SkyGeo

Detecting anomalies in InSAR Time series

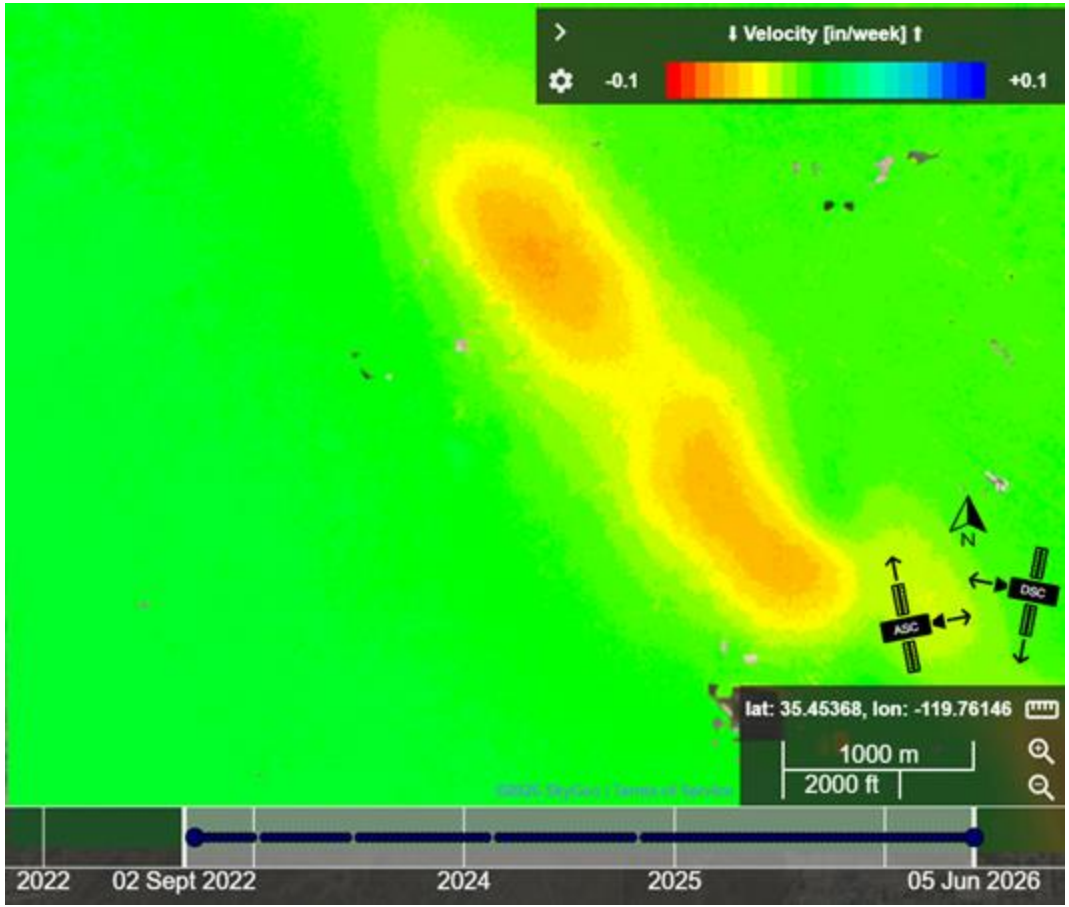
Mark Bemelmans and Pieter Bas Leezenberg

