ERATOSTHENES Centre of Excellence (ECoE)

EXCELSIOR

ERATOSTHENES:
Excellence Research Centre for Earth Surveillance & Space-Based Monitoring of the Environment

1st virtual EXCELSIOR International Technical Workshop

15 July 2020

Landslide monitoring and susceptibility mapping in Cyprus

@excelsior2020eu

Skevi Perdikou

Geofem

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857510

This project has received funding from the Government of the Republic of Cyprus through the Directorate General of the European's Programmes, Coordination and Development

CONSORTIUM

Cyprus University of Technology · DLR · TROPOS Leibniz Institute for Tropospheric Research · DEC

Principles of InSAR

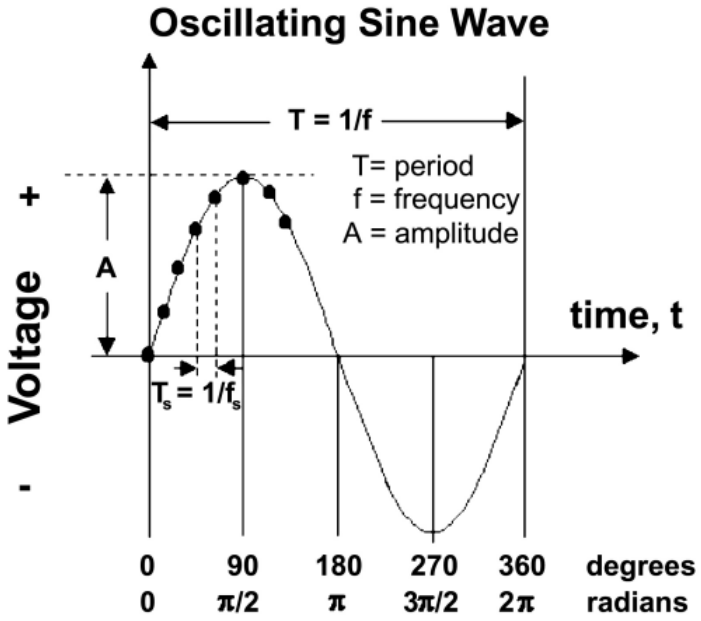
InSAR: Interferometric Synthetic Aperture Radar

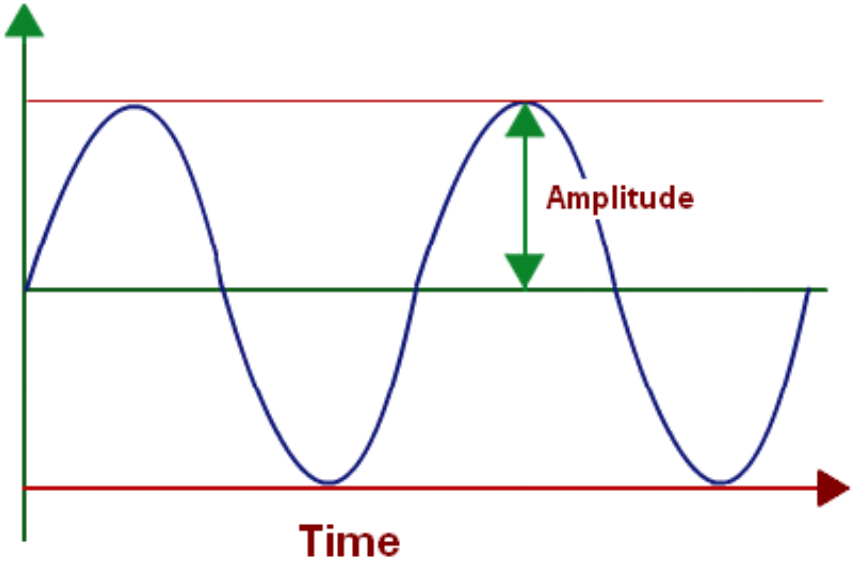
- The radar is an active system, transmitting a radio wave from a satellite antenna and receiving a reflected wave from a target.

- Radar observations can be made ***day and night*** as they don't rely on sunlight to operate and under any weather conditions.

Principles of InSAR

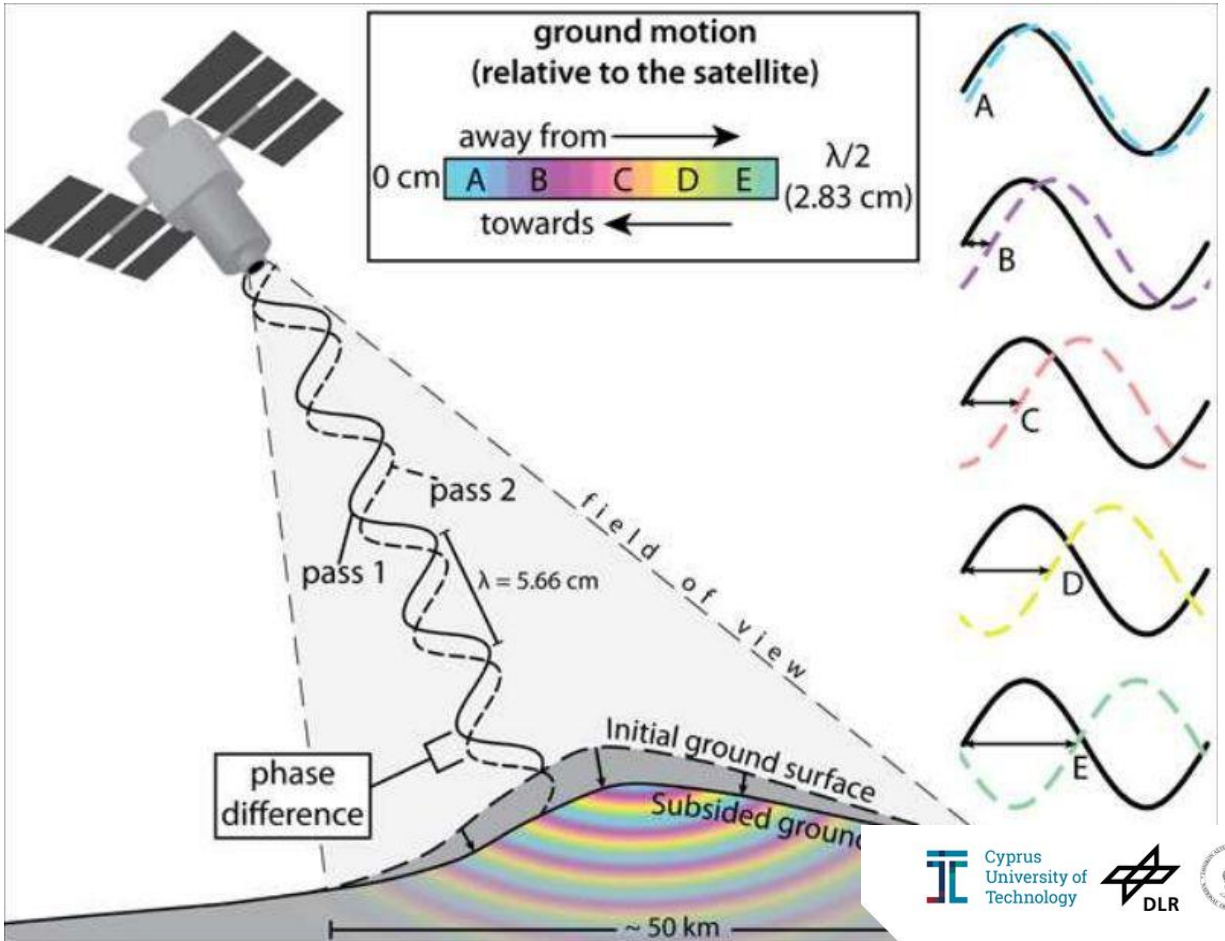
- The basic measurements made by SAR are the ***amplitude*** and the ***phase*** of the reflected wave.





