



Opportunity for an Australian Ground Motion Data Infrastructure

Matt Garthwaite

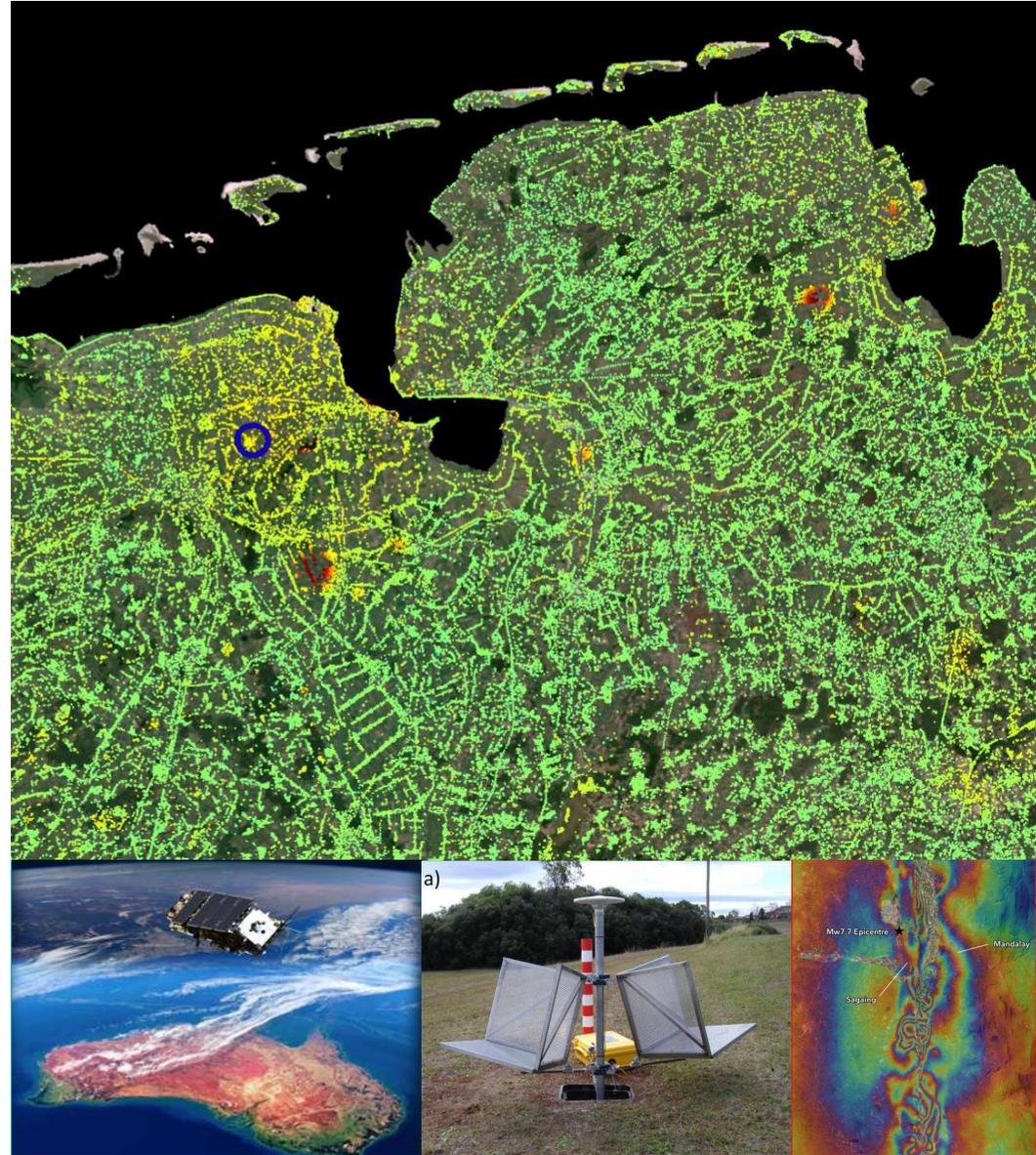
Matt King, Uni of Tasmania

Tim Ravillings, AuScope

2-10 Nov 2022 in Darwin, Australia
