Westlake US 2
Received 8/23/2023

# TSX/PAZ Satellite Update
# InSAR Subsidence
August 21, 2023

Longuist comment:

The TSX satellite from the TSX/PAZ constellation (4 & 7-day revisit) passed by Sulphur on Monday August 21. We received the dataset today and noted that a few of the review areas now have three consecutive datapoints falling slightly below trend. Based on past experience this is not enough data to assume a departure from trend is occurring in those areas but we did feel it was worth noting. The attached time series plots have been prepared for reference.

The PAZ data will be received Sunday and it will be reviewed to see if the drop is persisting in any way.

We also reviewed the SNT dataset within the time window of these most recent constellation datapoints. From that review we can clearly see that no drop below trend is being seen in these review areas in the SNT data as of that most recent dataset (8/17).

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

**August 21, 2023 Update**

Date Signed: August 23, 2023
Austin, TX

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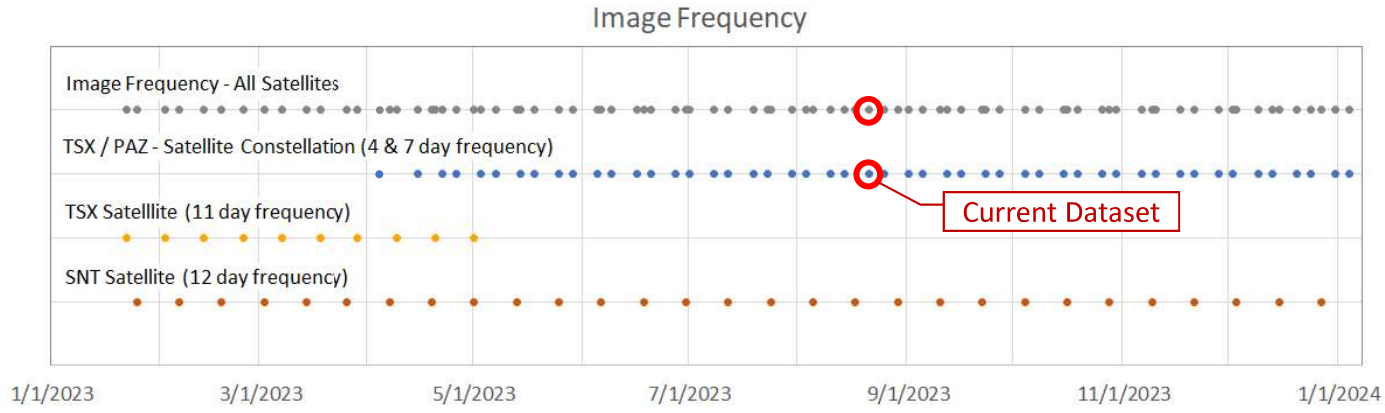
LONQUIST & CO. LLC
PETROLEUM ENGINEERS | ENERGY ADVISORS