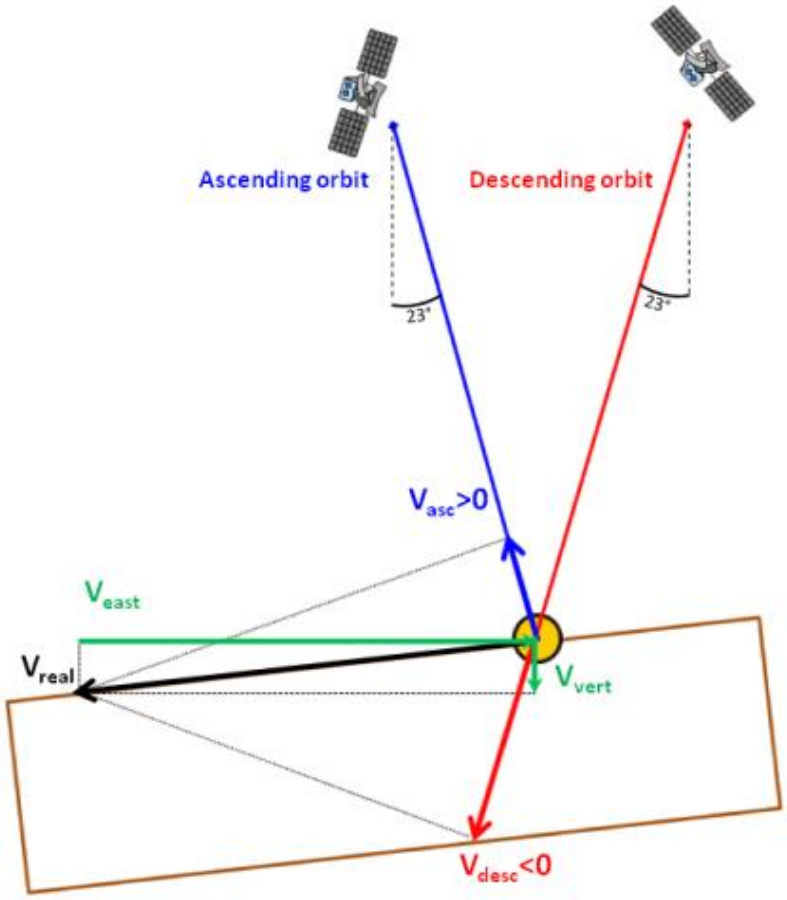
What do we measure?

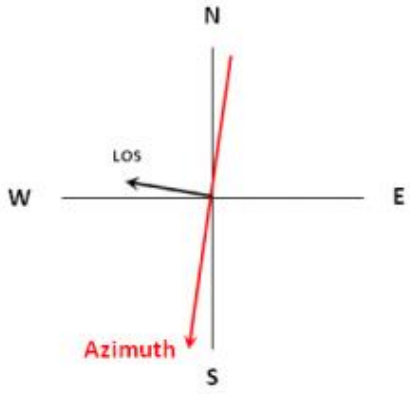
- We use phase difference to measure displacement.

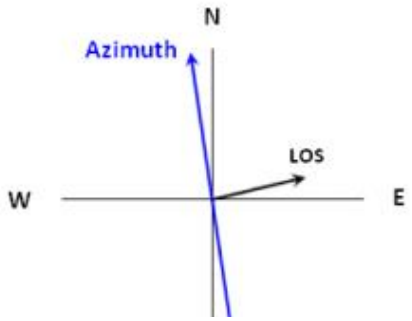


What do we measure?

