INSAR TO SUPPORT CIVIL ENGINEERING PROJECTS : RISK REDUCTION ON CONSTRUCTION SITES AND MAINTENANCE ON ASSETS

AGS Technical Seminar

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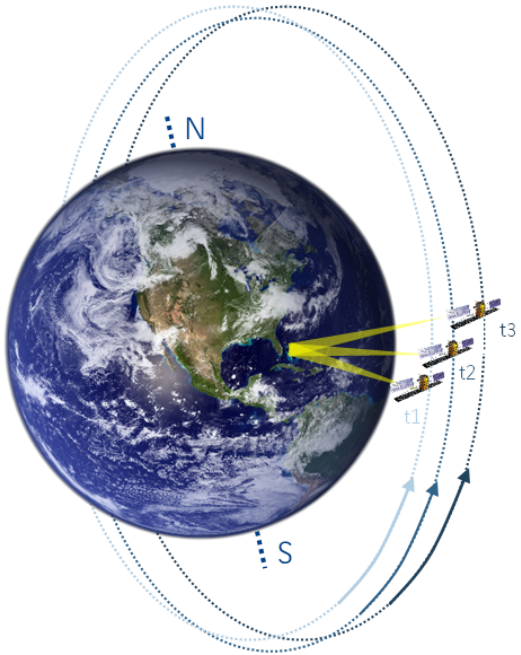
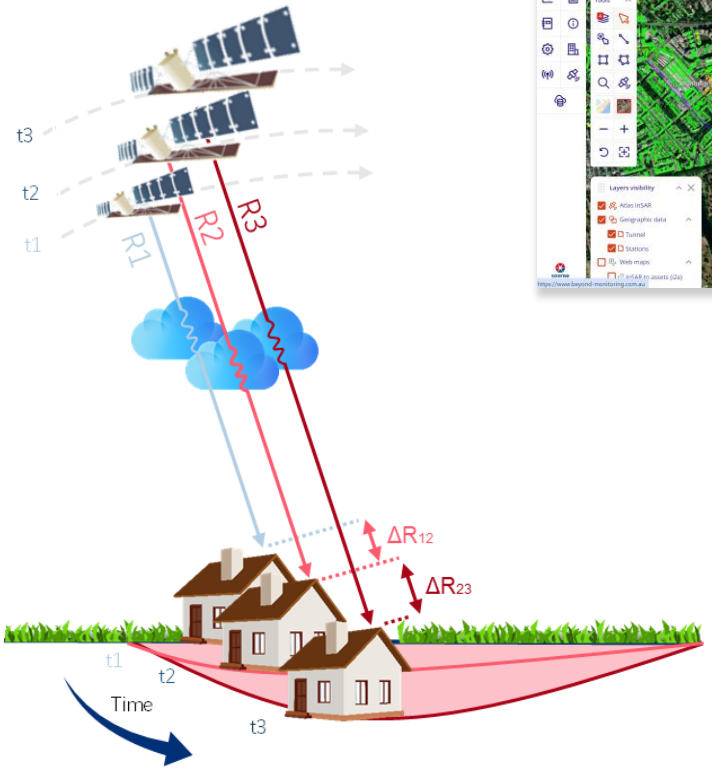
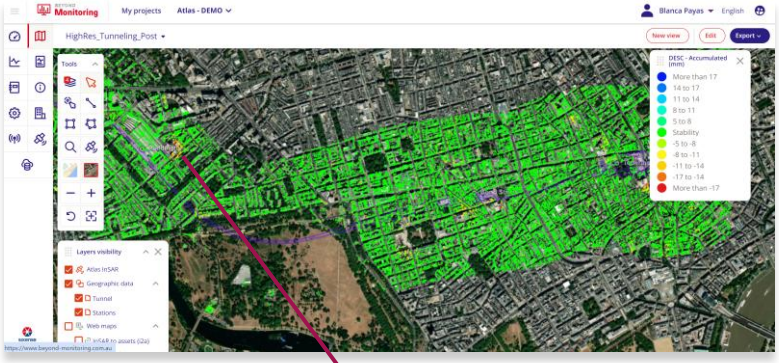
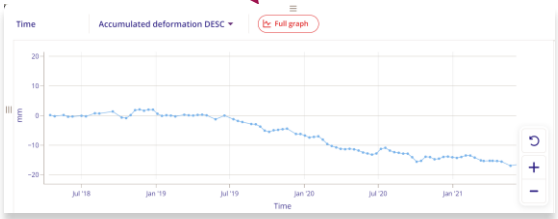
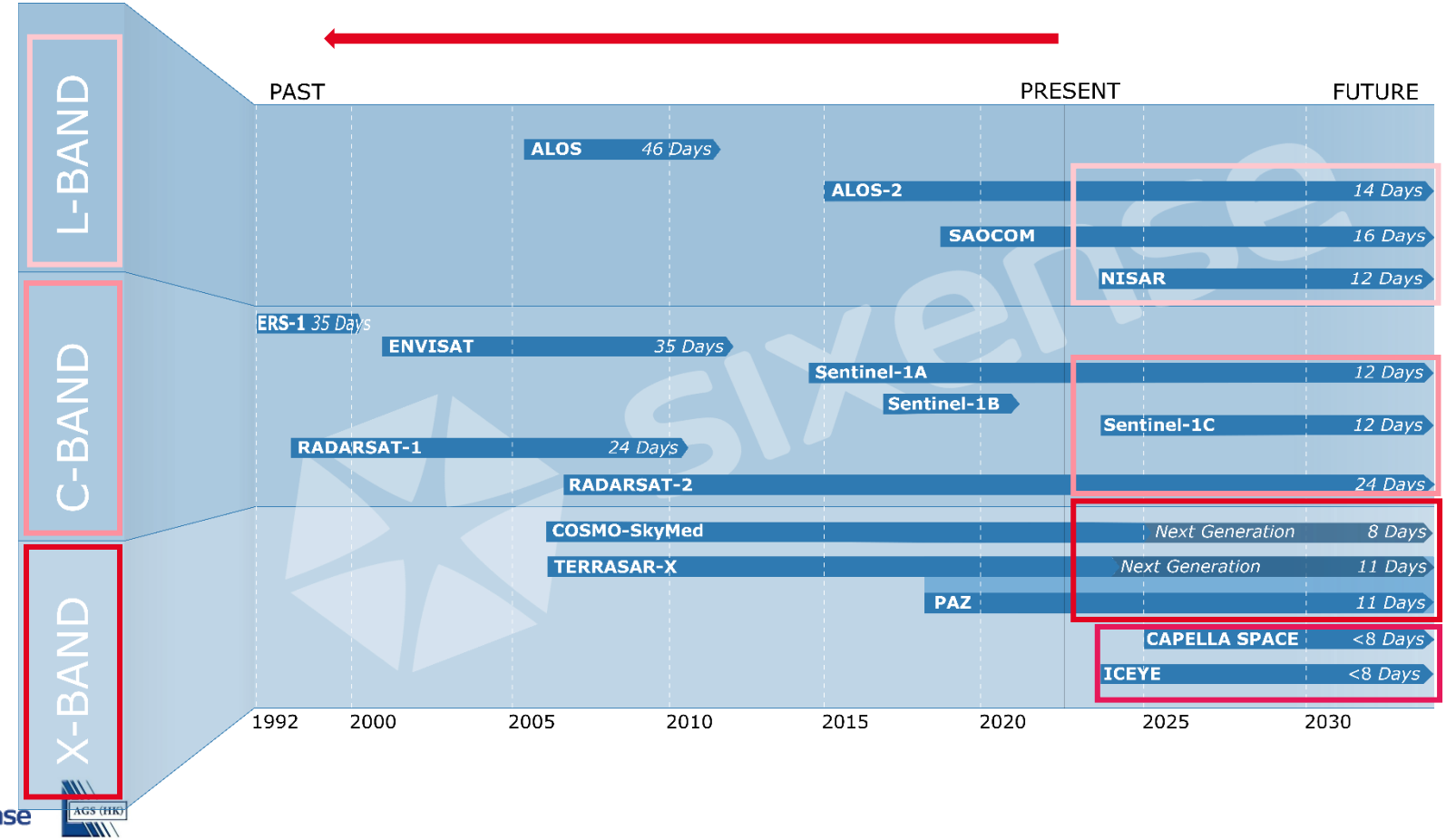

N
S
t1
t2
t3


t3
t2
t1
R1
R2
R3
ΔR12
ΔR23
t1
t2
t3
Time


Monitoring
My projects
Atlas - DEMO
Blanca Payas
English
HighRes_Tunneling_Post
New view
Edit
Export
Tools
DESC - Accumulated (mm)
More than 17
14 to 17
11 to 14
8 to 11
5 to 8
Stability
-5 to -8
-8 to -11
-11 to -14
-17 to -14
More than -17
Layers visibility
Atlas InSAR
Geographic data
Tunnel
Stations
Web maps


Time
Accumulated deformation DESC
Full graph
mm
20
10
0
-10
-20
Jul '18
Jan '19
Jul '19
Jan '20
Jul '20
Jan '21
Time


L-BAND
C-BAND
X-BAND
PAST
PRESENT
FUTURE
ALOS 46 Days
ALOS-2 14 Days
SAOCOM 16 Days
NISAR 12 Days
ERS-1 35 Days
ENVISAT 35 Days
Sentinel-1A 12 Days
Sentinel-1B
Sentinel-1C 12 Days
RADARSAT-1 24 Days
RADARSAT-2 24 Days
COSMO-SkyMed Next Generation 8 Days
TERRASAR-X Next Generation 11 Days
PAZ 11 Days
CAPELLA SPACE <8 Days
ICEYE <8 Days
1992
2000
2005
2010
2015
2020
2025
2030

Good Natural Reflectance

Man made and metallic structures reflect the radar signal very well, as do arid soils, scarce vegetated areas, rocks etc....

