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Subsidence over Hampton Roads: SqueeSAR Cosmo-SkyMed Analysis

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TRE
ALTAMIRA
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Subsidence over Hampton Roads: SqueeSAR Cosmo-SkyMed Analysis

October 2017

Jessica Morgan
Mike Aslaksen
Dave Maune

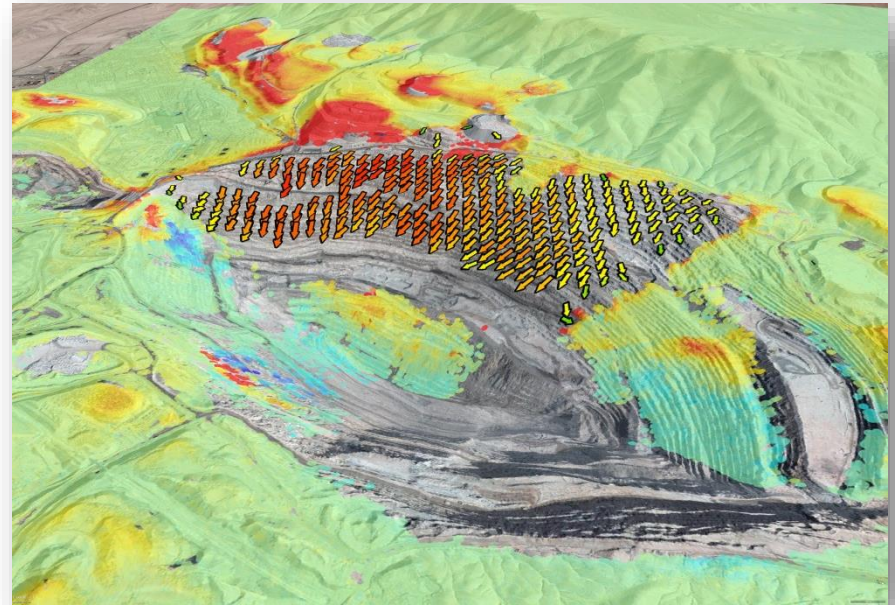
TRE Altamira Inc.
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Dewberry

What is InSAR?

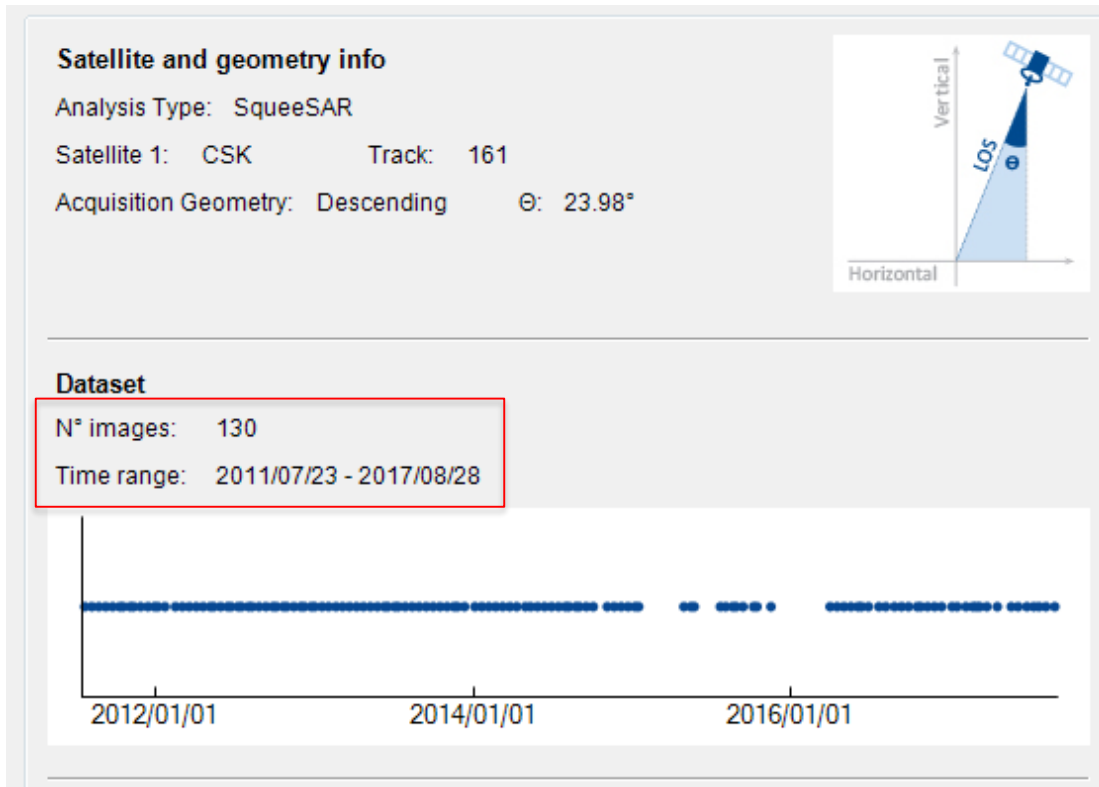
(Interferometric Synthetic Aperture Radar)

Remote sensing technique for measuring ground deformation:

- » Using data from radar satellites
- » Without the need to install instrumentation on the ground



- » An InSAR analysis was carried out over Hampton Roads, Virginia using radar imagery collected from 2011 to present.
- » The objective of this project was to quantify subsidence rates with sub-millimetric accuracy and help to identify coastal areas most vulnerable to flooding/sea level rise.
- » This presentation summarizes the initial results obtained over this area.



