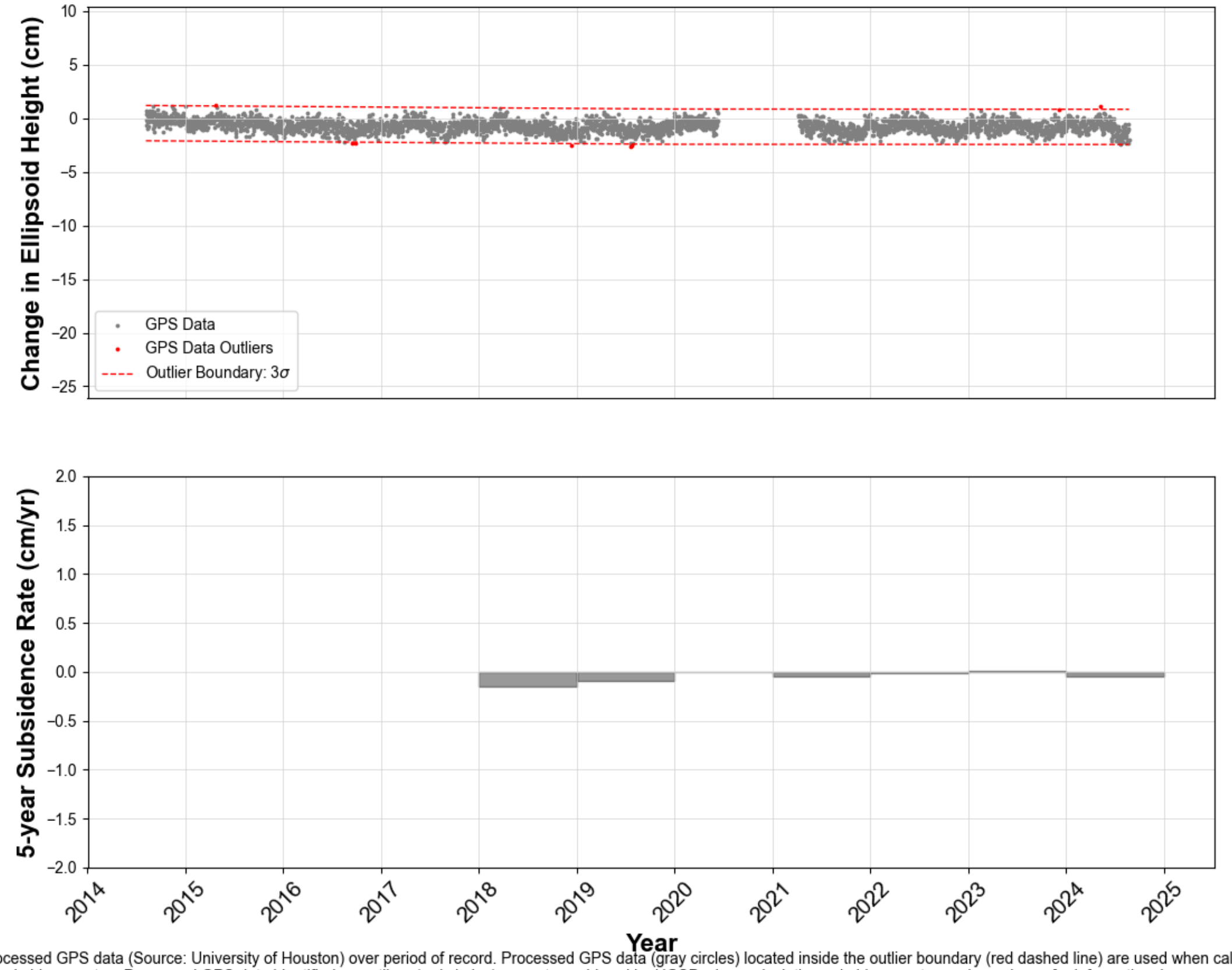


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHEB

East Bernard, TX

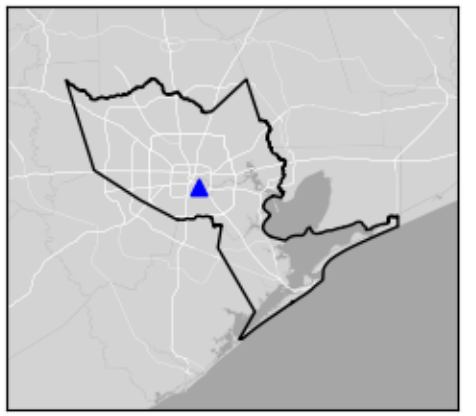


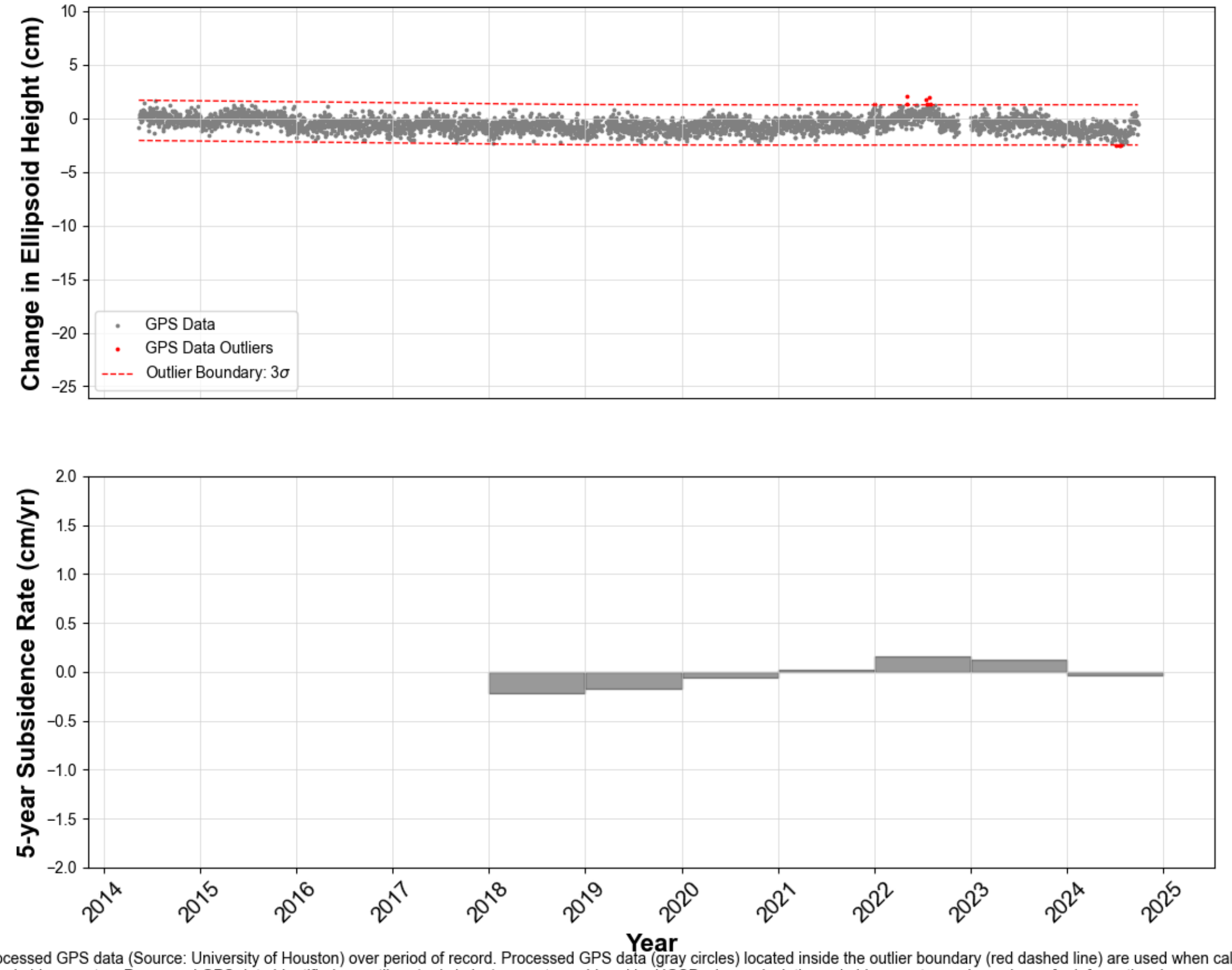