Fringe 2026 - 16 June

Default product

Velocity or displacement map

- No dynamics
- No interaction
- Remains similar across many monitoring updates

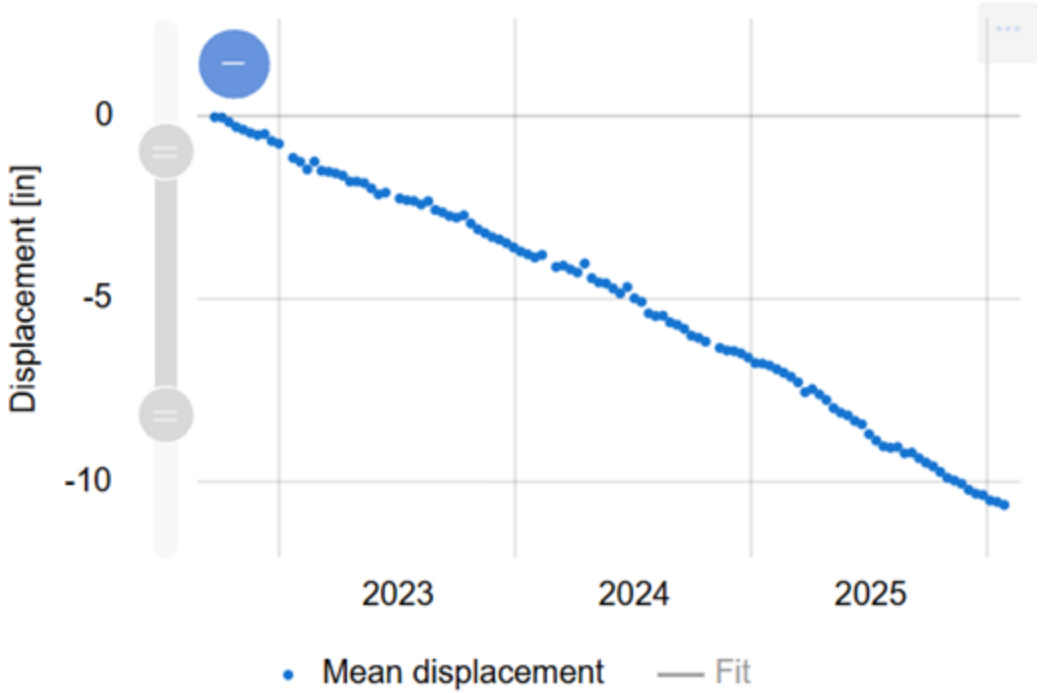


Motivation

“I just want to know when something changes”

“Is there a change because of our [construction / extraction / injection]?”

“I want to know where to look first”



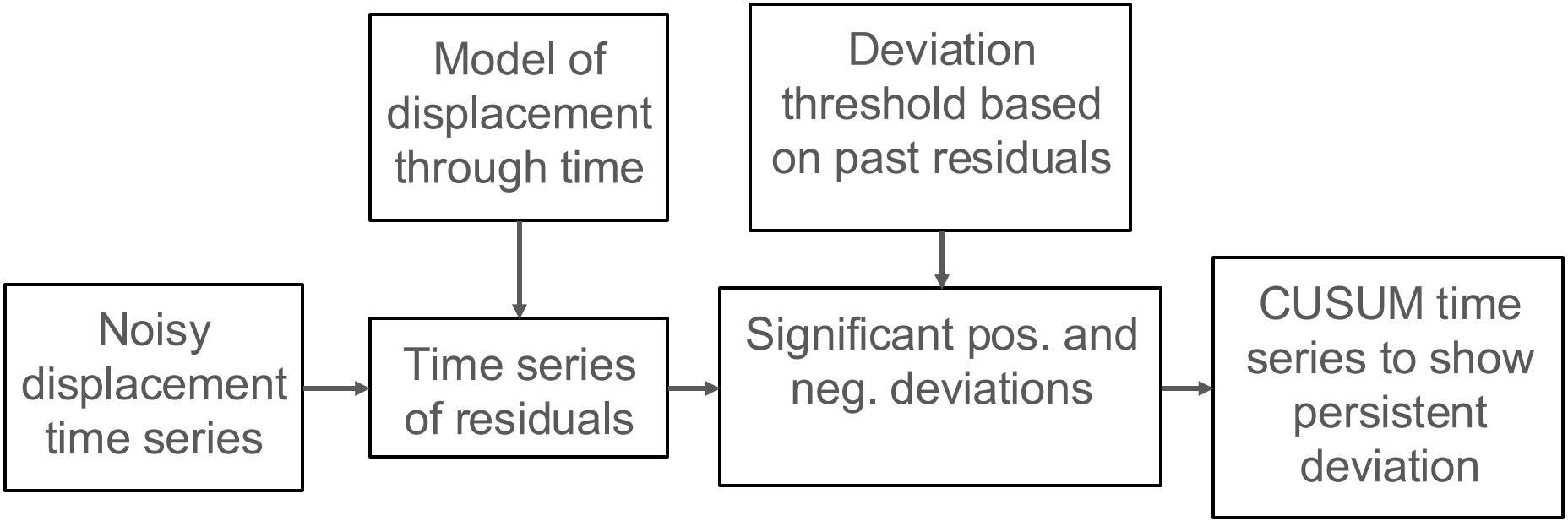
SkyGeo

Requirements

1. Simple → explainable to non-experts
1. General → to fit a wide range of applications
1. Tunable → one man's noise is another man's signal
1. Scalable → generation of data has outpaced our ability to inspect it all