Presented at the 1st Australian Geospatial Week 2022
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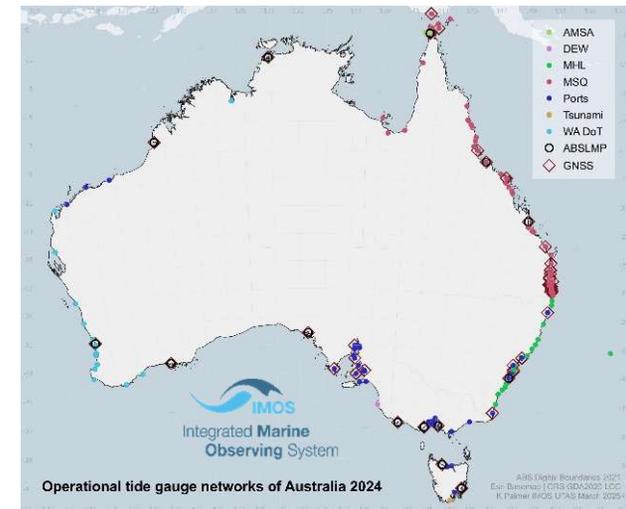
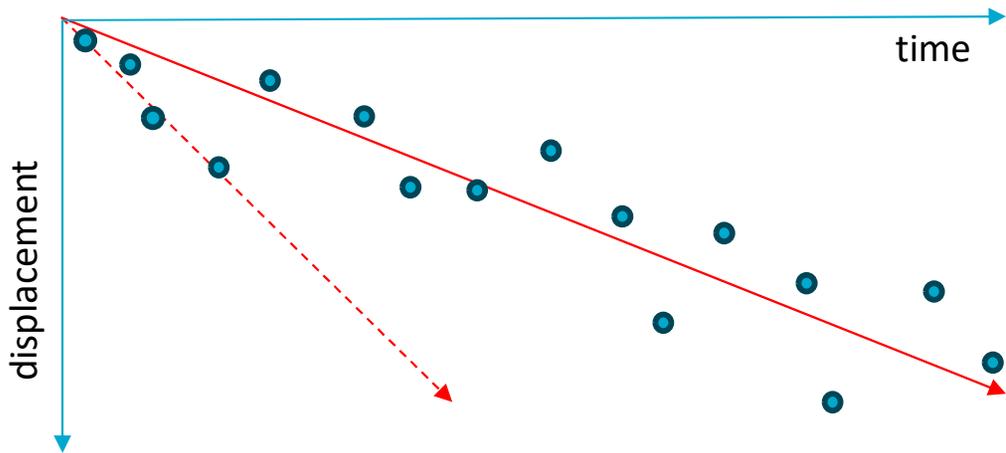
Australia's National Science Agency