# 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 |

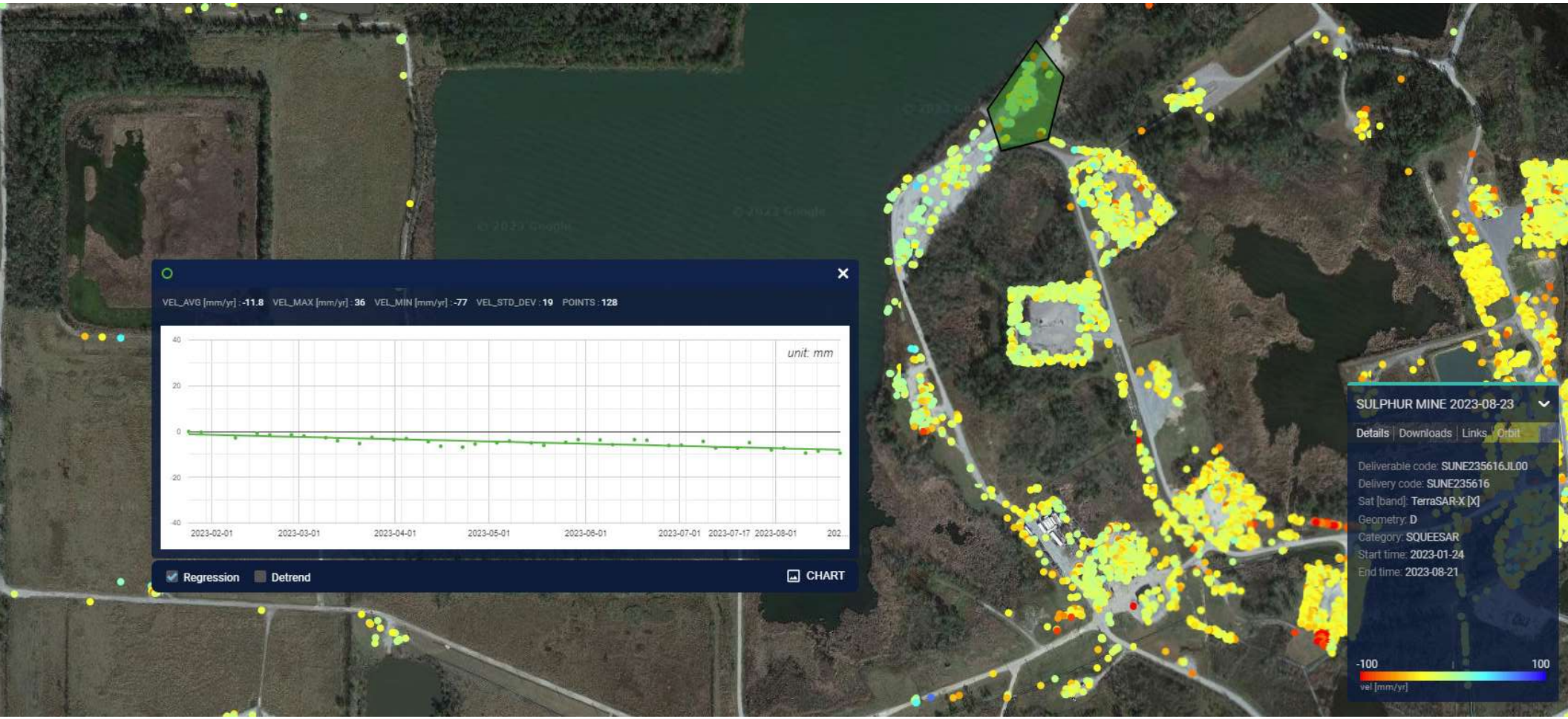


# Overview and Monitoring History

- 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 Monday August 21, 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 – August 21, 2023 Update

# PPG 21


VEL_AVG [mm/yr] : -11.8
VEL_MAX [mm/yr] : 36
VEL_MIN [mm/yr] : -77
VEL_STD_DEV : 19
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
2023-07-17
2023-08-01
Regression
Detrend
CHART
SULPHUR MINE 2023-08-23
Details
Downloads
Links
Orbit
Deliverable code: SUNE235616.JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# PPG 6