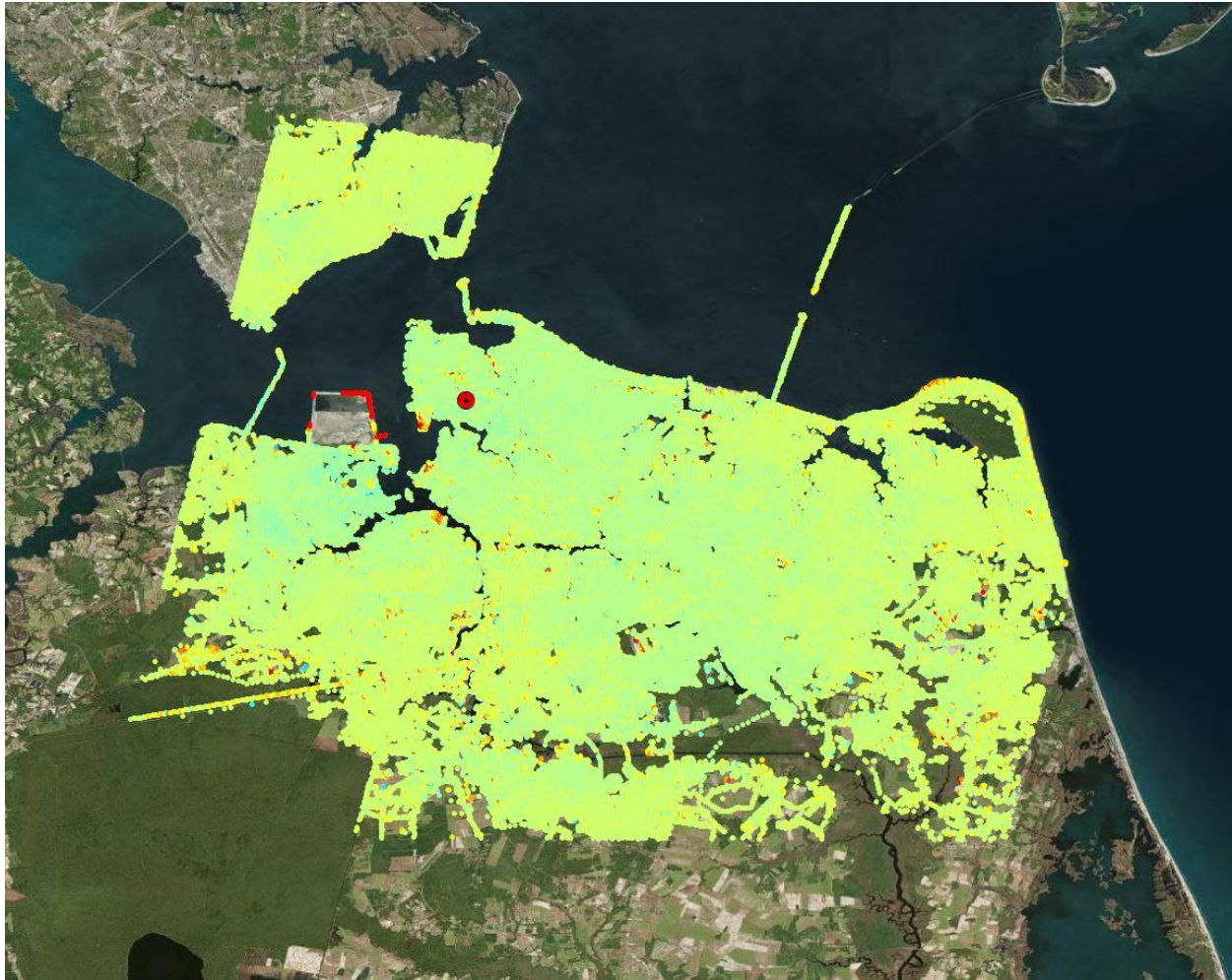
- » 130 Cosmo-SkyMed images analyzed over 6 years (2011 – 2017)
- » **4,176,201 measurement points identified** (from natural features)

Area of Interest

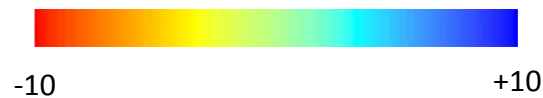


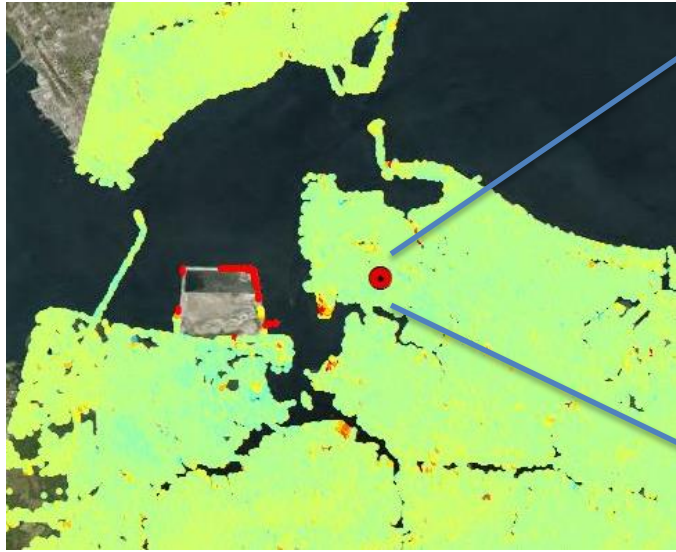
- » Hampton Roads, Virginia
- » The full area processed was approximately 2,000 km² in size