Sea Level Rise and Vertical Land Motion

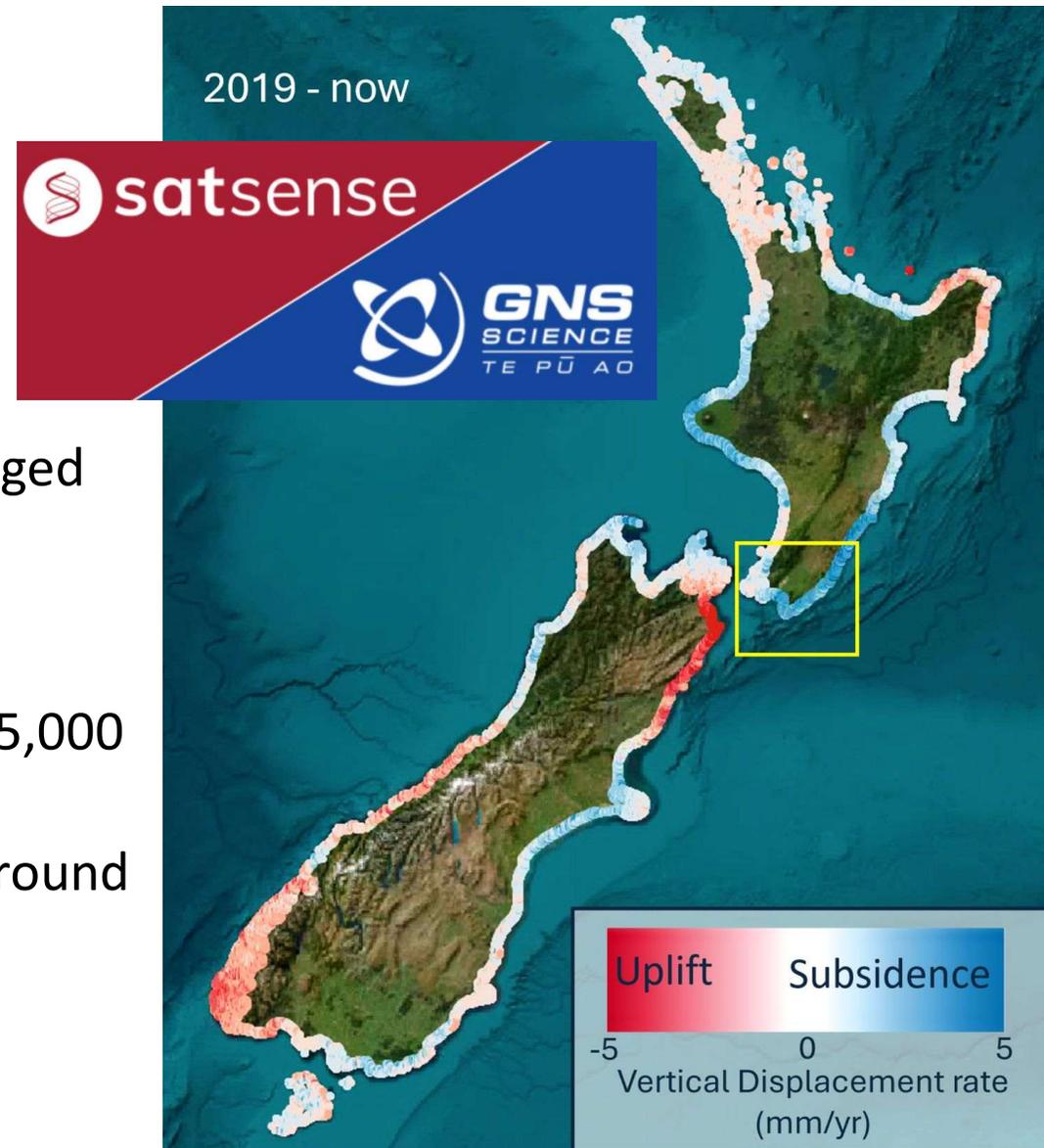
- CSIRO hosted a workshop in September 2024 that considered the observing needs for coastal sea level rise research in Australia.
- Two needs were identified:
 1. Long time series of observations to resolve the expected rates of VLM (0 to -2 mm/yr in Australia; Riddell et al 2020)
 2. Spatially dense observations around the whole coastline (~60,000 km) are needed to gap fill between existing geodetic infrastructure.