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHEP

Houston, TX

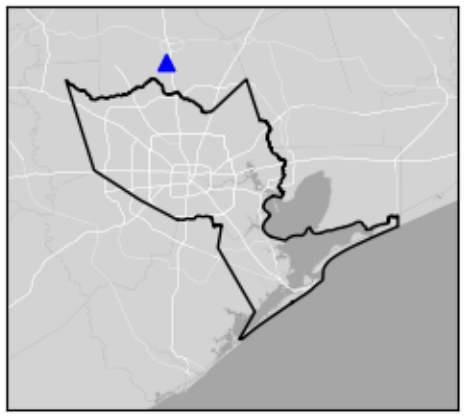


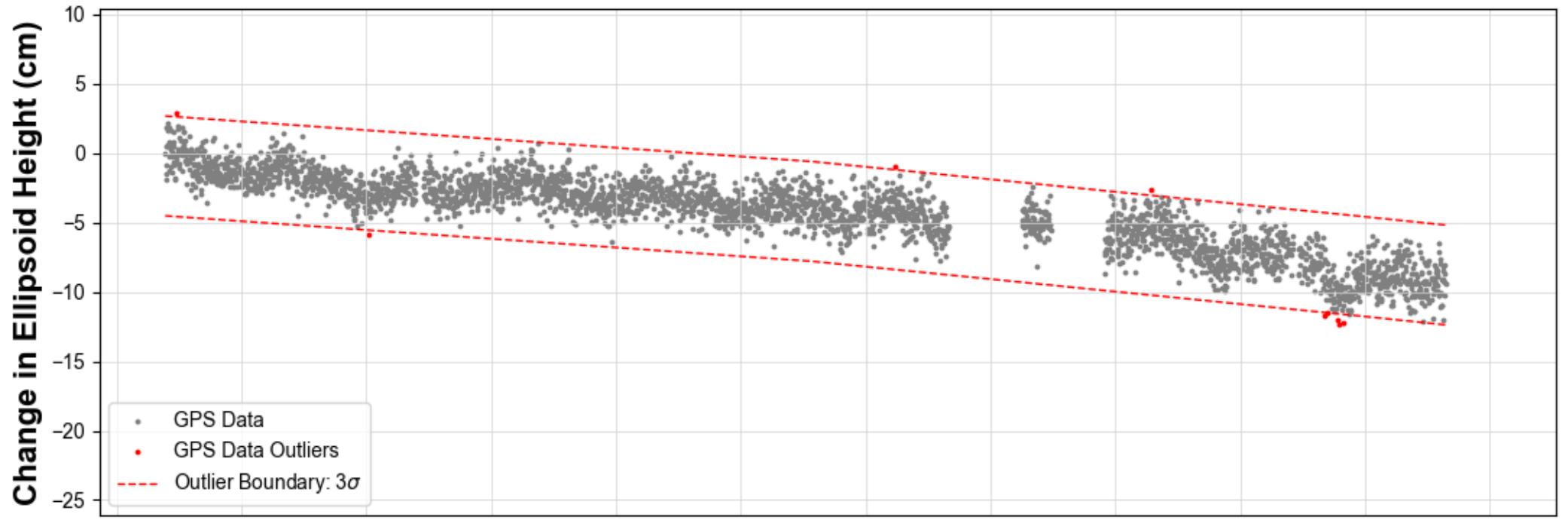


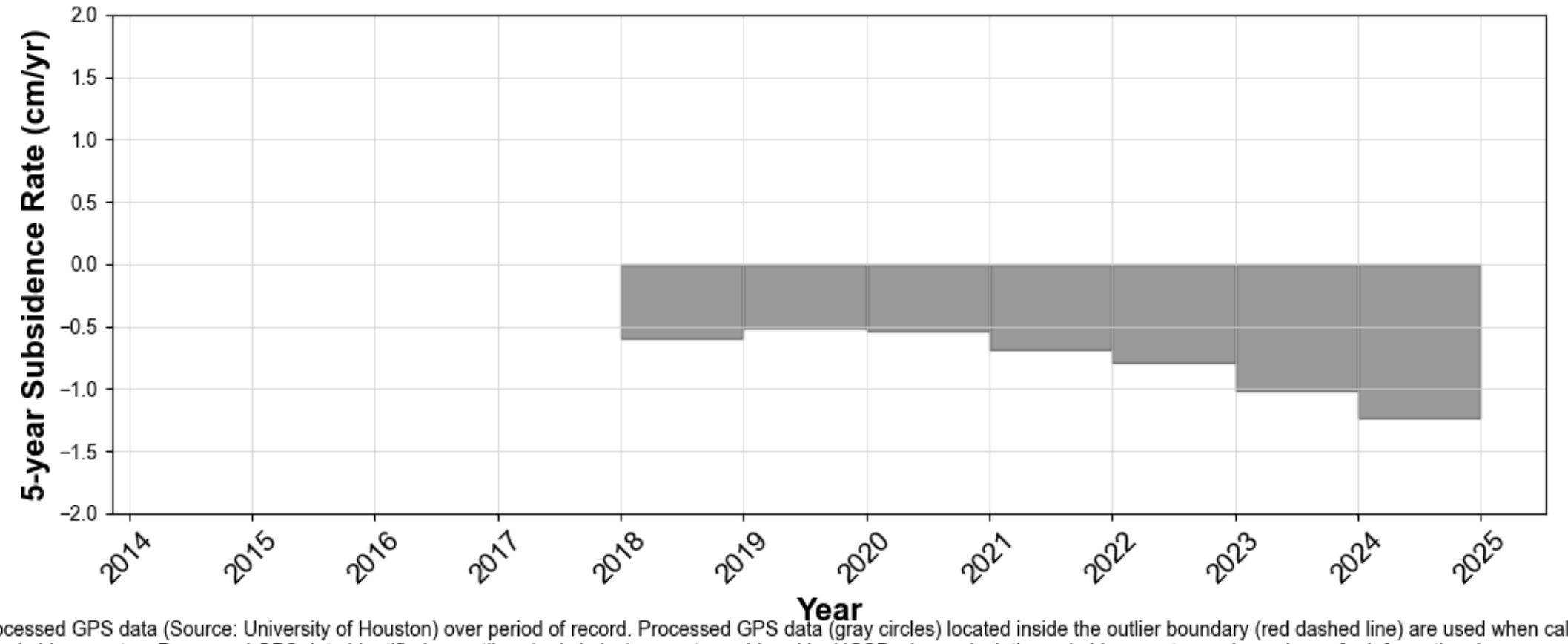
Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHF1

