InSAR: querying a global library of dynamic shape changes

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InSAR: like GPS from space – no hardware needed
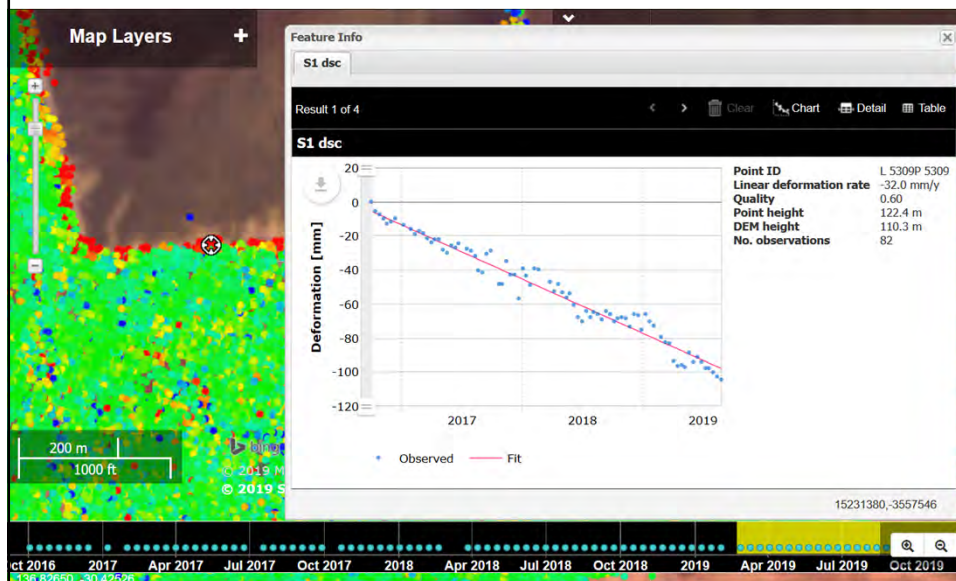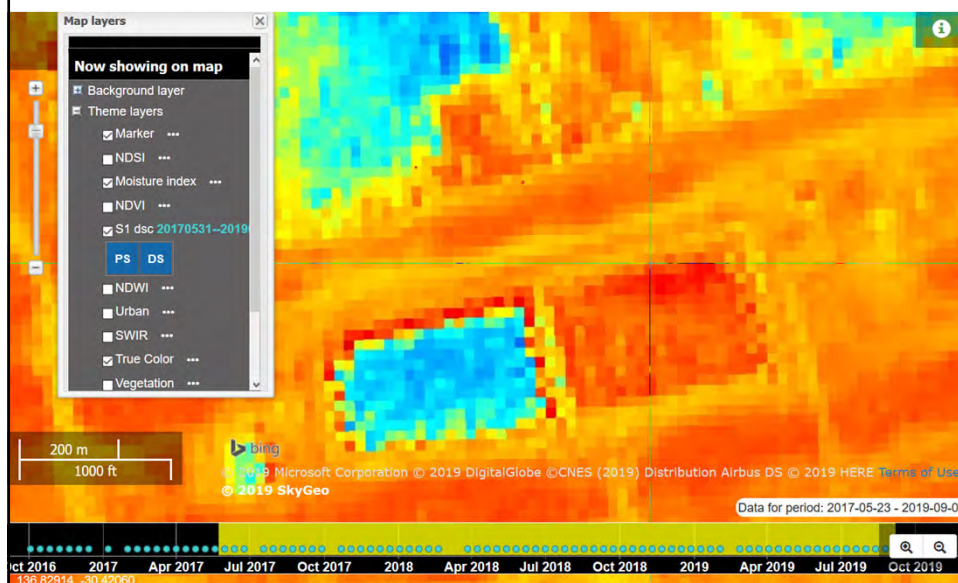

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In archive: 360,000 GPS stations

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Site-wide data: soil moisture Sentinel-2
(note separate color scale)

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Site-wide data: soil moisture
Look for dynamic patterns

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Library of dynamic shape changes

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Global microscope, making infrastructure transparent

The data is here
As a routine service

Translate patterns in [millimeter dynamics and water] to risk

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We're all data scientists now