Displacement Rates



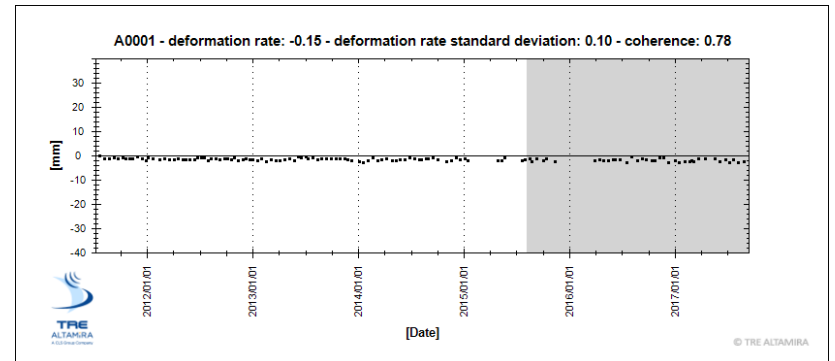
- » Average displacement rate **-1.01 mm/year**
- » The range of displacement rates identified was -48.9 to +16.1 mm/year



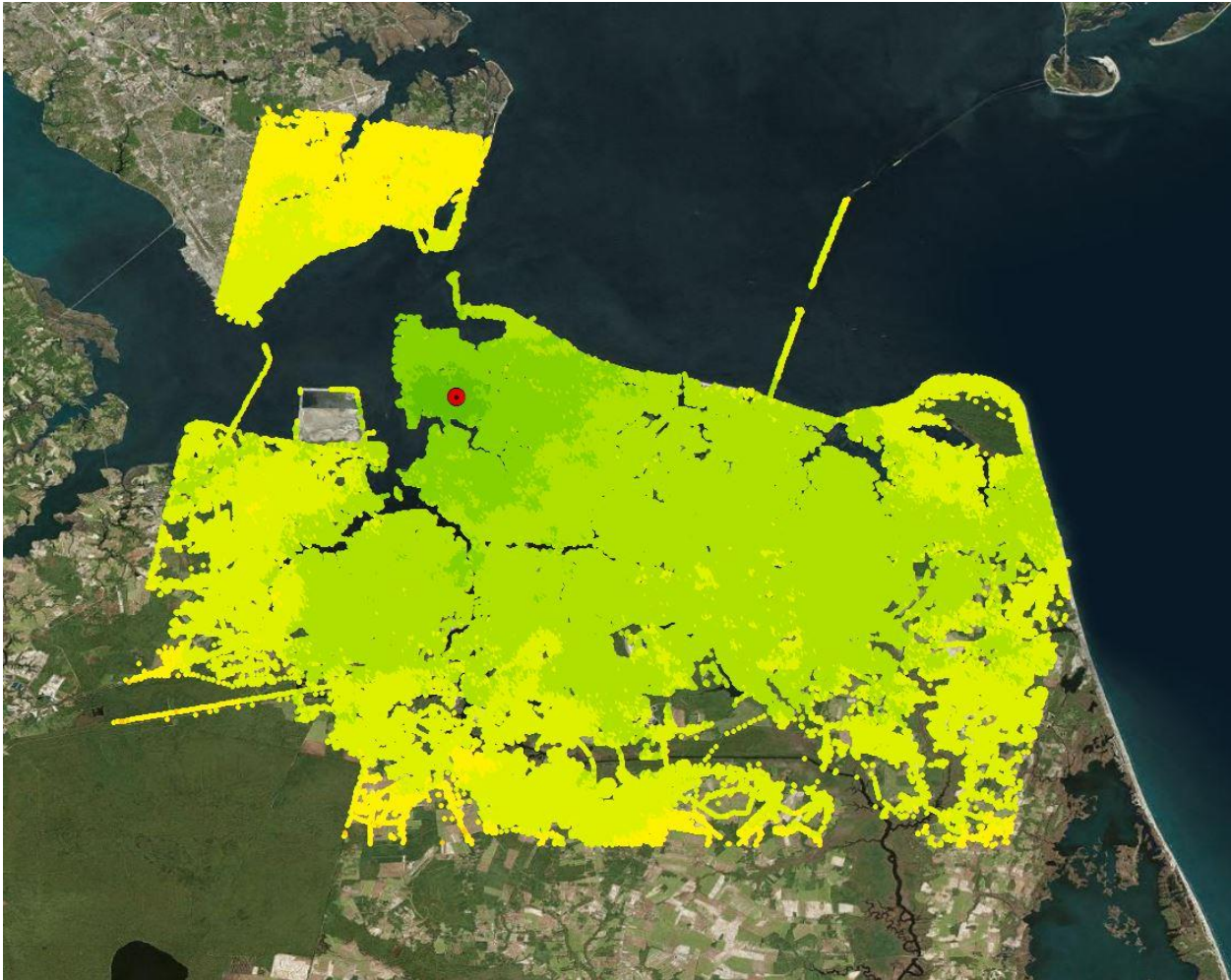


-10 +10

- » The reference point was selected based on processing algorithm
- » Conversion to absolute movement rates is possible with GPS control

