Hungarian Space Office

SZENT ISTVÁN UNIVERSITY

esa

→ 7th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

4–9 September 2017 | Szent István University | Gödöllő, Hungary

Sentinels for Science and Applications

Zoltan Bartalis

Data Applications Division
Science, Applications and Climate Department
ESA – European Space Agency
Frascati, Italy

ESA–DEVELOPED EARTH OBSERVATION MISSIONS

2010

Proba-1
SMOS
GOCE
CryoSat
Proba-V
Swarm
Meteosat 10 (MSG)
MetOp-B
Sentinel-1A
Sentinel-2A
Sentinel-1B
Sentinel-2B
Sentinel-3A
Sentinel-3B
Sentinel-5p
Aeolus
EarthCARE
Biomass
FLEX

2015

Meteosat 11 (MSG)
Seosat
Sentinel-6A
Sentinel-1C
Sentinel-2C
Sentinel-3C
Sentinel-1D
Sentinel-2D
Sentinel-3D
Sentinel-6B

2020

MetOp-C
Sentinel-5A
MetOp-SG-A1
MetOp-SG-B1
MTG-I
Sentinel-4A
MTG-S1

2025

MTG-I2
Sentinel-5B
MetOp-SG-A2
MTG-I3
MetOp-SG-B2

2030

Sentinel-4B
MTG-S2

Science
Copernicus
Meteorology
EUMETSAT

www.esa.int

European Space Agency

Sentinels: A New Generation of Data Source

- Copernicus - European space flagship programme, led by the EU
- ESA is responsible for space component, Sentinel development, operation of some Sentinels, data buy from other partners, system evolution
- Sentinels – designed to monitor various elements of the Earth System in a fully operational manner
- Free, full and open data policy