SkyGeo

The Concept



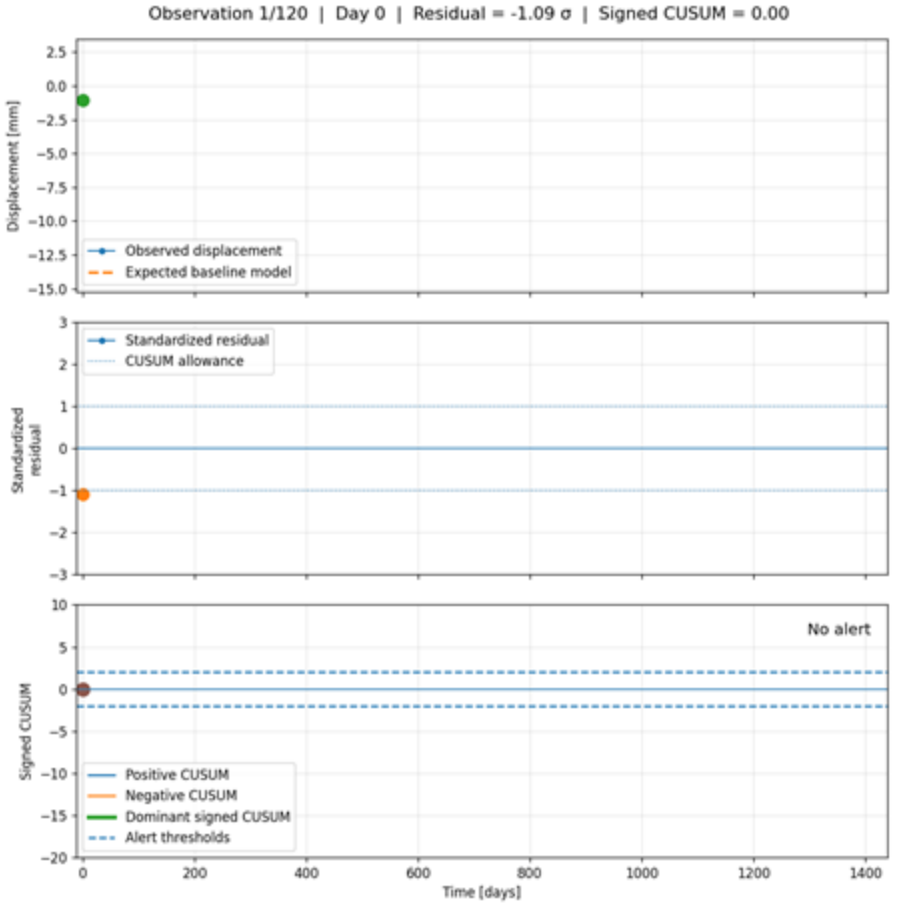
Chang & Gan 1995, Albino et al., 2020

SkyGeo

Simulated Example

Simulated noisy time series

Deviation introduced at Observation 85 (day 1020)