Conroe, TX



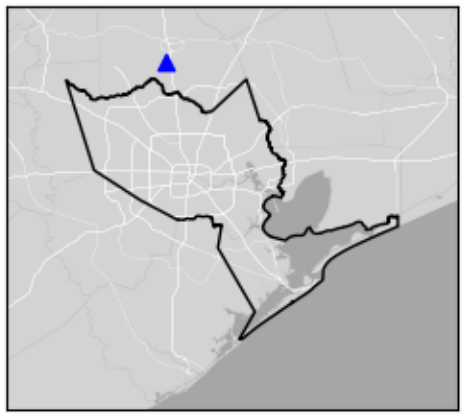


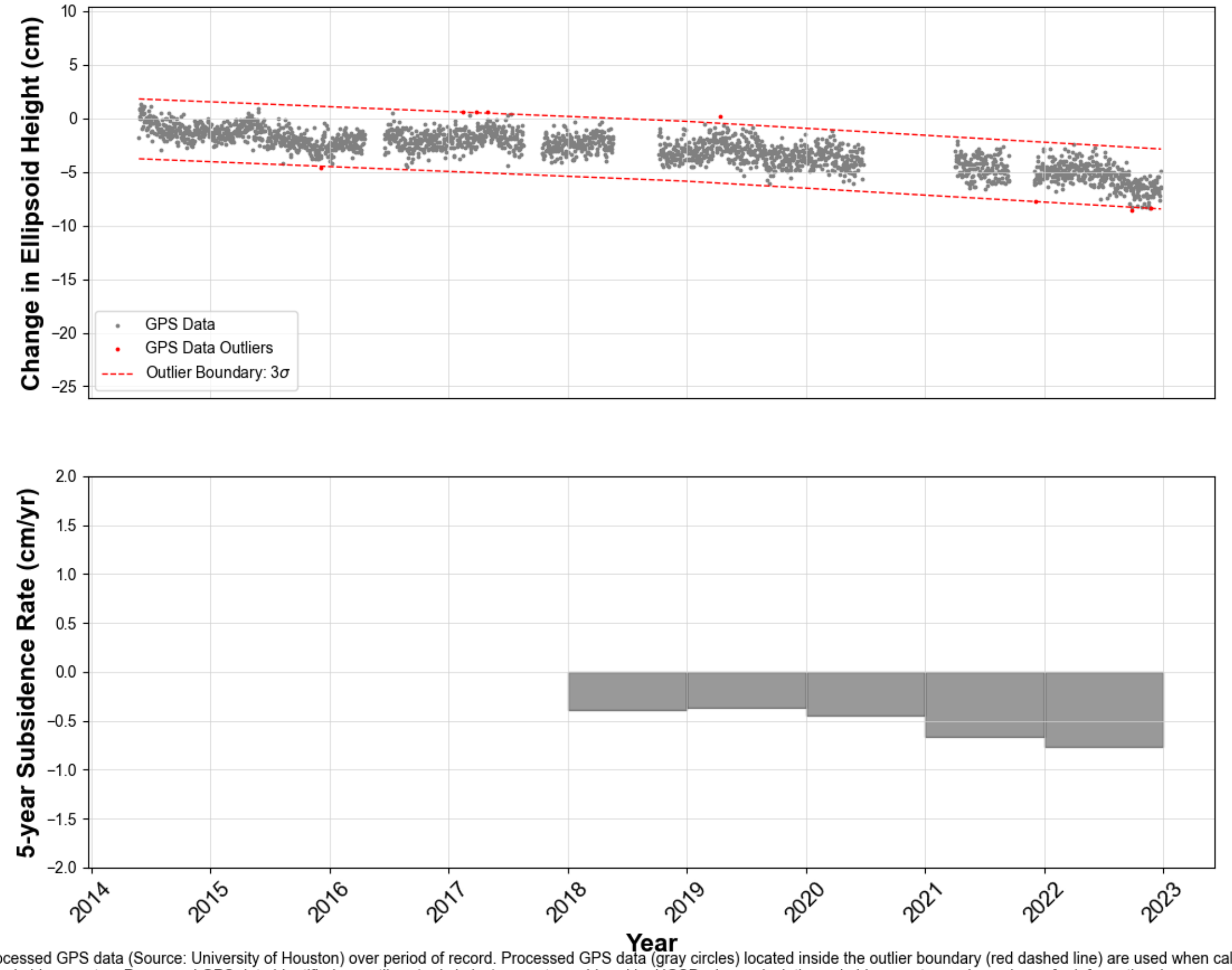


Processed GPS data (Source: University of Houston) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed line) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by HGSD when calculating subsidence rates and are shown for informational purposes only.

UHJF

Conroe, TX





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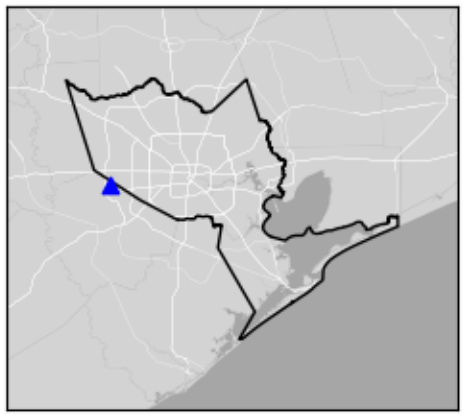
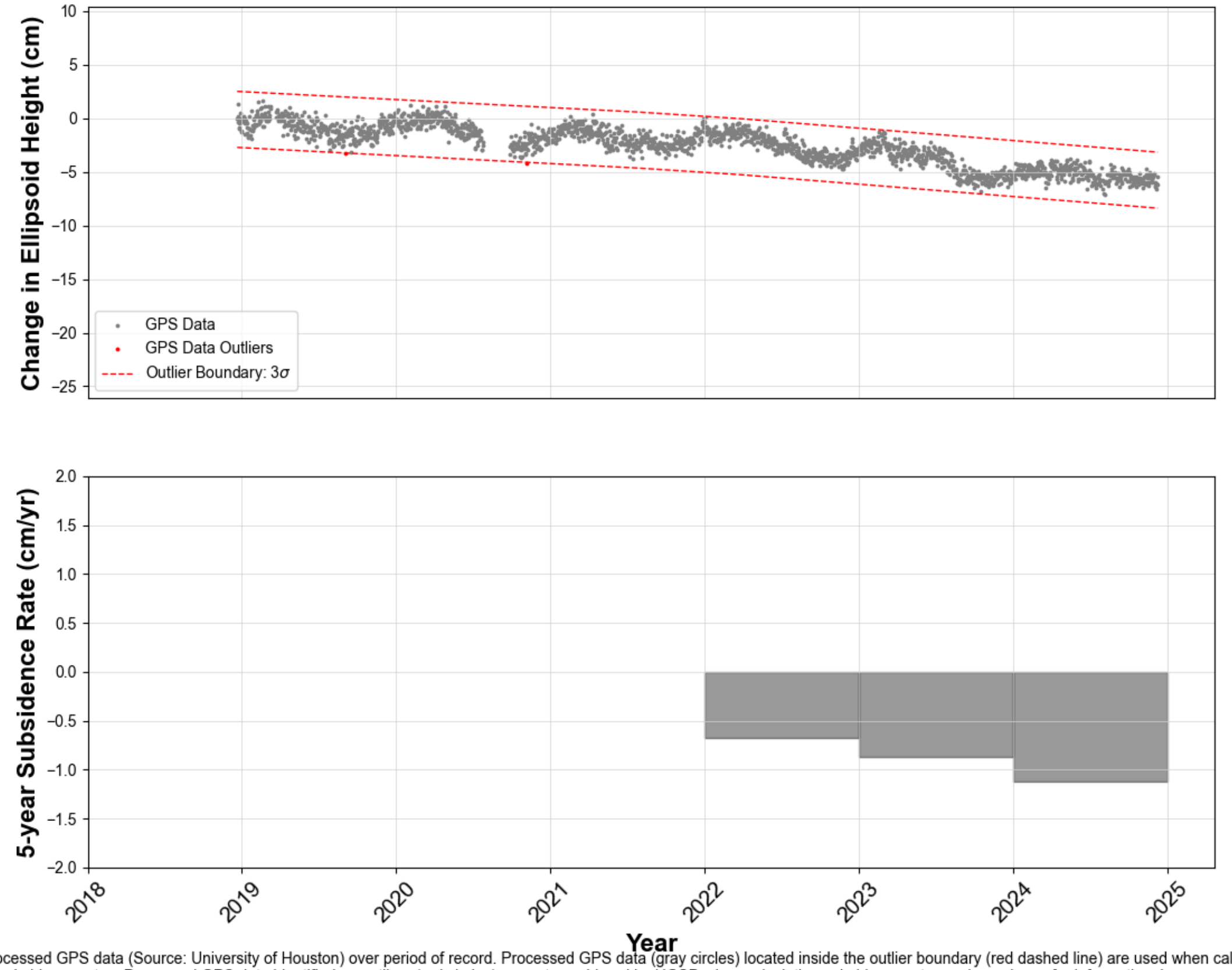
UHKD

Katy, TX





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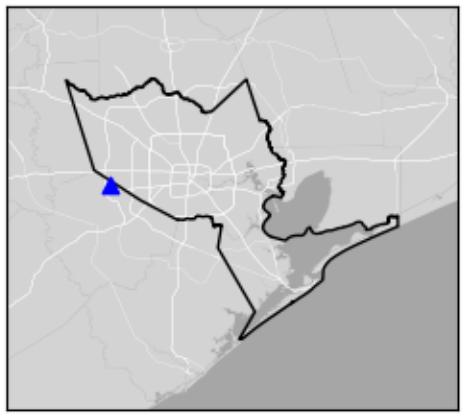
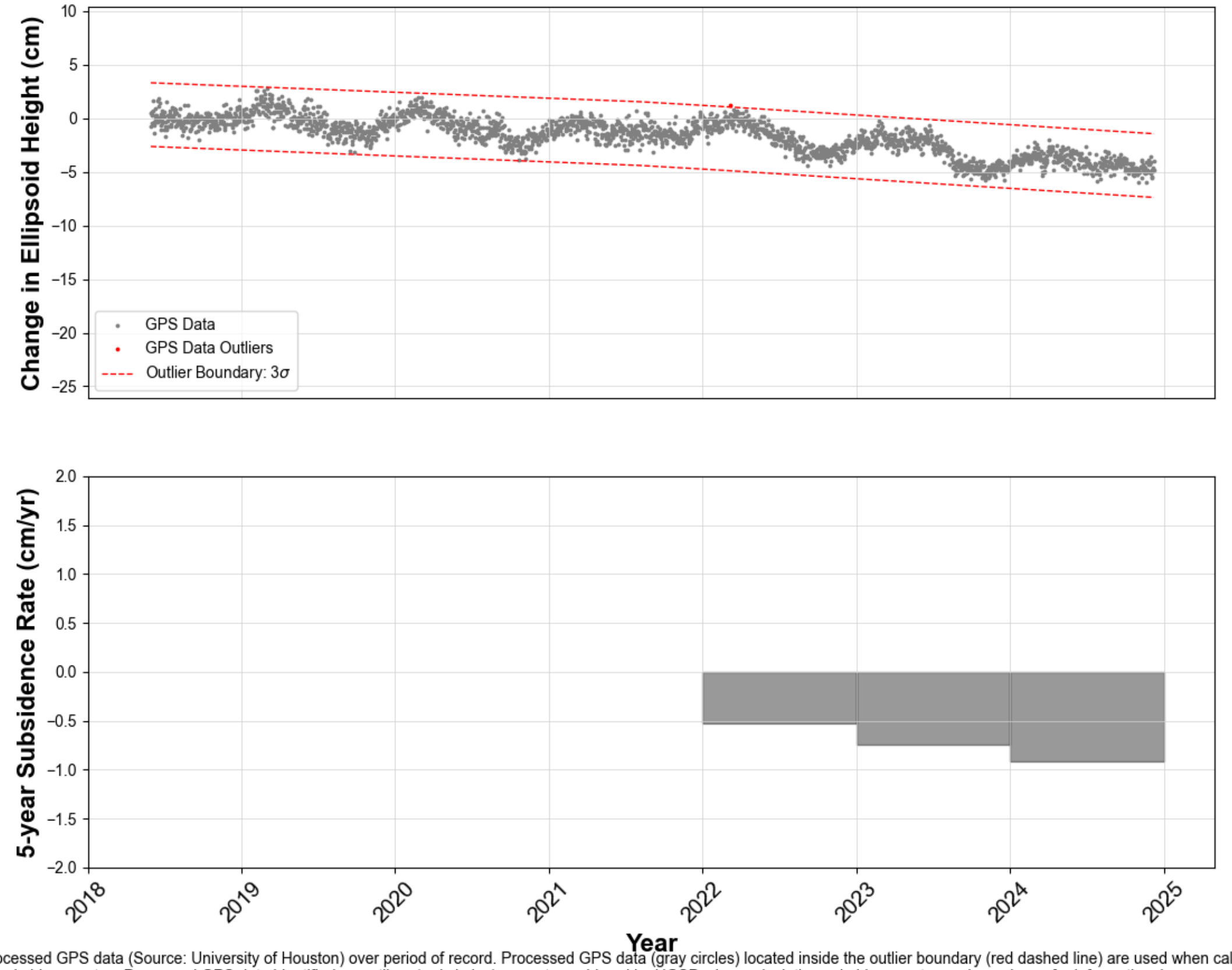
UHKS