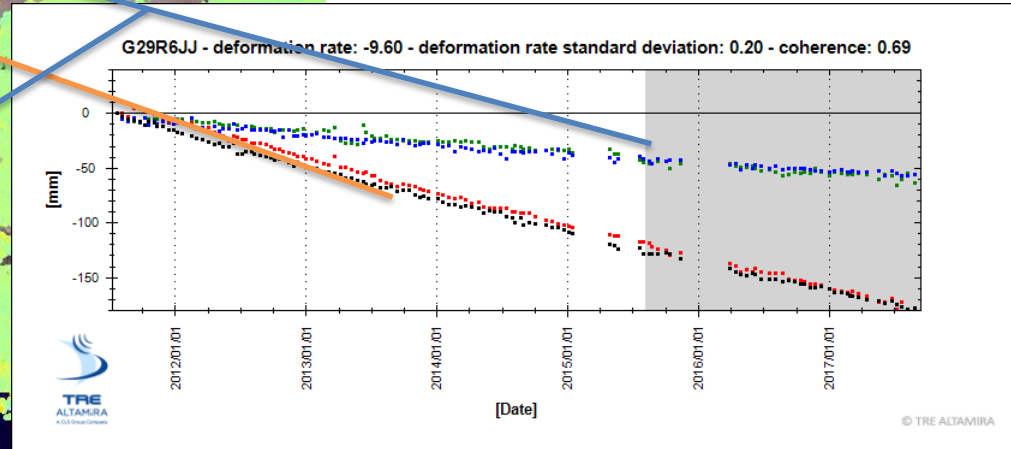
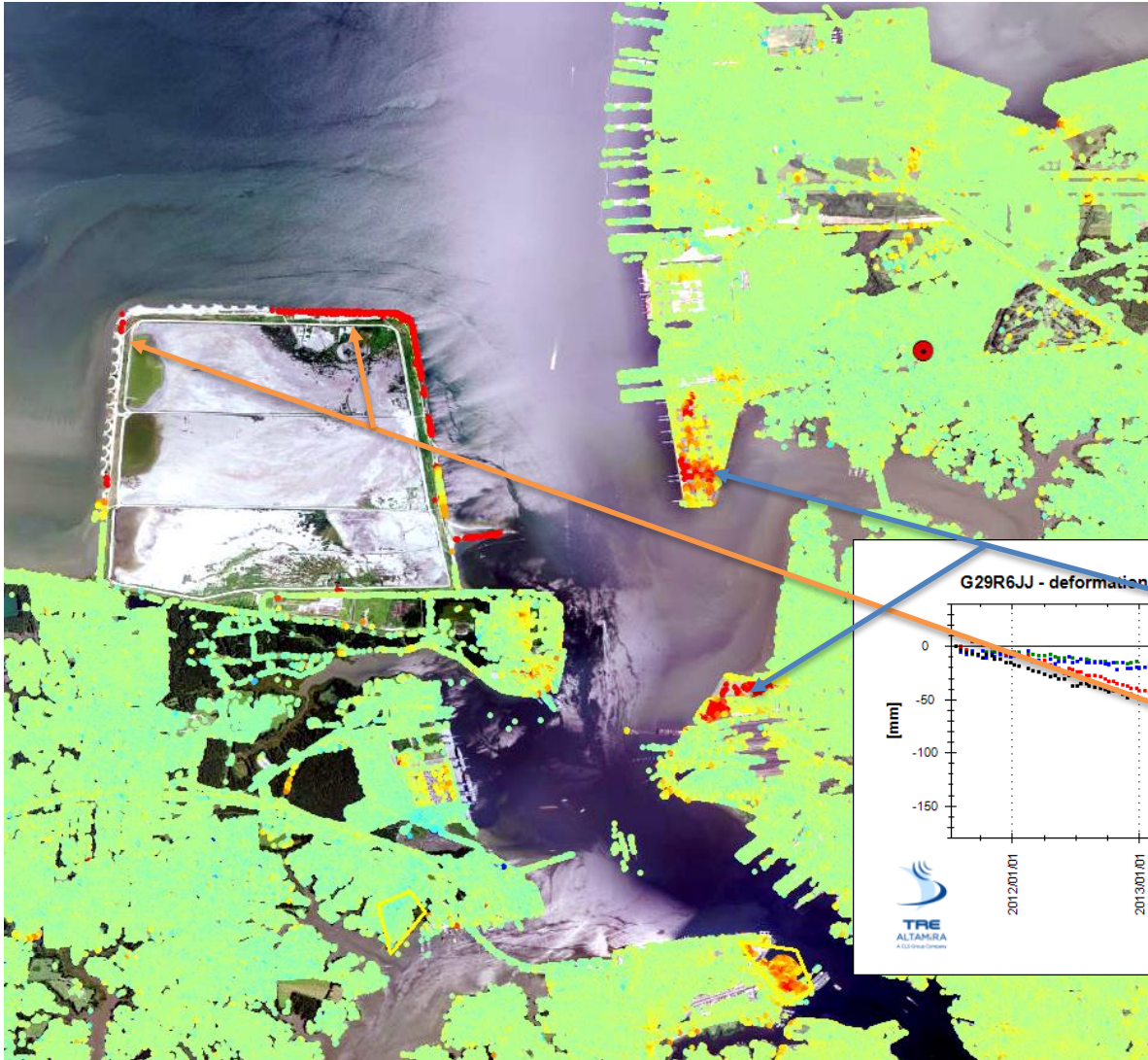


