TSX/PAZ Satellite Update
InSAR Subsidence
April4, 2023

Lonquist comment:

TREA has completed their development of a baseline stack of radar images collected from the TSX / PAZ satellite constellation. The dataset is comprised of 13 radar images and covers a date range from January 24, 2023 to April 4, 2023. The first dataset update for the constellation is scheduled to be received on April 24, after which updates will be received with each pass of one of the two satellites with a 4 & 7-day revisit frequency.

The data was reviewed and it was verified that none of the datapoint areas around the dome and caverns near the western flank are showing deviation from their linear trend. The attached time series plots have been prepared for reference.

Submitted by: Nathaniel Byars (Lonquist)

TSX/PAZ Constellation Baseline Dataset

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

Sulphur Dome
Westlake Chemicals

April 4, 2023 Update

Date Signed: April 21, 2023
Austin, TX

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PETROLEUM ENGINEERS   ENERGY ADVISORS

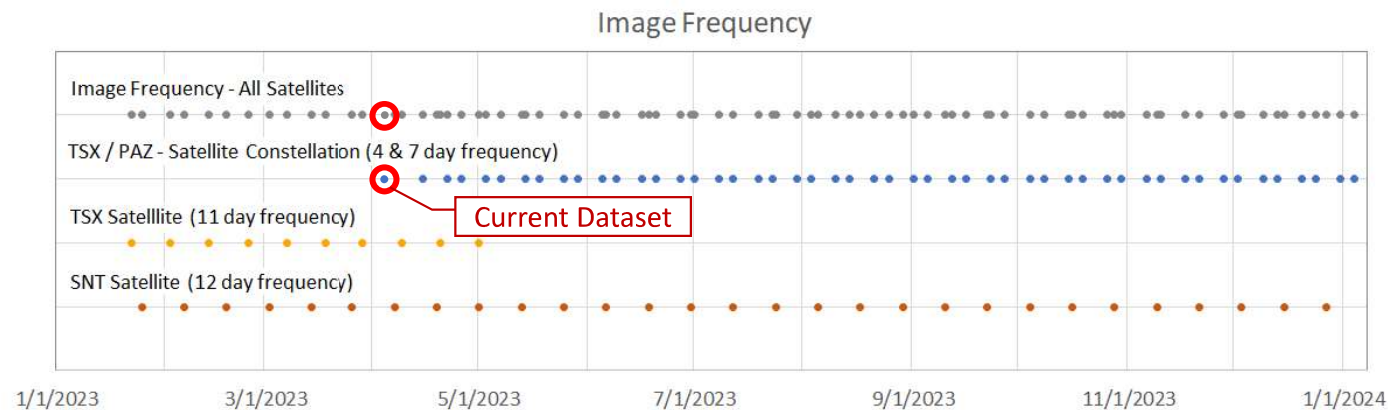# Parameters of InSAR Dataset and Collection Frequency

- Current Satellite and Data Delivery Frequency:
  - Sentinel 1 (SNT) 12 days
  - TerraSAR-X (TSX) 11 days
  - 5.40-day avg. frequency
- Starting April 2023:
  - Sentinel 1 (SNT) 12 days
  - TSX / PAZ Constellation 4 & 7 days
  - 3.96-day avg. frequency

	Sentinel-1	TerraSAR-X	TSX/PAZ Constellation	
			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

Image Frequency

Image Frequency - All Satellites
TSX / PAZ - Satellite Constellation (4 & 7 day frequency)
TSX Satelllite (11 day frequency)
SNT Satellite (12 day frequency)

Current Dataset

1/1/2023   3/1/2023   5/1/2023   7/1/2023   9/1/2023   11/1/2023   1/1/2024

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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 baseline dataset for the TSX/PAZ satellite constellation (4 & 7-day revisits) contains 13 radar images and covers a time span from January 24, 2023 to April 4, 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 Satellite – April 4, 2023 Update

PPG 21

PPG 6

VEL_AVG [mm/yr] : −42.8   VEL_MAX [mm/yr] : −21.6   VEL_MIN [mm/yr] : −70.3   VEL_STD_DEV : 8.4   POINTS : 443

unit: mm

☑ Regression   ☐ Detrend   🖼 CHART

SULPHUR MINE 2023−04−20 ⌄

Details | Downloads | Links | Orbit

Deliverable code: SUNE232617JL01
Delivery code: SUNE232617
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-04-04

−100   100
vel [mm/yr]

PPG 7

PPG 22

AOI #1

VEL_AVG [mm/yr] : **−37.3**   VEL_MAX [mm/yr] : **−13.6**   VEL_MIN [mm/yr] : **−73.2**   VEL_STD_DEV : **10.2**   POINTS : **122**

unit: mm

☑ Regression   ☐ Detrend   🖼 CHART

SULPHUR MINE 2023-04-20 ⌄

Details | Downloads | Links | Orbit

Deliverable code: SUNE232617JL01
Delivery code: SUNE232617
Sat [band]: TerraSAR-X [X]
Geometry: D
Category: SQUEESAR
Start time: 2023-01-24
End time: 2023-04-04

−100 ■■■■■■■■ 100

vel [mm/yr]

AOI #2

AOI #3

AOI #4