Poor Natural Reflectance

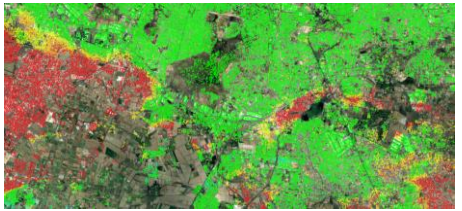
Areas with vegetation, snow, ongoing construction or earth works may require Artificial Corner Reflectors

INSAR FOR CIVIL ENGINEERING | **APPLICATIONS**

- Asset Owners/Local Authorities
- Asset Managers / Concessionaries
- Construction companies
- Consulting & engineering firms

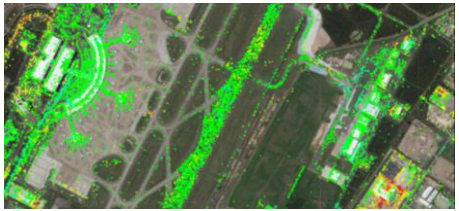
Tunnelling

Municipalities

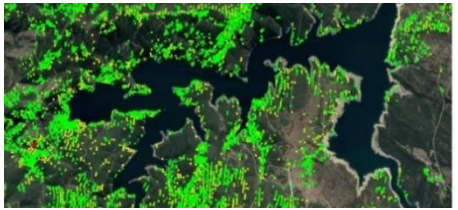


Linear infrastructures

Airports



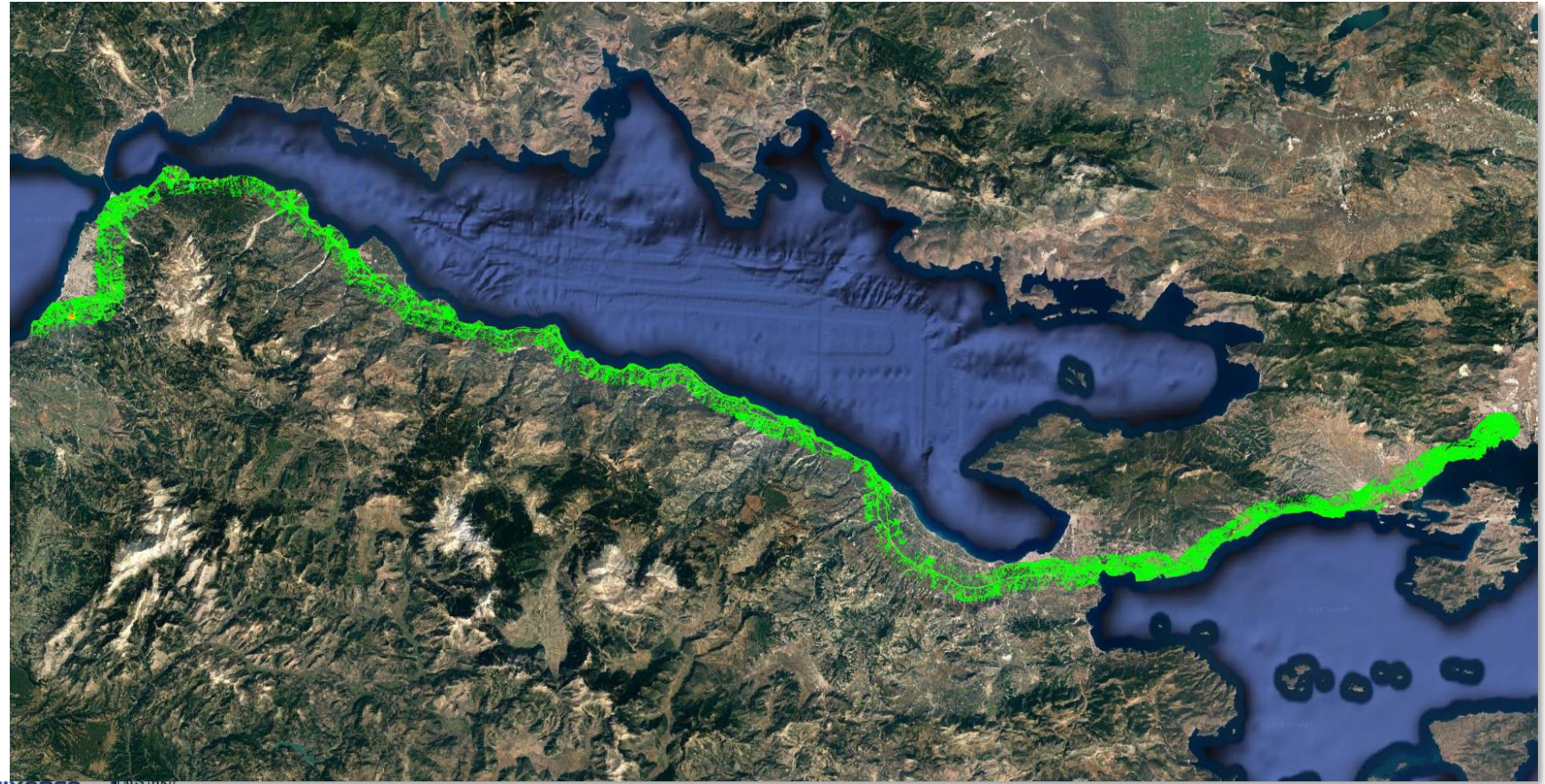
Hydro dams, canals



Ports, coastal zones

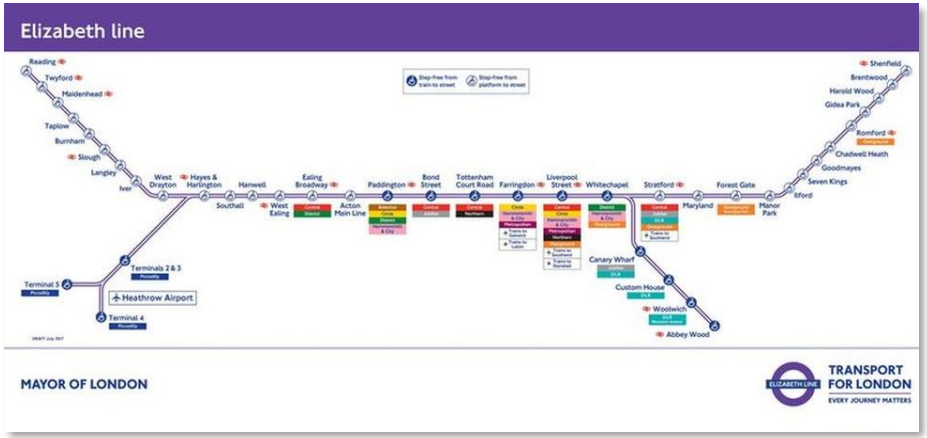
250Km Highway fully monitored with InSAR with a buffer of 1.5Km each side of the alignment:

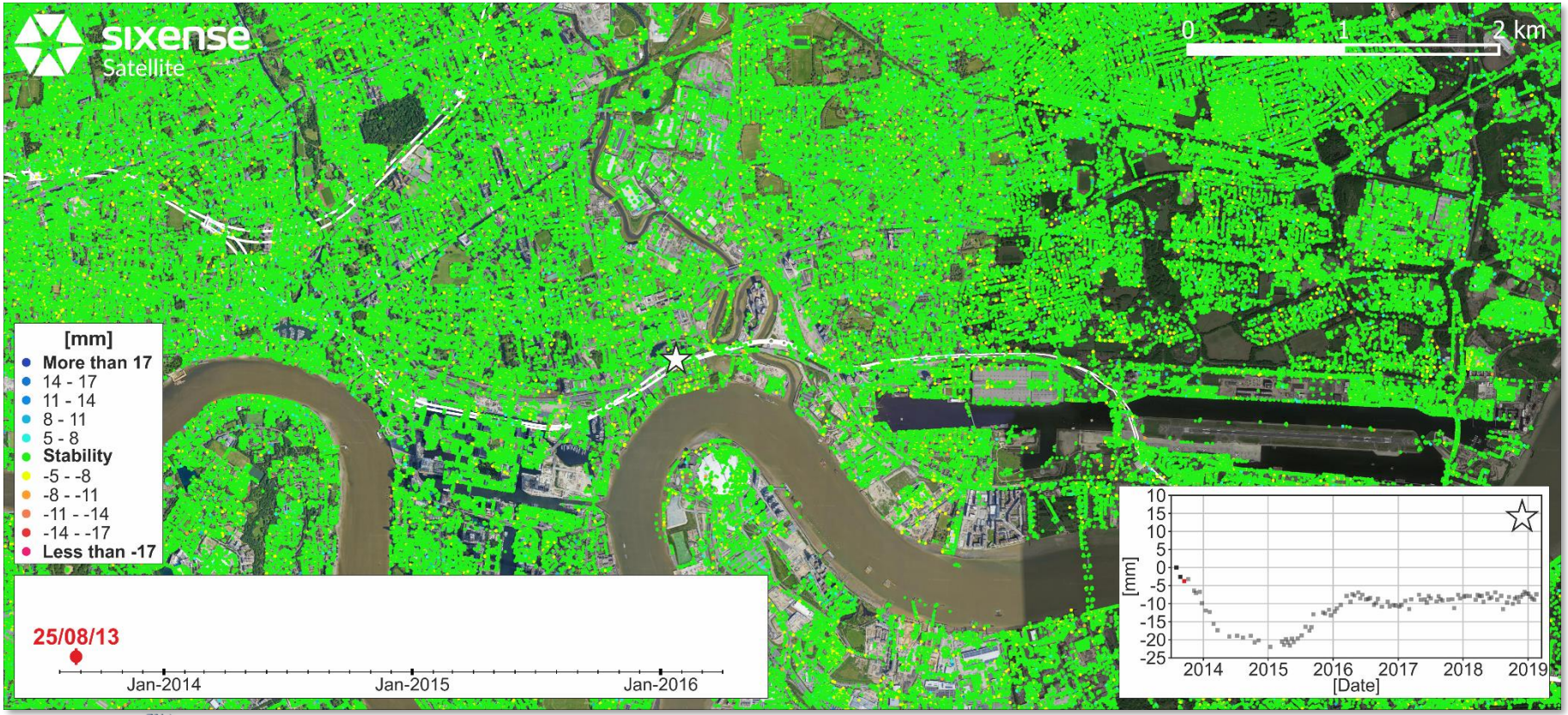
- Historical study:
  - From 2014 to 2018
  - Ascending + Descending → East-West + Up-Down
- Long-term monitoring:
  - Yearly updates
- Specific delivery on demand due to earthquake event
- Detection of the onset of potential landslides with advanced analytics.



Historical study, monitoring during construction and post construction (2011-2023)

- 21 km tunnel and 750m buffer on each side of the route
- Study carried out using high resolution TerraSAR-X band images
- 1,000,000 measuring points for each delivery
- Atlas InSAR was deployed throughout the project lifecycle.
- Analyzes are still underway to analyze residual movements and have technical documents in the event of disputes.