Katy, TX





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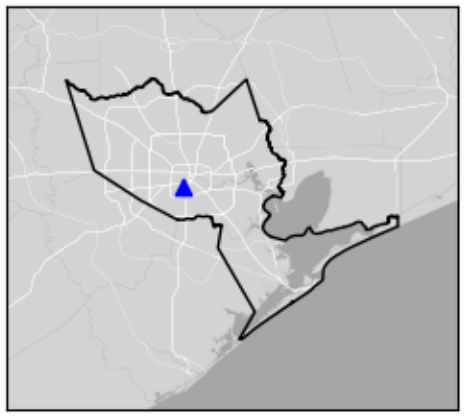
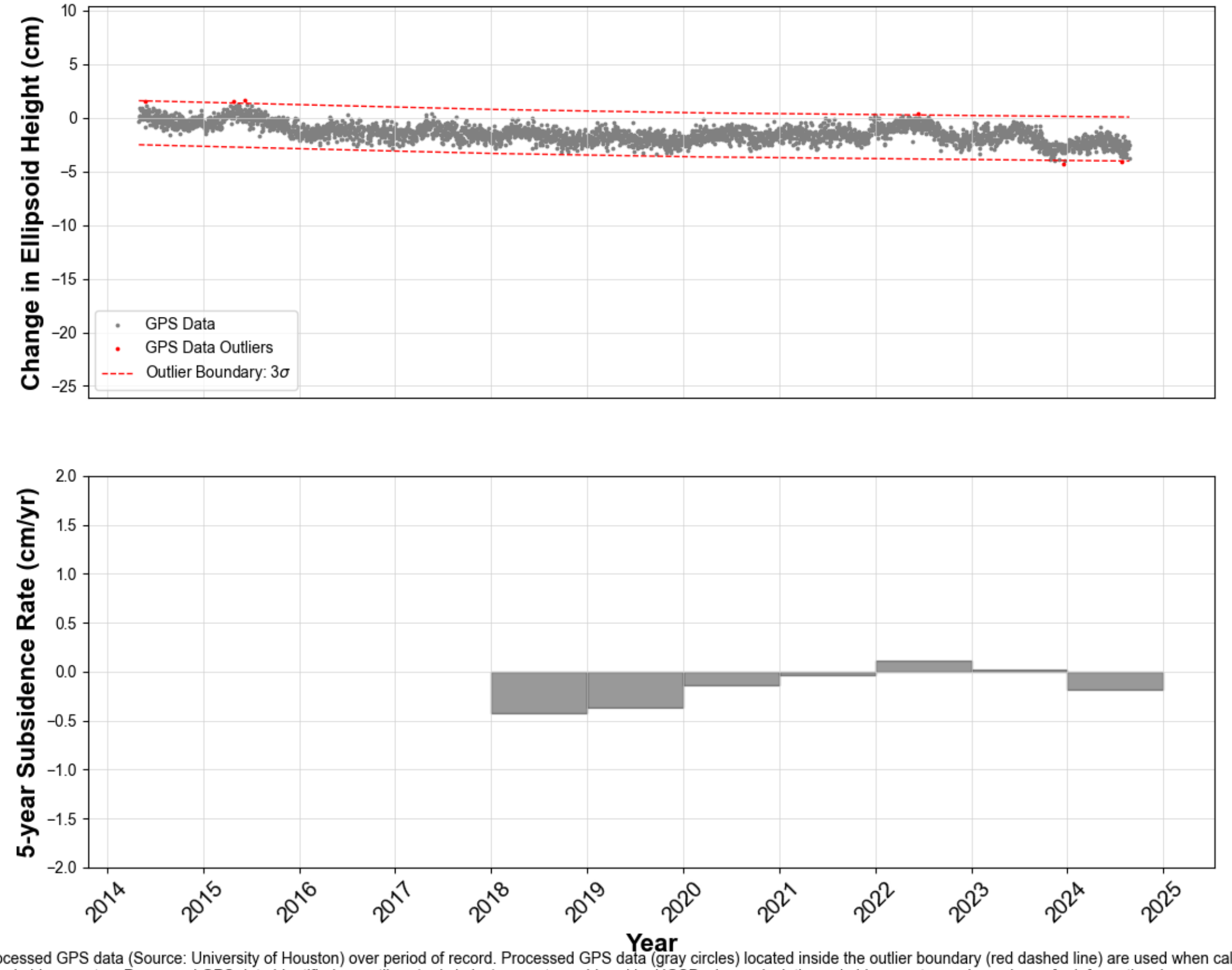
UHRI

Houston, TX





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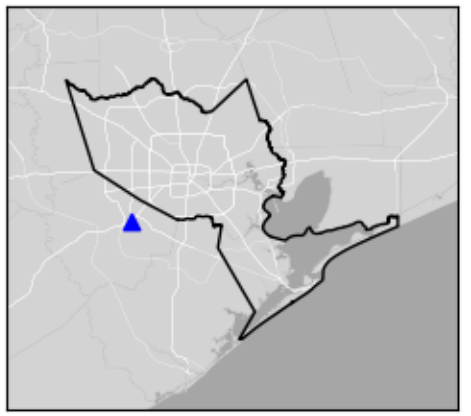
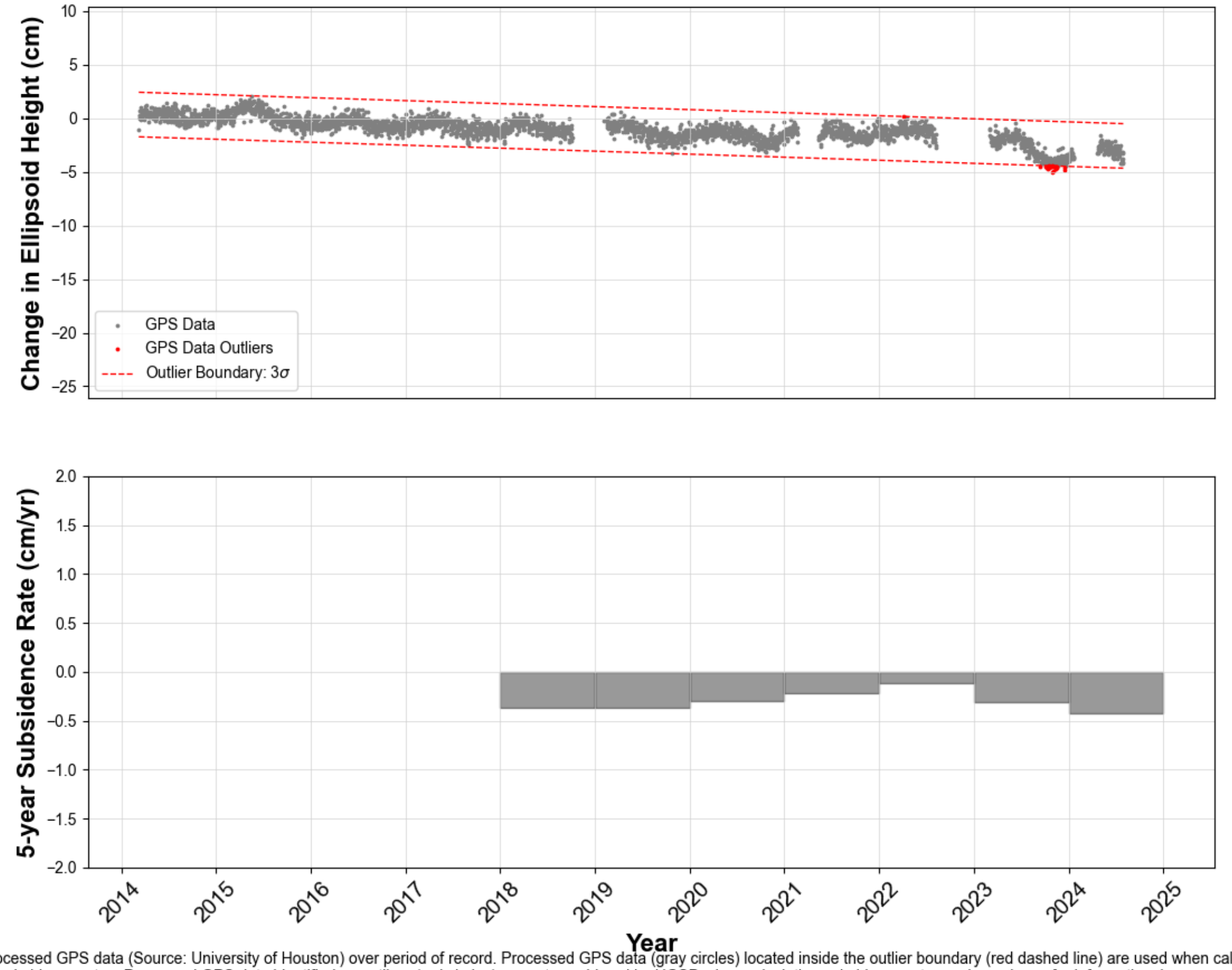
UHSL