Test Case 1 - Localized subsidence on a heap leach

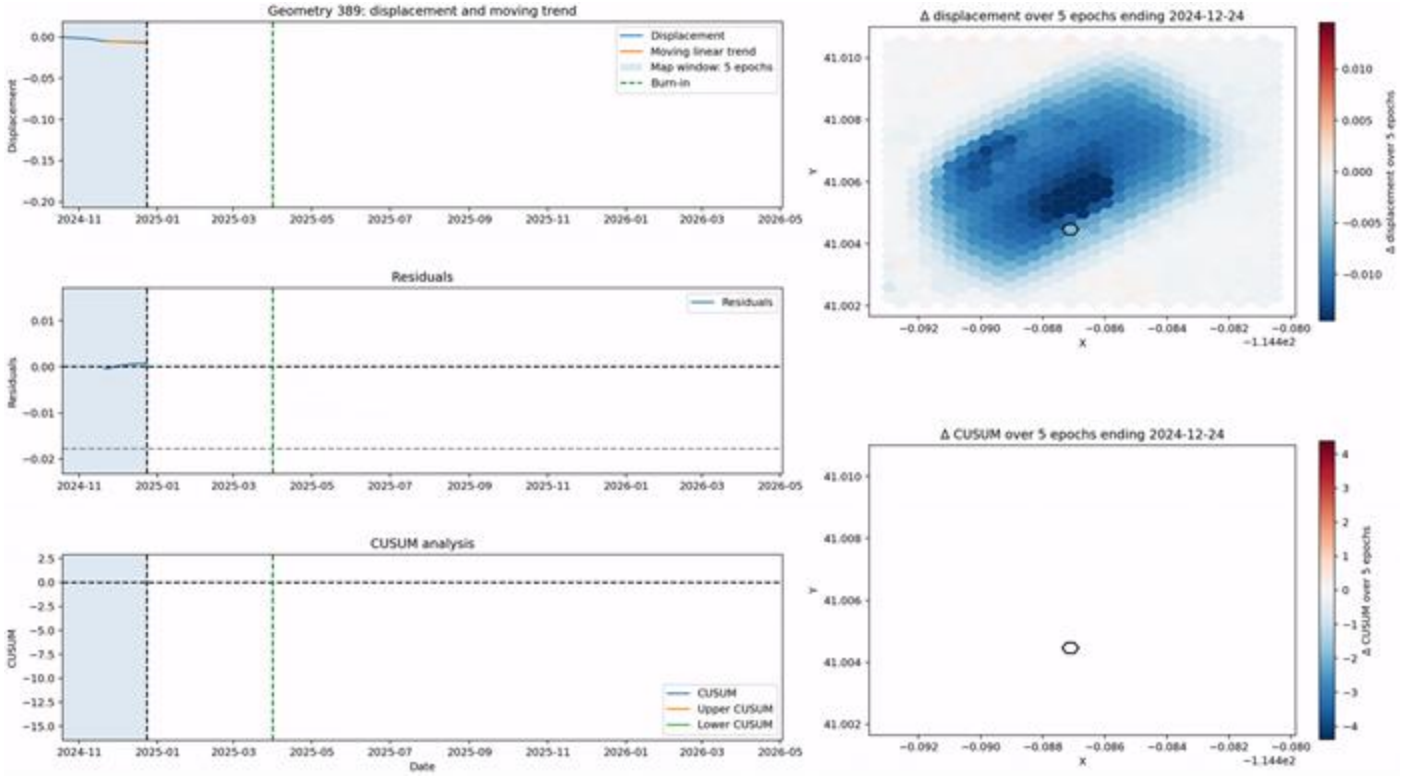
Gold ore heap leach

Sprayed with acid solution to leach gold from the ore