VEL_AVG [mm/yr] : -18.1
VEL_MAX [mm/yr] : 45.6
VEL_MIN [mm/yr] : -77.6
VEL_STD_DEV : 16
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
2023-07-17
2023-08-01
Regression
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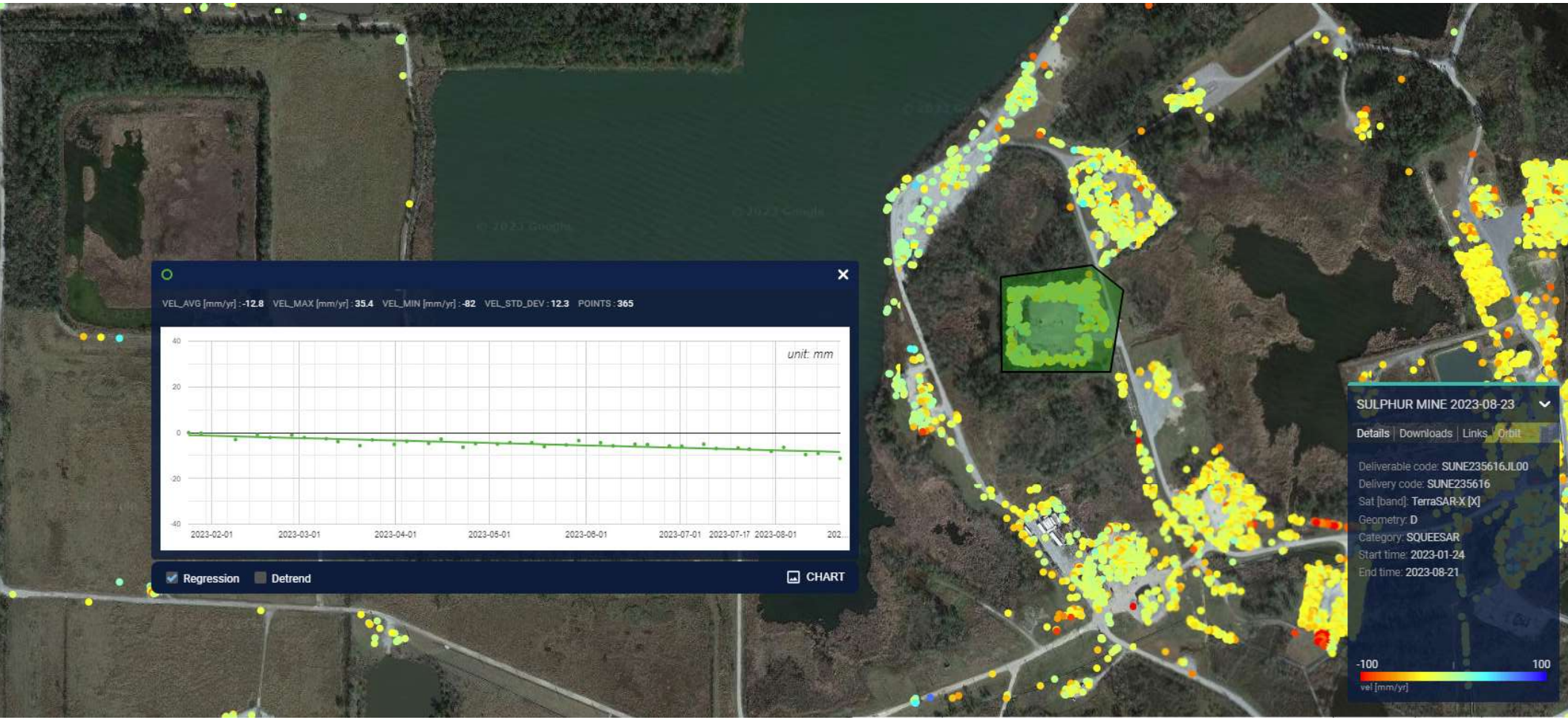
CHART
SULPHUR MINE 2023-08-23
Details
Downloads
Links
Orbit
Deliverable code: SUNE235616JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# PPG 7