Sugar Land, TX





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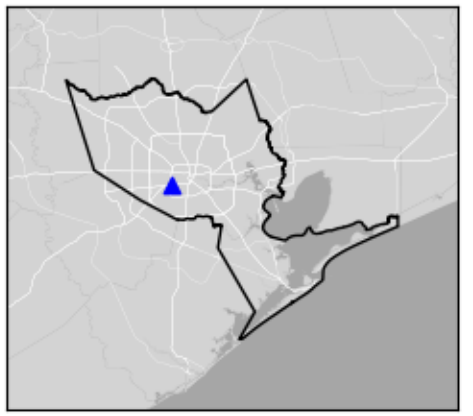
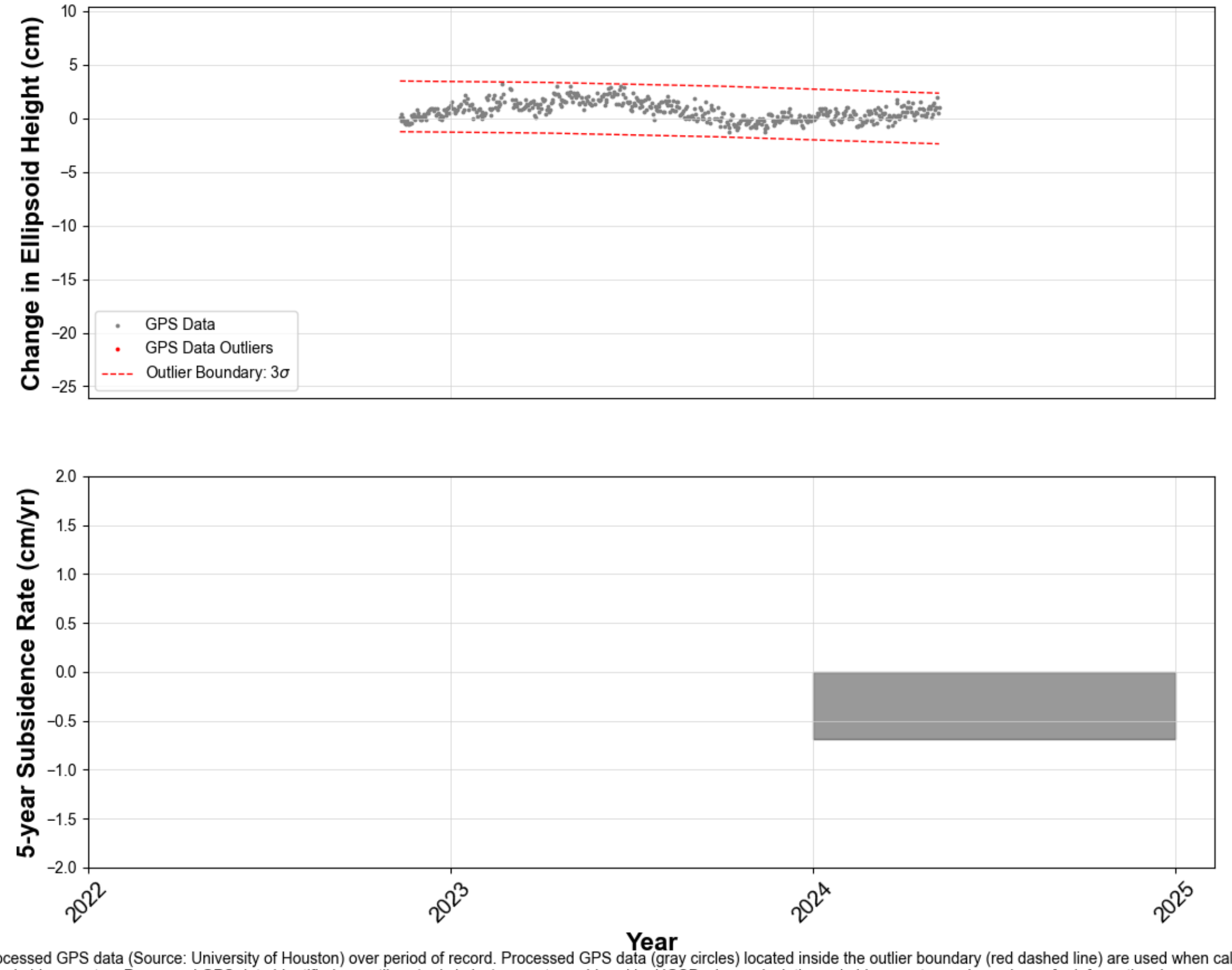
UHSW