sixense
Satellite
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2 km
[mm]
More than 17
14 - 17
11 - 14
8 - 11
5 - 8
Stability
-5 - -8
-8 - -11
-11 - -14
-14 - -17
Less than -17
25/08/13
Jan-2014
Jan-2015
Jan-2016
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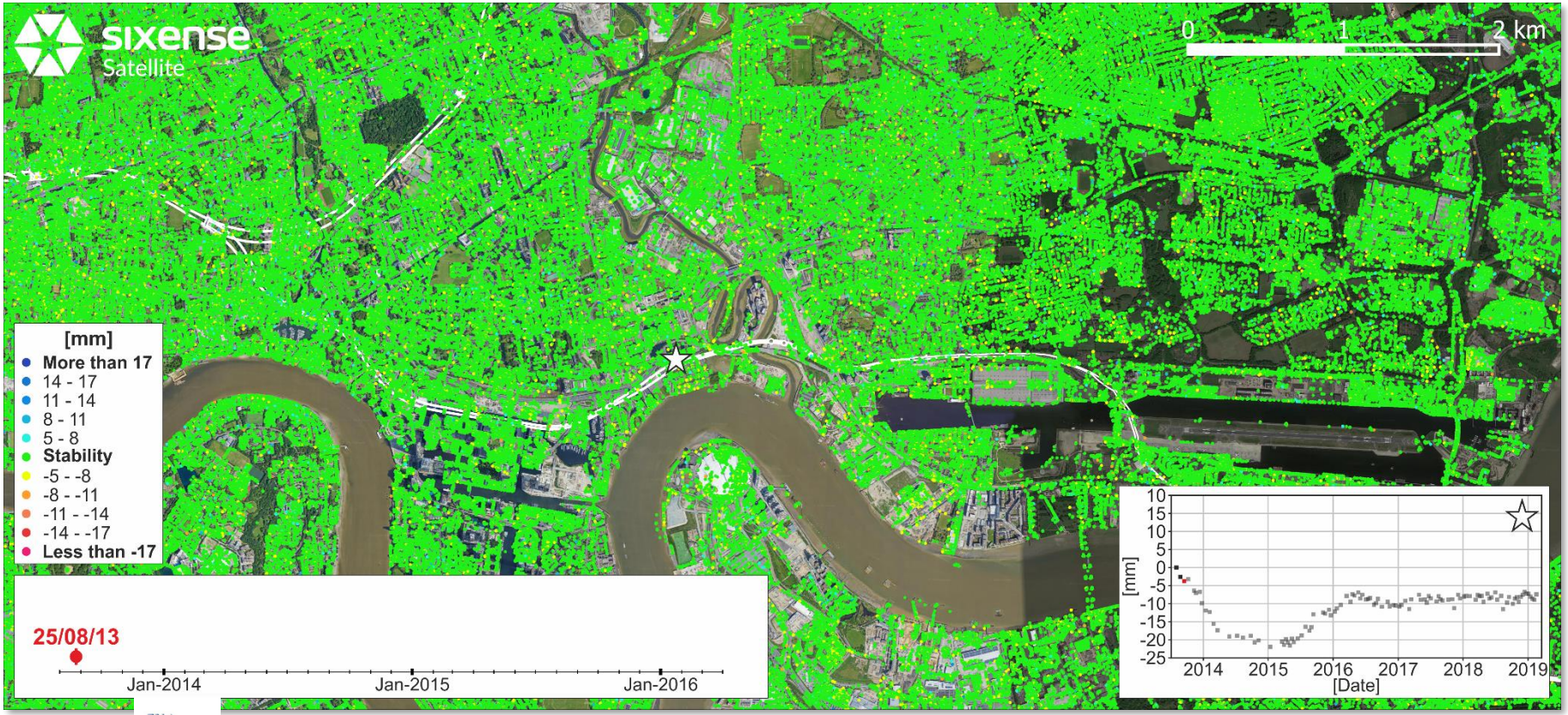
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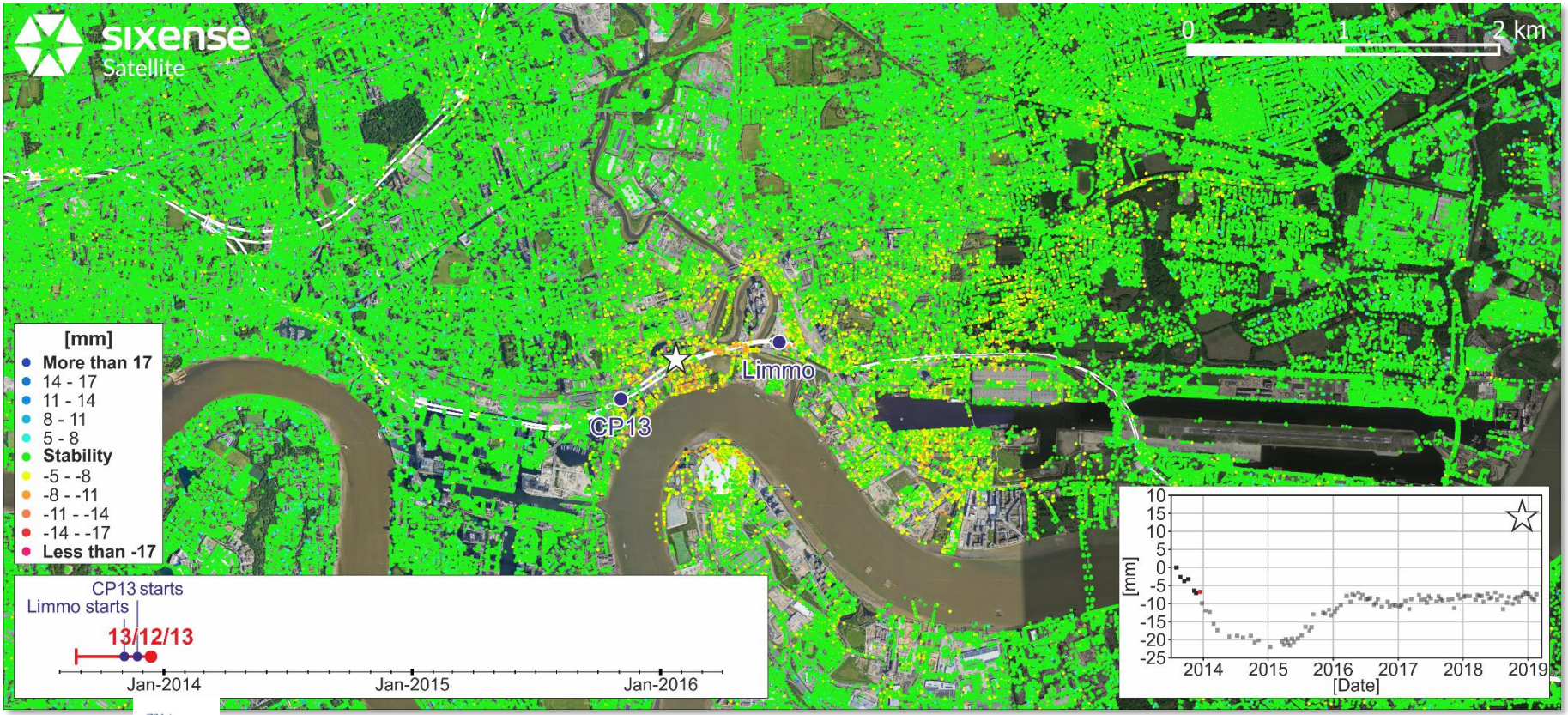
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Less than -17
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CP13 starts
Limmo starts