VEL_AVG [mm/yr] : -12.8
VEL_MAX [mm/yr] : 35.4
VEL_MIN [mm/yr] : -82
VEL_STD_DEV : 12.3
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
2023-07-17
2023-08-01
Regression
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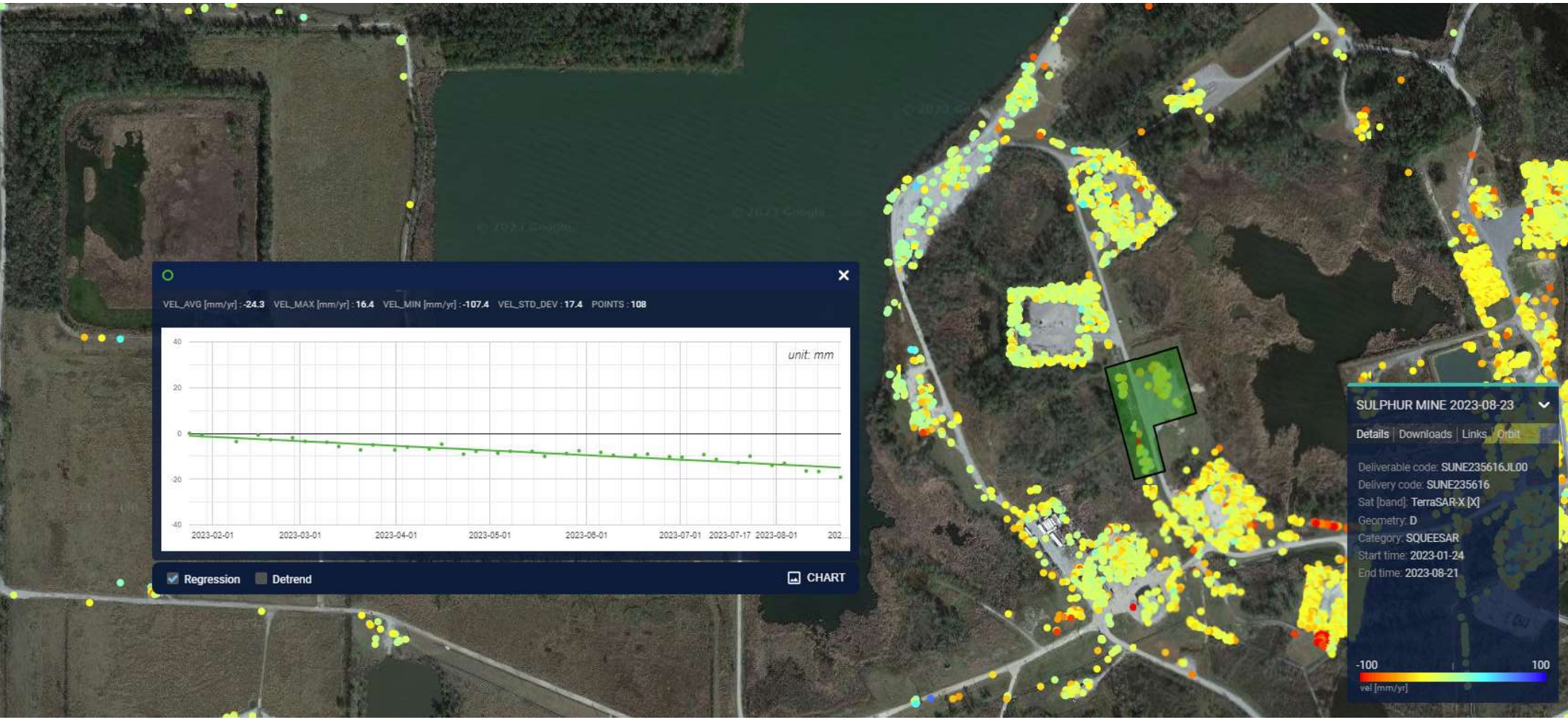
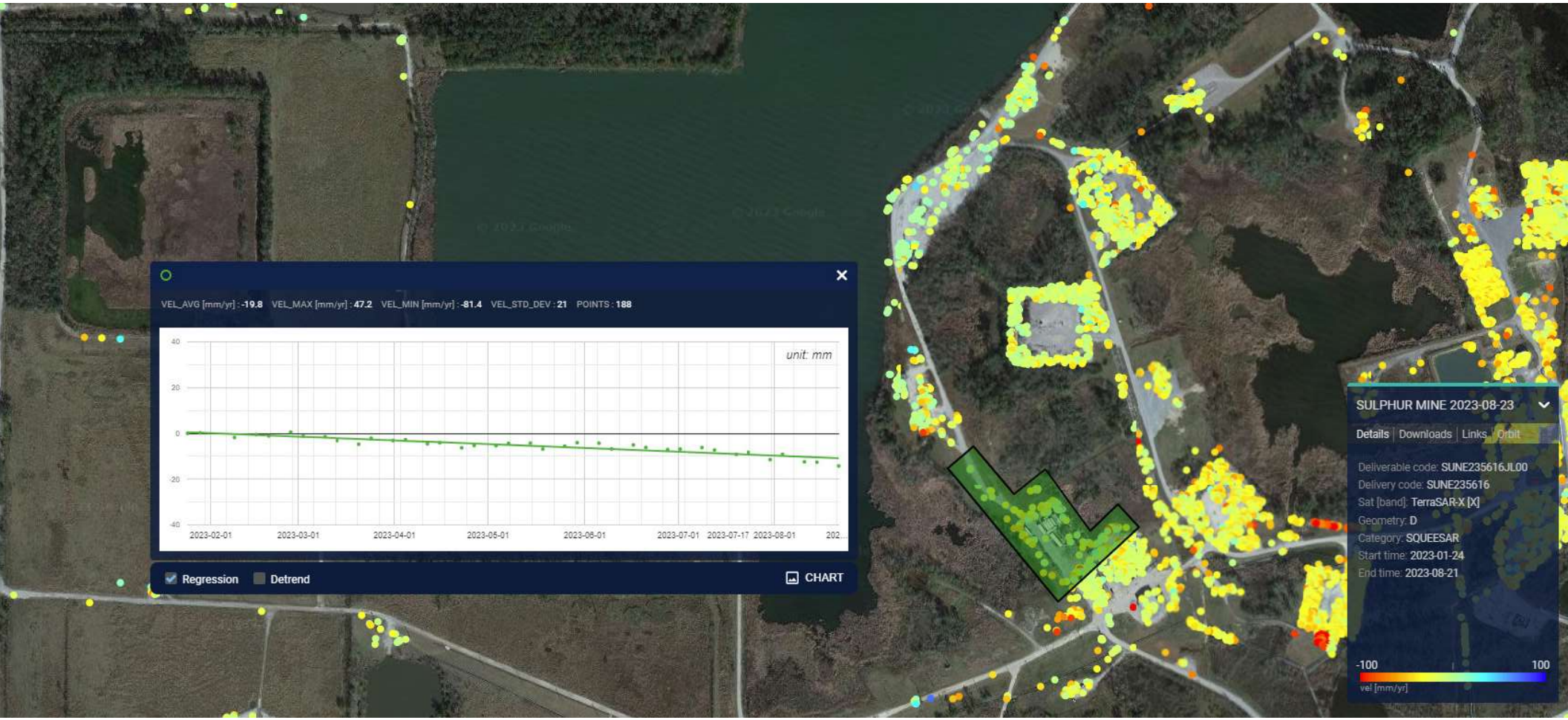
Orbit
Deliverable code: SUNE235616.JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# PPG 22