New Zealand

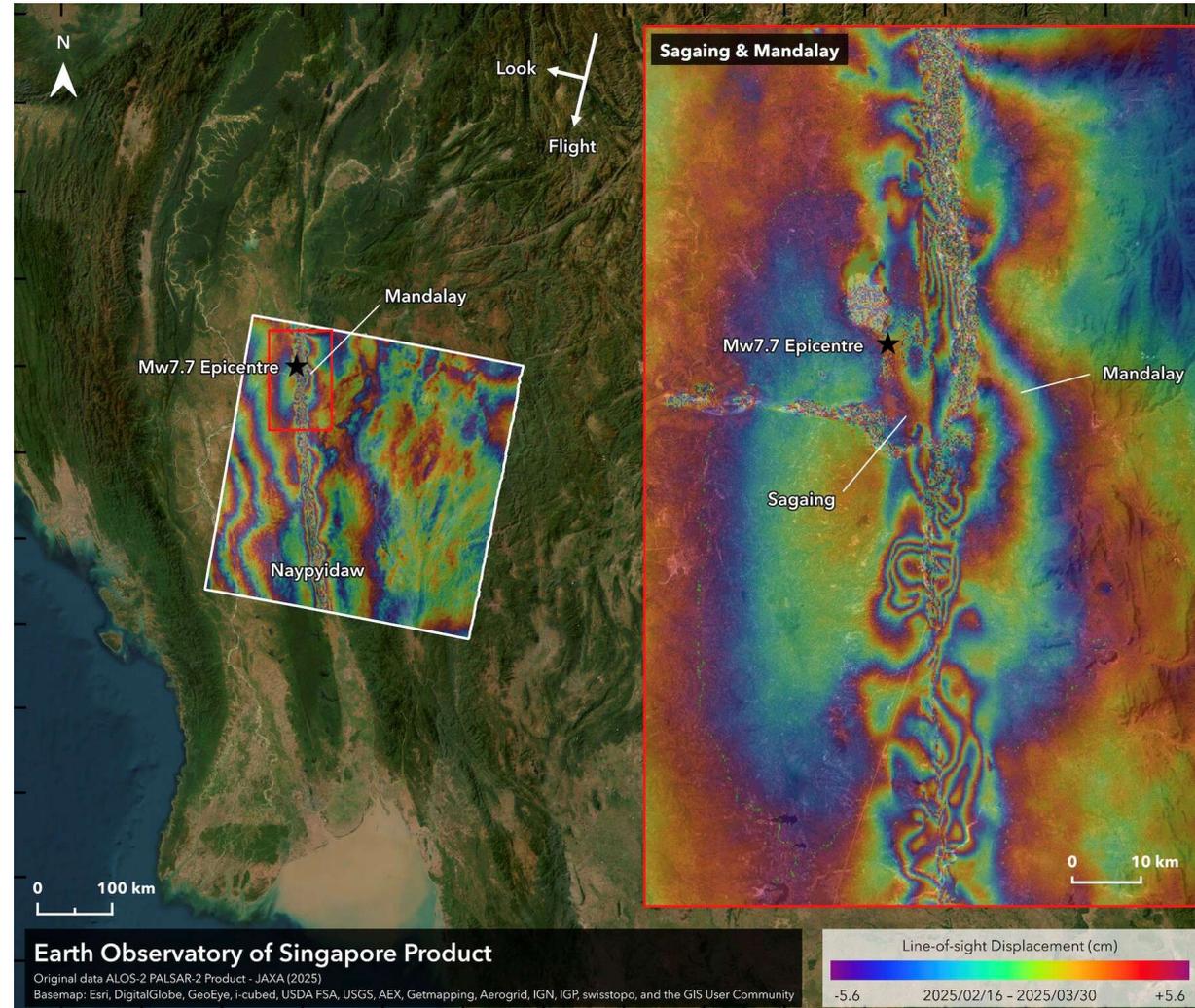
- In New Zealand, GNS Science has engaged with SatSense to produce nationwide ground motion products with **satellite InSAR**
- VLM rate measurements around the 15,000 km coastline of New Zealand
- Variability of ~ 10 mm/yr is observed around the coastline





What is InSAR?