Displacement Rate Standard Deviation



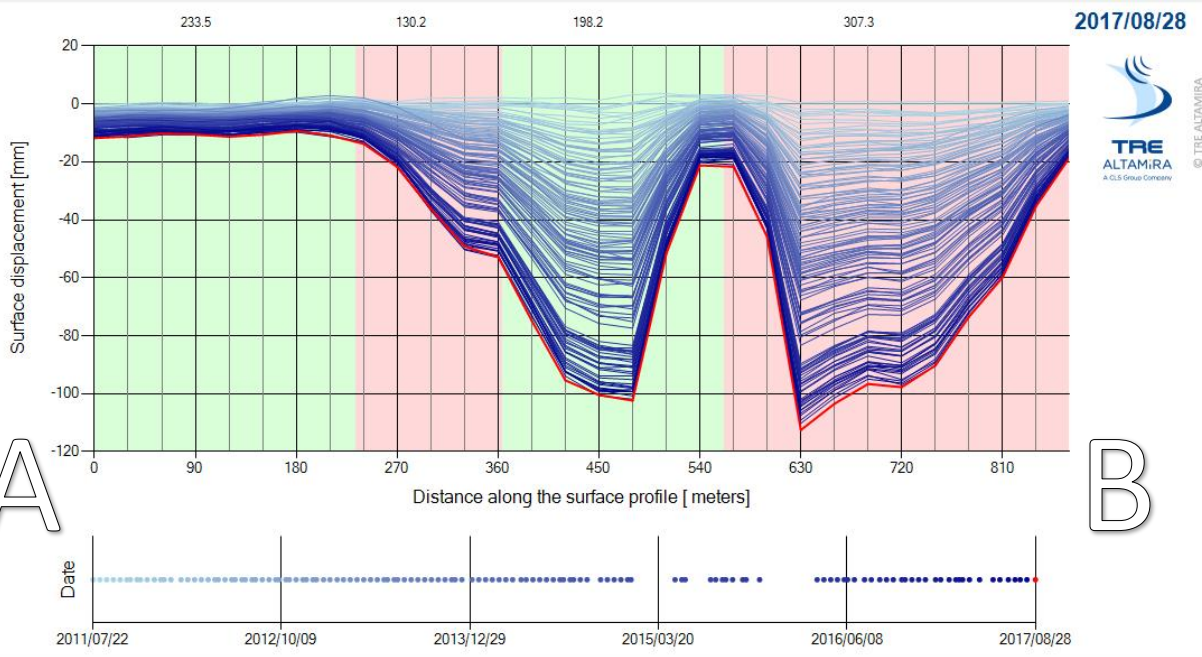
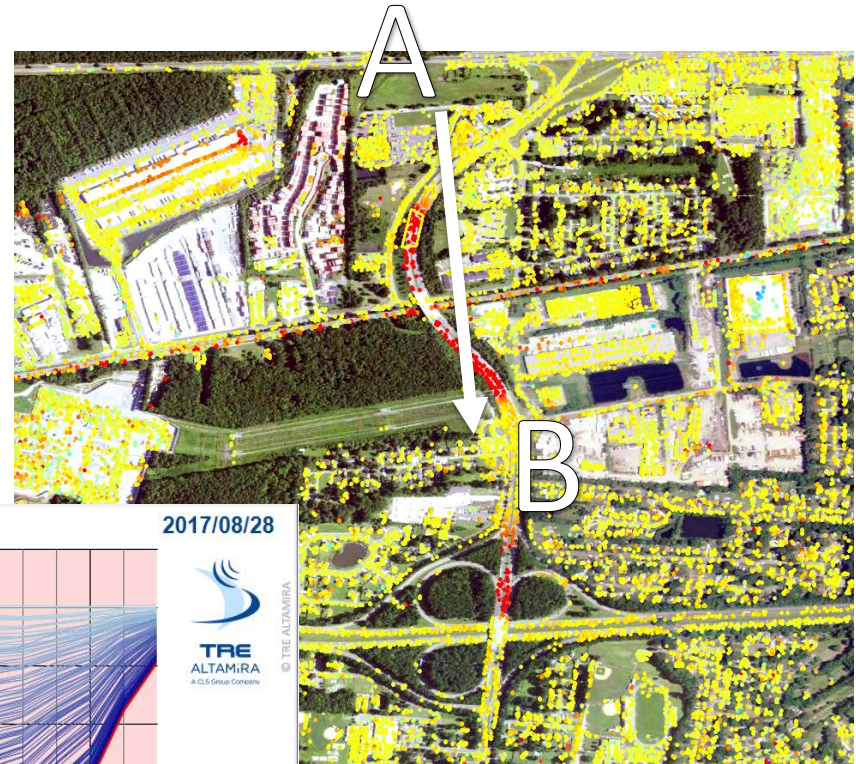
- » Average standard deviation value of measured rates **± 0.34 mm/year**
- » The range of standard deviation values identified was ± 0 to ± 0.6 mm/year