Slope failure can be deadly and is polluting to the environment

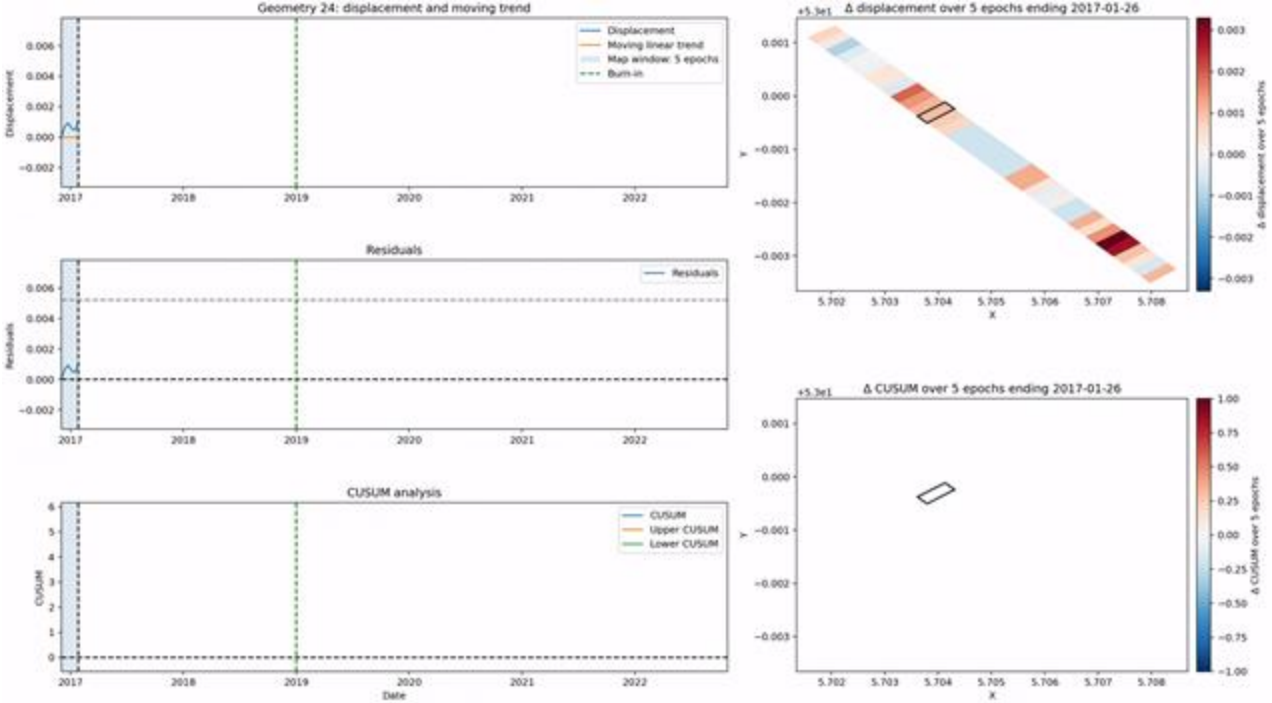
SkyGeo

Test Case 1 - Localized subsidence on a heap leach