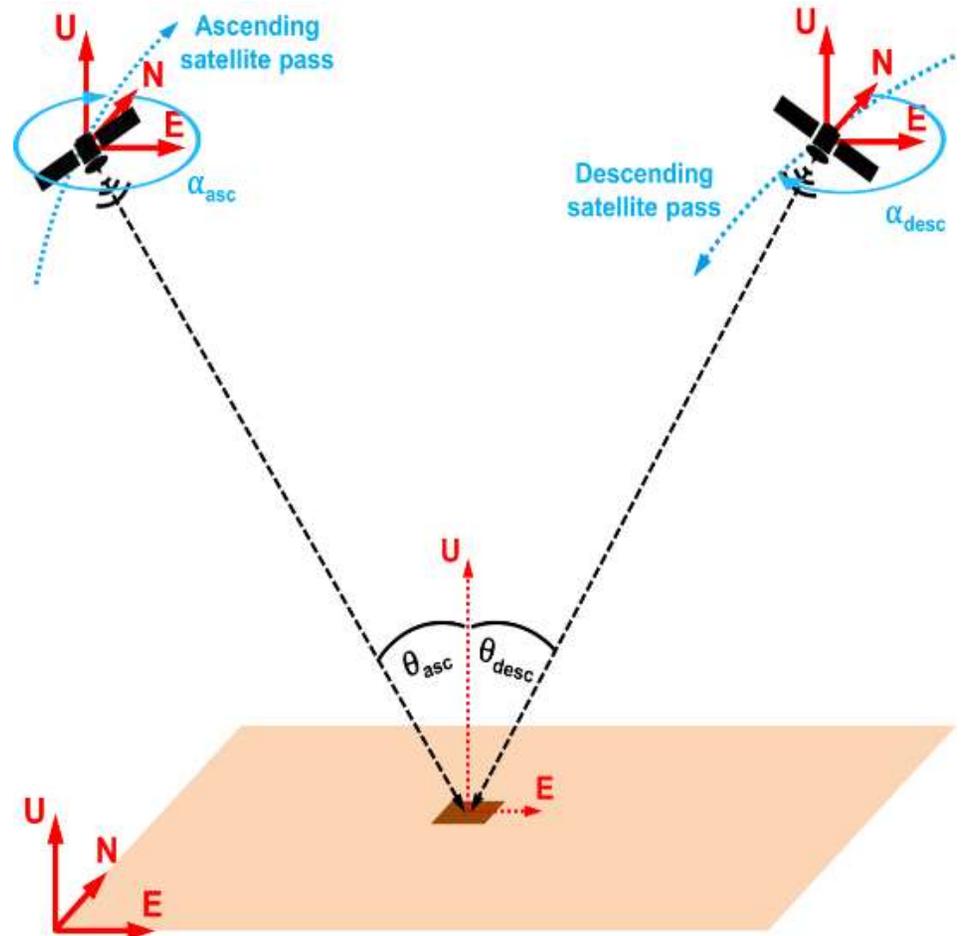
- Makes use of radar images collected by active SAR sensors on orbiting satellites (e.g. Sentinel-1)
- Image pairs are “interfered” to generate maps of phase change – “interferogram”
- Collections of interferograms can be decomposed to produce ground motion time series maps





What is InSAR?

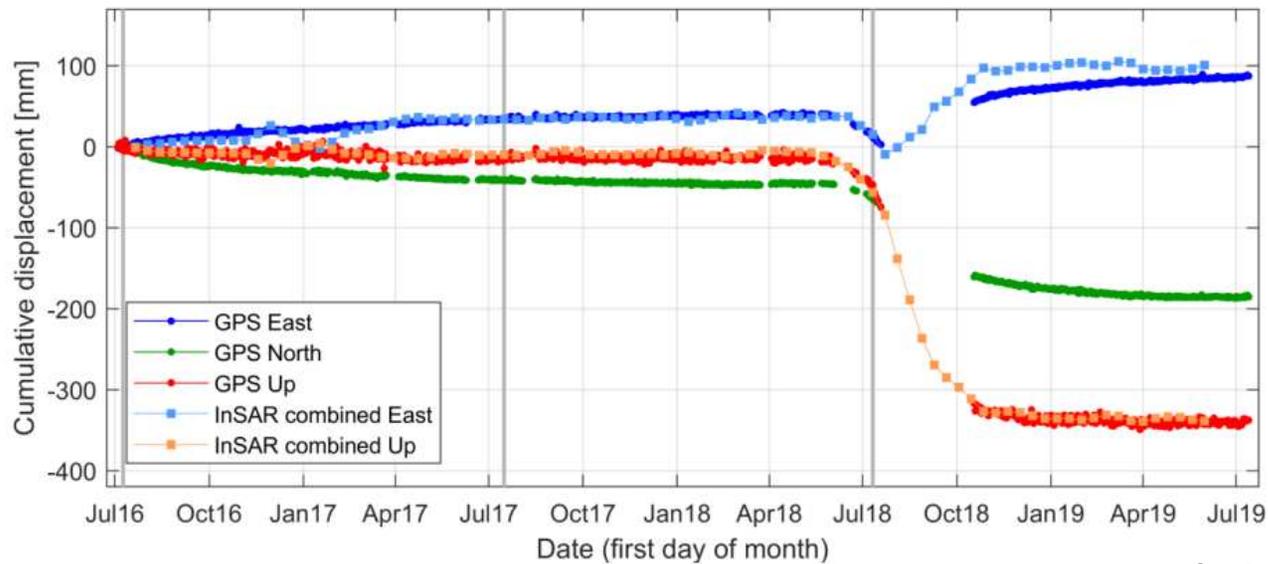
- But conventional InSAR is limited by its 1D “Line of sight” viewing geometry
- 3D ground motion is mapped into the line of sight
- VLM can be accurately retrieved if multiple viewing geometries are available (e.g. ascending and descending orbit passes)





