Westlake US 2
Received 9/16/2023

TSX/PAZ Satellite
Update InSAR
Subsidence
September 12, 2023

Longuist comment:

The TSX satellite from the TSX/PAZ constellation (4 & 7-day revisit) passed by Sulphur on Tuesday September 12. We received the dataset Thursday and noted that the latest data point is again falling slightly below the linear trends in most of the review areas. The attached time series plots have been prepared for reference.

This and recent observations regarding below trend readings were discussed with TREA on a call on Friday. We learned that they are currently in the process of reviewing and reprocessing the entire TSX/PAZ dataset as a result of the observations that have been made over the past few weeks. There are a number of areas further out from the dome that are experiencing similar or greater below-trend deviations, and they would like to confirm the accuracy of these measurements. They are hoping this reprocessing effort can be completed in the next week or two. The results will be applied to subsequent data updates we receive from them once complete.

The next datapoint from the PAZ satellite will be received on Monday. We will be working on a data review method for the TSX/PAZ data that will incorporate an evaluation of velocity and acceleration. The dataset has grown with time, and will hopefully allow for an estimate of rate change that is not too influenced by the accuracy range of the measurements."

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

September 12, 2023 Update

Date Signed: September 16, 2023
Austin, TX

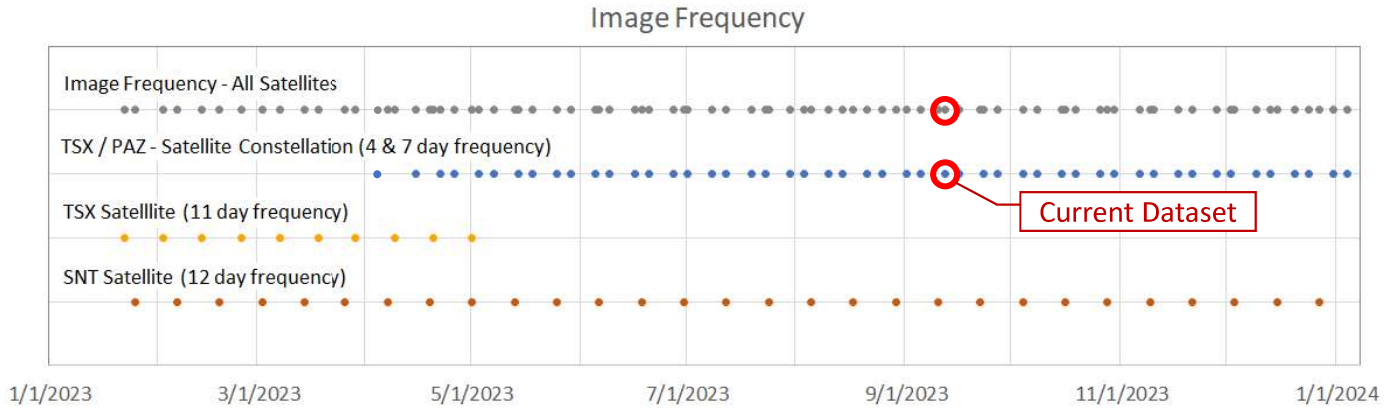
Nathaniel L. Byars, P.E.
Principal Engineer
Louisiana License No. 40697

