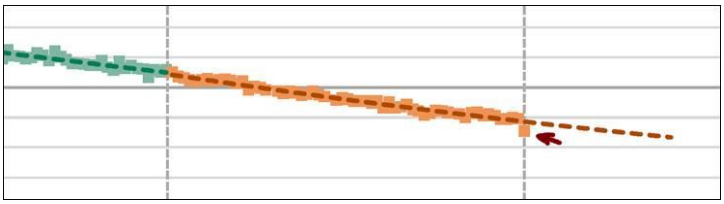
Westlake US 2
5/22/2023

TSX/PAZ Satellite Update
InSAR Subsidence
May 18, 2023

Longuist comment:

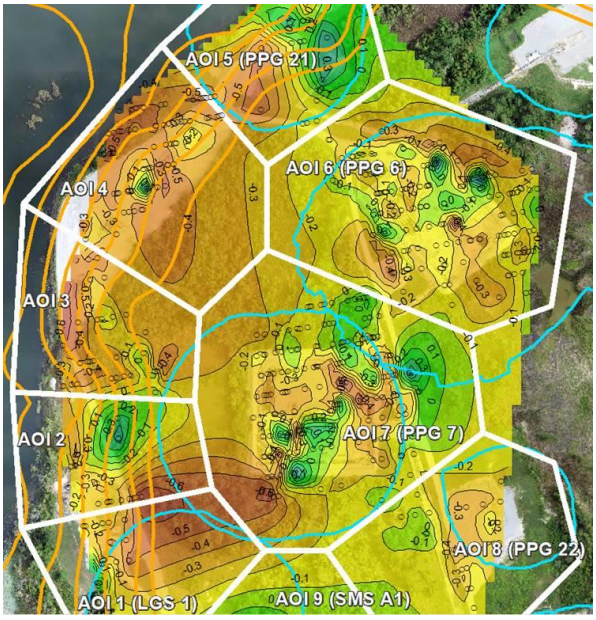
Both the SNT satellite (12-day revisit) and the TSX satellite from the TSX/PAZ constellation (4 & 7-day revisit) passed by Sulphur on Thursday May 25. We received the dataset Saturday and a preliminary evaluation revealed a greater than normal increase in the negative displacement values in AOI 4 in the SNT data (chart below). No indication of the same was observed in the TSX data from the same date. This is believed to be related to the data precision range in the SNT data. The next few datasets will be reviewed to confirm that measurements in that area have returned to trend.

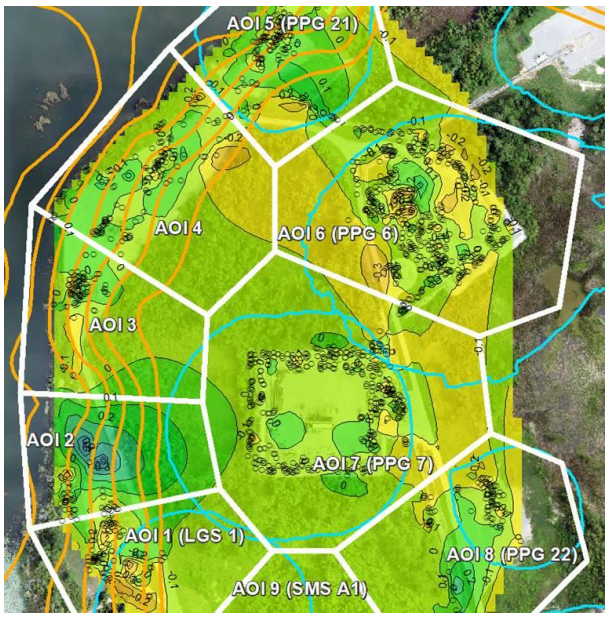
AOI 4



The below maps have been provided for reference on this supplementary evaluation in addition to the standard reports (attached). The two maps below show the change in displacement values in inches between the 5/25 satellite image and the average of the displacement values from the prior month of images. Map 1 shows the SNT data and Map 2 shows the TSX/PAZ data. An area of negative displacement values in Map 1 stretching across AOI 3, 4, & 5 is not seen in Map 2 with similar datapoint coverage. A negative displacement region in Map 1 between AOI 1, 2 & 7 was also noted but it is created by a small number of datapoints and is also assumed to be related to data precision. The below comparison also highlights the difference in measurement precision between the SNT and TSX/PAZ data generally, which is related to the different resolution of the satellites. More spatial consistency and smaller magnitudes of change are shown in the TSX/PAZ data.