Houston, TX





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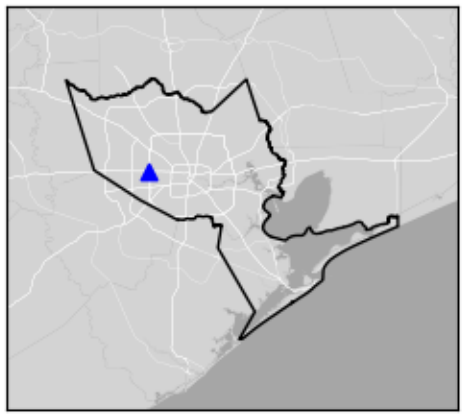
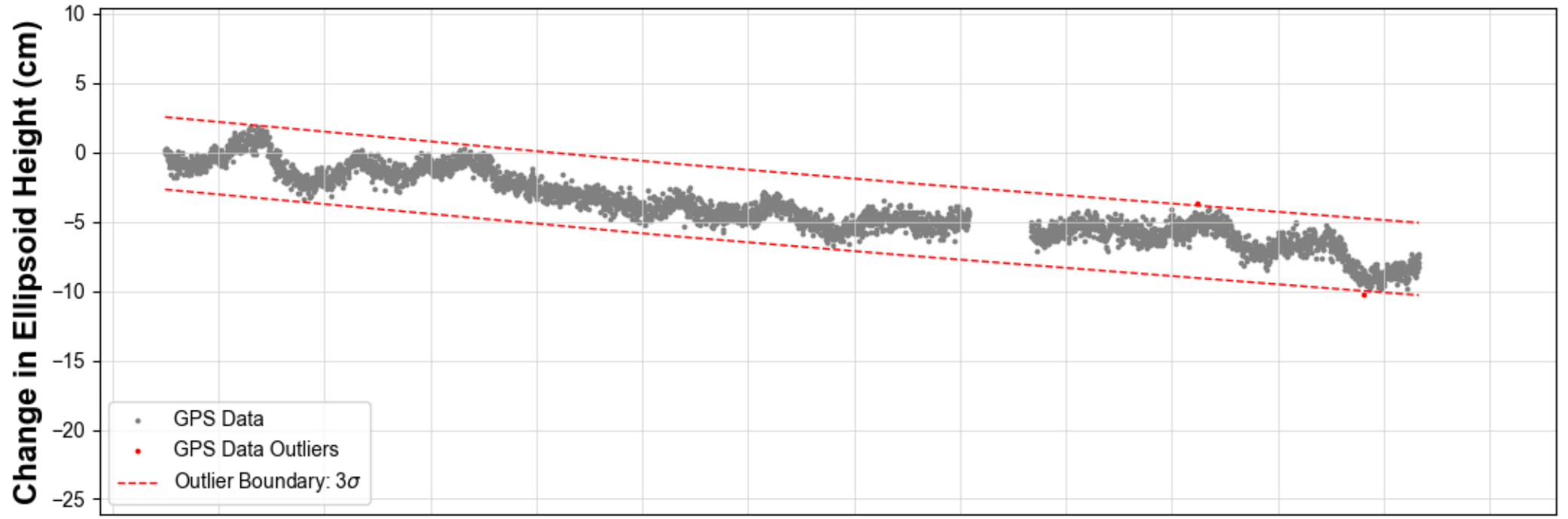
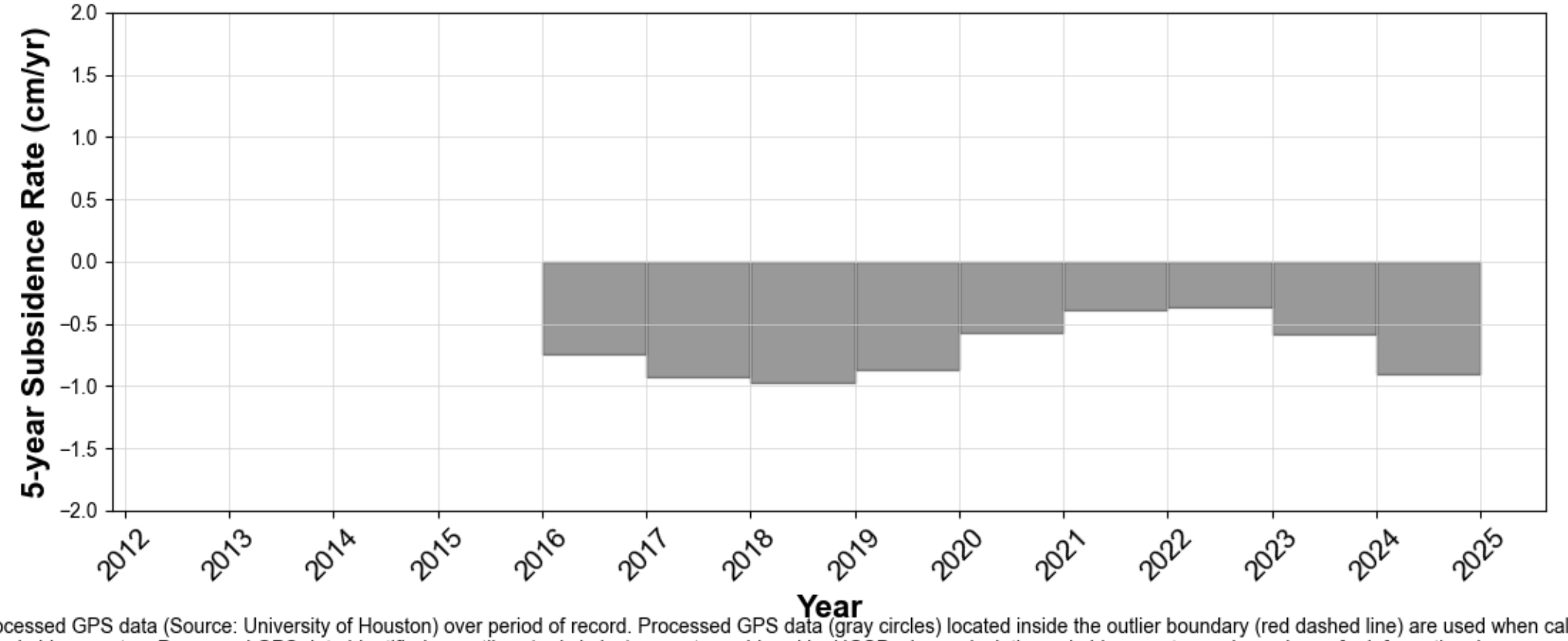
UTEX

Houston, TX







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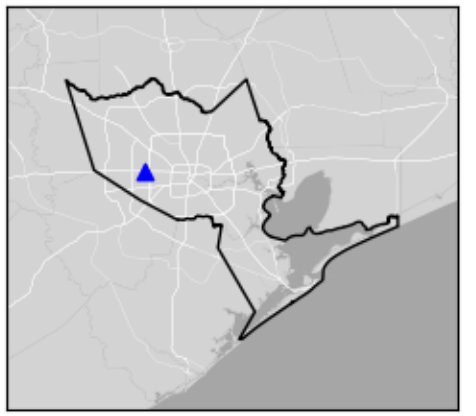
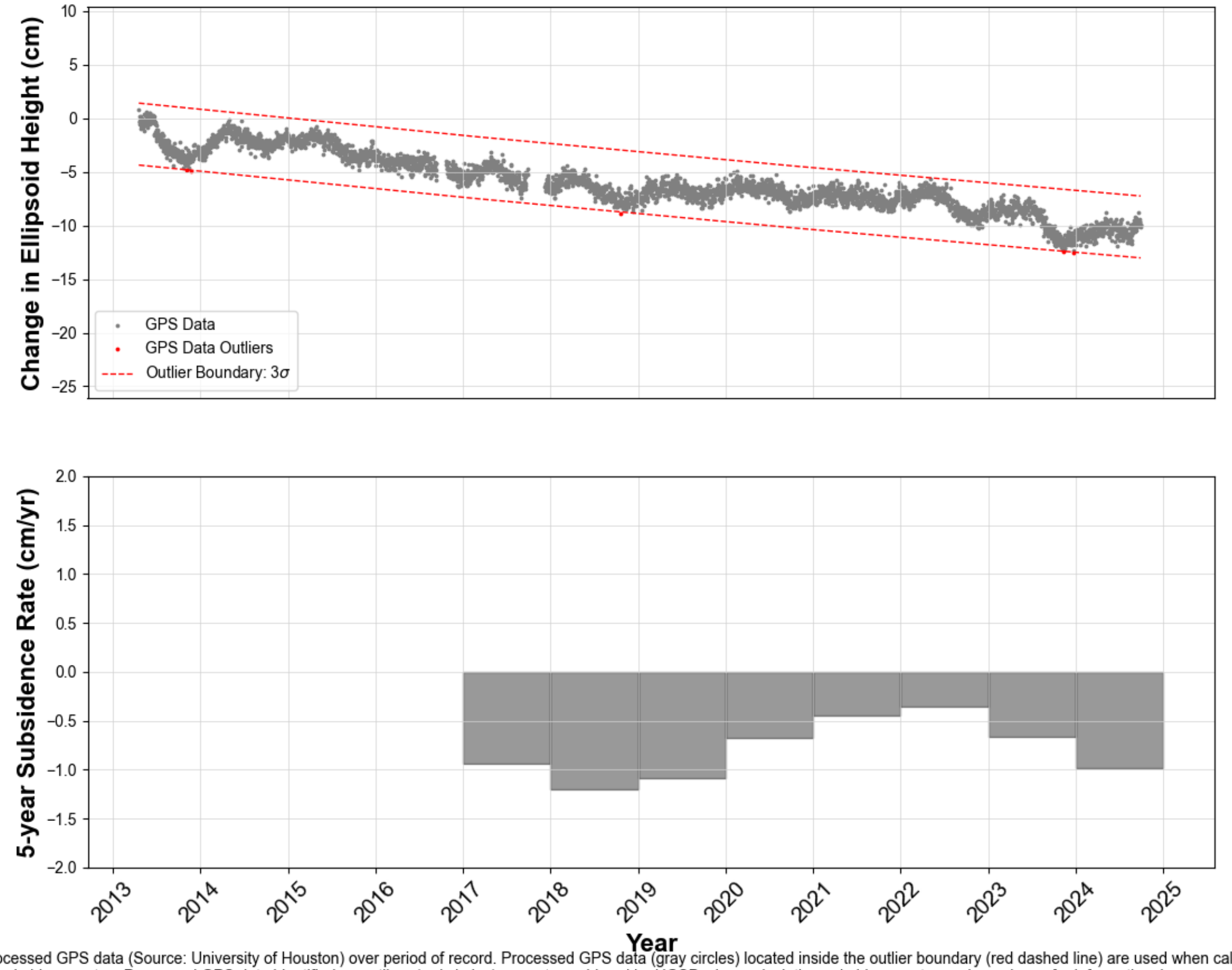
WCHT