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

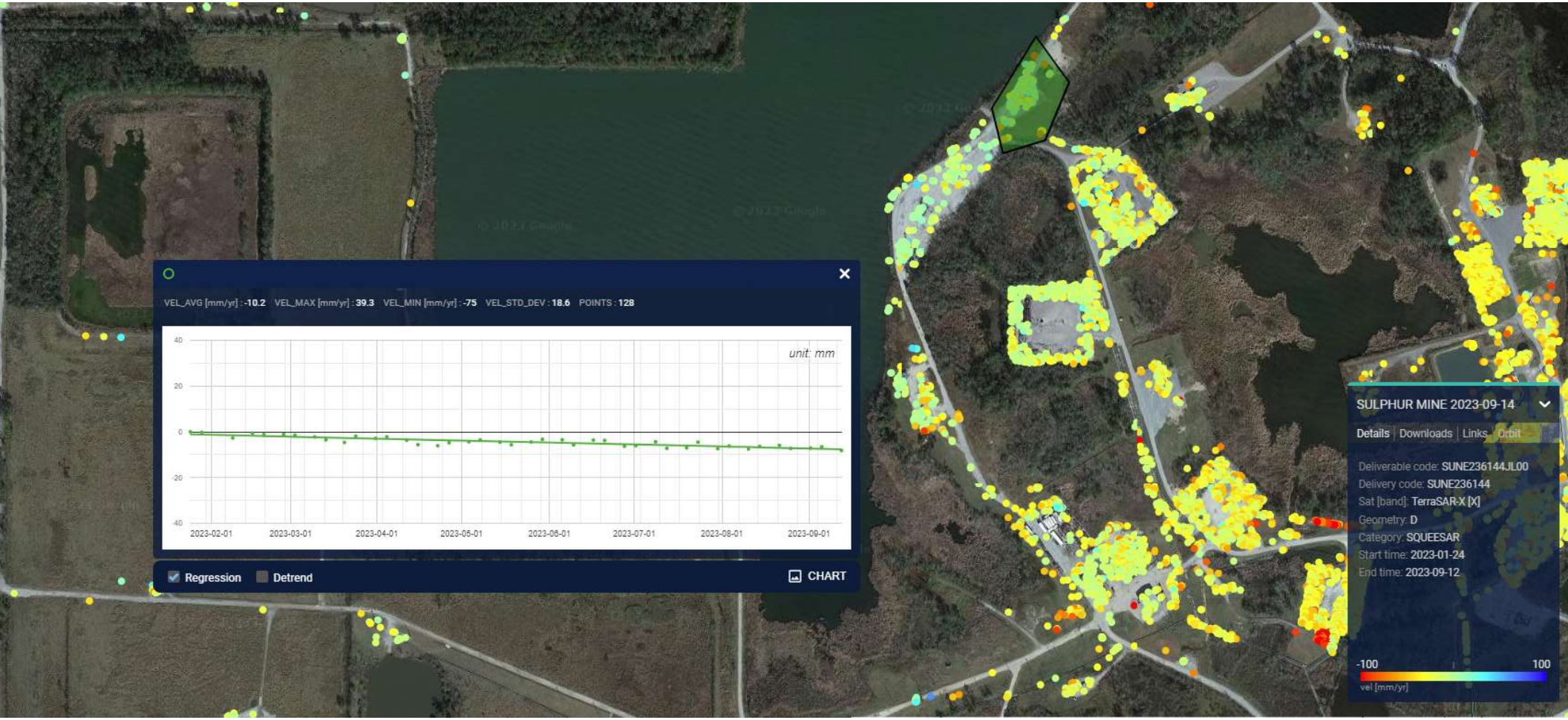


Overview and Monitoring History

- 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 considered 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 Tuesday September 12, 2023
- The following slides present the time series and associated linear trends for each location evaluated from this dataset
- The prior recent updates from the TSX/PAZ satellite constellation have begun to show some below trend measurements in the areas reviewed, including the most recent measurement. This is also occurring in certain areas further away from the dome. TREA is currently reprocessing the TSX/PAZ dataset in an effort to confirm the accuracy of the measurements due to these observations.