Submitted by: Nathaniel Byars (Lonquist)





Submitted by: Nathaniel Byars (Lonquist)

TSX/PAZ Constellation Update

Continuous InSAR Monitoring of Ground Displacement Near Western Caverns and Dome Flank

Sulphur Dome
Westlake Chemicals

May 25, 2023 Update

Date Signed: May 30, 2023
Austin, TX

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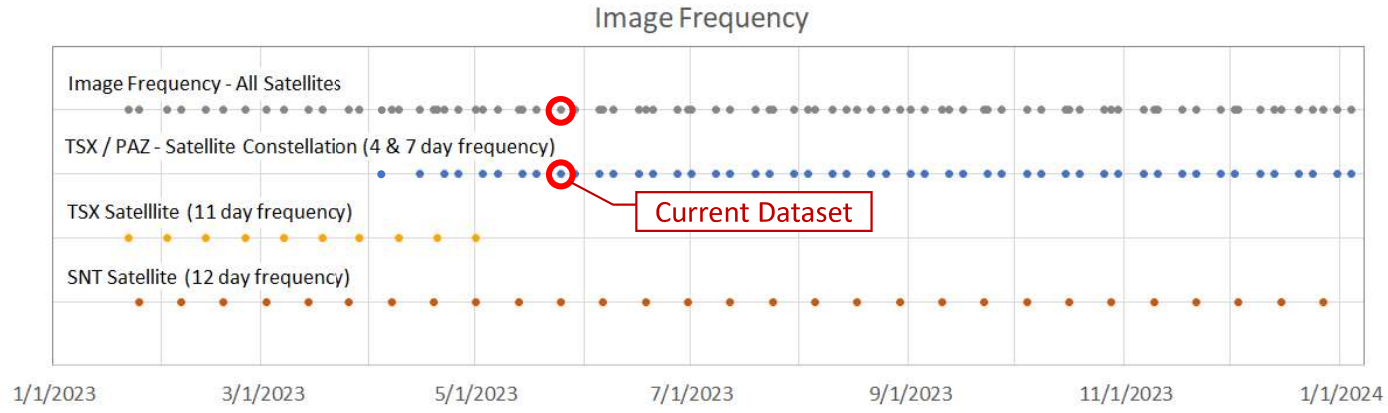
LONQUIST & CO. LLC
PETROLEUM ENGINEERS | ENERGY ADVISORS

Parameters of InSAR Dataset and Collection Frequency

- Satellite Data Delivery Frequency as of April 2023:
  - Sentinel 1 (SNT) 12 days
  - TSX / PAZ Constellation 4 & 7 days
  - 3.96-day avg. frequency

			TSX/PAZ Constellation	
	Sentinel-1	TerraSAR-X	TerraSAR-X	PAZ
Mode / Resolution	16 x 65 ft	Spotlight (3 x 3 ft)	Spotlight (3 x 3 ft)	Spotlight (3 x 3 ft)
Track	T136	T29	T67	T120
Band (wavelength)	C-Band (2.32 in)	X-Band (1.22 in)	X-Band (1.22 in)	X-Band (1.22 in)
Nominal frequency	12- day	11- day	11- day	11- day
Orbit (LOS angle)	Ascending 43°	Descending 17°	Descending 37°	Descending 37°
Date range	04 Oct 2016 – 20 Jan 2024	16 Jun 2022 – 01 May 2023	24 Jan 2023 – 11 Jan 2024	28 Jan 2023 – 15 Jan 2024
Number of images	199	30	34	33



Overview and Monitoring History

- Beginning in late January, ground displacement over the western portion of the Sulphur Mines Salt Dome has been evaluated following the delivery of each dataset update from TRE-Altamira
- An automated process and set of deliverables to convey the results of the datasets is being developed that will evaluate multiple factors including trend consistency and mapped acceleration of ground displacement
- Current updates are focused on the review of time series charts of averaged data for selections of points around the dome and caverns on the western flank
- The TSX/PAZ satellite constellation (4 & 7-day revisit) passed by Sulphur on Thursday May 25, 2023
- The following slides present the time series and associated linear trends for each location evaluated from this dataset
- To-date there has been no material deviation from the established subsidence trends in the areas investigated