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Jan-2015
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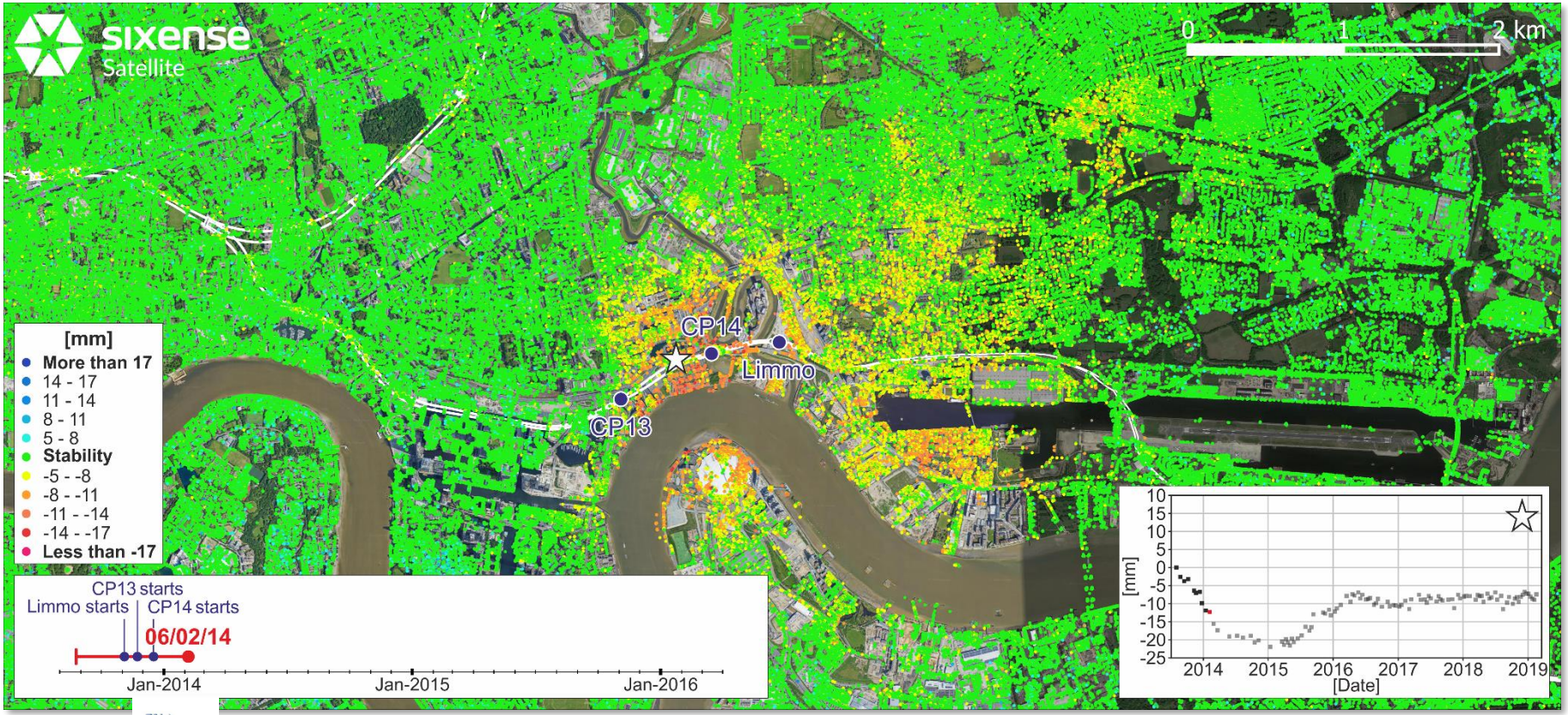
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CP13 starts
Limmo starts | CP14 starts
06/02/14
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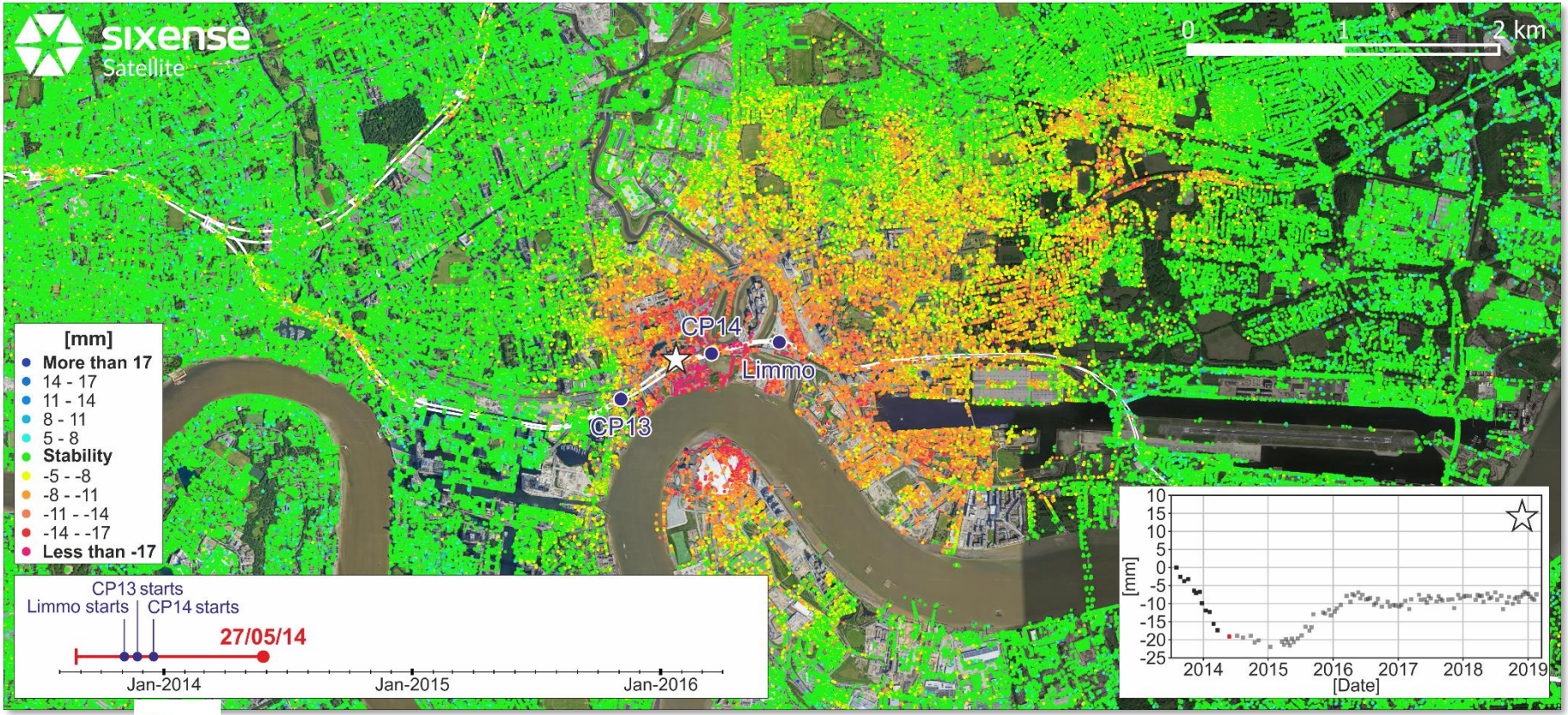
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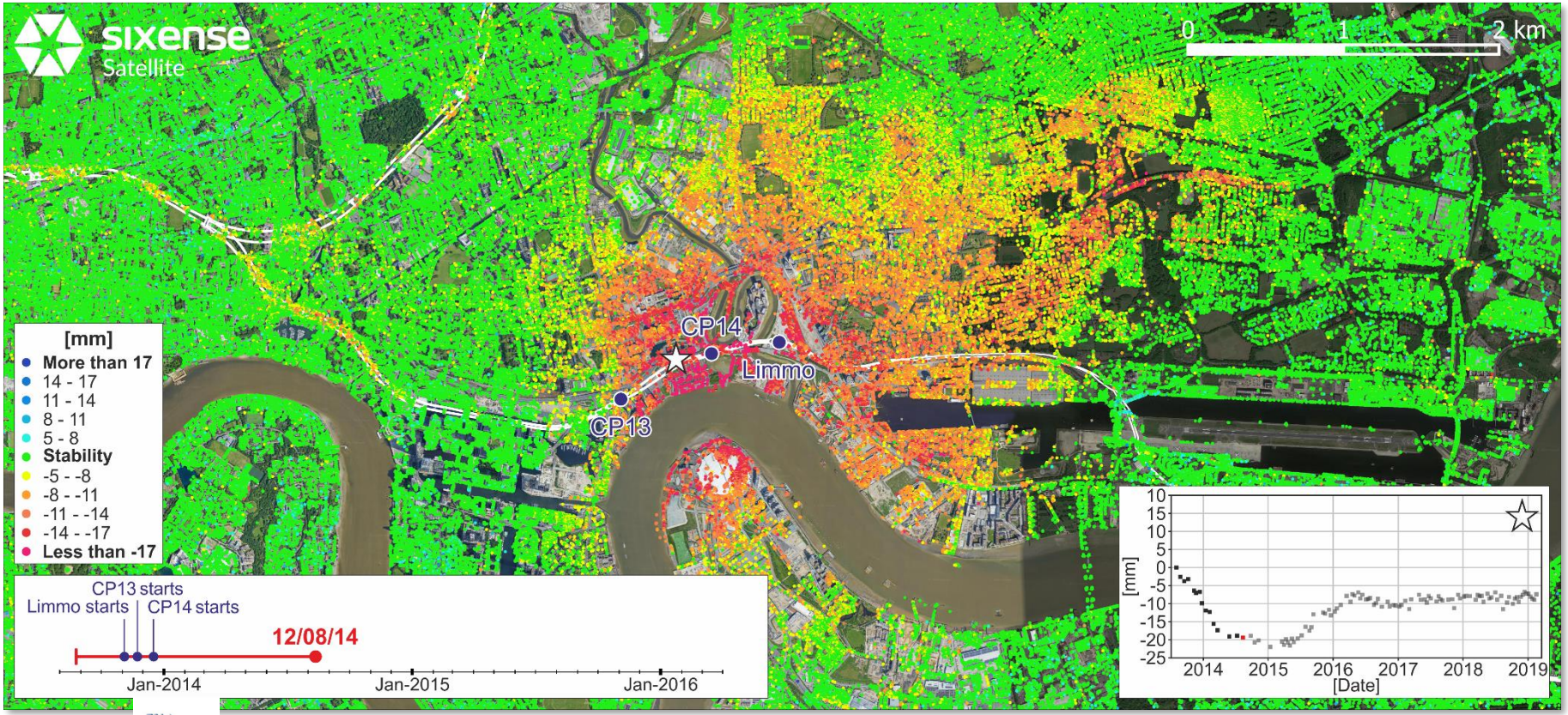
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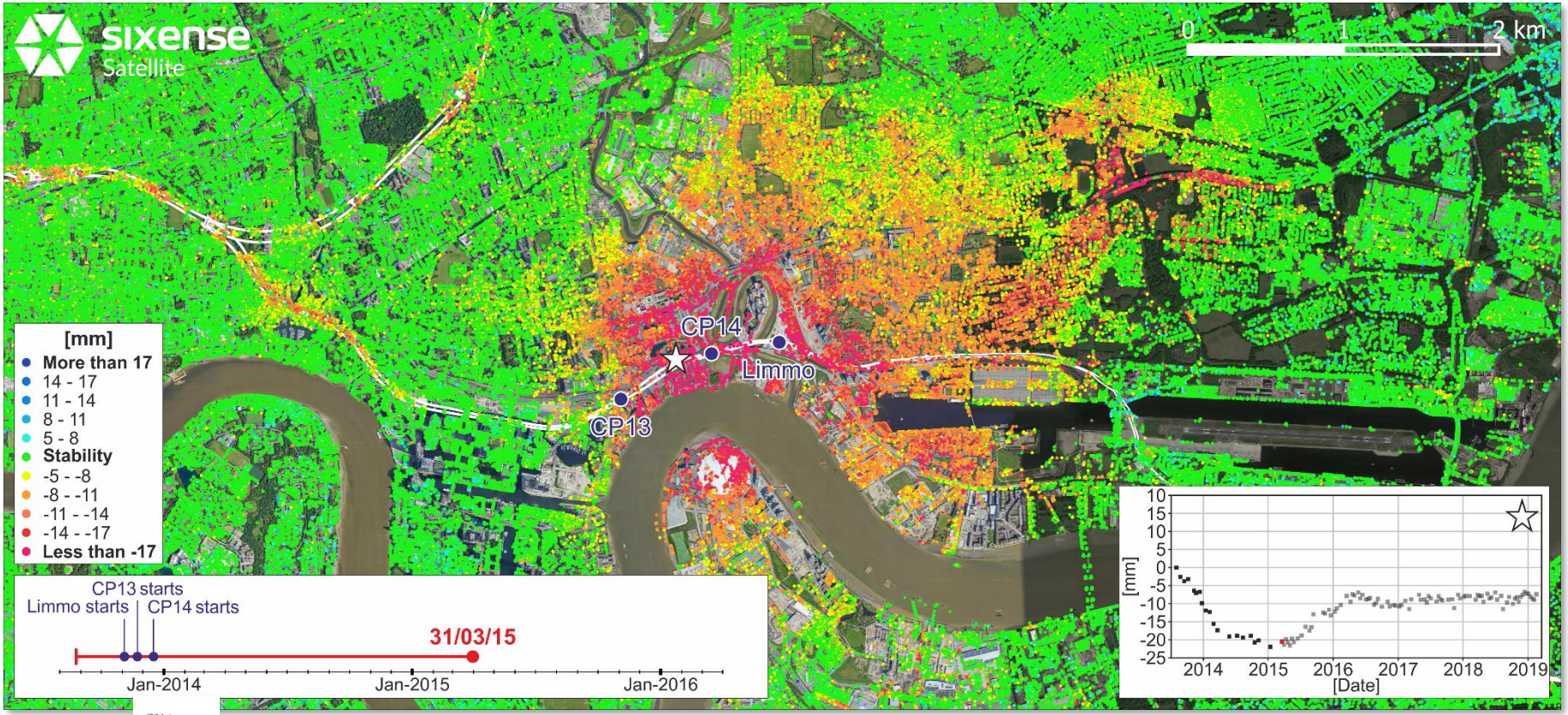