Sentinel-1A/B

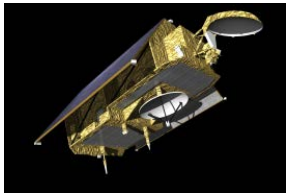
Sentinel-2A/B

Sentinel-3A/B

Sentinel-4A/B

Sentinel-5/5P

Sentinel-6A/B

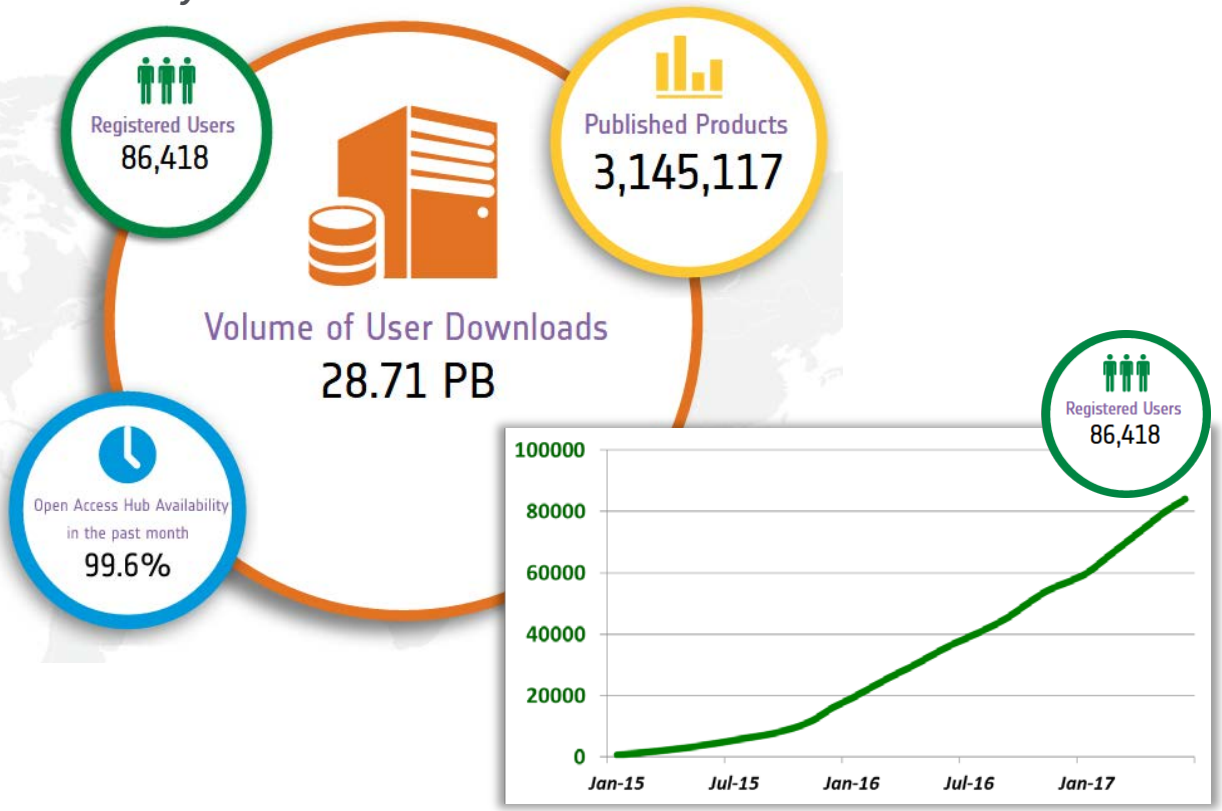


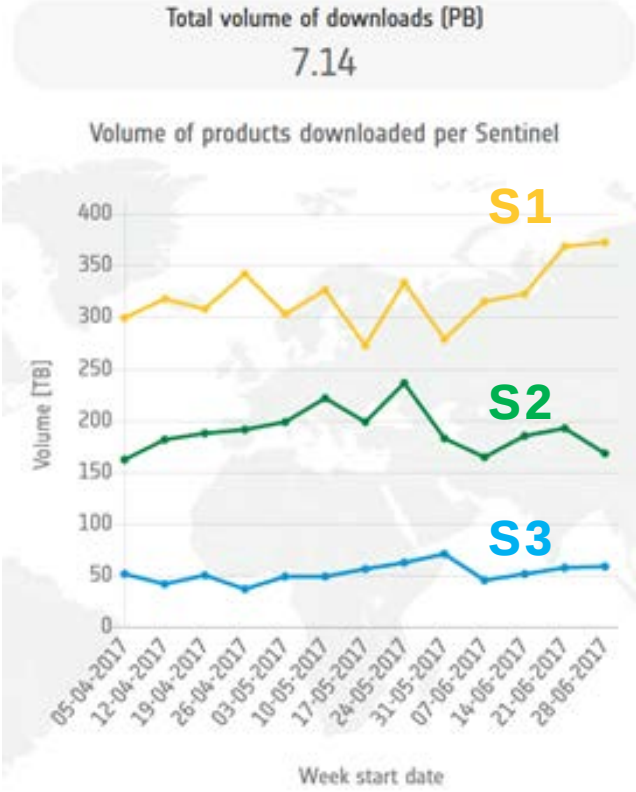
Sentinel Launches

	S1A/B: Radar Mission	3 Apr 2014 / 25 Apr 2016
	S2A/B: High Resolution Optical Mission	23 June 2015 / 6 March 2017
	S3A/B: Medium Resolution Imaging and Altimetry Mission	16 Feb 2016 / Q1 2018
	S4A/B: Geostationary Atmospheric Chemistry Mission	2021/2027
	S5P: Low Earth Orbit Atmospheric Chemistry Mission	Oct 2017
	S5A/B/C: Low Earth Orbit Atmospheric Chemistry Mission	2021/2027
	S6A/B: Altimetry Mission	2020/2025