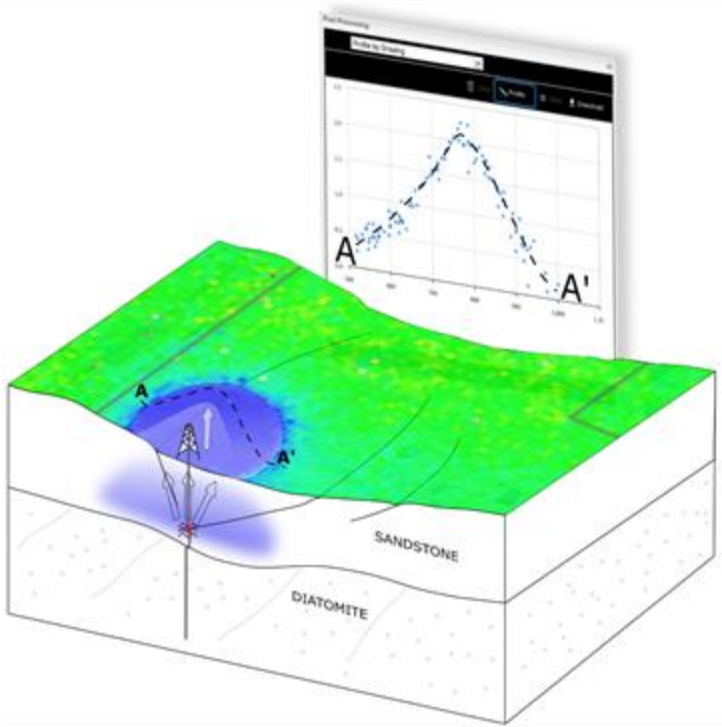


Test Case 2 - Uplift of bridge segment

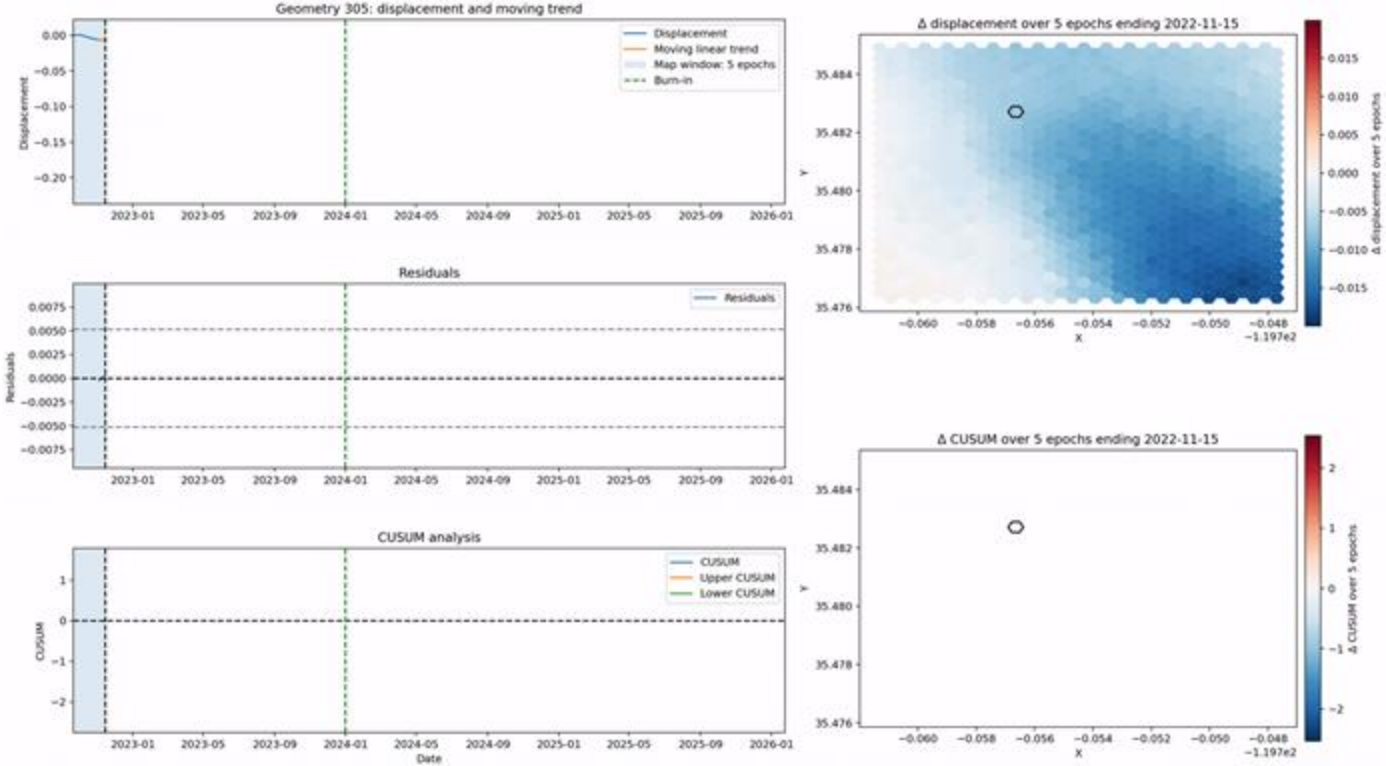
Test Case 2 - Uplift of bridge segment