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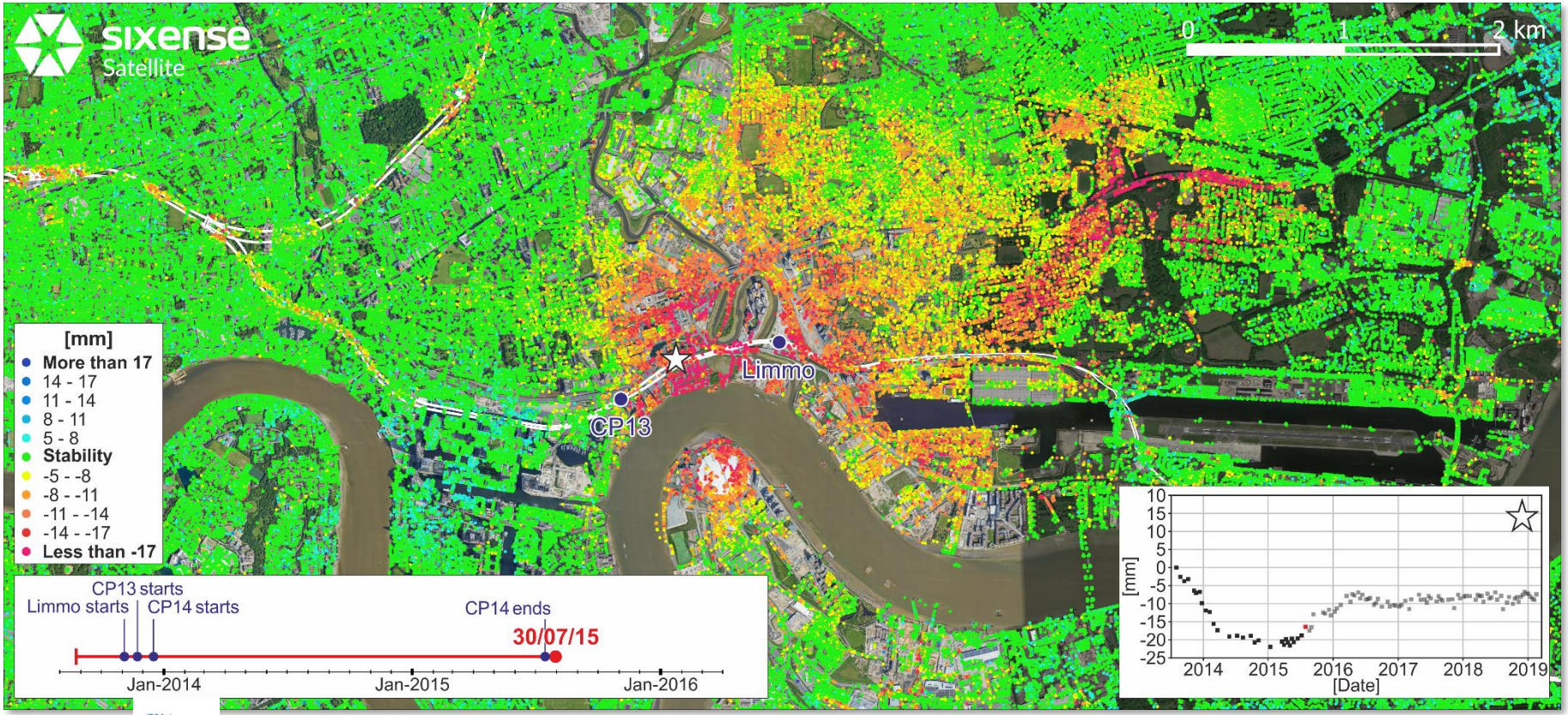
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Less than -17
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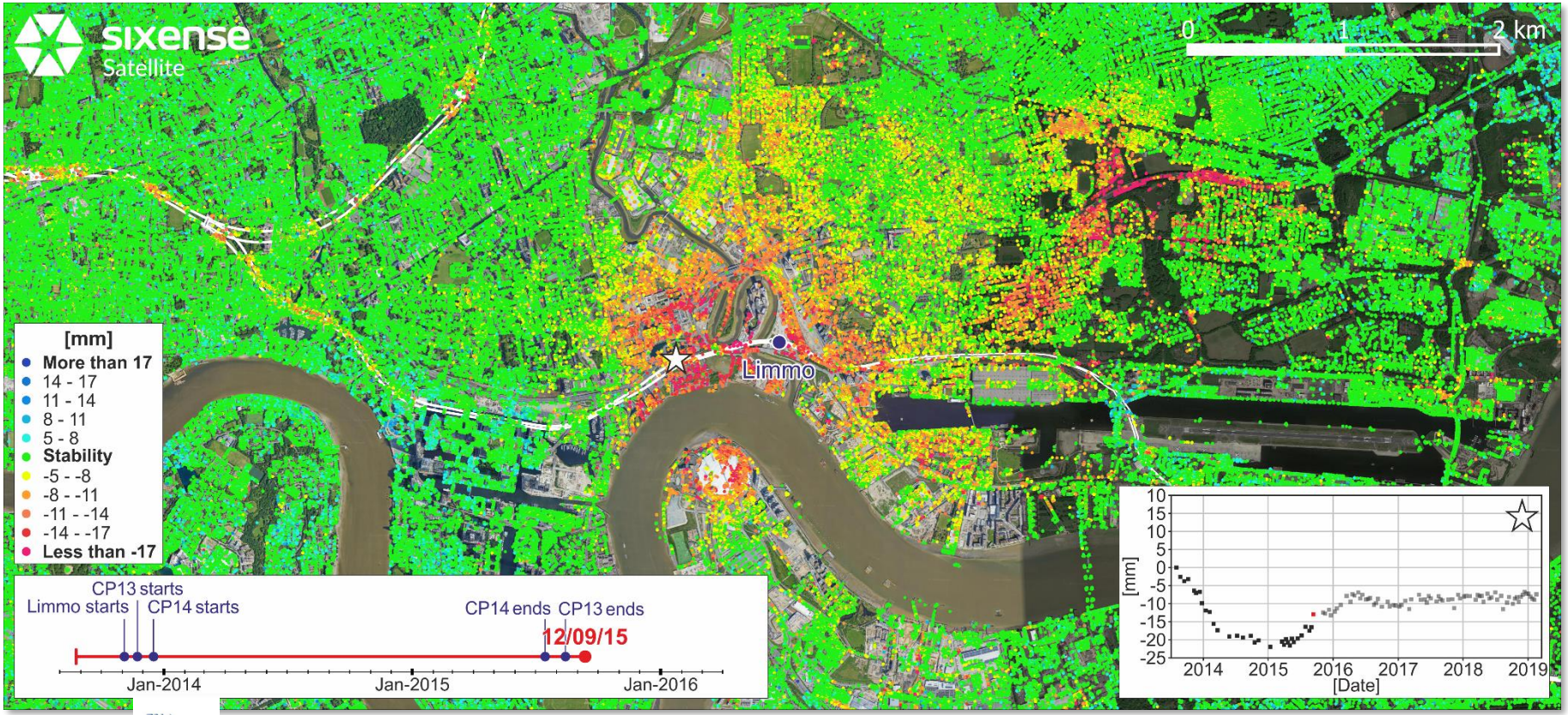
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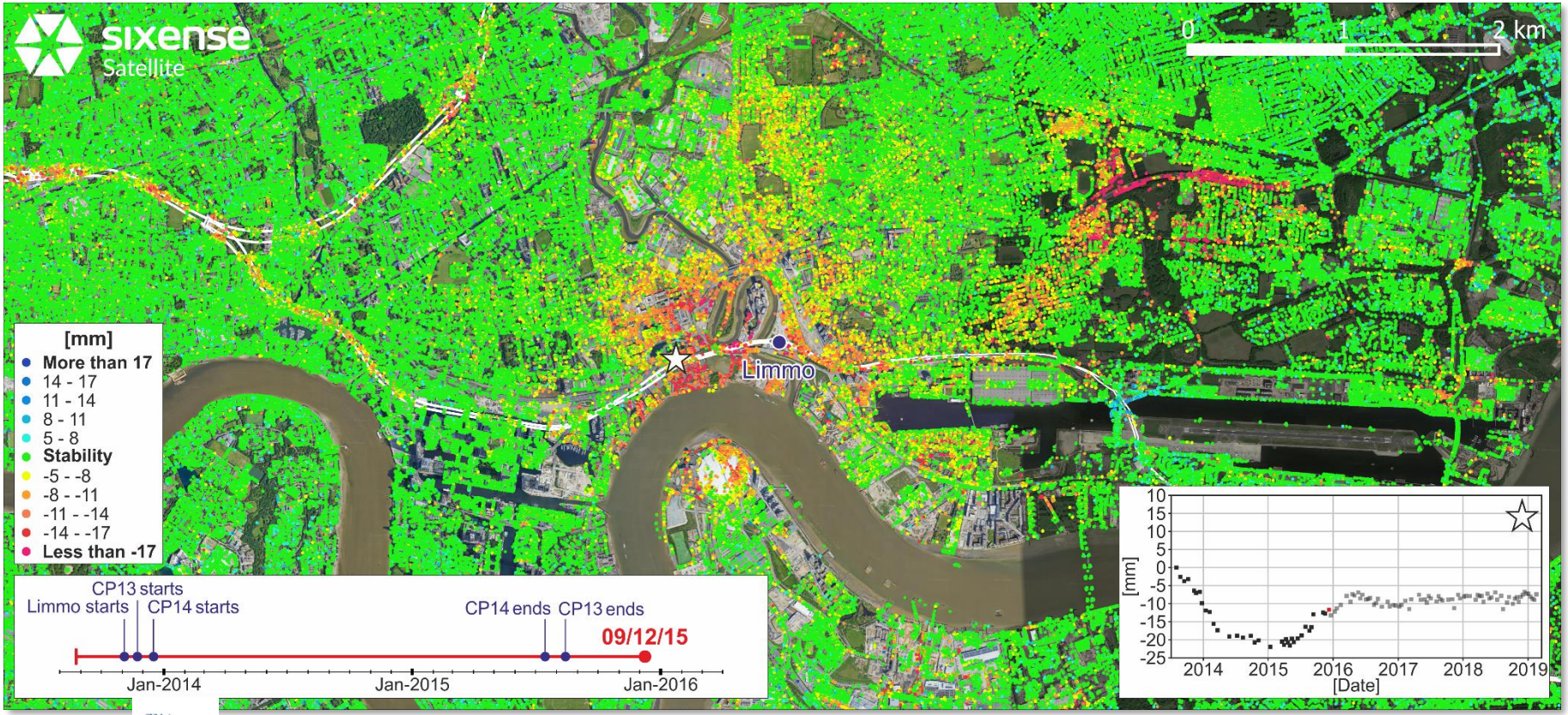
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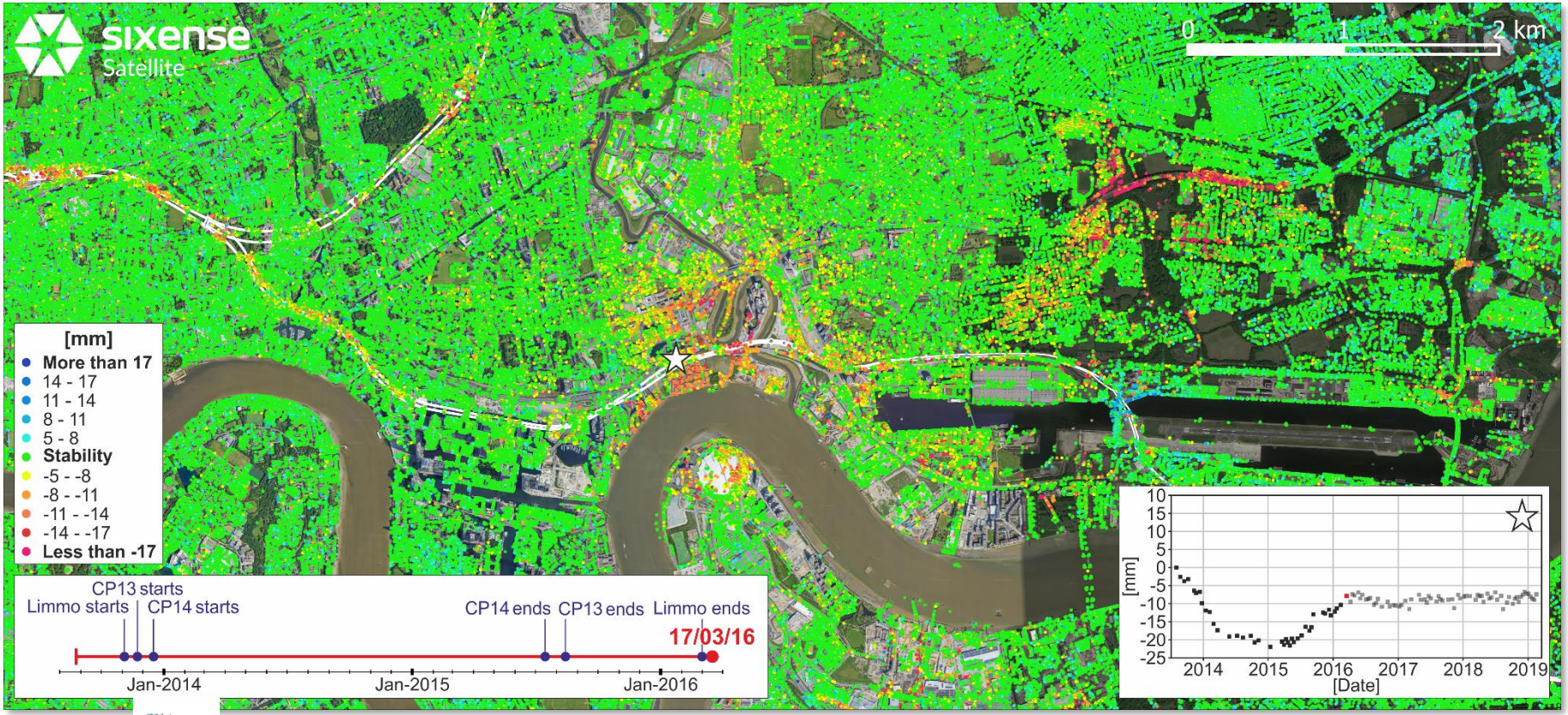
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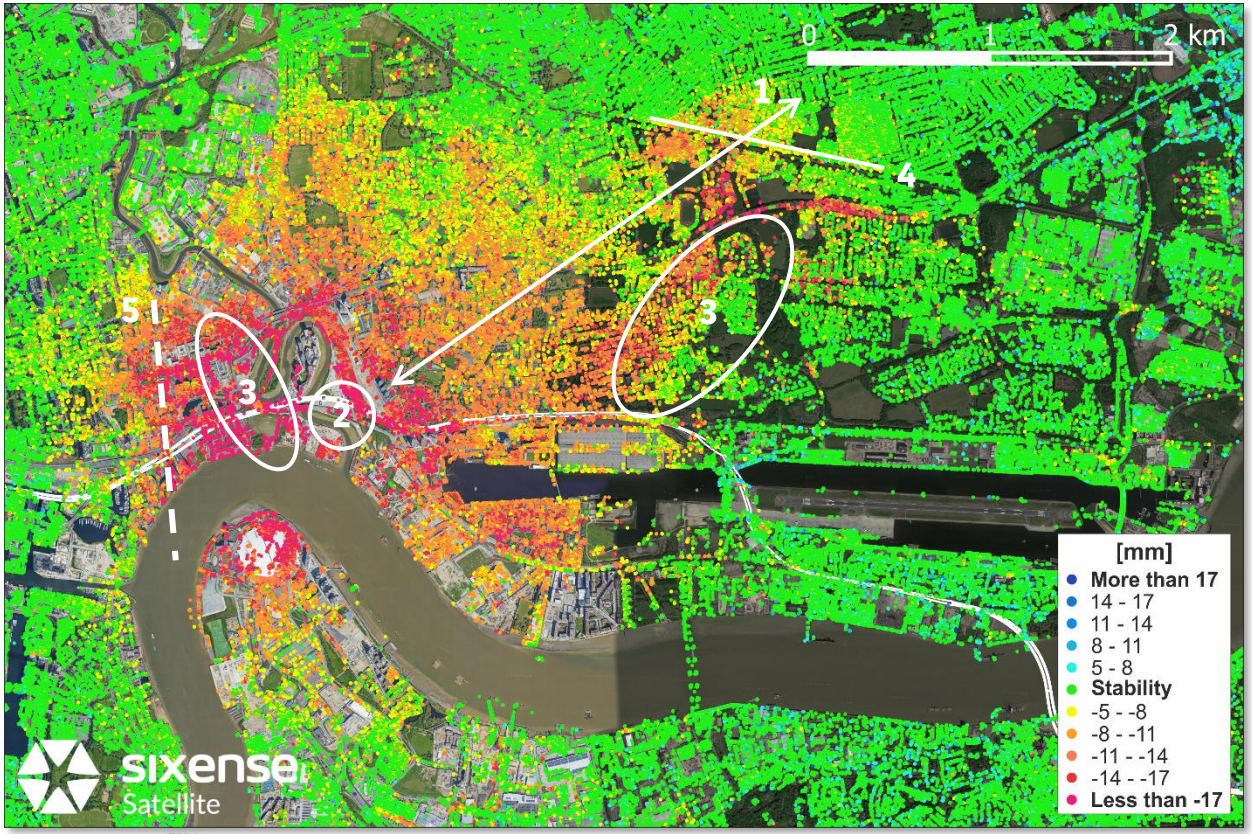
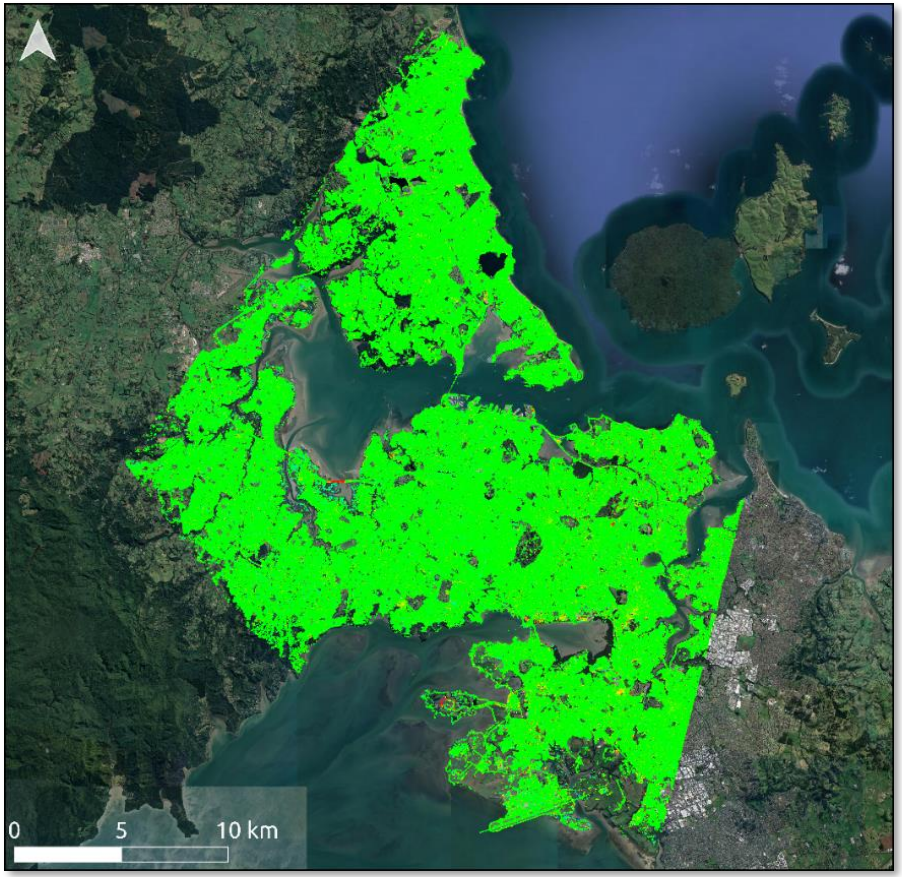
CAS D'ÉTUDE | URBAN TUNNELING