VEL_AVG [mm/yr] : -24.3
VEL_MAX [mm/yr] : 16.4
VEL_MIN [mm/yr] : -107.4
VEL_STD_DEV : 17.4
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
2023-07-17
2023-08-01
Regression
Detrend
CHART
SULPHUR MINE 2023-08-23
Details
Downloads
Links
Orbit
Deliverable code: SUNE235616JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# AOI #1


VEL_AVG [mm/yr] : -19.8 VEL_MAX [mm/yr] : 47.2 VEL_MIN [mm/yr] : -81.4 VEL_STD_DEV : 21 POINTS : 188
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
2023-07-17
2023-08-01
Regression
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Deliverable code: SUNE235616.JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# AOI #2

VEL_AVG [mm/yr] : -11 VEL_MAX [mm/yr] : 42.2 VEL_MIN [mm/yr] : -85.5 VEL_STD_DEV : 20.1 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
2023-07-17
2023-08-01
Regression
Detrend
CHART
SULPHUR MINE 2023-08-23
Details | Downloads | Links | Orbit
Deliverable code: SUNE235616JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# AOI #3

VEL_AVG [mm/yr] : -0.2 VEL_MAX [mm/yr] : 40.7 VEL_MIN [mm/yr] : -48.8 VEL_STD_DEV : 12.1 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
2023-07-17
2023-08-01
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Detrend
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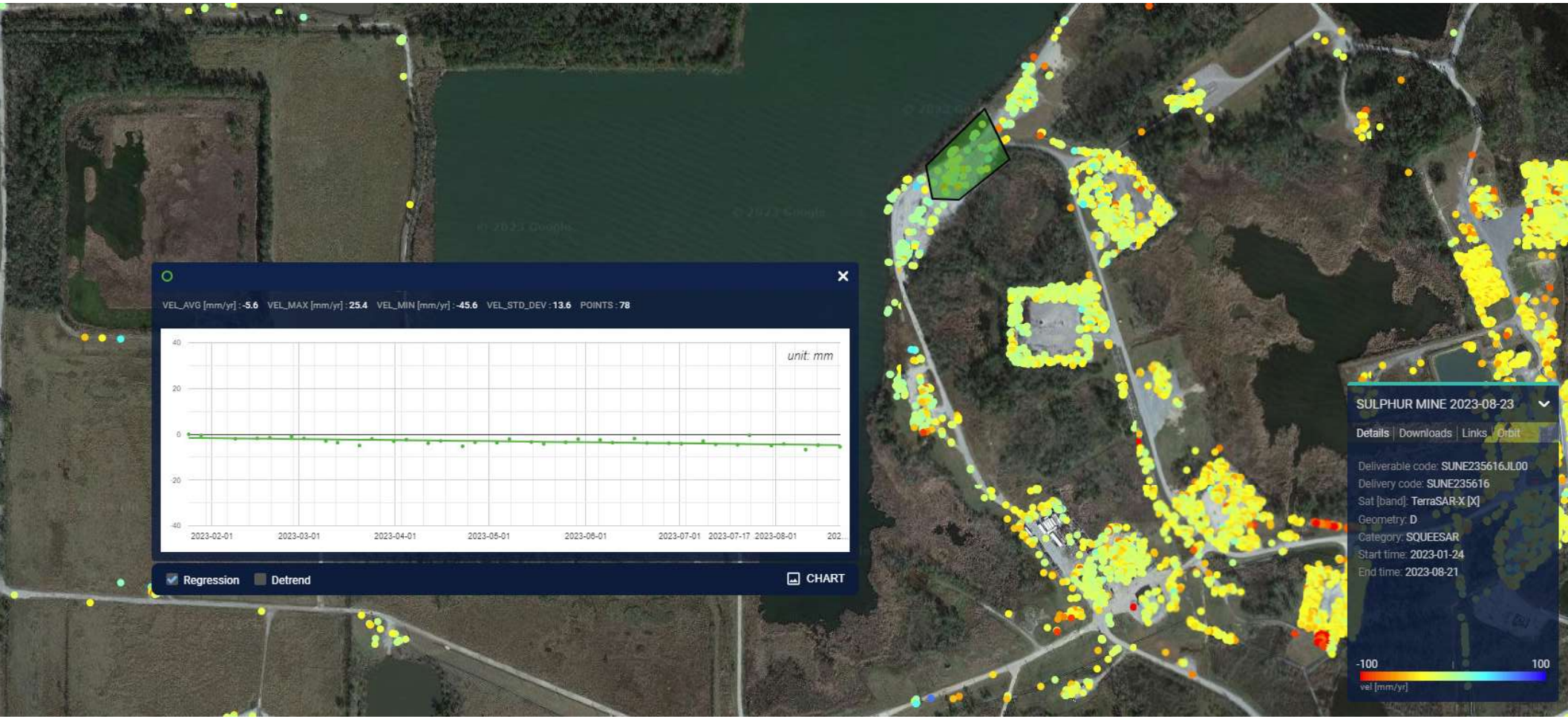
Details | Downloads | Links | Orbit
Deliverable code: SUNE235616JL00
Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]

# AOI #4


VEL_AVG [mm/yr] : -5.6 VEL_MAX [mm/yr] : 25.4 VEL_MIN [mm/yr] : -45.6 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
2023-07-17
2023-08-01
Regression
Detrend
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Delivery code: SUNE235616
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-08-21
-100
100
vel [mm/yr]