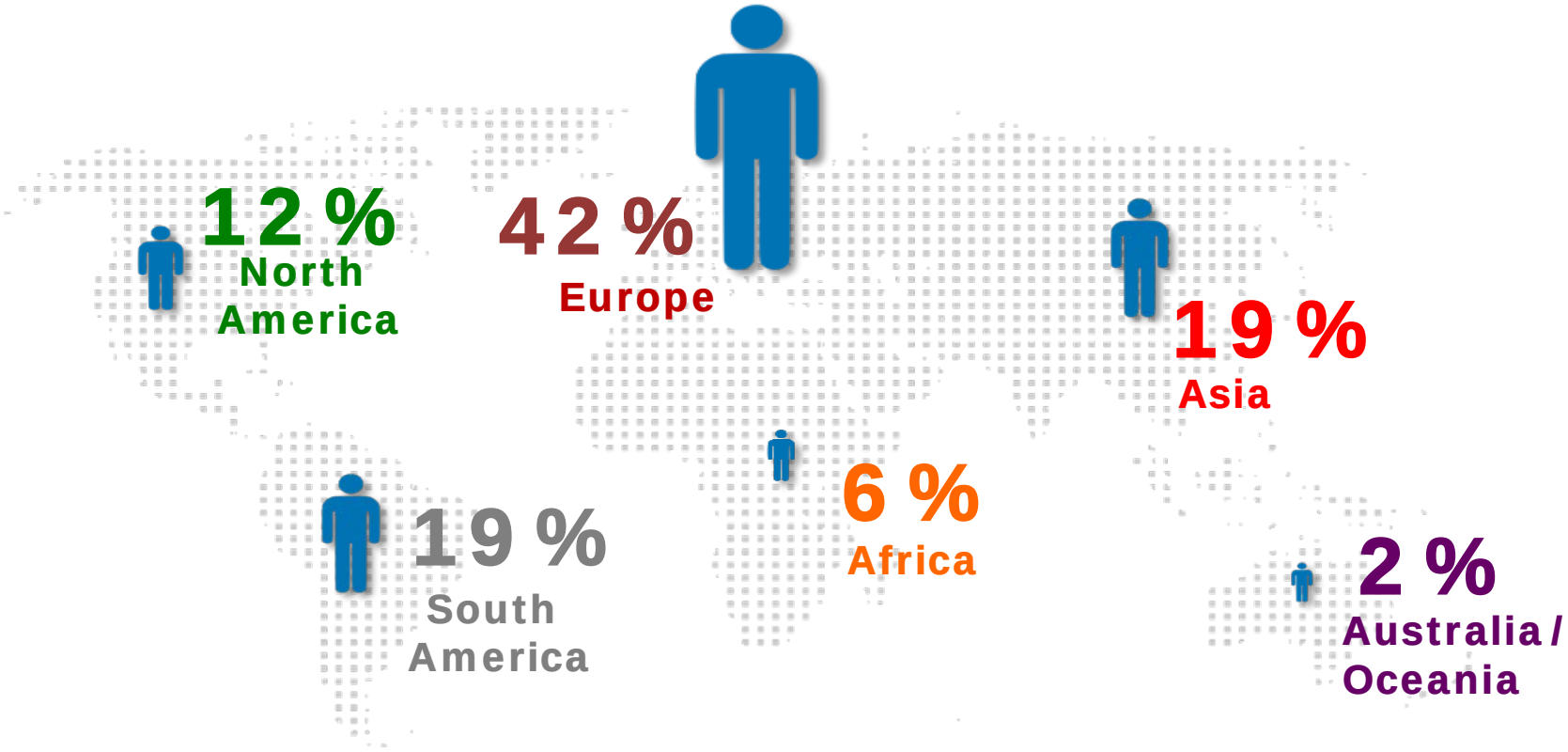
Sentinel Data Access – Statistics at ESA