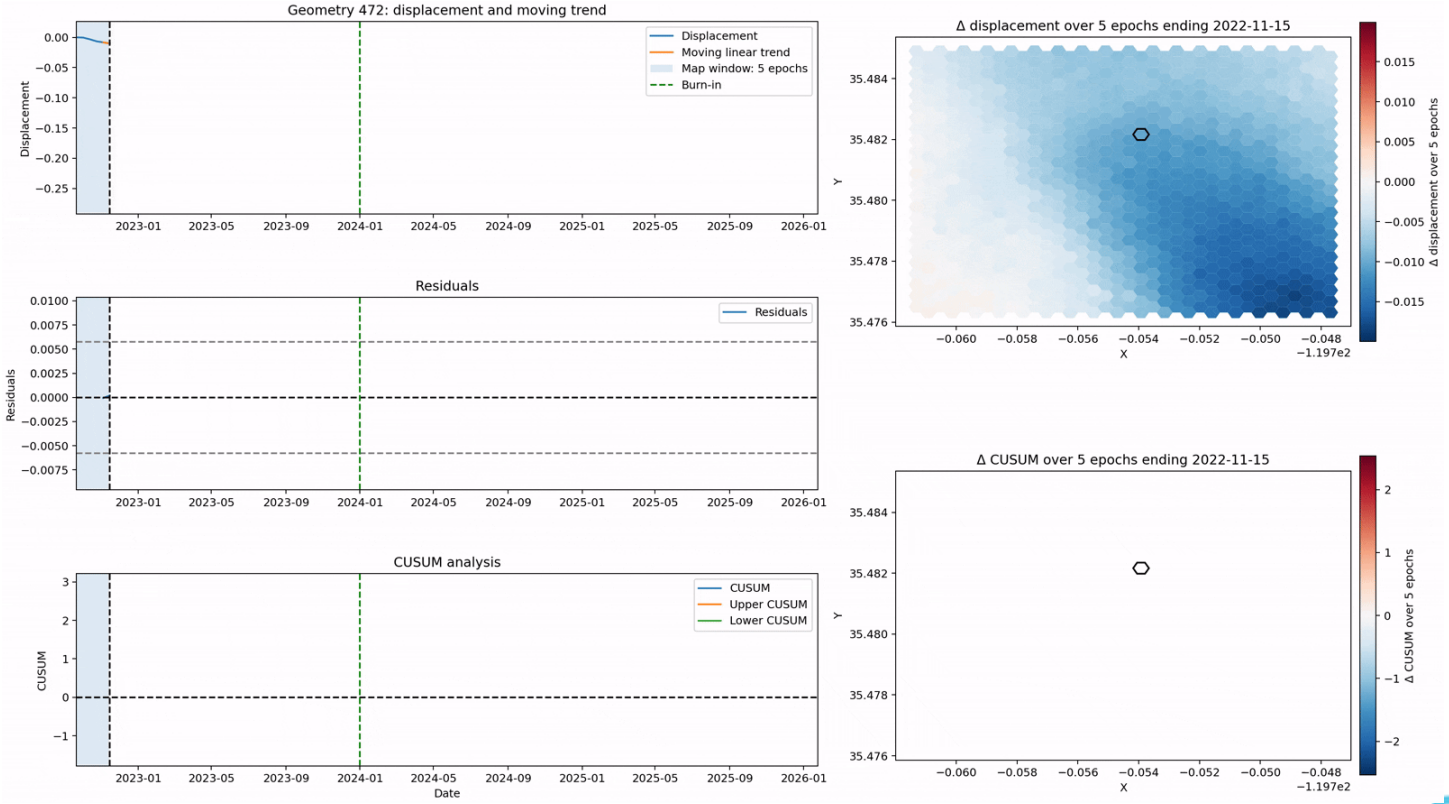
Test Case 3 - Water injection at an oil field



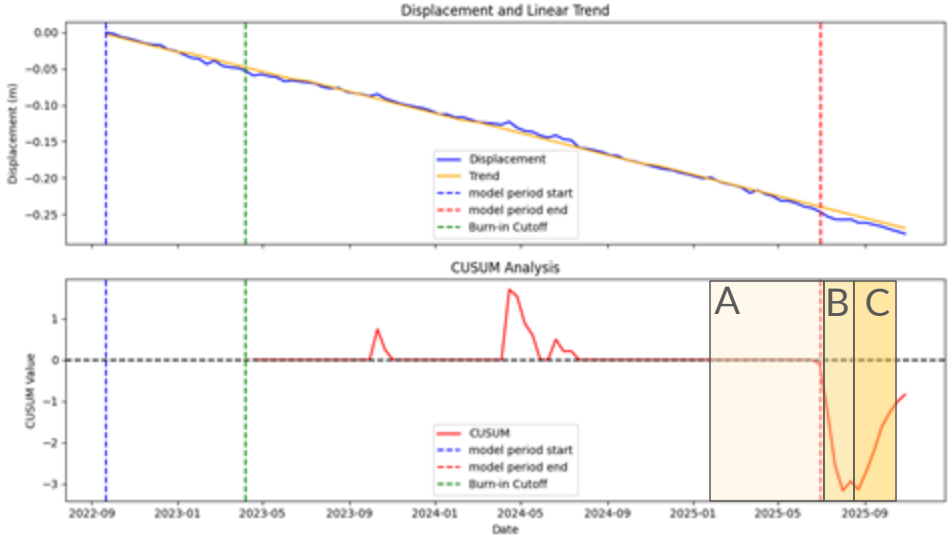
Test Case 3 - Water injection at an oil field