TSX/PAZ Constellation – May 25, 2023 Update

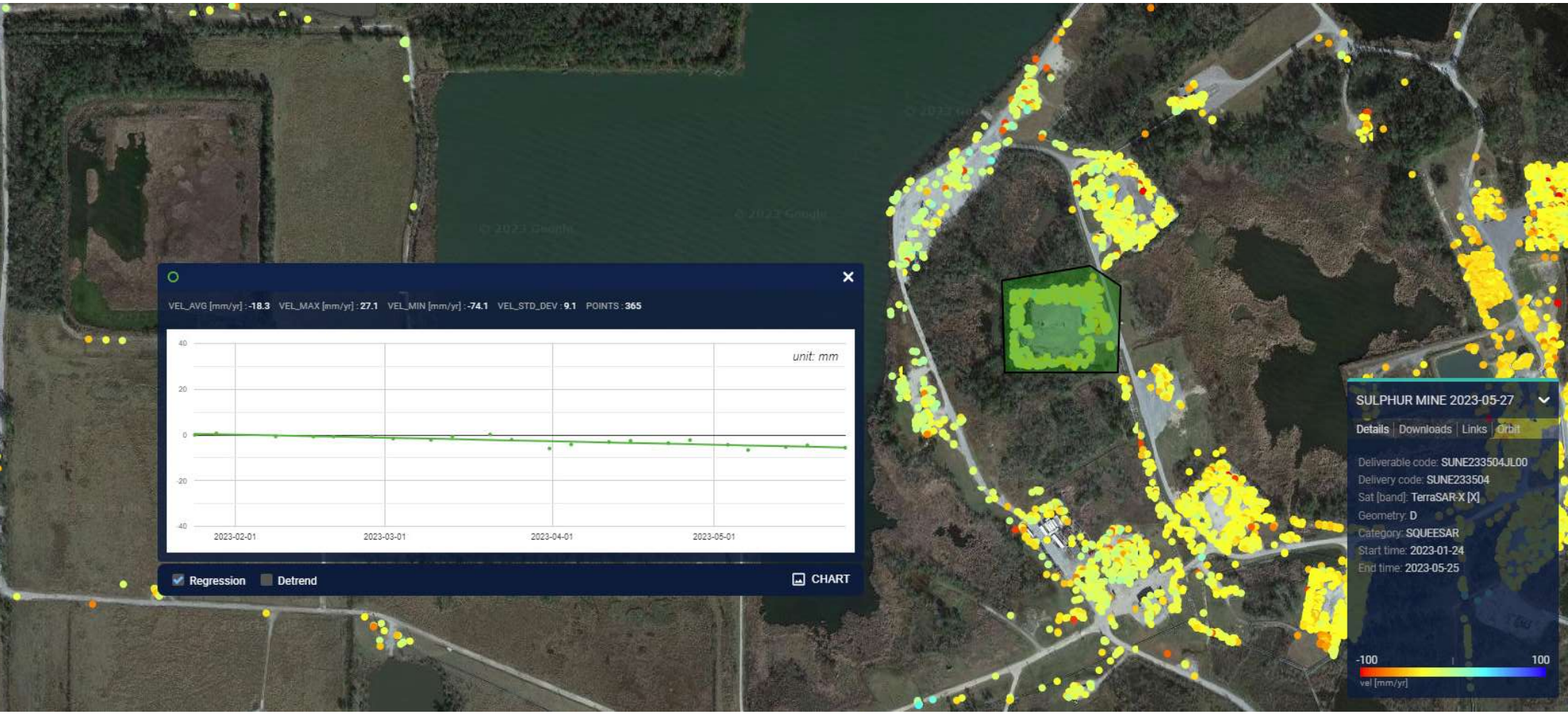
PPG 21


VEL_AVG [mm/yr] : -19.4
VEL_MAX [mm/yr] : 20.8
VEL_MIN [mm/yr] : -83.4
VEL_STD_DEV : 22.6
POINTS : 128
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details
Downloads
Links
Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

PPG 6


VEL_AVG [mm/yr] : -21.7
VEL_MAX [mm/yr] : 24.6
VEL_MIN [mm/yr] : -92.9
VEL_STD_DEV : 13.3
POINTS : 443
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details
Downloads
Links
Orbit
Deliverable code: SUNE233504.JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

PPG 7


VEL_AVG [mm/yr] : -18.3 VEL_MAX [mm/yr] : 27.1 VEL_MIN [mm/yr] : -74.1 VEL_STD_DEV : 9.1 POINTS : 365
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details
Downloads
Links
Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

PPG 22


VEL_AVG [mm/yr] : -30.3 VEL_MAX [mm/yr] : 19.6 VEL_MIN [mm/yr] : -82.9 VEL_STD_DEV : 14.4 POINTS : 108
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details | Downloads | Links | Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

AOI #1


VEL_AVG [mm/yr] : -24.9 VEL_MAX [mm/yr] : 30.2 VEL_MIN [mm/yr] : -85.8 VEL_STD_DEV : 21.5 POINTS : 150
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details | Downloads | Links | Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

AOI #2


VEL_AVG [mm/yr] : -13.3 VEL_MAX [mm/yr] : 5.6 VEL_MIN [mm/yr] : -71.7 VEL_STD_DEV : 12.9 POINTS : 117
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details
Downloads
Links
Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

AOI #3


VEL_AVG [mm/yr] : -9 VEL_MAX [mm/yr] : 18.7 VEL_MIN [mm/yr] : -89.3 VEL_STD_DEV : 11.2 POINTS : 144
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details
Downloads
Links
Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]

AOI #4


VEL_AVG [mm/yr] : -12.4
VEL_MAX [mm/yr] : 22.4
VEL_MIN [mm/yr] : -82.2
VEL_STD_DEV : 13.8
POINTS : 78
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
Regression
Detrend
CHART
SULPHUR MINE 2023-05-27
Details
Downloads
Links
Orbit
Deliverable code: SUNE233504JL00
Delivery code: SUNE233504
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-05-25
-100
100
vel [mm/yr]