Validation of InSAR

- Validation of InSAR-derived ground motions is crucial for correct interpretation of data
- Comparison with in-situ data from GNSS
- Millimetric precision, Centimetric accuracy



Content credit: Geoscience Australia



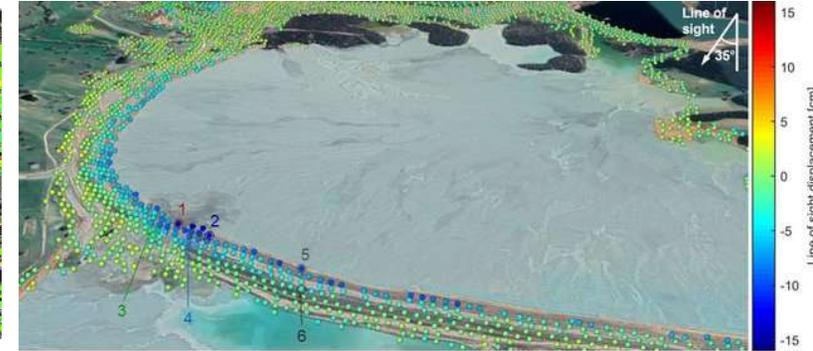
Application of InSAR

Content credit: Geoscience Australia

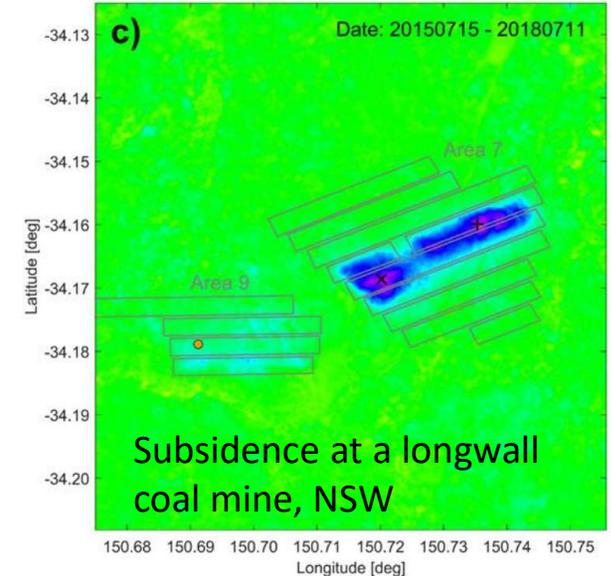
Urban monitoring, Melbourne