TSX/PAZ Constellation – September 12, 2023 Update

PPG 21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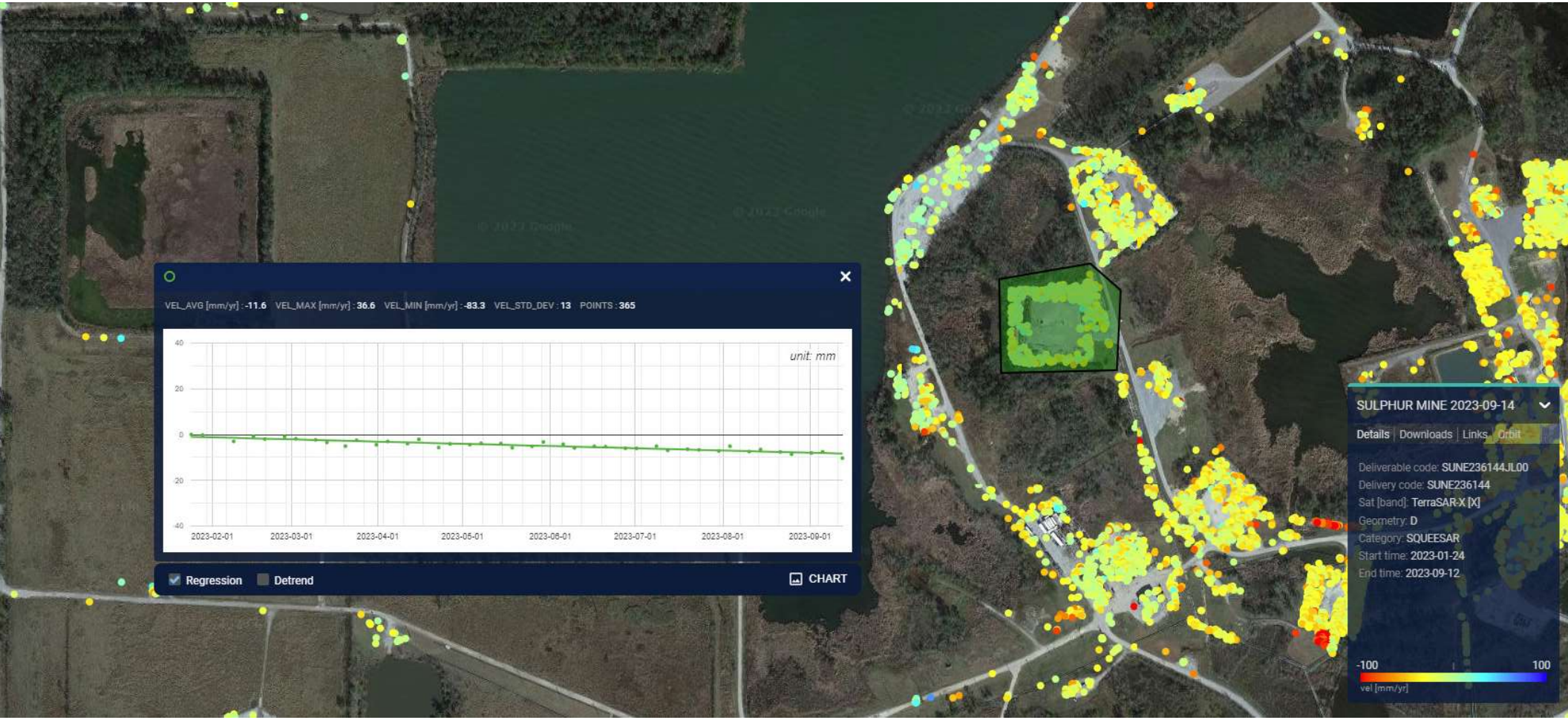
VEL_MAX [mm/yr] : 39.3
VEL_MIN [mm/yr] : -75
VEL_STD_DEV : 18.6
POINTS : 128
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
Regression
Detrend
CHART
SULPHUR MINE 2023-09-14
Details
Downloads
Links
Orbit
Deliverable code: SUNE236144.JL00
Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

PPG 6


VEL_AVG [mm/yr] : -17.4 VEL_MAX [mm/yr] : 43.4 VEL_MIN [mm/yr] : -87.4 VEL_STD_DEV : 17.1 POINTS : 443
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
Regression
Detrend
CHART
SULPHUR MINE 2023-09-14
Details | Downloads | Links | Orbit
Deliverable code: SUNE236144JL00
Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

PPG 7


VEL_AVG [mm/yr] : -11.6 VEL_MAX [mm/yr] : 36.6 VEL_MIN [mm/yr] : -83.3 VEL_STD_DEV : 13 POINTS : 365
unit: mm
40
20
0
20
40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
Regression
Detrend
CHART
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Details | Downloads | Links | Orbit
Deliverable code: SUNE236144.JL00
Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

PPG 22


VEL_AVG [mm/yr] : -23.2
VEL_MAX [mm/yr] : 24.2
VEL_MIN [mm/yr] : -104.5
VEL_STD_DEV : 19
POINTS : 108
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
Regression
Detrend
CHART
SULPHUR MINE 2023-09-14
Details
Downloads
Links
Orbit
Deliverable code: SUNE236144JL00
Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

AOI #1


VEL_AVG [mm/yr] : -19
VEL_MAX [mm/yr] : 44.9
VEL_MIN [mm/yr] : -81.6
VEL_STD_DEV : 20.3
POINTS : 237
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
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Orbit
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Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