Google Earth

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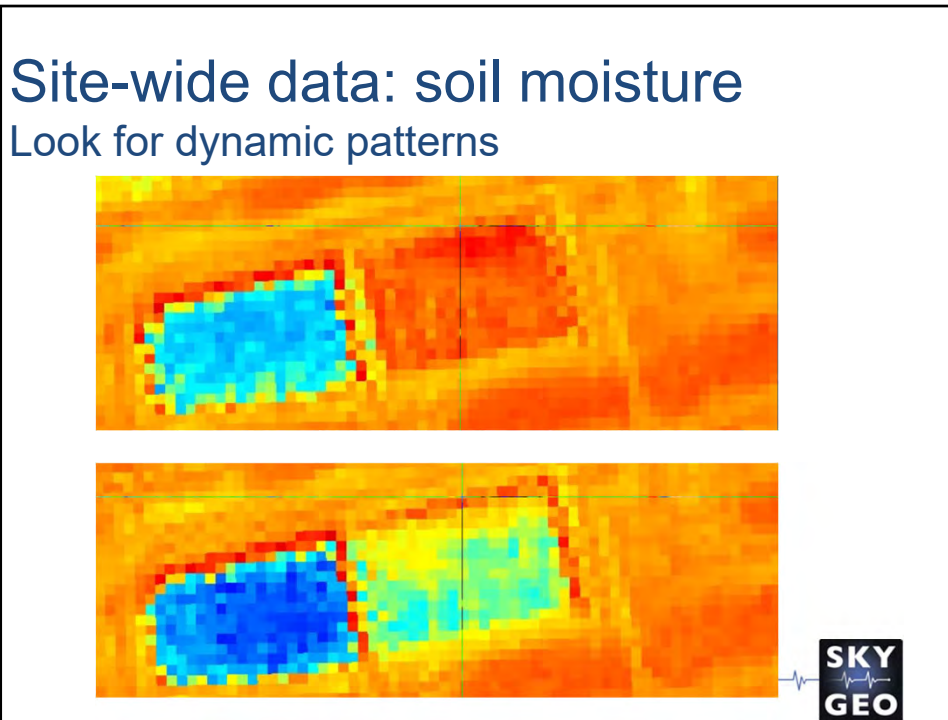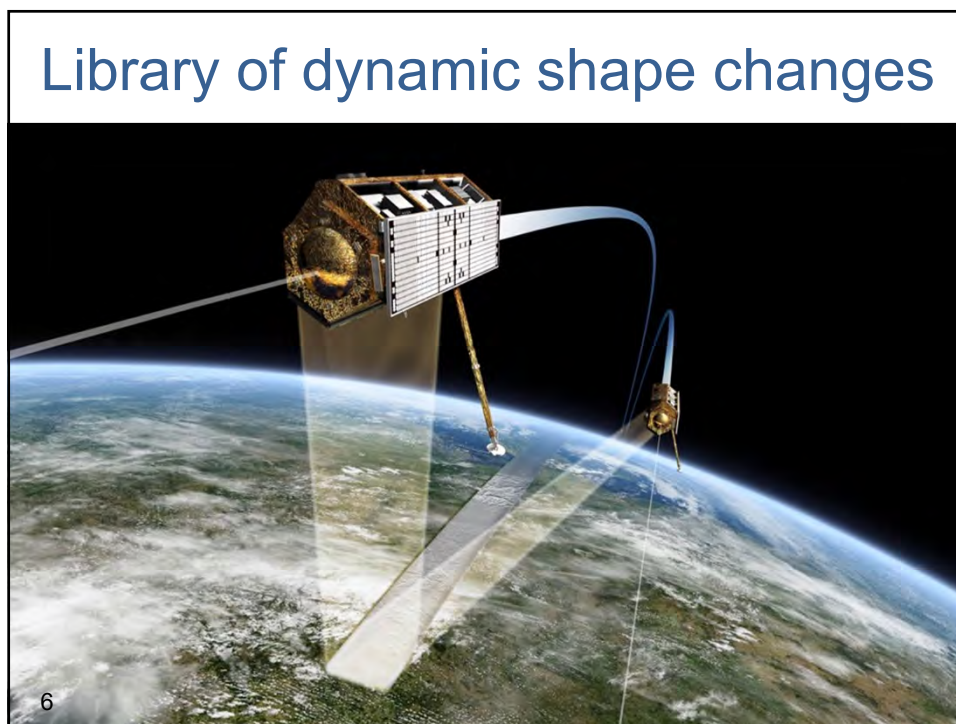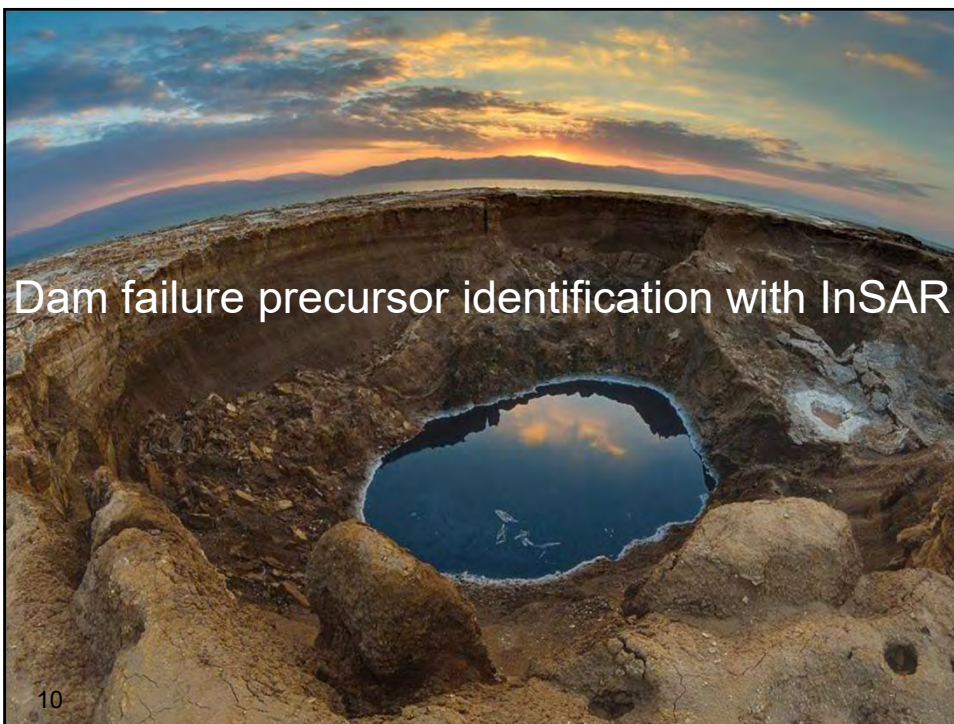
What if we can do dynamic mapping