- Resolve ascending and descending geometries





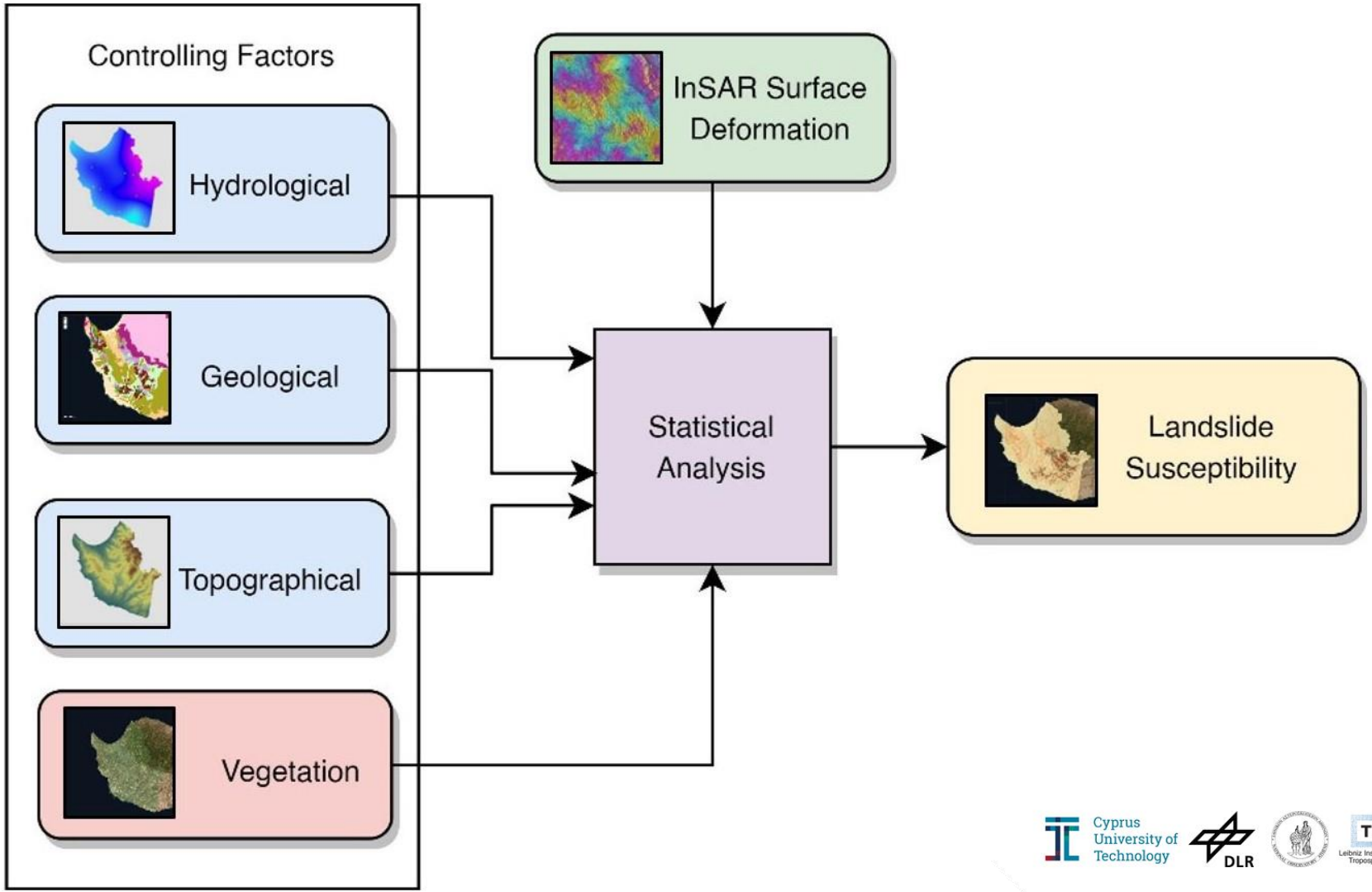


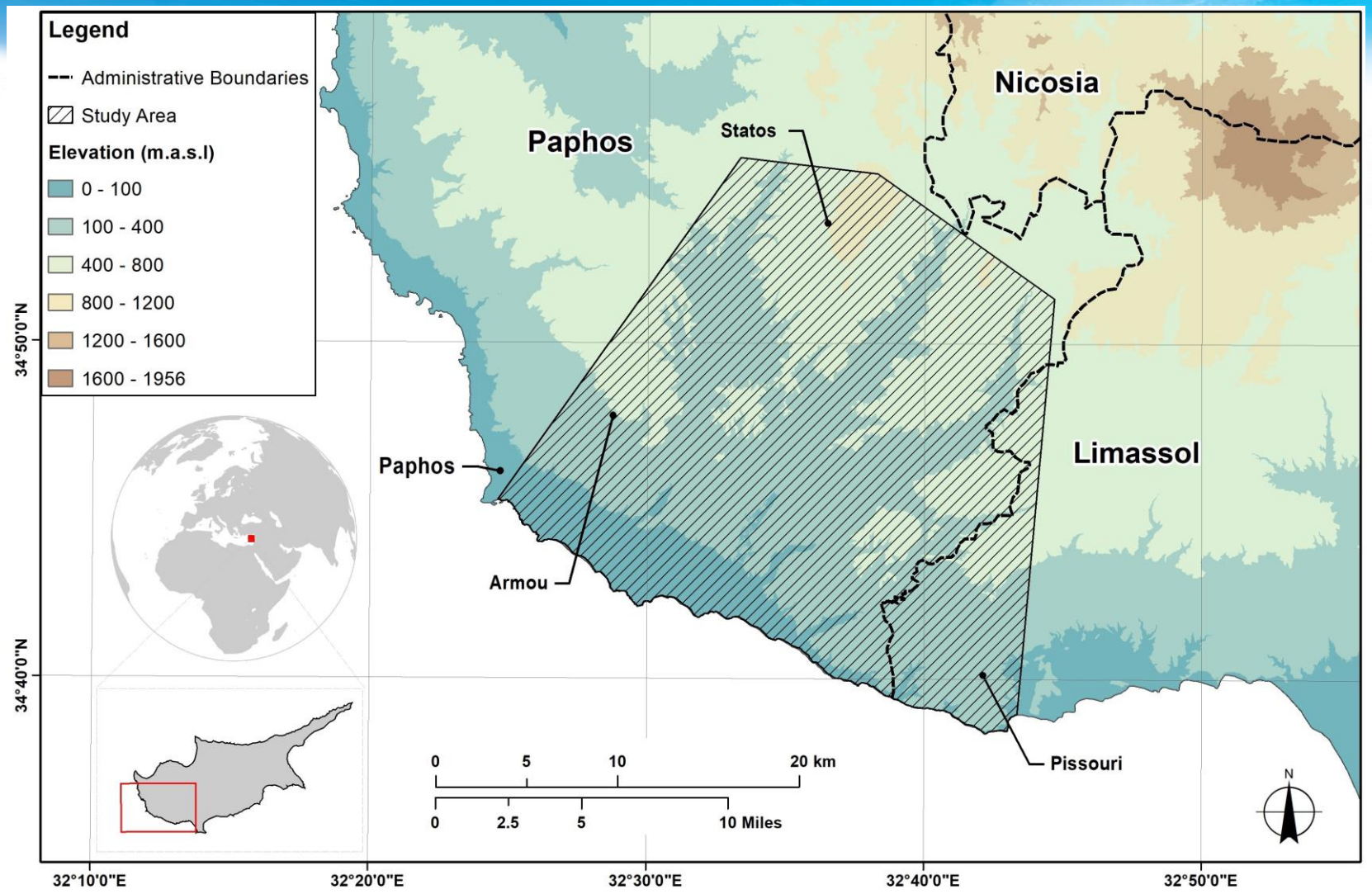
Tofani et. Al., 2013

Landslides

- ***The majority of losses due to landslides can be avoided if the problem is recognised prior to each landslide event.***
- A study in 2010 in the Paphos district by the Cyprus Geological Survey Department (GSD) and Scott Wilson Ltd, documented ***1842 landslides*** **extending over 134km2** (Hart and Hearn, 2013).

Methodology



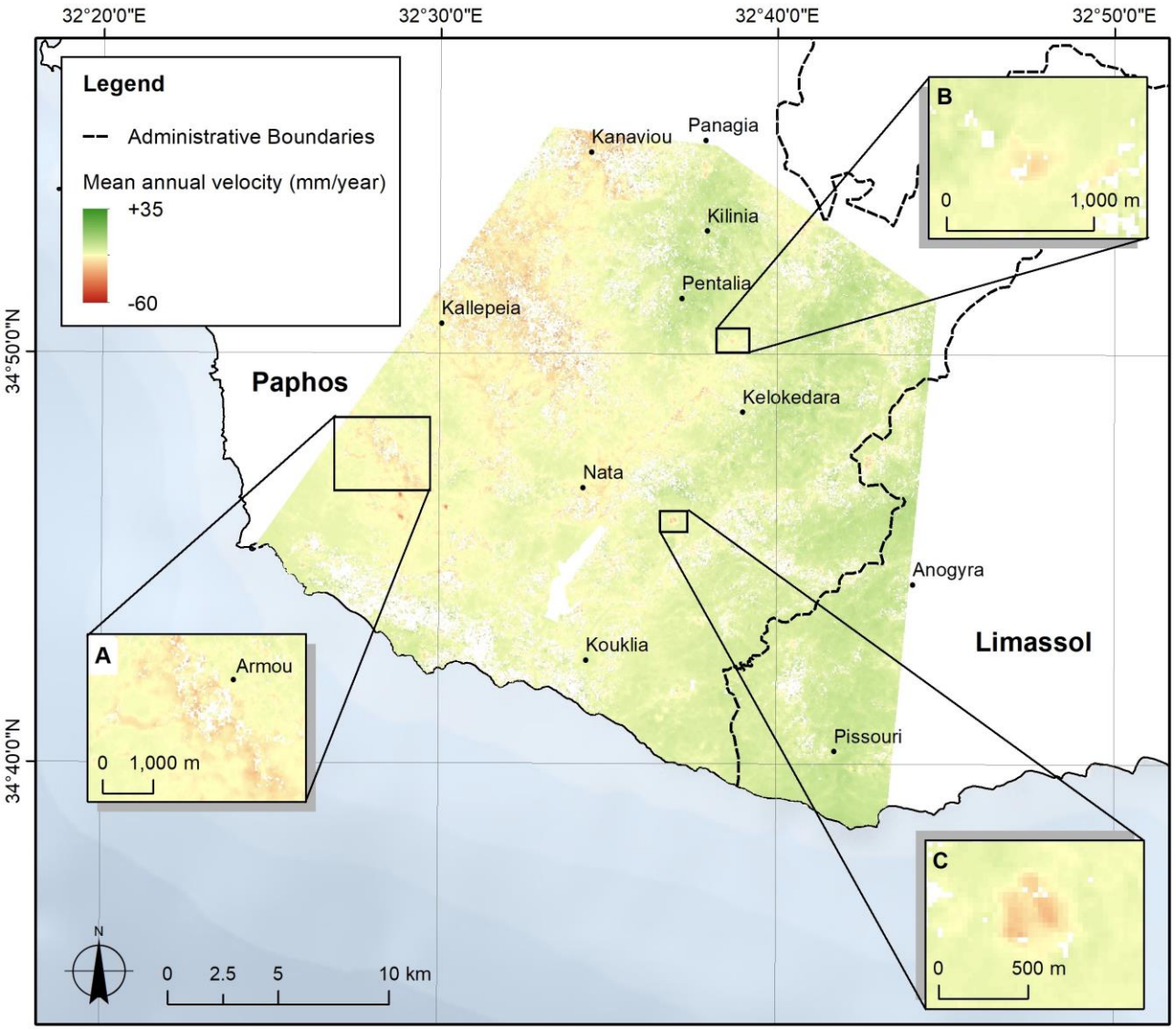

Legend
Administrative Boundaries
Study Area
Elevation (m.a.s.l)
0 - 100
100 - 400
400 - 800
800 - 1200
1200 - 1600
1600 - 1956
Nicosia
Paphos
Statos
Paphos
Armou
Limassol
Pissouri
0 5 10 20 km
0 2.5 5 10 Miles
N
34°50'0"N
34°40'0"N
32°10'0"E
32°20'0"E
32°30'0"E
32°40'0"E
32°50'0"E