Houston, TX





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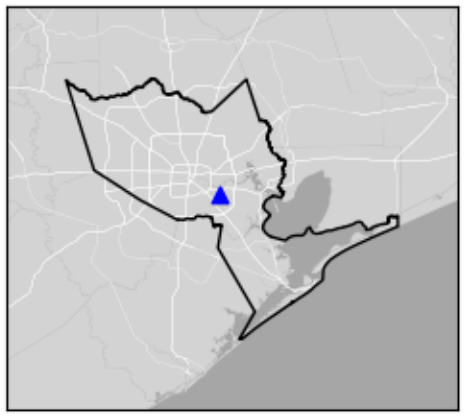
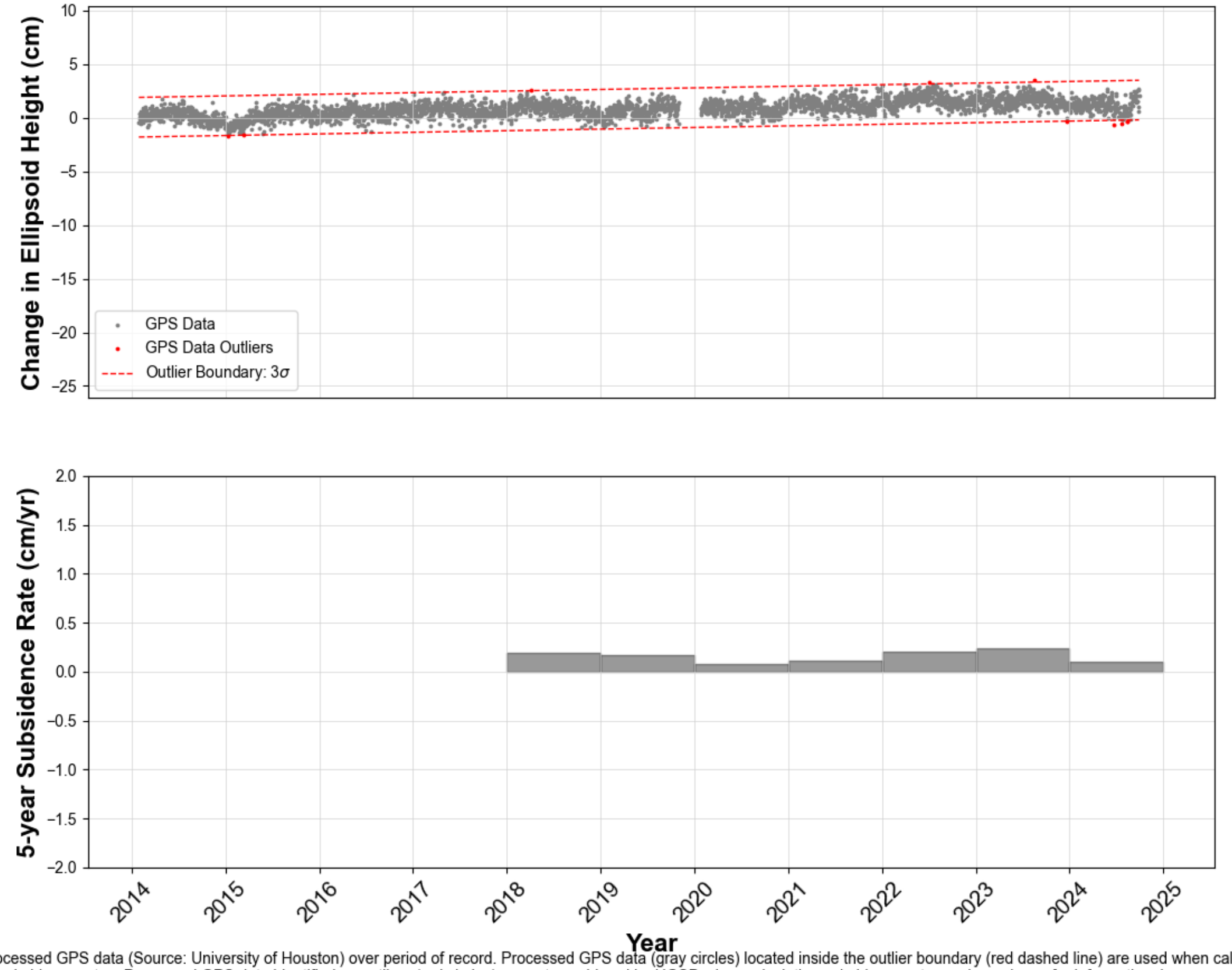
WEPD

Pasadena, TX





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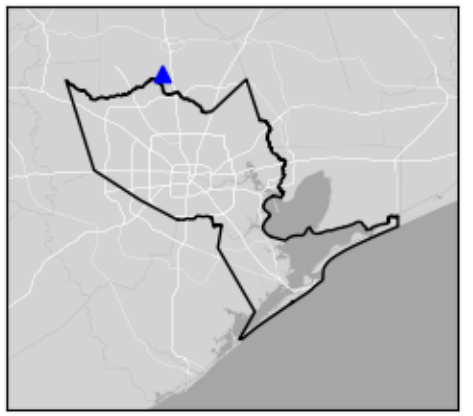
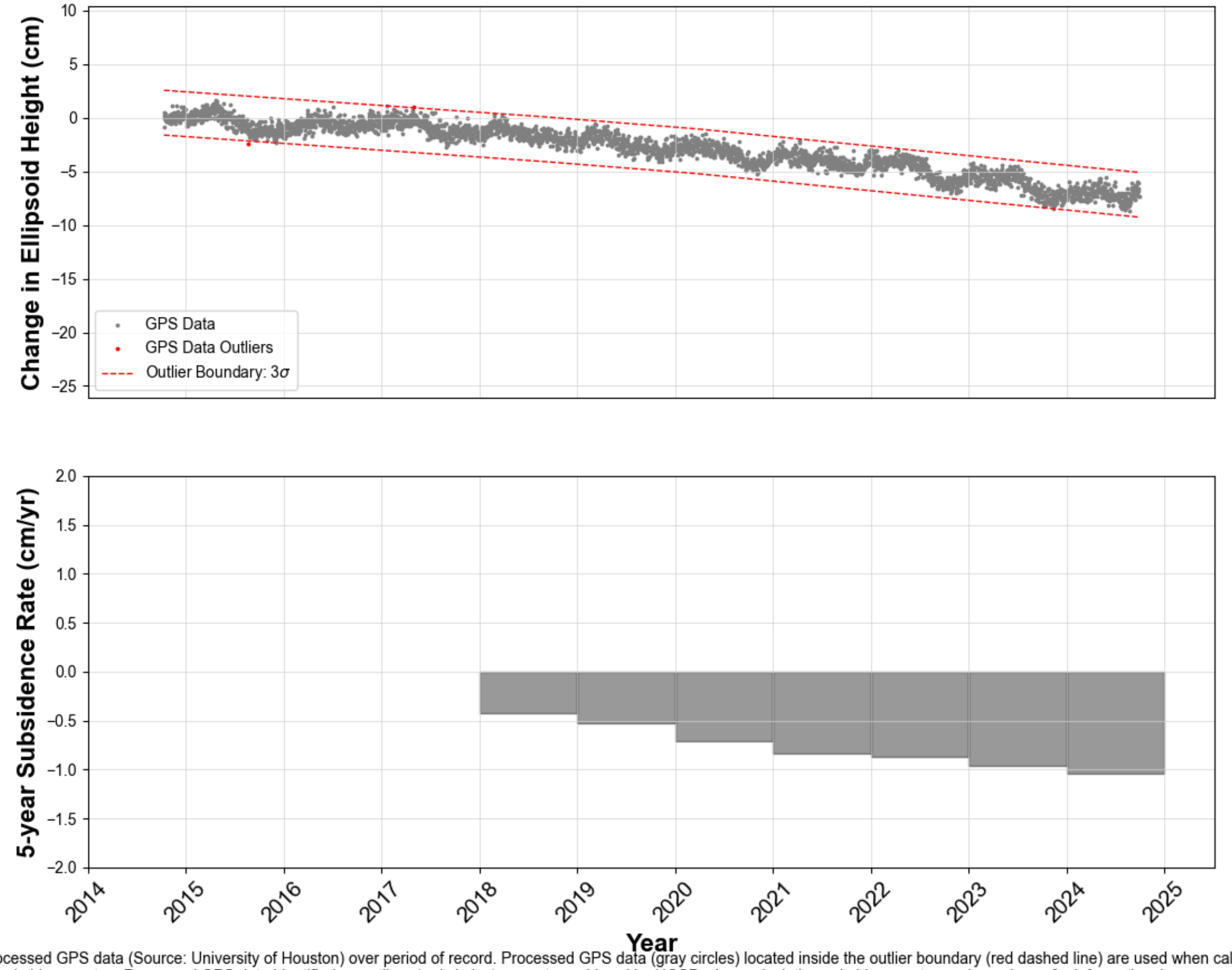
WHCR