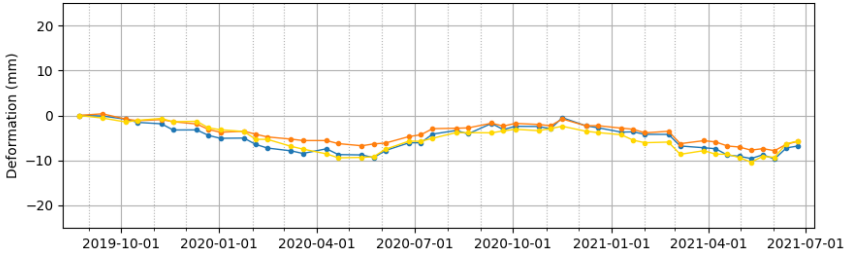
- 1. Zone of influence of 2.5 km, much more than planned during the design phase.
- 2. Settlements of up to 35 mm, exceeding the threshold planned during the design phase
- 3- Delineation of areas where the magnitude of movements is greater than expected.
- 4- Detection of movements linked to other construction projects (Lee Tunnel)
- 5- Identification of a fault with precision

- **Project objective:** For a climate change related project, the city council wanted a map highlighting areas with seasonal ground motion linked to expansive clays.
- **Solution:** High resolution InSAR & advanced analytics