Cadia Tailings Dam monitoring, NSW



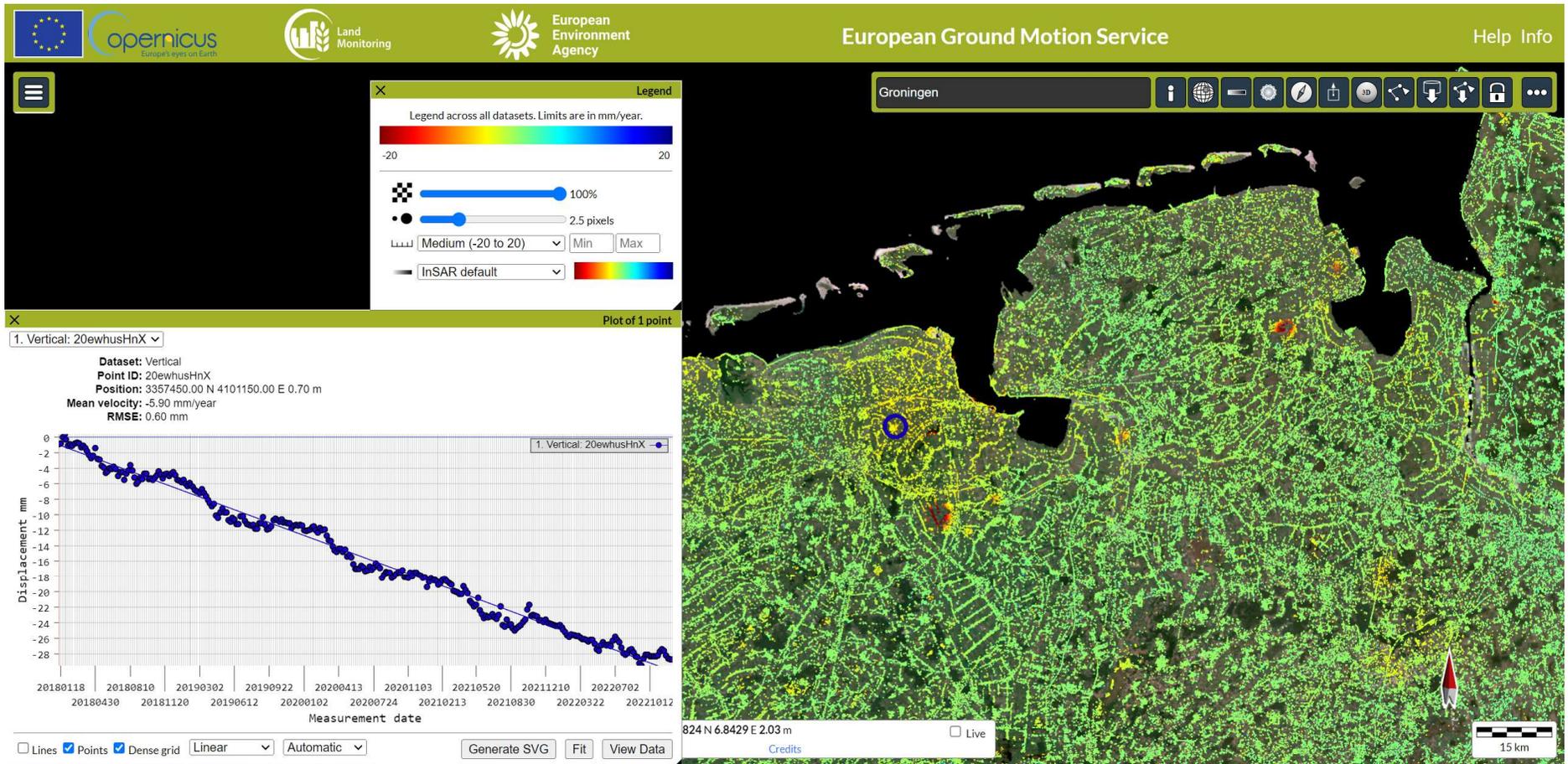
- InSAR is already widely applied in industrial applications in Australia:
 - Mine or gas extraction subsidence
 - Tailings monitoring
 - Tunnelling applications
 - Landslide monitoring
- Serviced by a large mature global commercial InSAR service industry – 10+ companies
- Some use commercial SAR data, many use Sentinel-1 (customer driven)





What's missing?