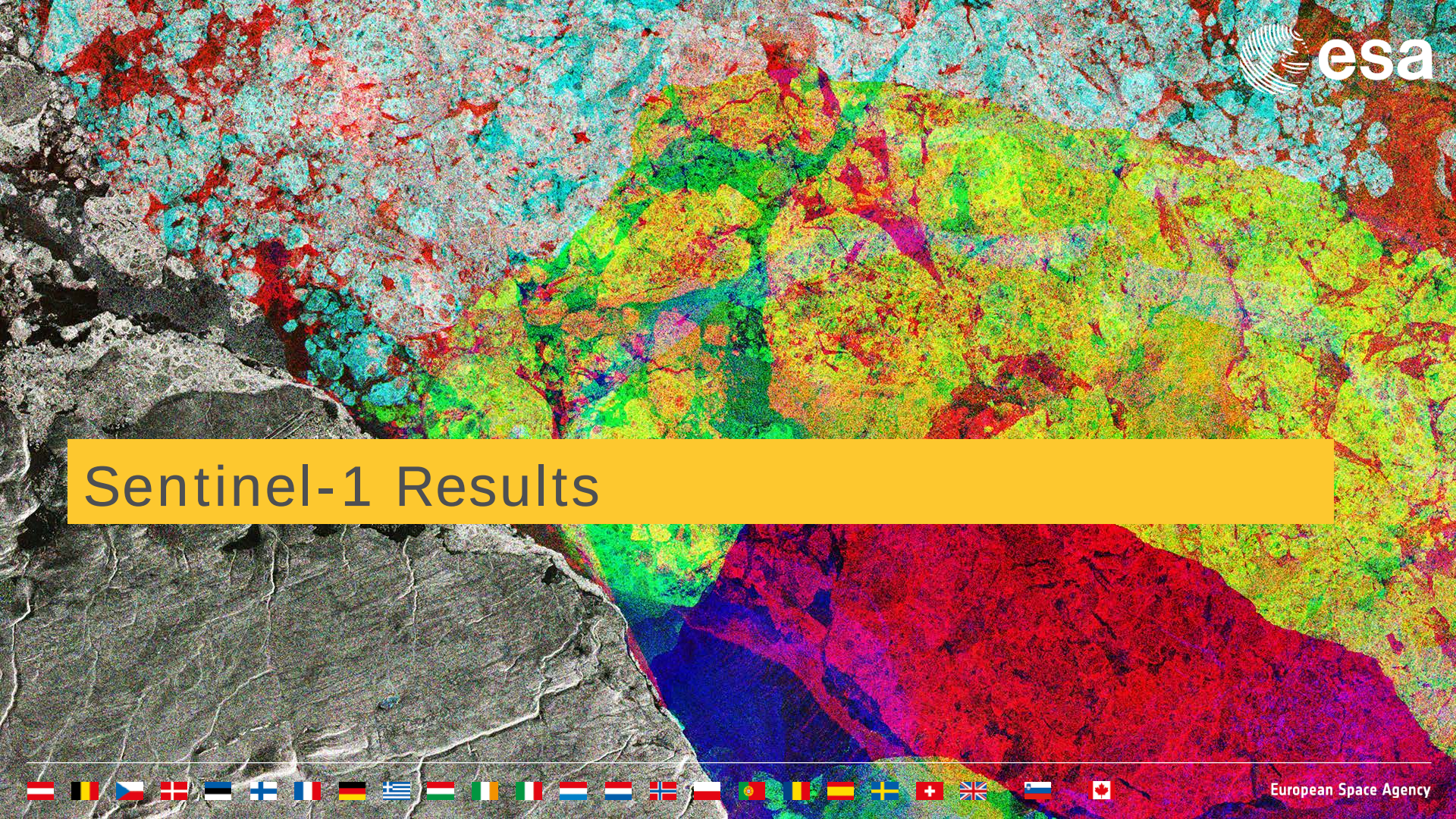
as of 5 July 2017





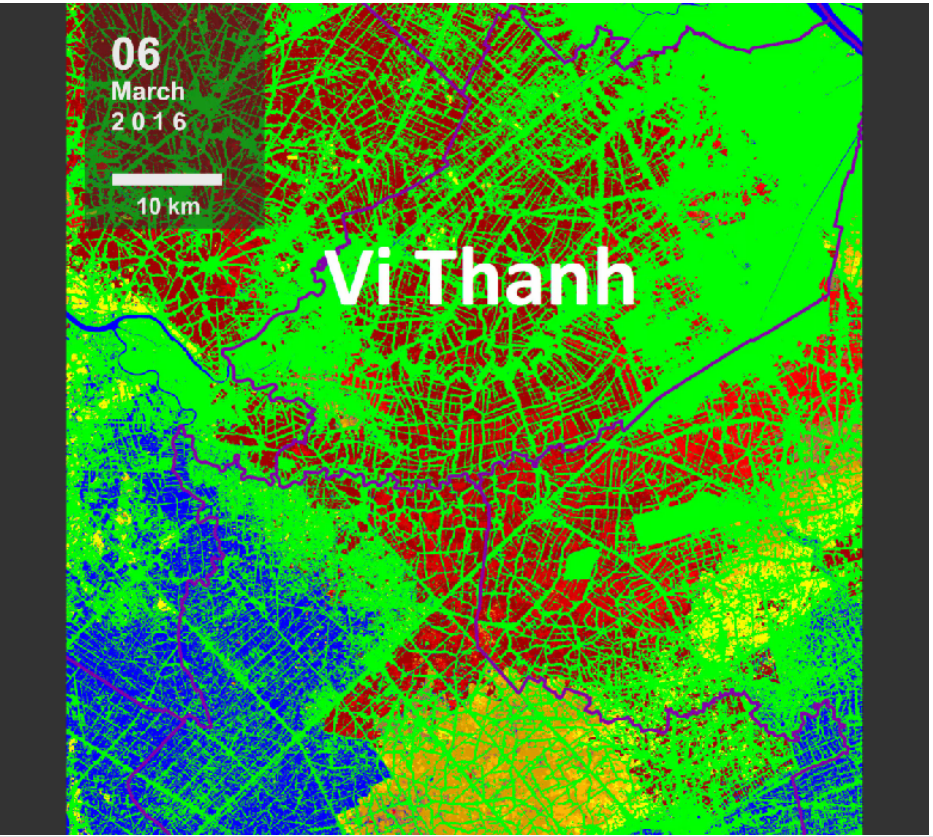
Sentinel Data Access – Statistics at ESA





Sentinel-1 Results

Monitoring of Crop Stages



Winter-Spring Rice 2015/16

- March 2015: 1.7 million ha rice
- March 2016: 1.4 million ha rice
- 16.5% loss in rice area due drought and salt water intrusion caused by El Niño
- 976,000 people affected, 67 million USD estimated damage
- Based on unprecedented Sentinel-1 time series