Remote risk audits:
- Shape changes
- Morphology
- Vegetation
- Soil moisture
- ....

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Dam failure precursor identification with InSAR

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Dead Sea dike system:
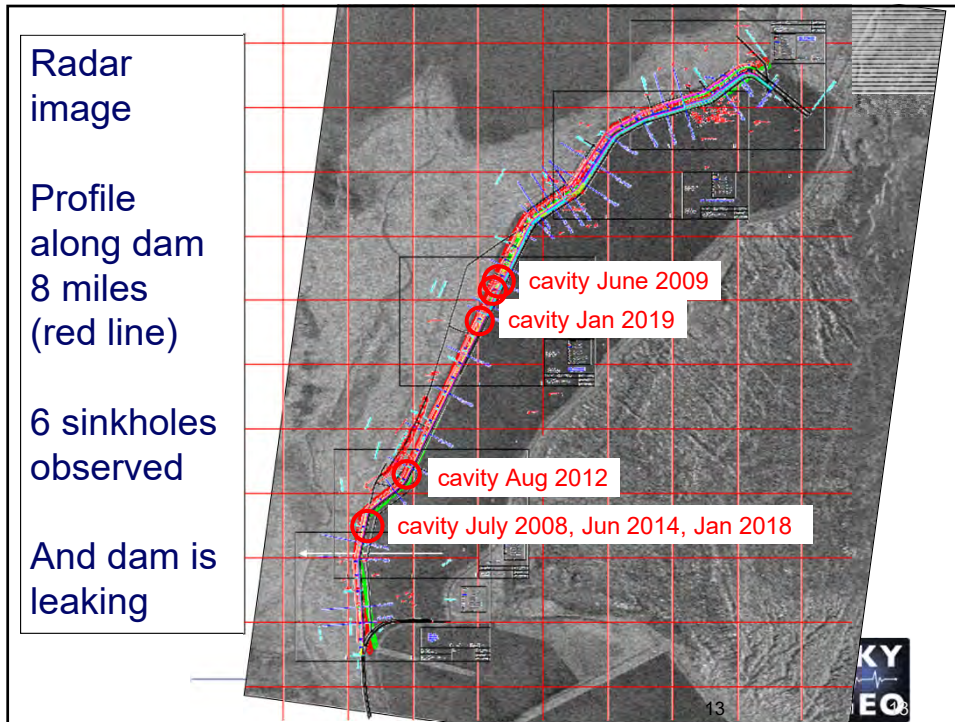
Assess risks across 100's km dam population