Methodology

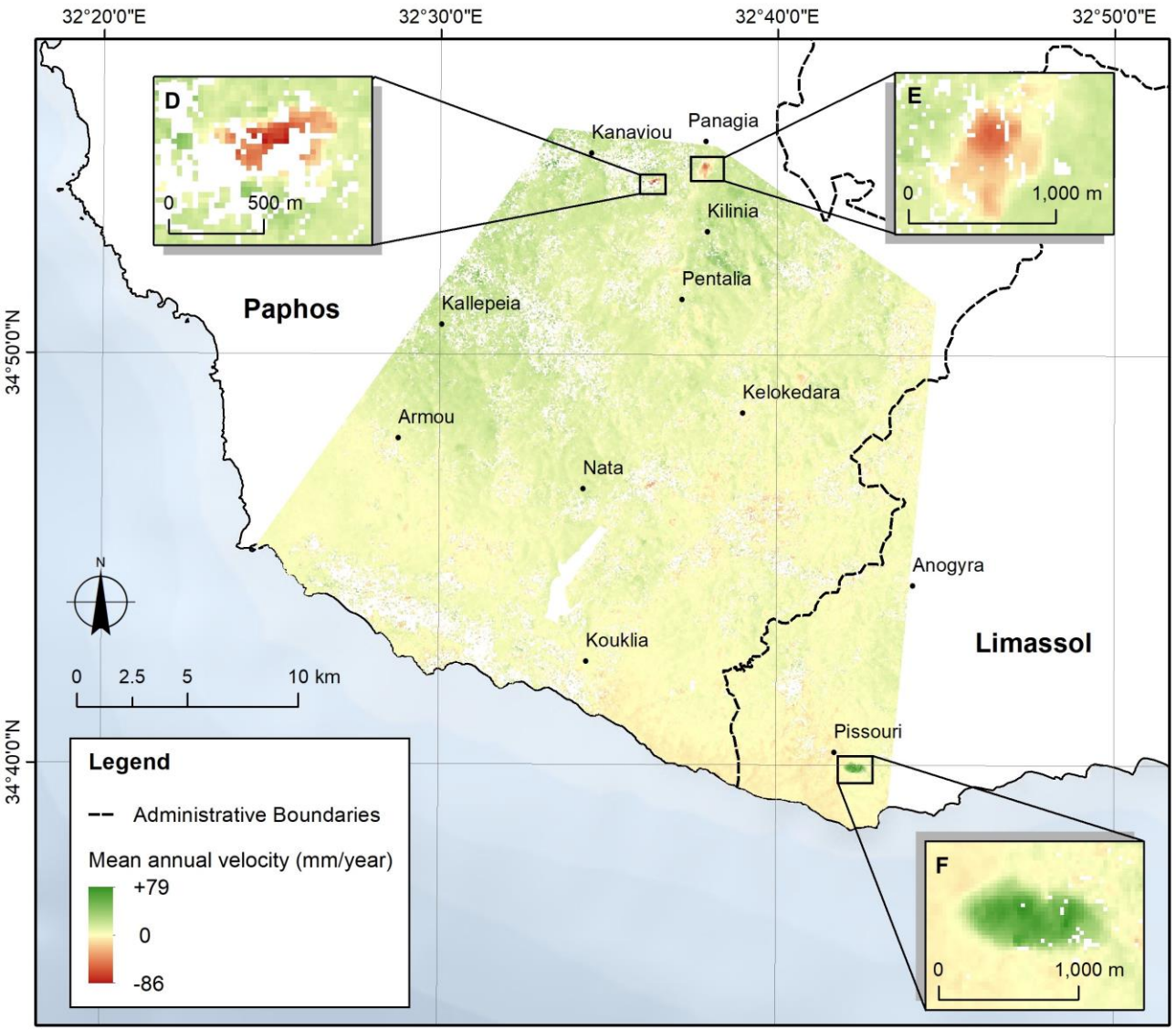
- ***Analysis: PS & SBAS***
  - ***PS: urban areas, linear movements***
  - ***SBAS: sparsely vegetated areas, non-linear movements (seasonal changes)***