innovators georice

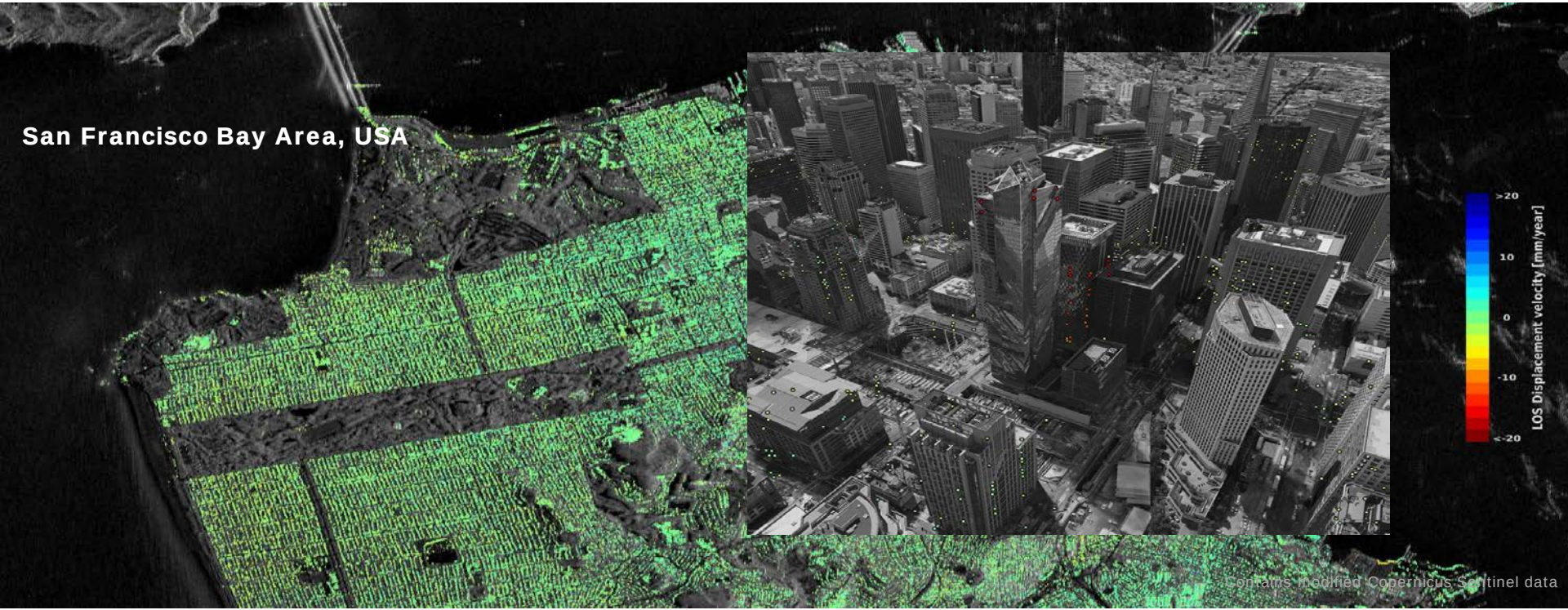
GEOGLAM Global Agricultural Monitoring

V.A.S.T

Asia-RiCE Crop Estimation and Monitoring

The Mekong Delta, Vietnam
300 km x 300 km, 20 m resolution

Subsidence Monitoring