The Woodlands, TX





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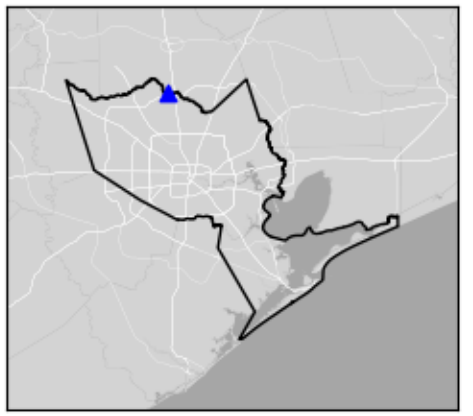
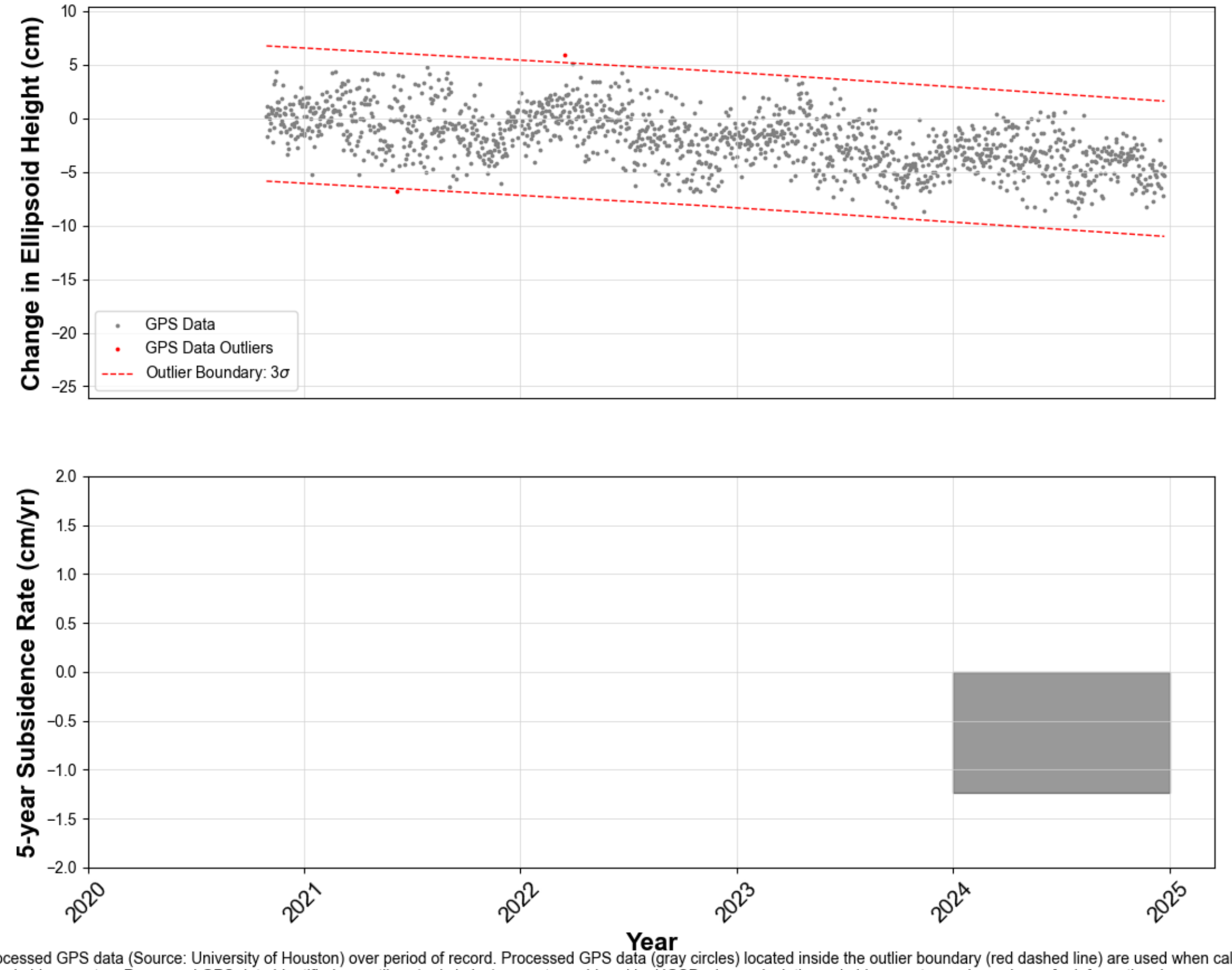
YORS

The Woodlands, TX





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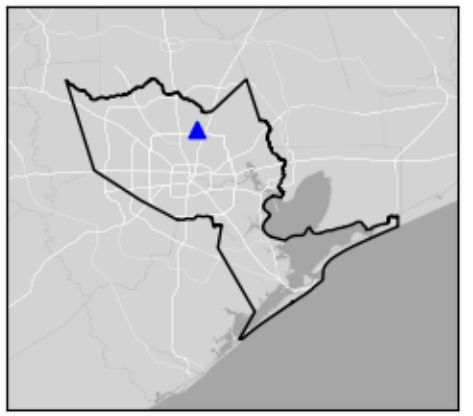
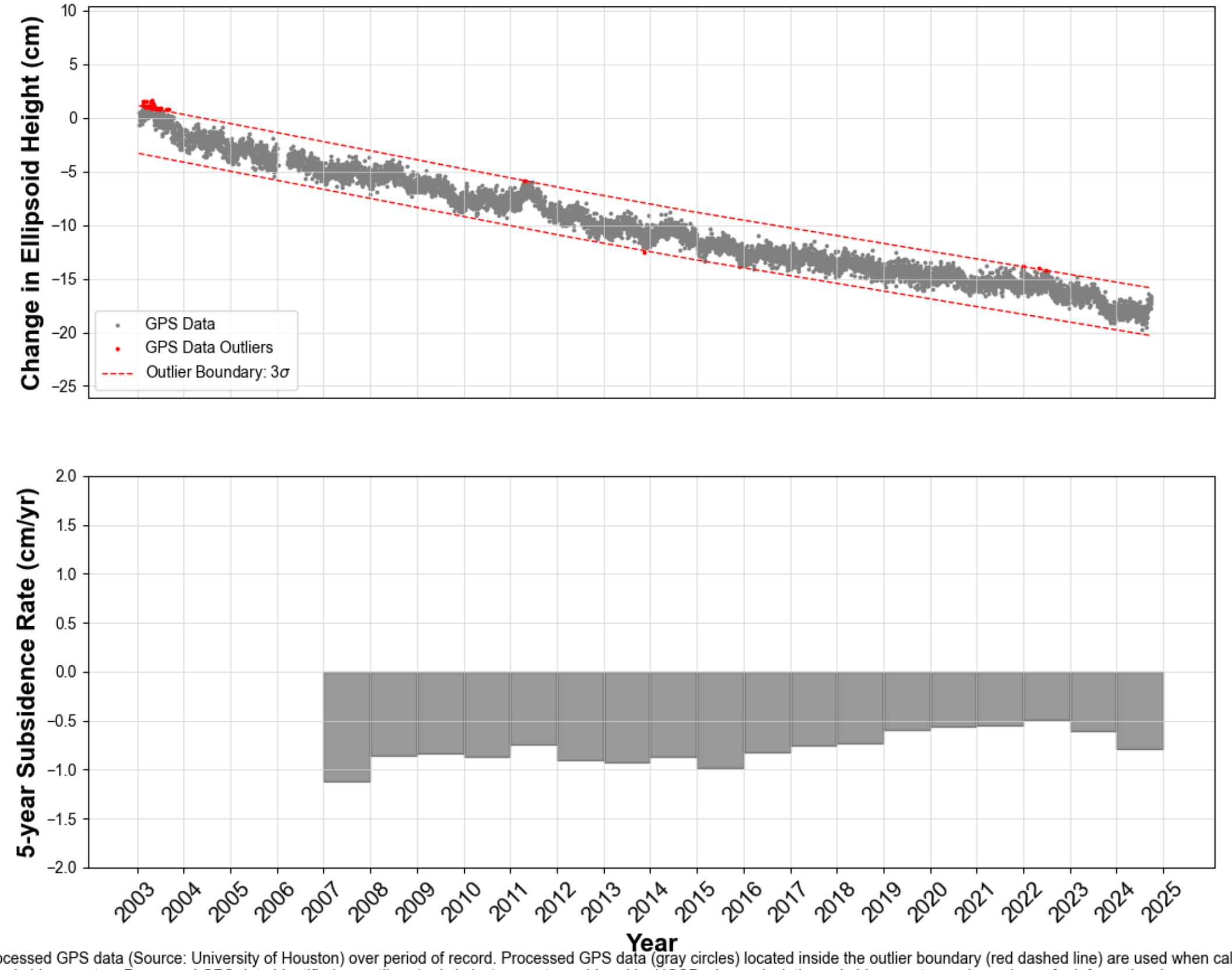
ZHU1

Houston, TX





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Appendix C – Public Testimony and Comments

Public Testimony and Comments

The public hearing for the 2024 Annual Groundwater Report was held on April 29th, 2025 and the record remained open for public testimony and comment until May 7th, 2025. One question was received and answered at the public hearing and are summarized below.

Question 1: Mr. Don Johnson (Board Director, HGSD) asked, “Is the hearing presentation posted on the website?”.

Answer: *Ms. Ashley Greuter (Director, HGSD) responded that a copy of the 2024 Annual Groundwater Report Public Hearing presentation was available on the District’s website on April 28th, 2025. She provided directions on how to access the presentation from the hgsubsidence.org website. For the direct link, please visit https://hgsubsidence.org/science-research/district-research/annual-groundwater-reports/ to view the District’s Annual Groundwater Report public hearing and report.*