- ***Sentinel-1 images: march 2016 – March 2018***

- ***Ascending and Descending geometries***

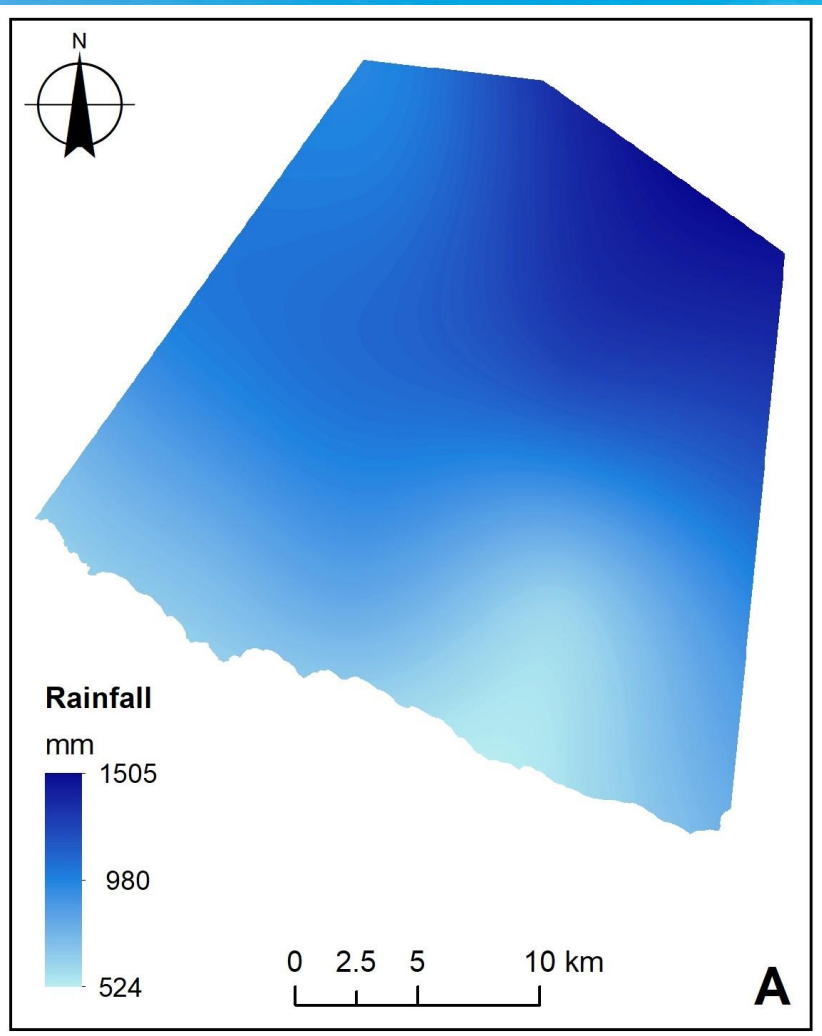


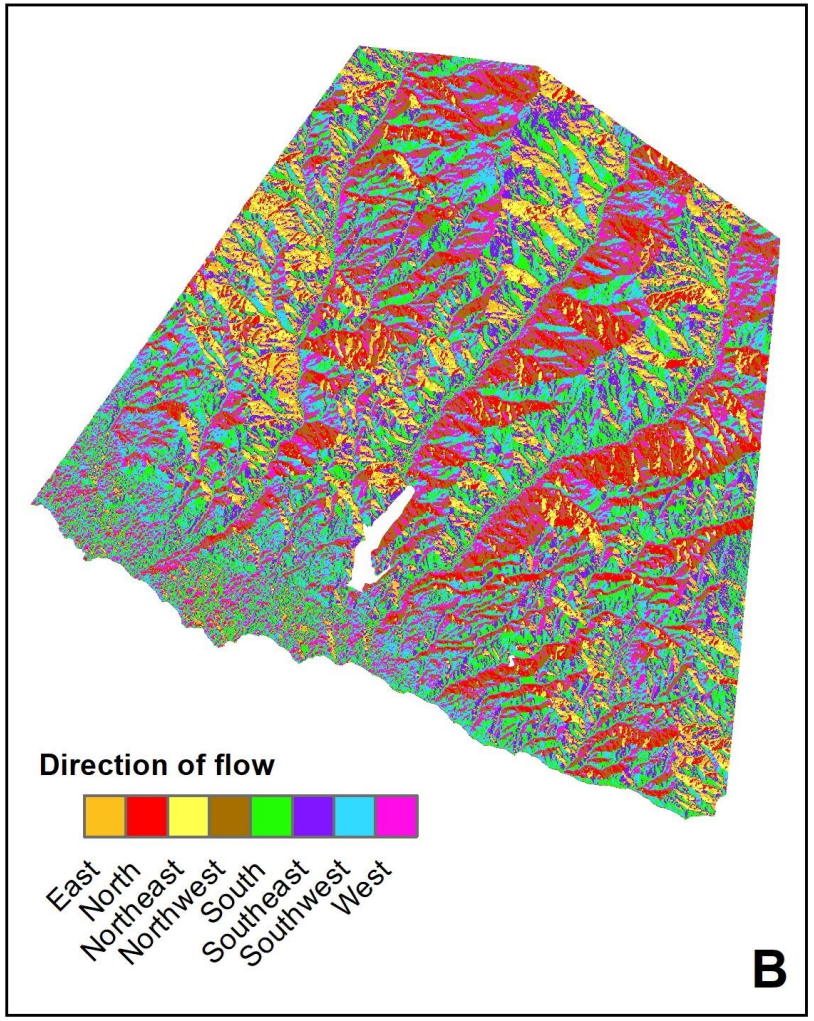
Mean annual ***vertical*** velocity: mm/year



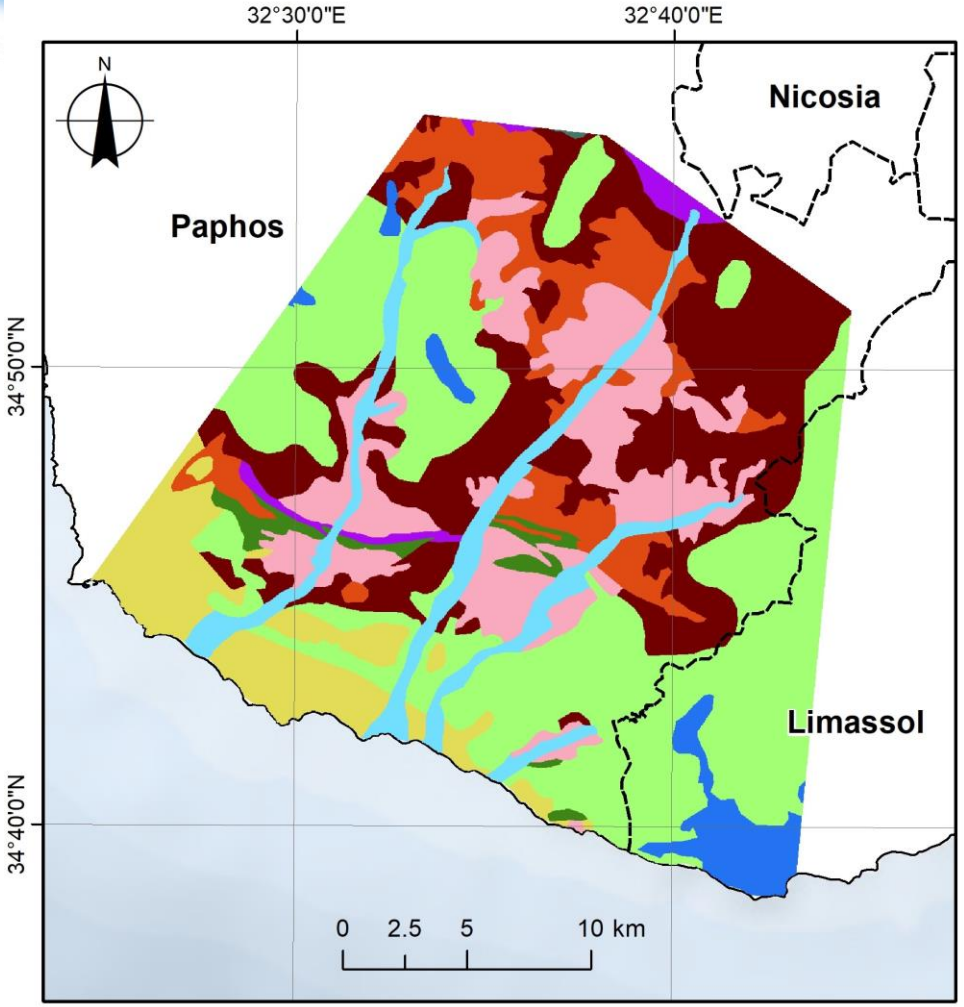
Mean annual ***horizontal*** velocity: mm/year