  - Historical study (2019-2021), yearly updates
  - Processed area: < 500 km^2
  - TRS-X Stripmap mode images: 3x3m
  - > 8 million measurement points
  - Precision: 1-2mm (annual velocity); 2-3mm (individual measurement points)




A
B
0
250
500 m


Deformation (mm)
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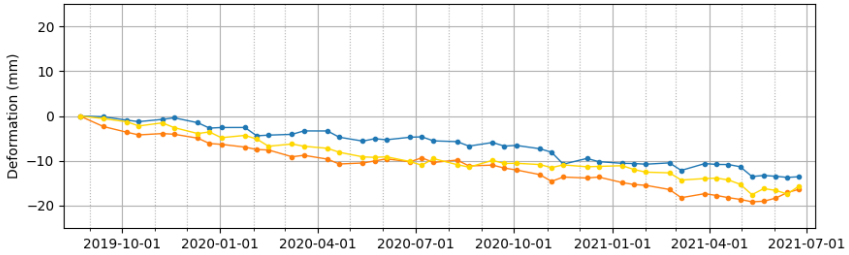
2019-10-01
2020-01-01
2020-04-01
2020-07-01
2020-10-01
2021-01-01
2021-04-01
2021-07-01


Deformation (mm)
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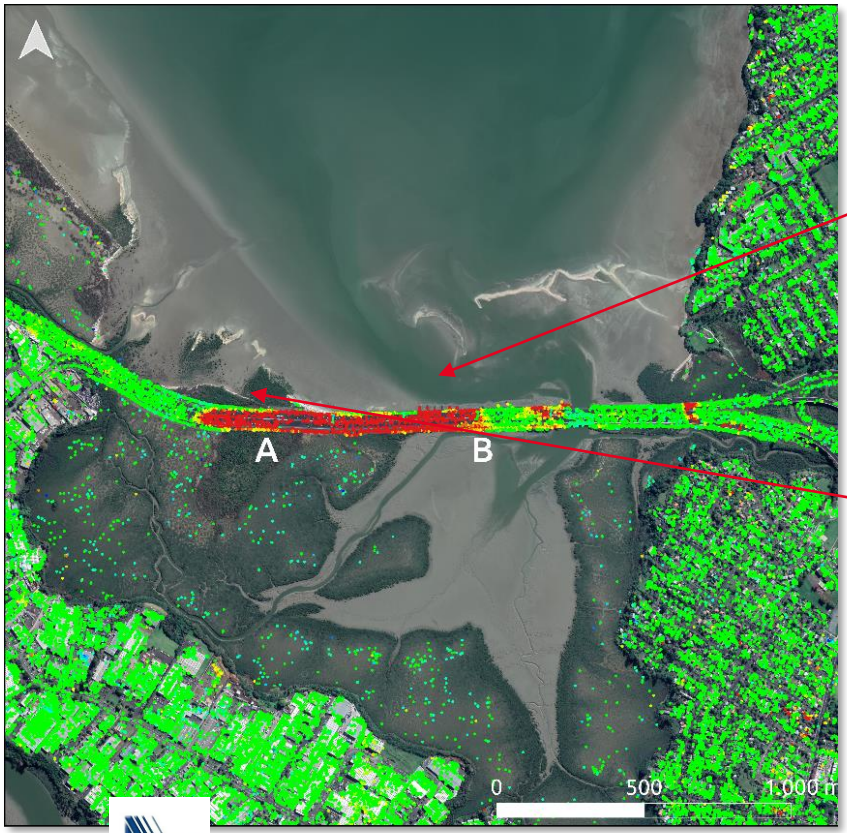
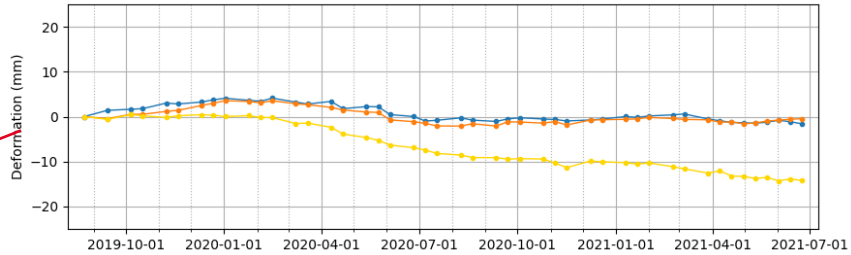
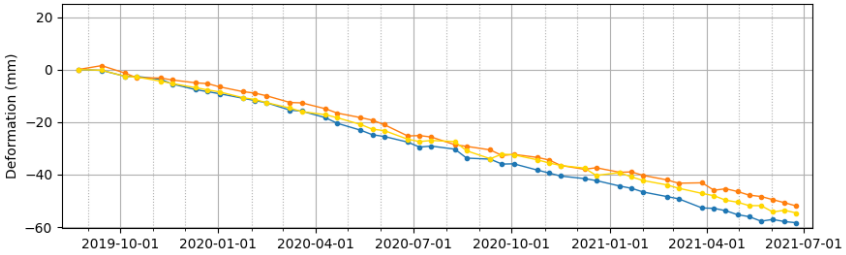
2019-10-01
2020-01-01
2020-04-01
2020-07-01
2020-10-01
2021-01-01
2021-04-01
2021-07-01

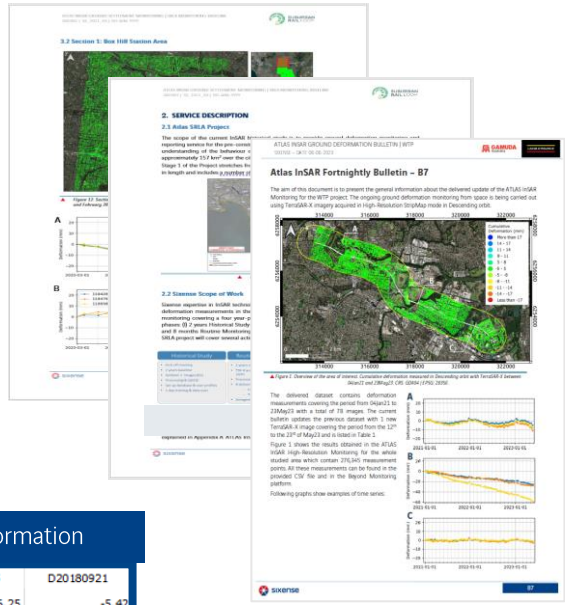
MUNICIPALITY FOR ASSETS MAINTENACE







- **Reports**: including technology description, summary of results and detailed analyses of specific areas.
- Dataset files in **CSV** and **SHP** formats for each of the processed sets ready to be uploaded onto any existing GIS platform
- Access to dedicated **WEB GIS Platform**
- **InSAR training courses:** SAR principles, data uses, interpretation and analysis of the results



	Identification				Associated Parameters			Time Series of Cumulative Deformation				
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2	PS_721737_4216522	721737.06	4216522.5	65.3	0.26	-0.29	0.59	0	1.61	31	-1.1	-0.68
3	PS_721706_4216527	721706.12	4216527	59.3	0.06	0.28	1.06	0	-3.01	34	2.81	3.05
4	PS_721970_4216458	721969.69	4216458	63.3	0.13	-0.09	0.8	0	0.39	.2	-6.57	-6.92
5	PS_721929_4216464	721929.25	4216464.5	64.3	0.66	0.98	2.27	0	-1.31	.2	-1.71	-3.91
6	PS_721889_4216470	721888.88	4216470.5	65.3	0.55	-0.7	2.51	0	1.33	78	-5.27	-5.65