Dynamic risk factors:
- Regional active faulting
- Sinkholes
- Soft river clays
- Salt tectonics
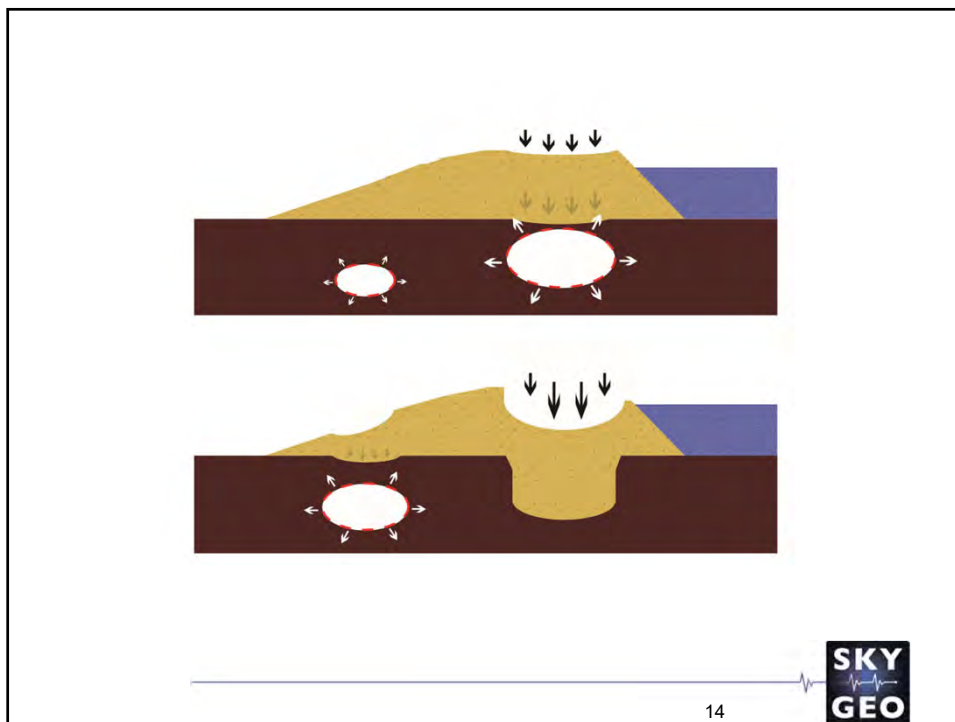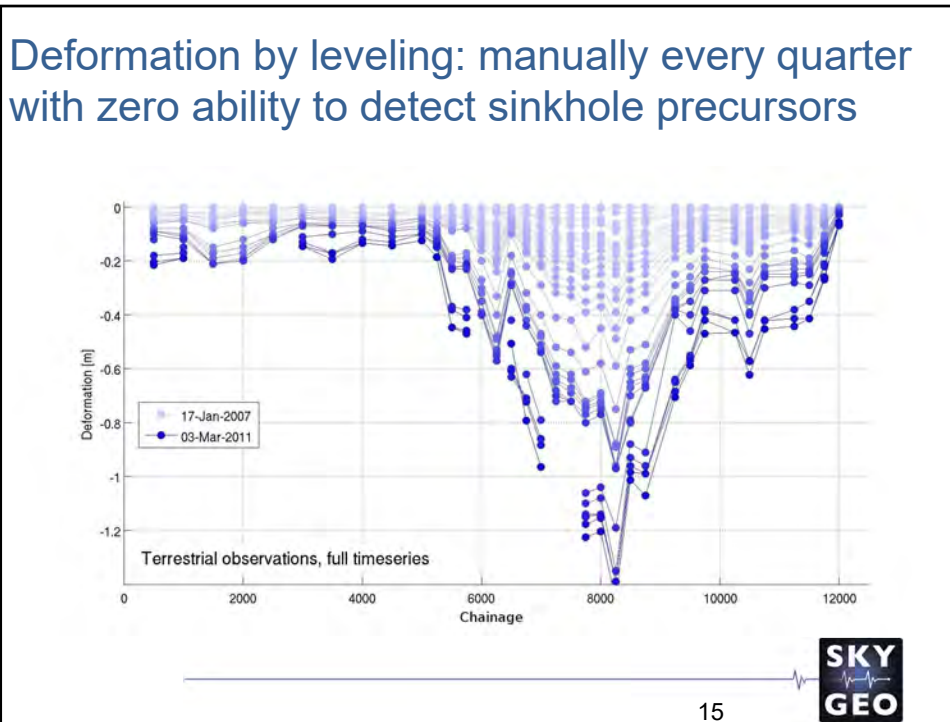- Rapid subsidence
- Various constructions of dams
- ....