Controlling factors





Controlling factors



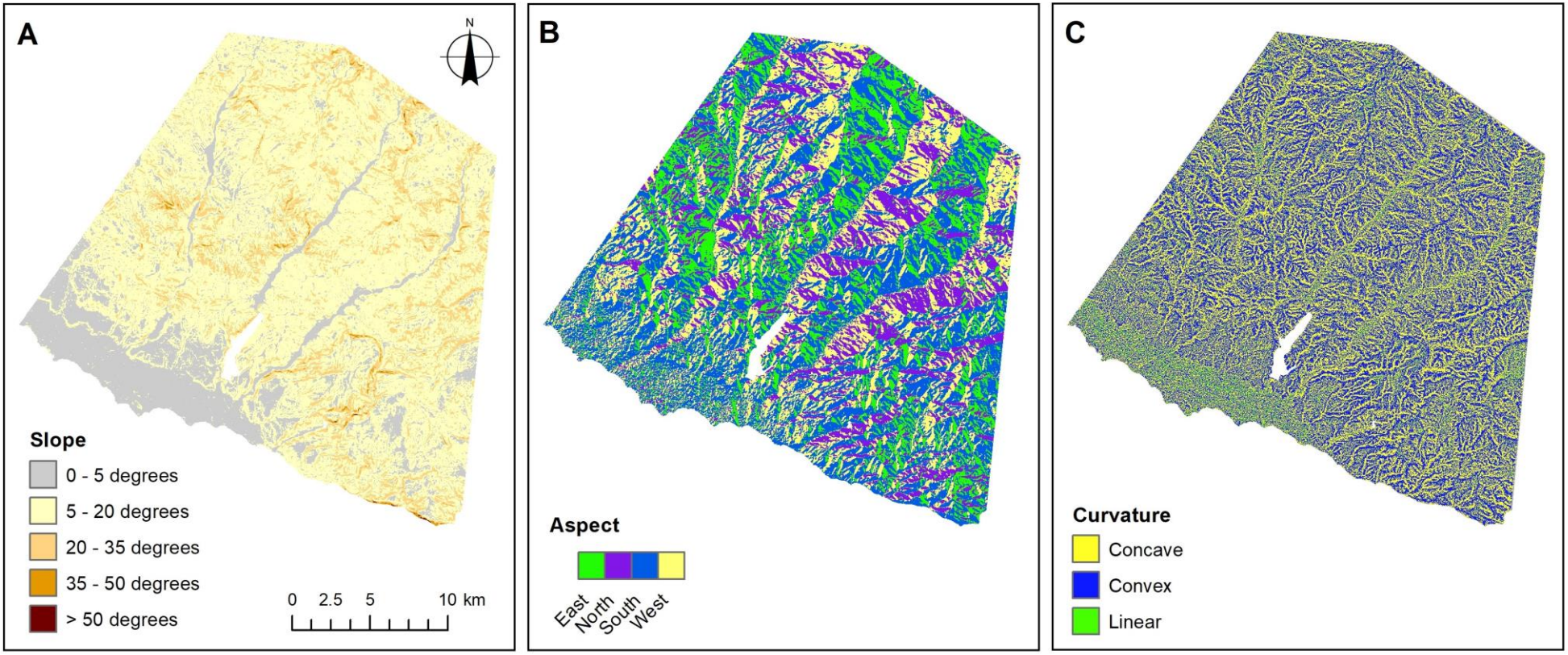
Legend

Administrative Boundaries

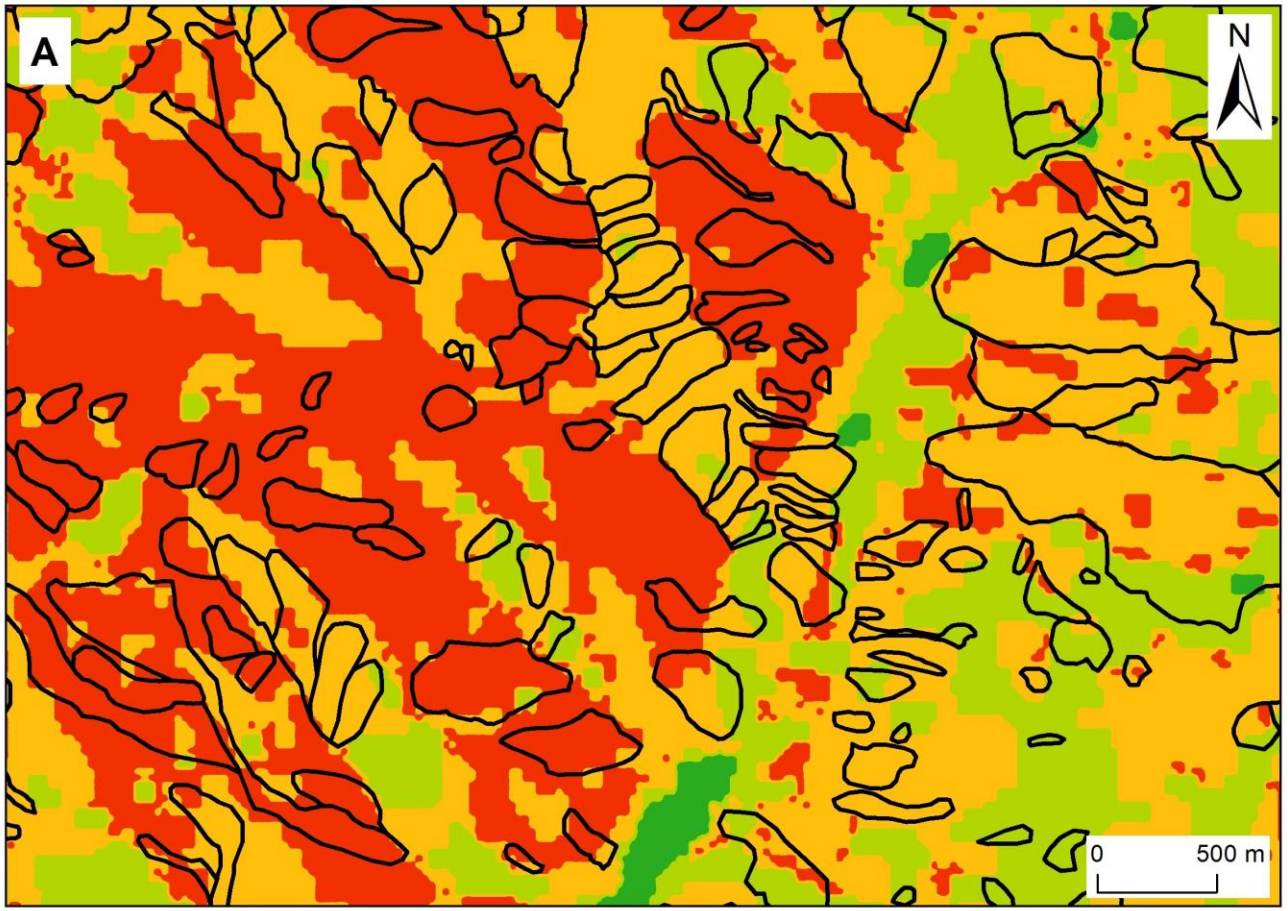
Geology

- Sheeted Dykes (Diabase)
- Upper and Lower Pillow Lavas and Basal Group
- Alluvium - Colluvium
- Moni, Kannaviou and Pera Pedi Formations - Bentonitic
- Apalos, Athalassa, Kakkaristra and Nicosia Formations
- Kalavaso and Pachna Formations
- Terrace Deposits, Fanglomerate
- Lefkara, Kalogrea-Ardana and Lapithos Formations
- Mamonia Complex
- Harzburgite and Serpentinite