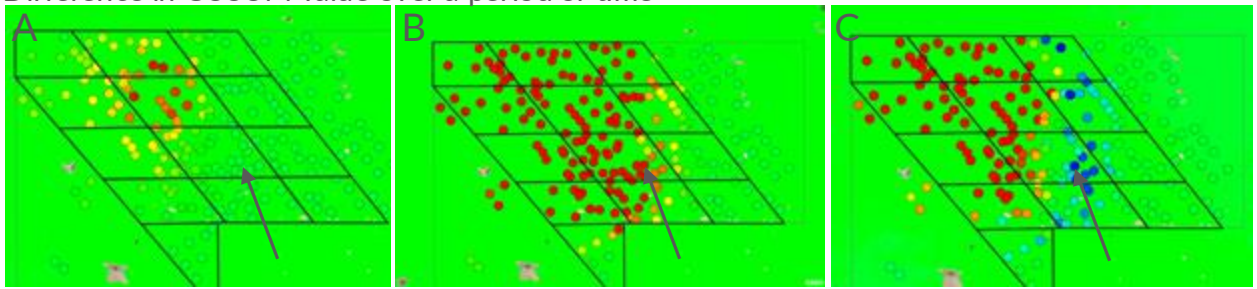
Test Case 3 - Water injection at an oil field



Test Case 3 - Water injection at an oil field



Difference in CUSUM value over a period of time

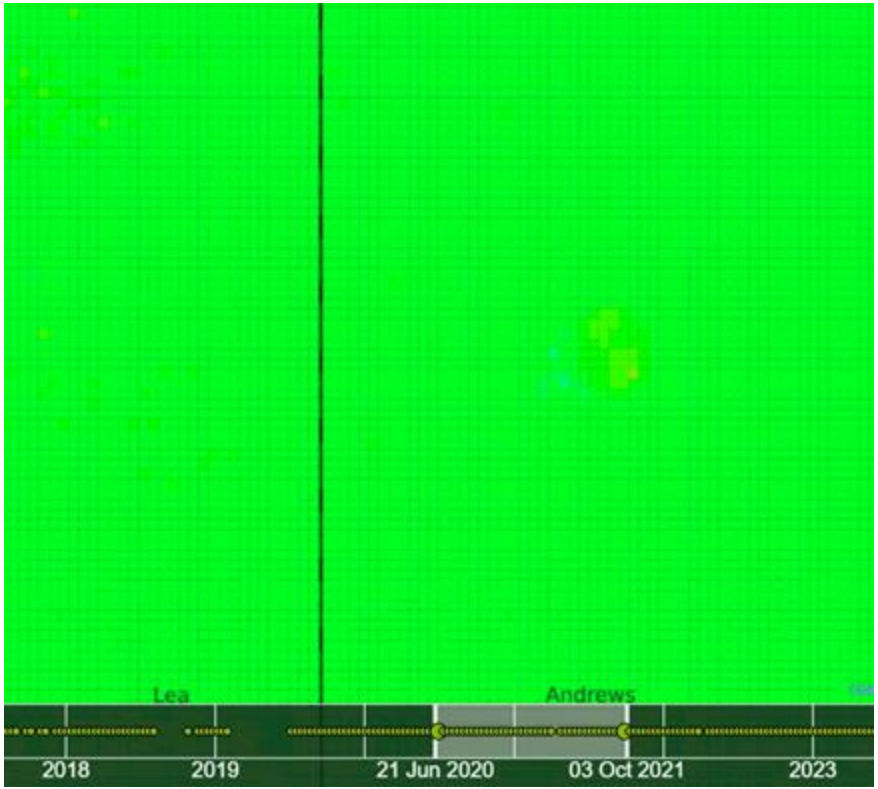


Tools of InSAR consultancy service

“I just want to know when something changes”

“Is there a change because of our [construction / extraction / injection]?”

“I want to know where to look first”



Summary

1. A linear rate or total displacement map hides true dynamics
2. Interpreting InSAR at scale requires tool to investigate anomalies
3. Each application is different, you need to adapt
4. Don’t overcomplicate.