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Radar image

Profile along dam 8 miles (red line)

6 sinkholes observed

And dam is leaking

cavity June 2009
cavity Jan 2019
cavity Aug 2012
cavity July 2008, Jun 2014, Jan 2018

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Deformation by leveling: manually every quarter with zero ability to detect sinkhole precursors

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Configuring the satellite

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1 SAR frame – 4 billion InSAR measurements

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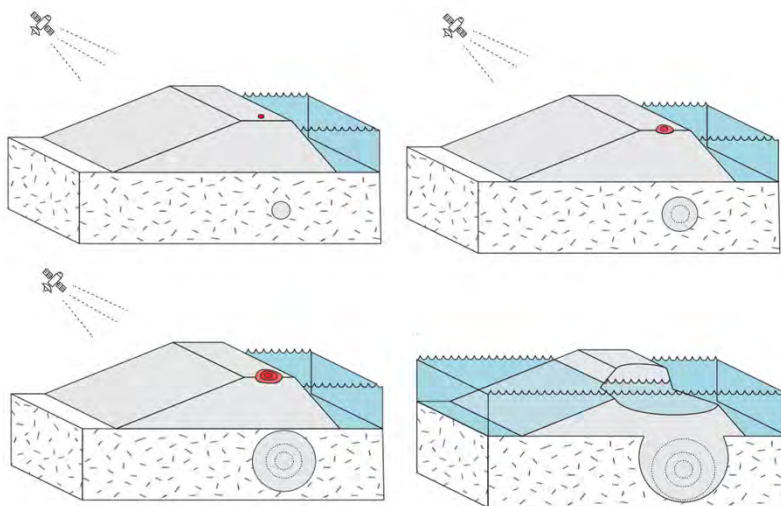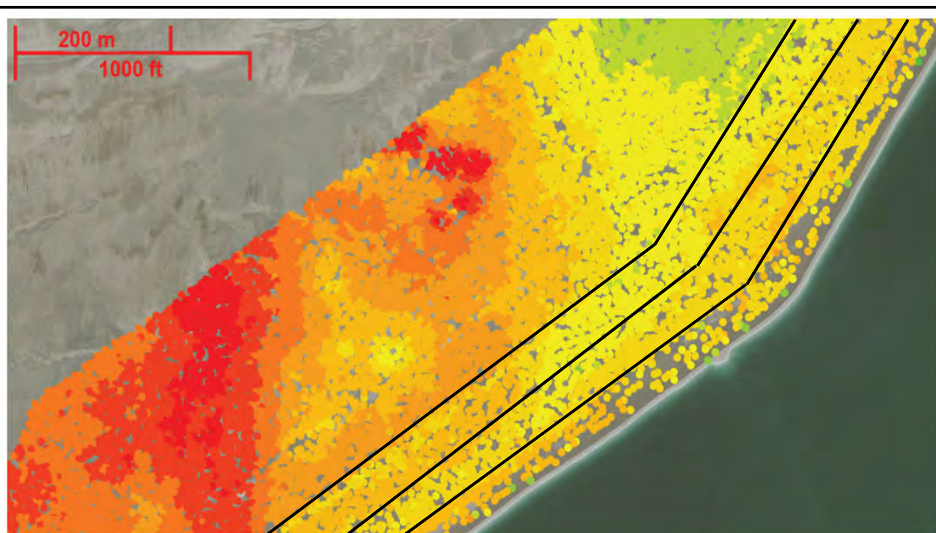
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Isolate from background
fast random subsidence