Controlling factors



Susceptibility mapping

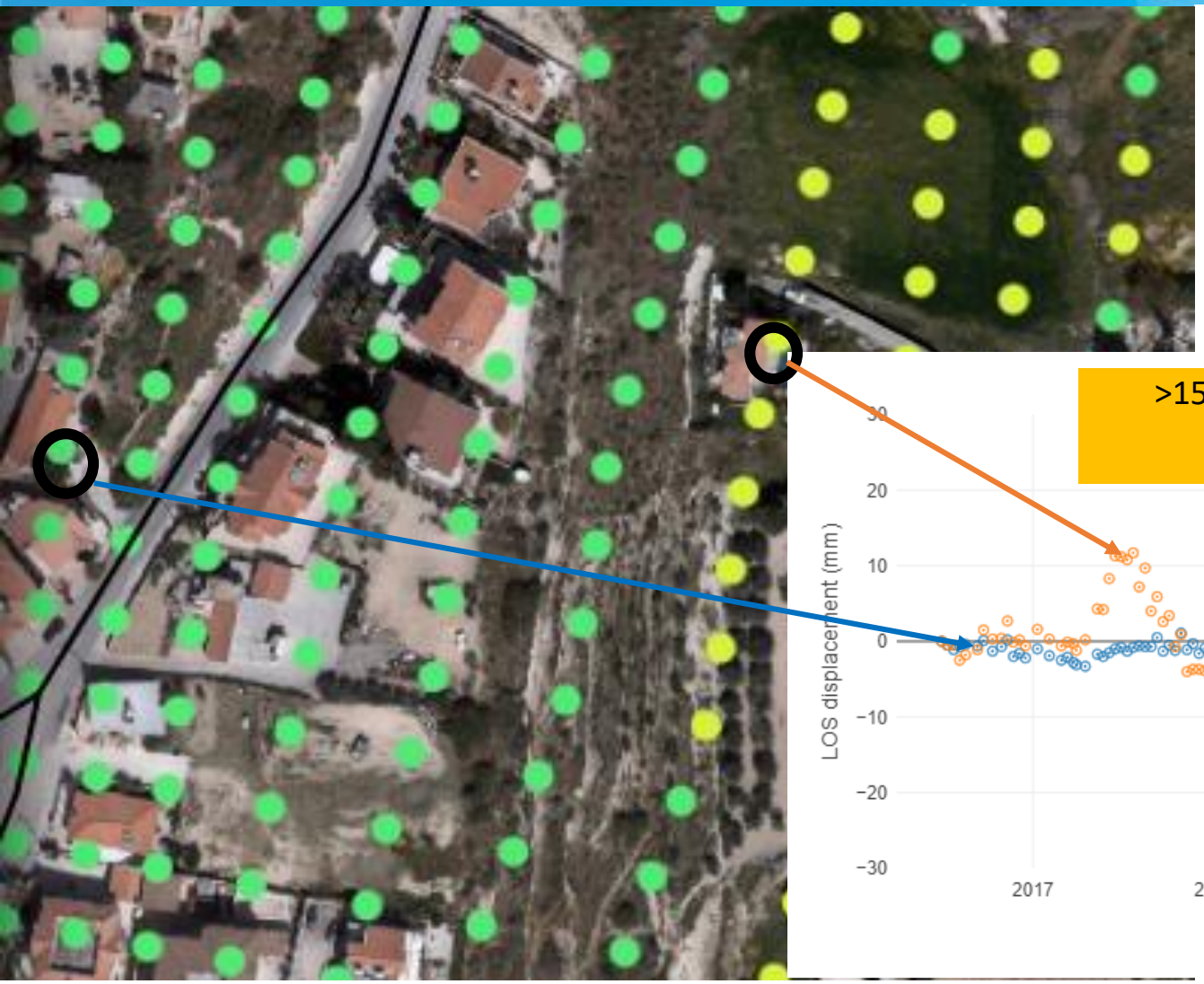


Statistical analysis: Weight of Evidence analysis

79.6% success rate & 78.9% prediction rate

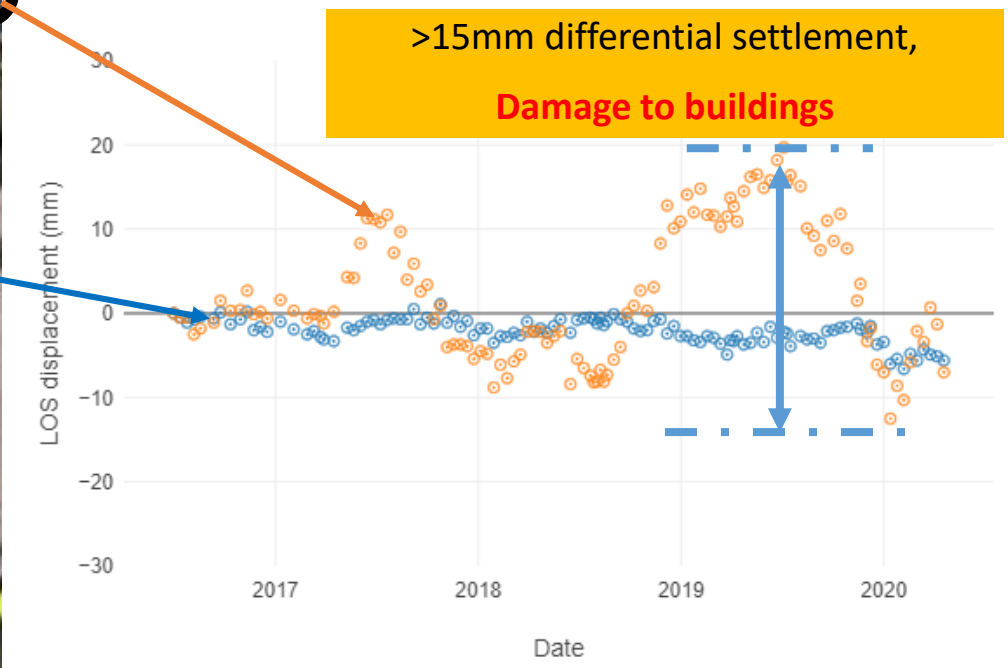
Web-GIS platform

- Assessment of building damage



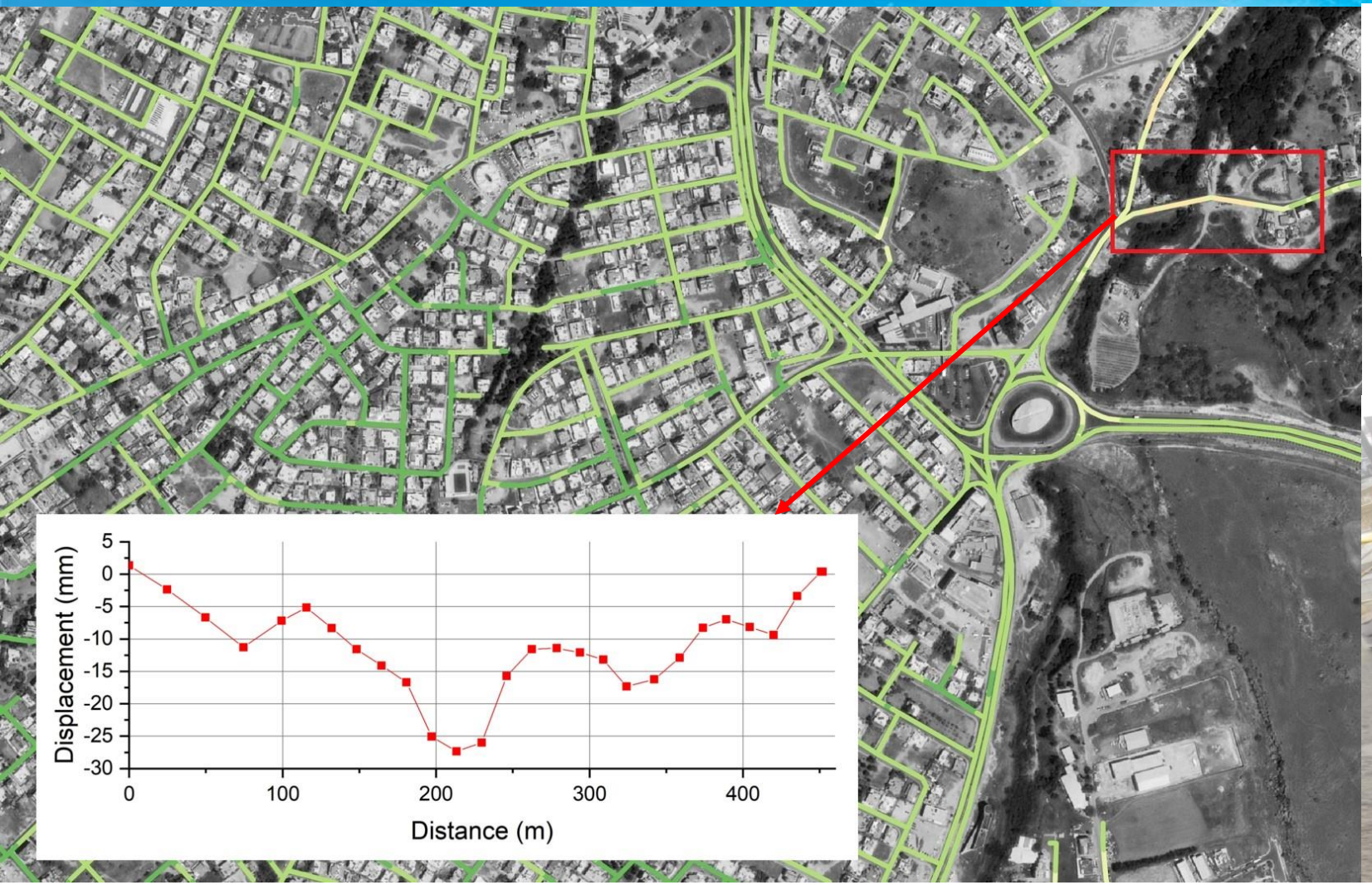
>15mm differential settlement,

Damage to buildings