Maximum Subsidence – Craney Island and Port



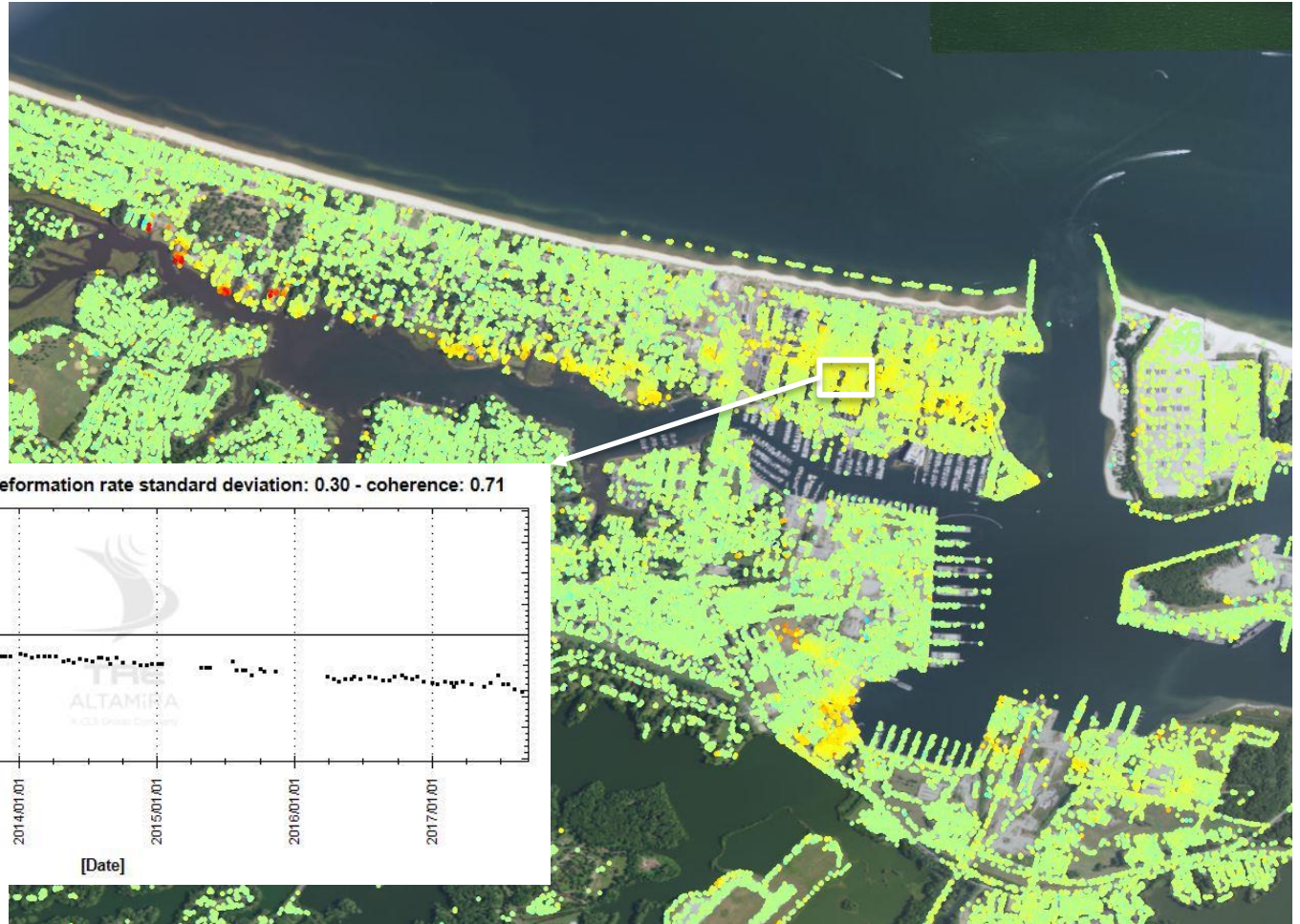
Subsiding Roads, Bridges, Overpasses

» Bridge approach on George Washington Highway over Yadkin Road

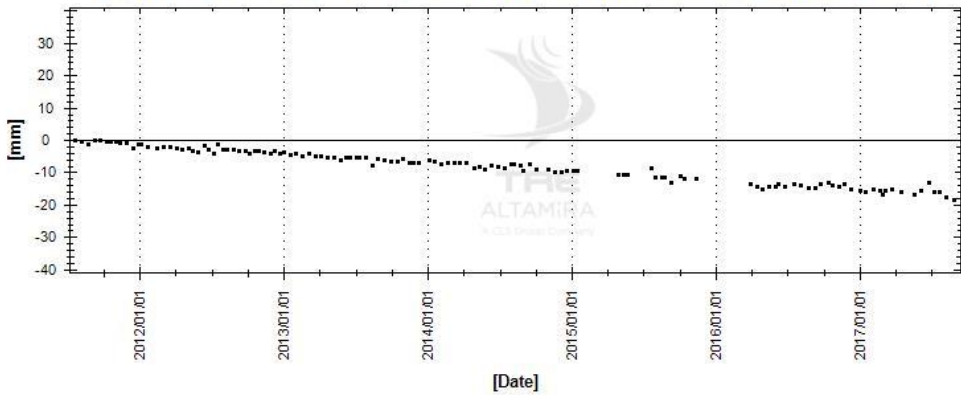


A

B



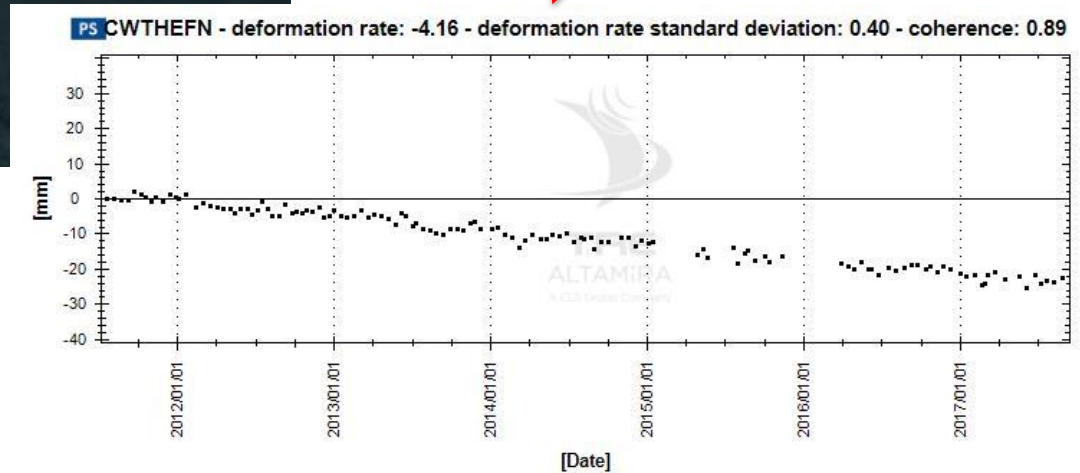
A0001 - deformation rate: -2.72 - deformation rate standard deviation: 0.30 - coherence: 0.71