Target / guide local site inspection: electrical resistivity

Figure 10. South-north electrical resistivity profile across I&W brine well site. This line passes within 2 m of the I&W wellhead, thus crossing directly over the subsurface cavern excavated during solution mining operations. Low resistivity zones, shown in blue and purple, probably indicate brine-filled cavities or brine-saturated breccia zones. The low resistivity zones labelled A, B, C, and D correspond to potentially hazardous areas indicated in Figure 11.

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Early warning: 6 weeks pre-failure

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Progressive dam failure:
6 weeks warning - InSAR runs out of steam

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Target local site inspection:
ground-based InSAR
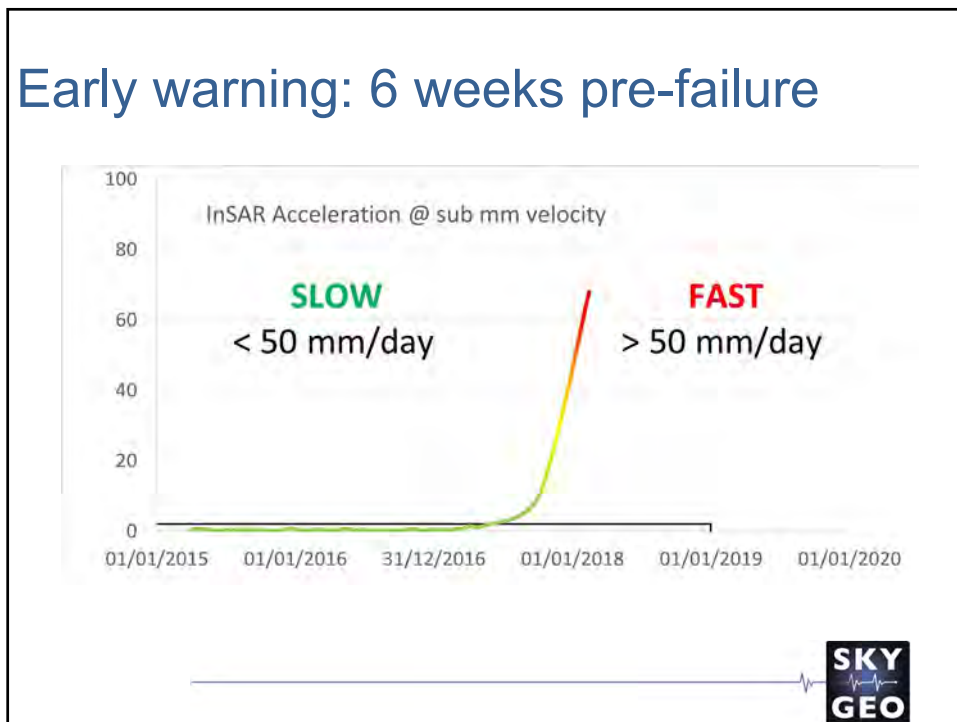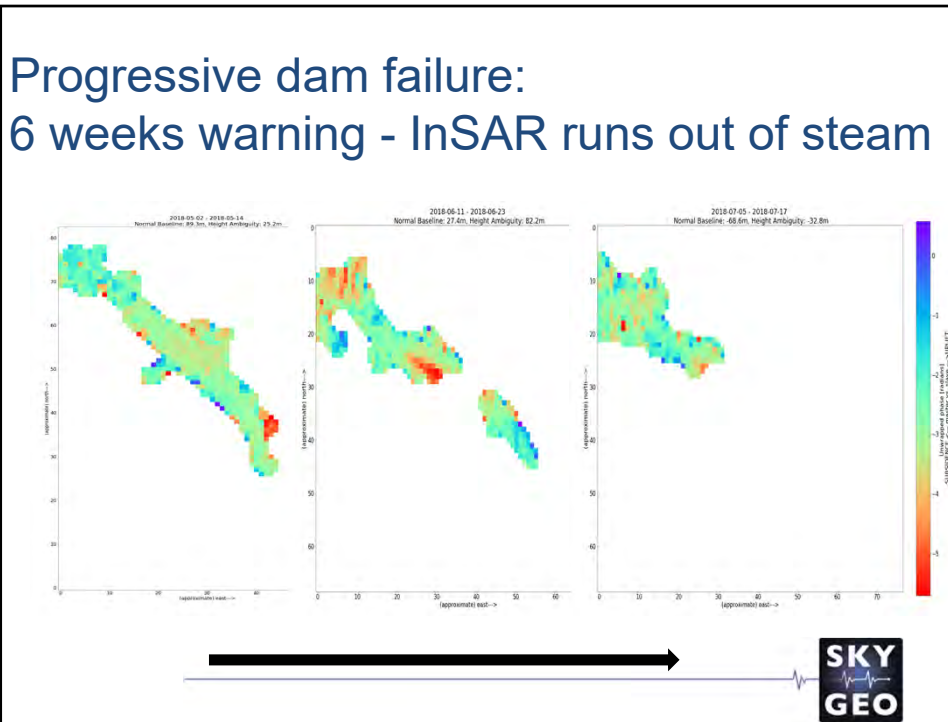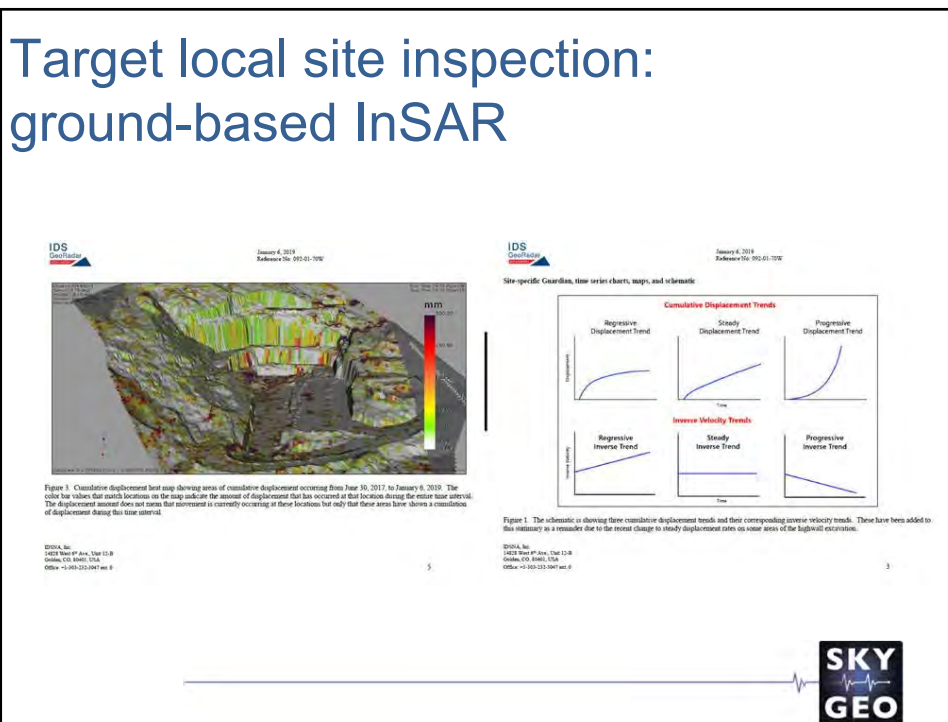

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==> Contextual re-processing

There is no one-size-fits-all processing

Dynamic risk audits:
- Pits / longwalls
- Piles / dumps
- Tailings storage facilities
- Environment
- ….

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Contextual, iterative InSAR processing engine

Insights

Civil engineering, urban, oil & gas, mining

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Contextual, iterative InSAR processing engine

MACHINE LEARNING

Insights

Civil engineering, urban, oil & gas, mining

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About SkyGeo

Engine to create a high quality, easy access data feed for risk audits

- Netherlands + California company
- >500 customers work with our data feed
- Global … anywhere
- 50% are civil engineering
- Shell, ExxonMobil
- Nationwide maps - Rijkswaterstaat
- 30 people in 3 offices
- Self-funded / break-even for 8+ years
- 80% high resolution

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SAR micro-satellites: future of persistent remote monitoring

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InSAR done right: a global library of dynamic patterns of structural shapes; match with geotechnical risks

We're recruiting

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