- Sinkhole,

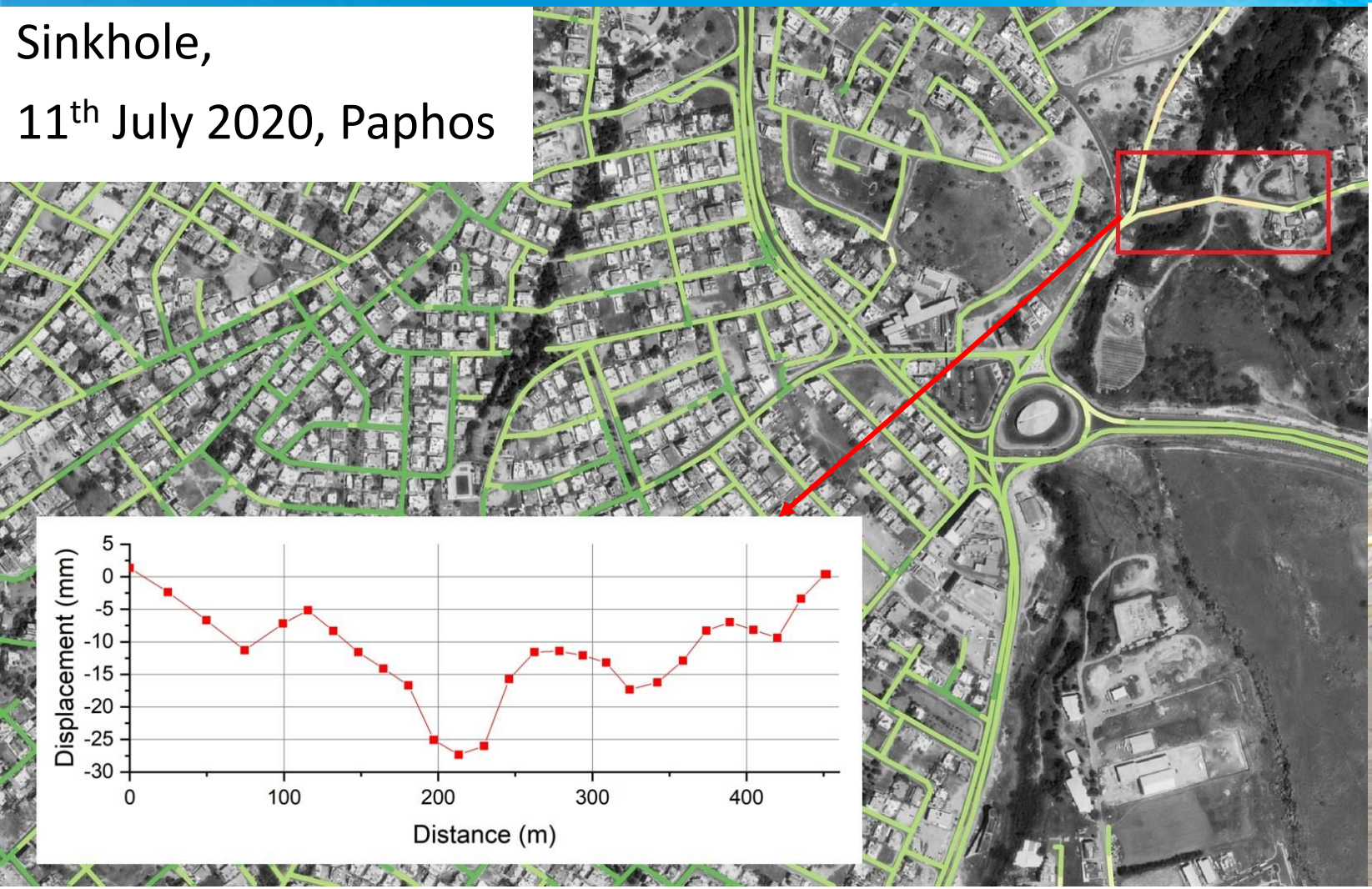
11th July 2020, Paphos,



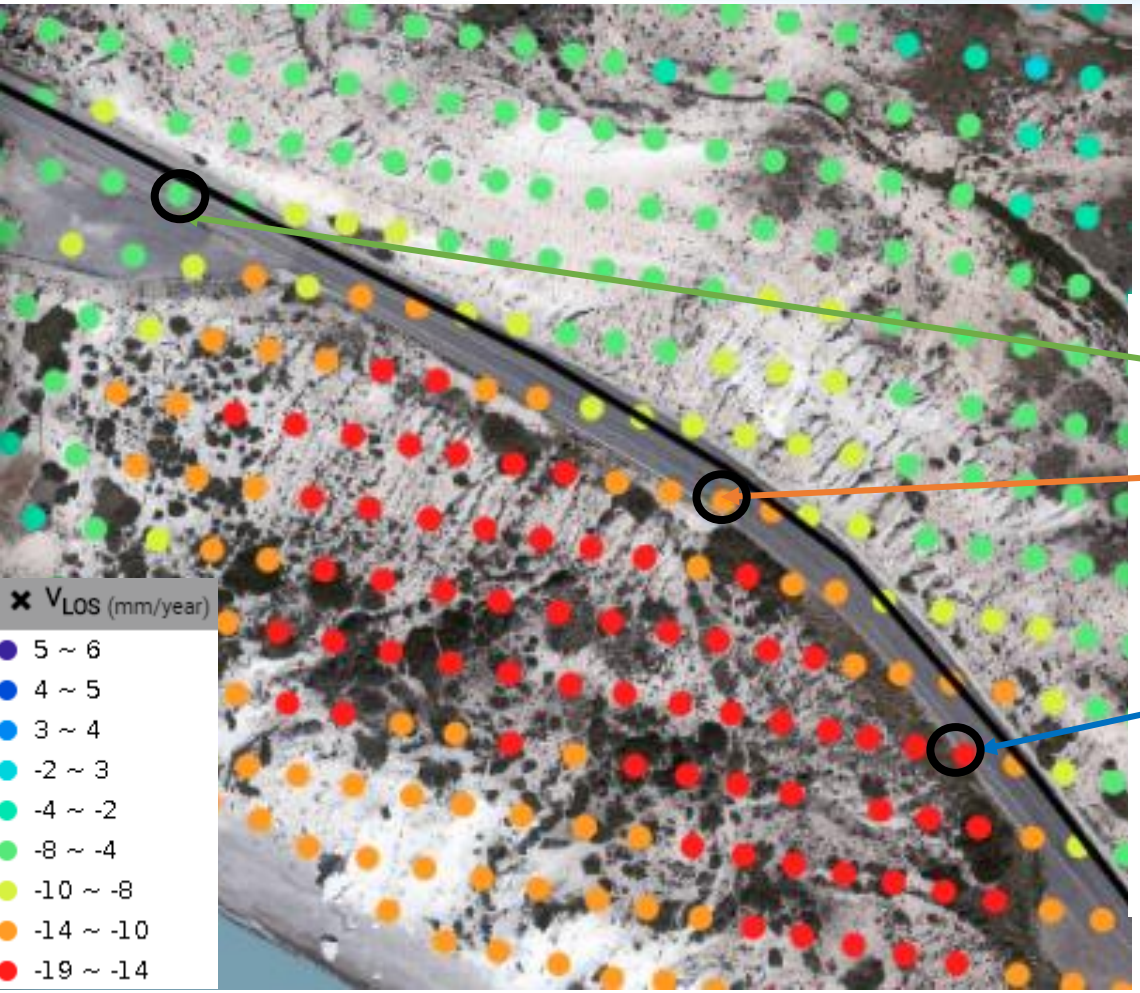
Sinkhole,

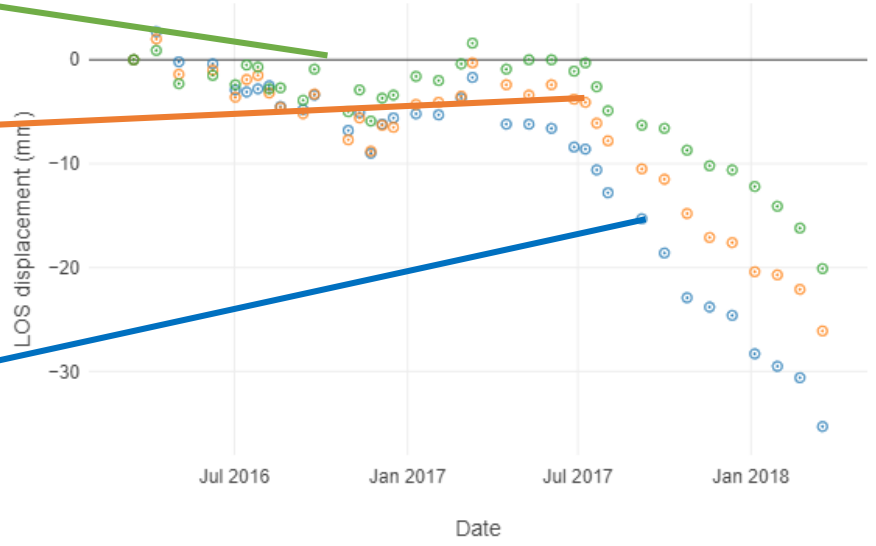
11th July 2020, Paphos

Displacement was identified in 2015



Monitoring of the road network





THANK YOU FOR YOUR ATTENTION

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