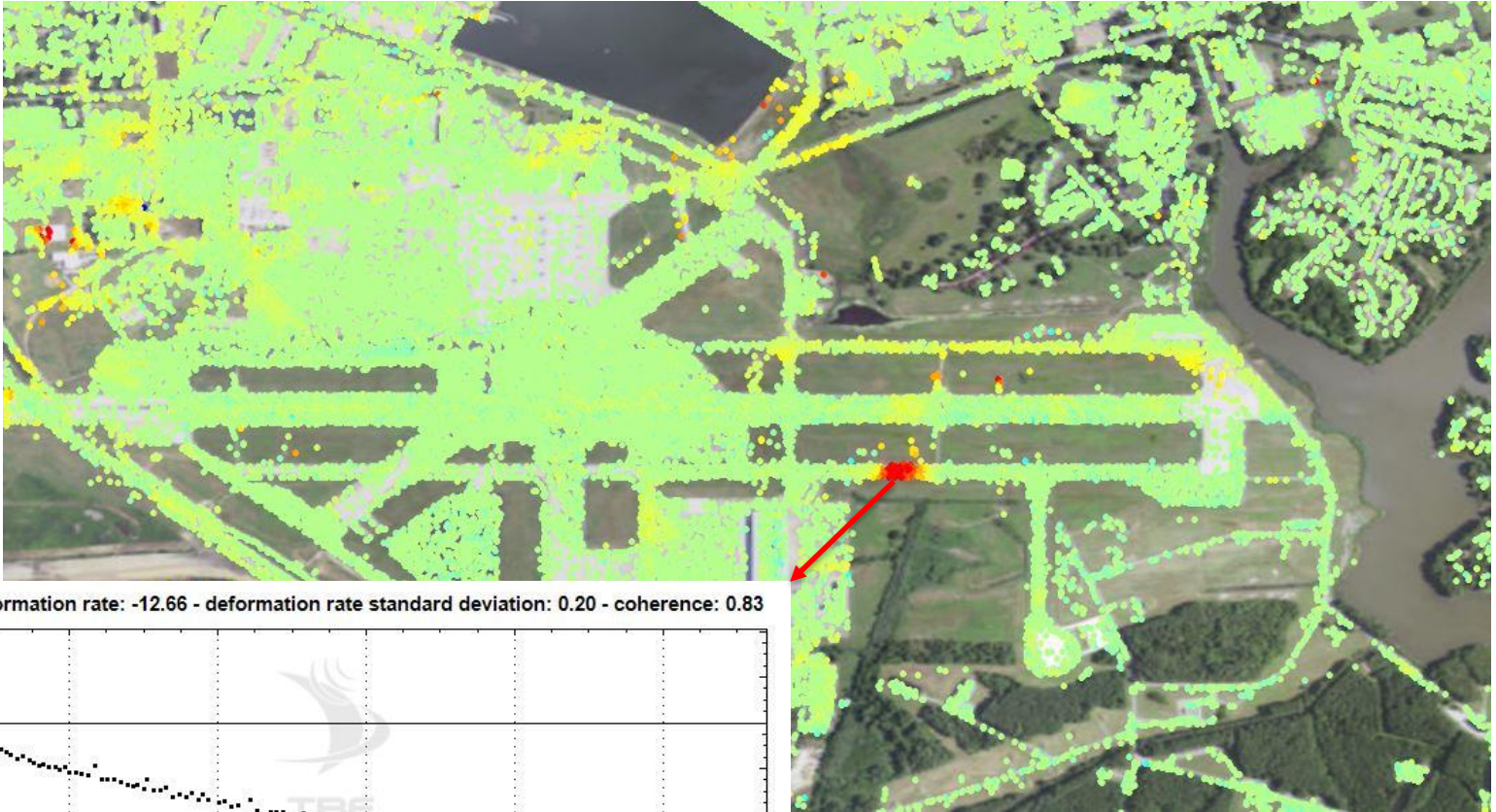


-10

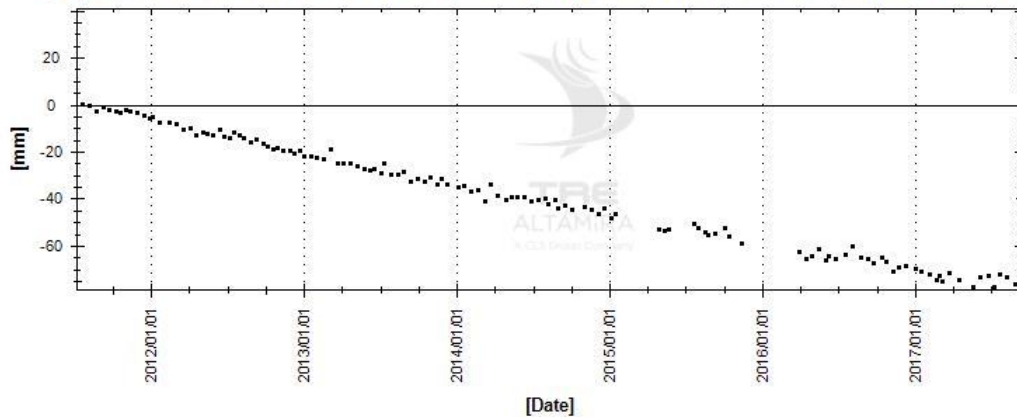
+10

Chesapeake Bay Bridge



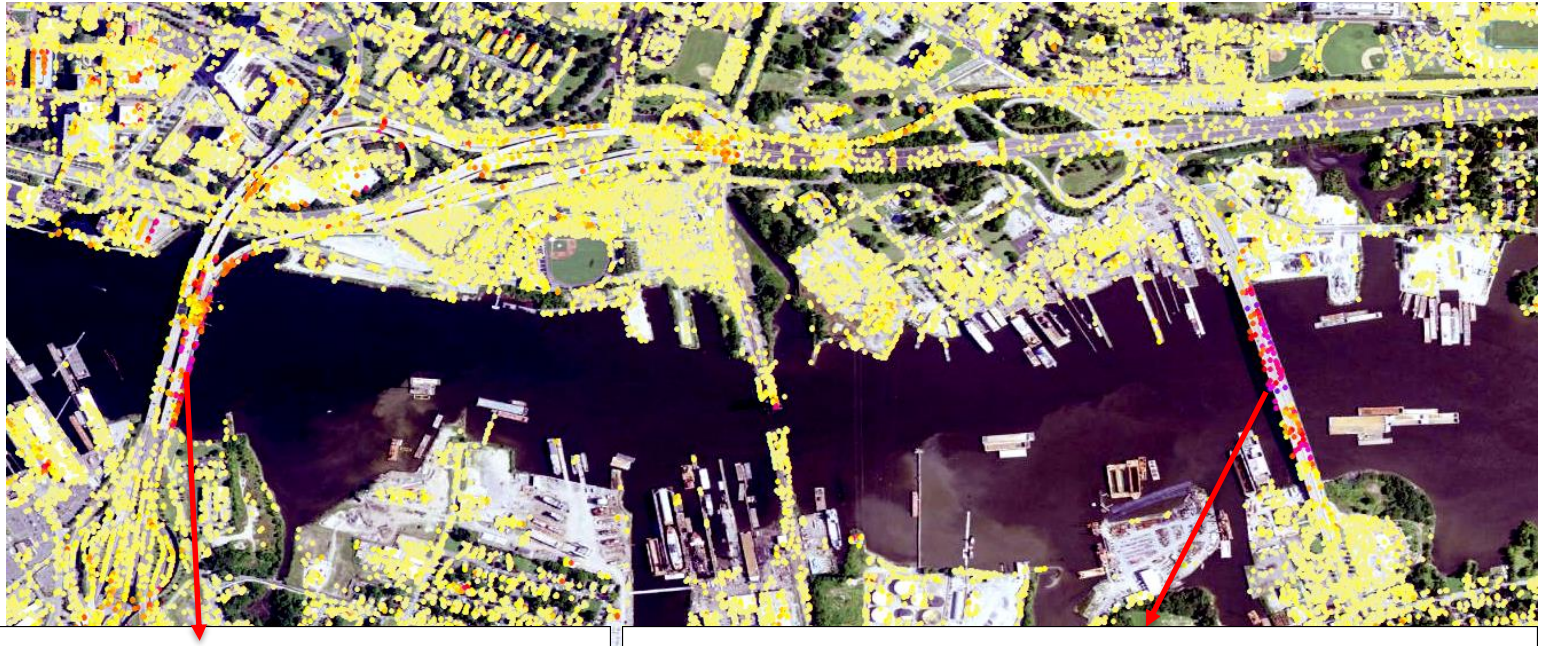


PS_FORXE94 - deformation rate: -12.66 - deformation rate standard deviation: 0.20 - coherence: 0.83

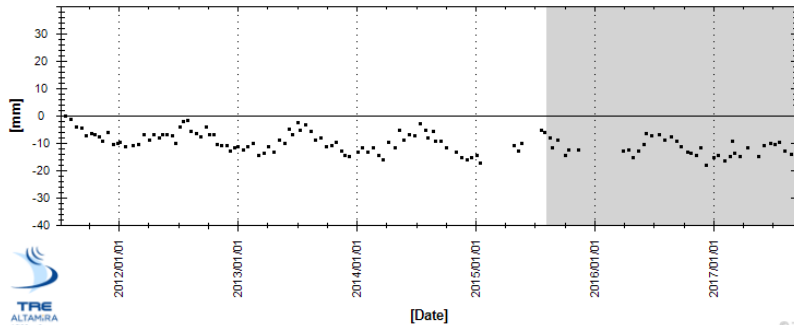


Seasonality – Bridges (Seasonal Amplitude)

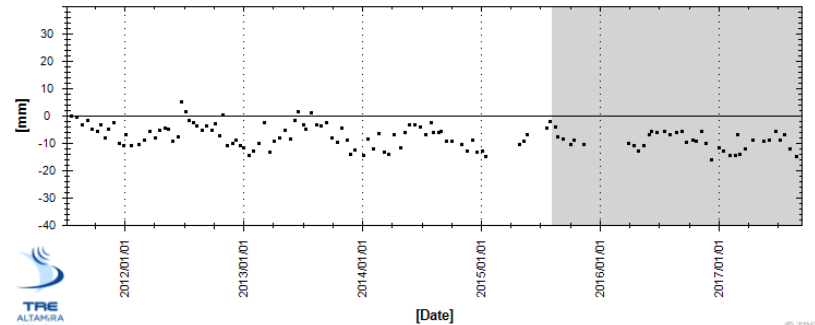
- < 0,25
- 0,26 - 0,50
- 0,51 - 0,75
- 0,76 - 1,00
- 1,01 - 1,25
- 1,26 - 1,50
- 1,51 - 1,75
- 1,76 - 2,00
- 2,01 - 2,25
- 2,26 - 2,50
- 2,51 - 2,75
- 2,76 - 3,00
- 3,01 - 3,25
- 3,26 - 3,50
- 3,51 - 3,75
- 3,76 - 4,00
- 4,01 - 4,25
- 4,26 - 4,50
- 4,51 - 4,75
- 4,76 - 5,00
- > 5,00



FBUCJOY - deformation rate: -0.98 - deformation rate standard deviation: 0.30 - coherence: 0.73



EYLGZV - deformation rate: -0.88 - deformation rate standard deviation: 0.30 - coherence: 0.60



- » Data delivery will include upload to TRE Altamira's online webGIS platform TREmaps: <https://tremaps.tre-altamira.com/>



- » Validation of displacement results with other sources of monitoring information (such as long-term GPS observations or precise leveling).
- » Conversion of displacement results from relative measurements to absolute (using GPS control).
- » Analysis of Sentinel (C-band) imagery to be carried out and results of the Cosmo-SkyMed and Sentinel InSAR analyses to be compared and contrasted.
- » Displacement results to be integrated with other types of monitoring information.