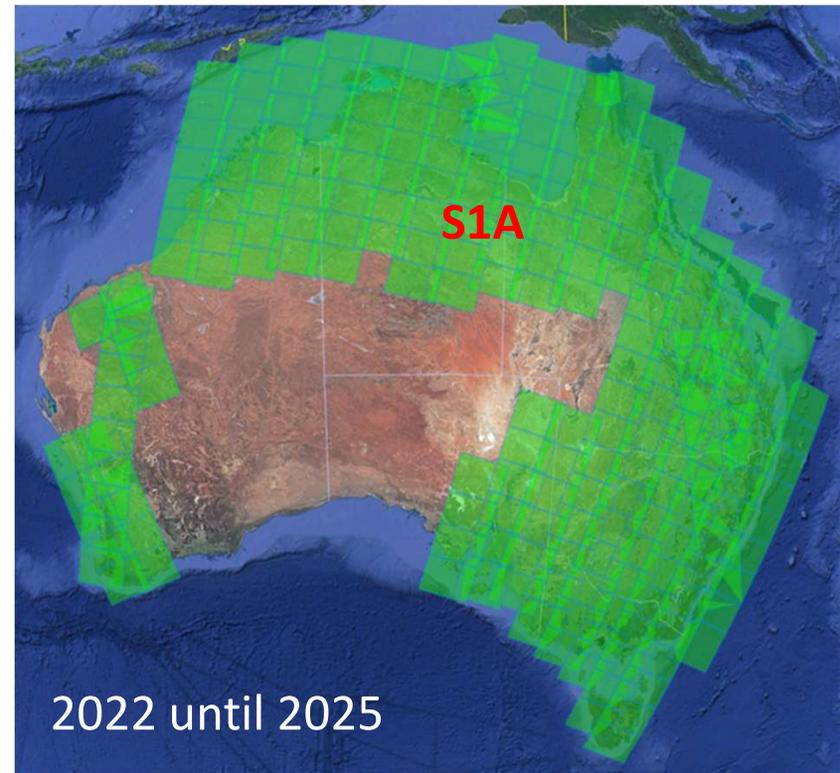
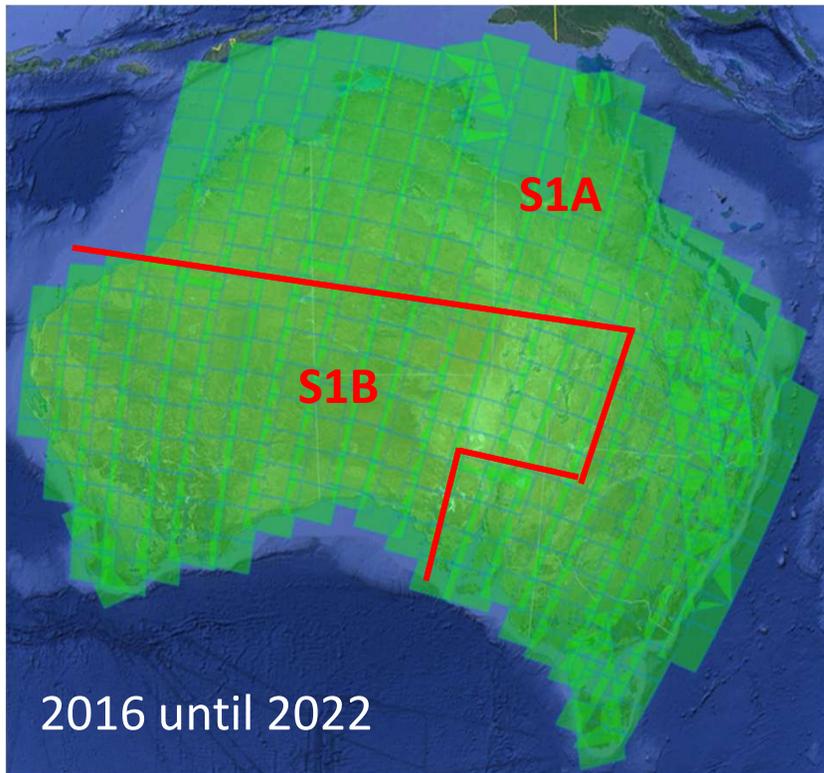
- An Australia-wide ground motion dataset for identifying motion hot-spots





Is this possible in Australia?

- The data exists - Sentinel-1 will again capture continental coverage in descending orbits when 1C begins operations in 2025.
- Compute resources exist – CSIRO EASI, NCI, Pawsey





Is this possible in Australia?

- Capacity/Capability – could be increased!
- The CSIRO Industry PhD program is currently offering a PhD scholarship with Curtin Uni and Kurloo
- Focus is on improving large infrastructure risk management by integrating next-generation InSAR with GNSS
- Talk to me or Lee Hellen (Kurloo) if interested!



Get paid to study a PhD
in satellite geodetics,
engineering & surveying

Apply now through **CSIRO's Industry PhD program**

The complex block features a background image of a satellite in space with Earth's horizon. It contains the Kurloo logo (a yellow grid icon), the Curtin University logo (a yellow square with a white sun icon), and the CSIRO logo (a blue circle with a white signal icon). The text is white on a dark blue background.



Summary

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- An Australian ground motion data infrastructure could provide geospatially dense 1D ground motion information potentially over the whole of Australia and certainly around the coastline.
- It would benefit:
 - Research – understanding of key societal issues
 - Governments – evidence for decision making
 - Industry – more awareness of infrastructure risks
 - InSAR service industry – more awareness of technology drives further uptake and more in-depth monitoring

Content credit: Copernicus EGMS