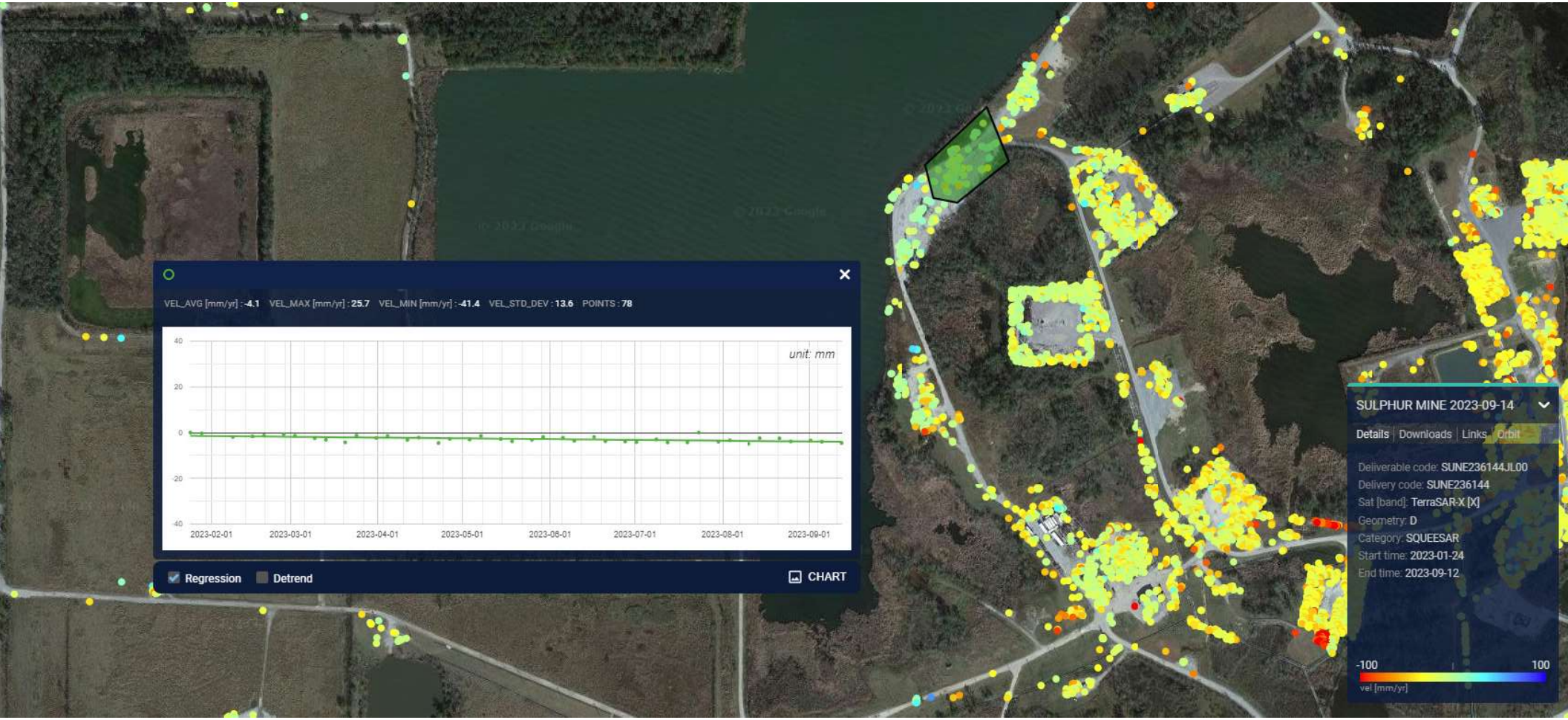
AOI #2


VEL_AVG [mm/yr] : -11.5 VEL_MAX [mm/yr] : 39.7 VEL_MIN [mm/yr] : -89.7 VEL_STD_DEV : 21.3 POINTS : 117
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
Regression
Detrend
CHART
SULPHUR MINE 2023-09-14
Details | Downloads | Links | Orbit
Deliverable code: SUNE236144.JL00
Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

AOI #3


VEL_AVG [mm/yr] : 0.7 VEL_MAX [mm/yr] : 38.7 VEL_MIN [mm/yr] : -48.9 VEL_STD_DEV : 12.2 POINTS : 144
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
Regression
Detrend
CHART
SULPHUR MINE 2023-09-14
Details | Downloads | Links | Orbit
Deliverable code: SUNE236144JL00
Delivery code: SUNE236144
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]

AOI #4


VEL_AVG [mm/yr] : -4.1 VEL_MAX [mm/yr] : 25.7 VEL_MIN [mm/yr] : -41.4 VEL_STD_DEV : 13.6 POINTS : 78
unit: mm
40
20
0
-20
-40
2023-02-01
2023-03-01
2023-04-01
2023-05-01
2023-06-01
2023-07-01
2023-08-01
2023-09-01
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Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-09-12
-100
100
vel [mm/yr]