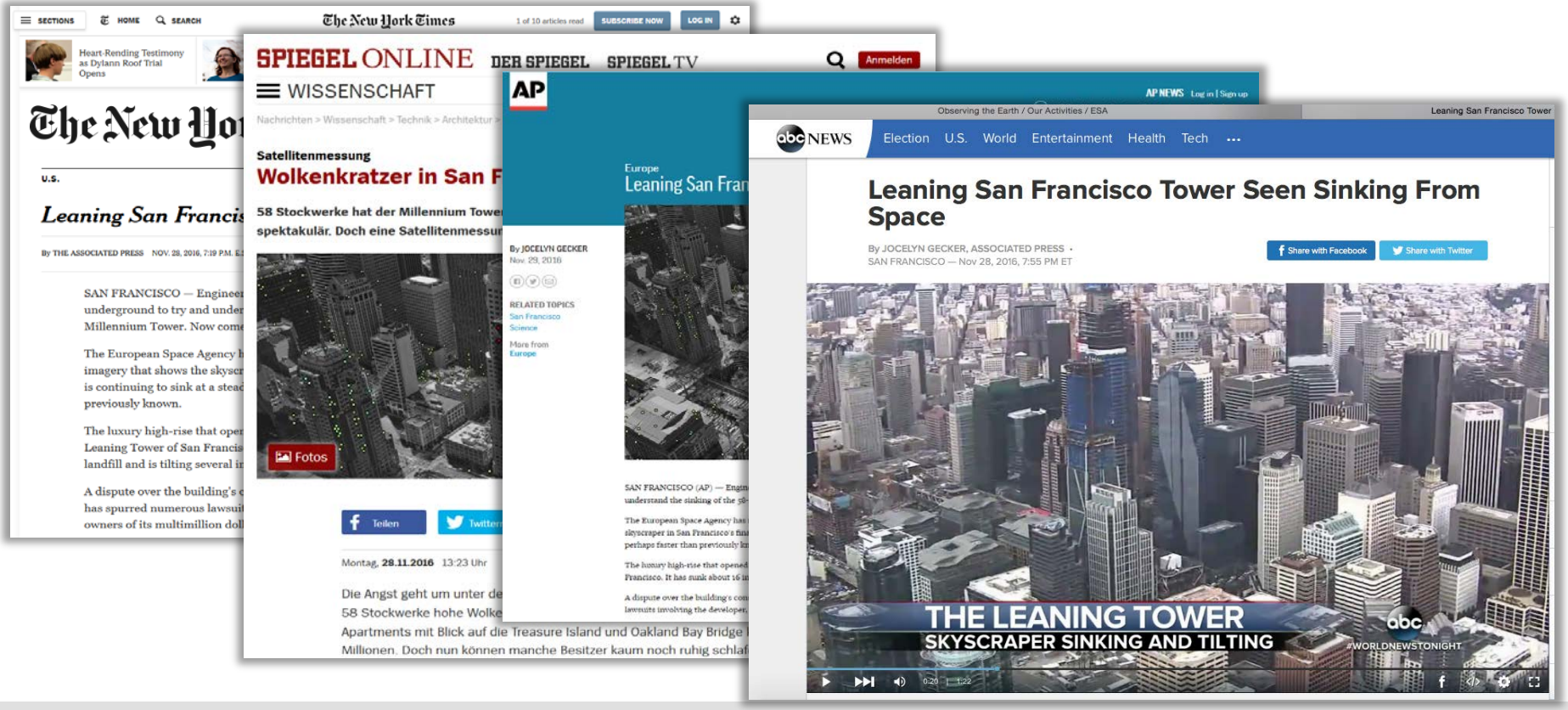


http://insarap.org

PPO.LABS

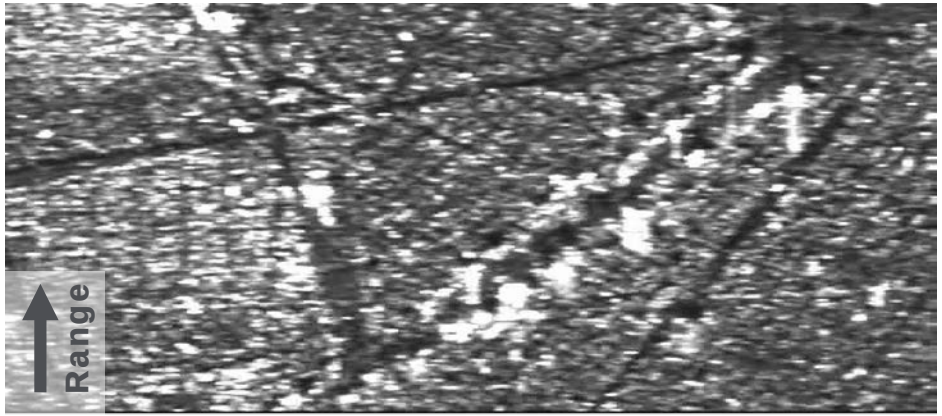
norut
NORTHERN RESEARCH INSTITUTE

Subsidence Monitoring

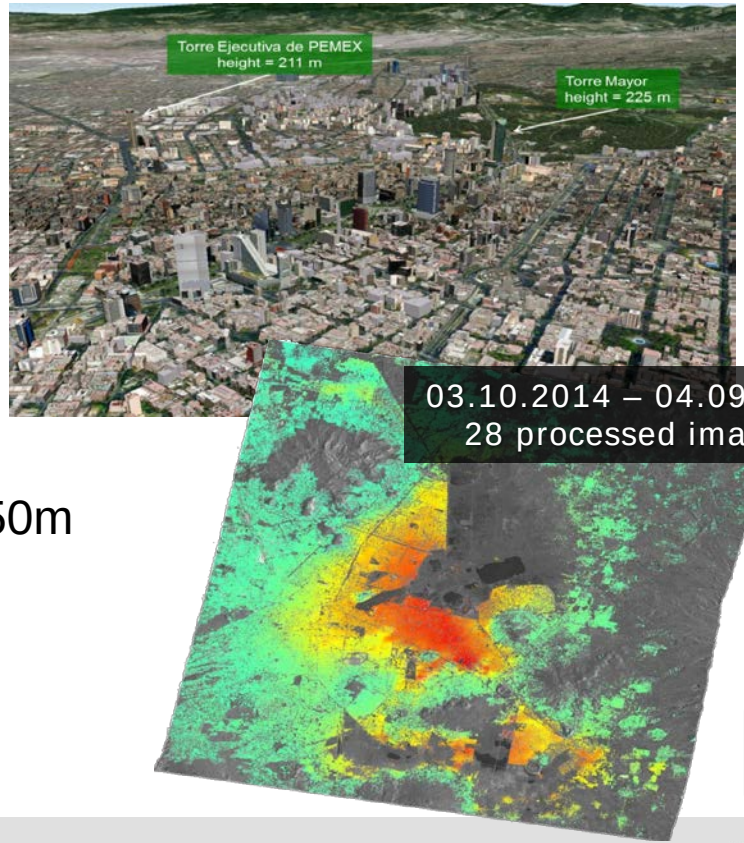


SAR Tomography

Mexico City

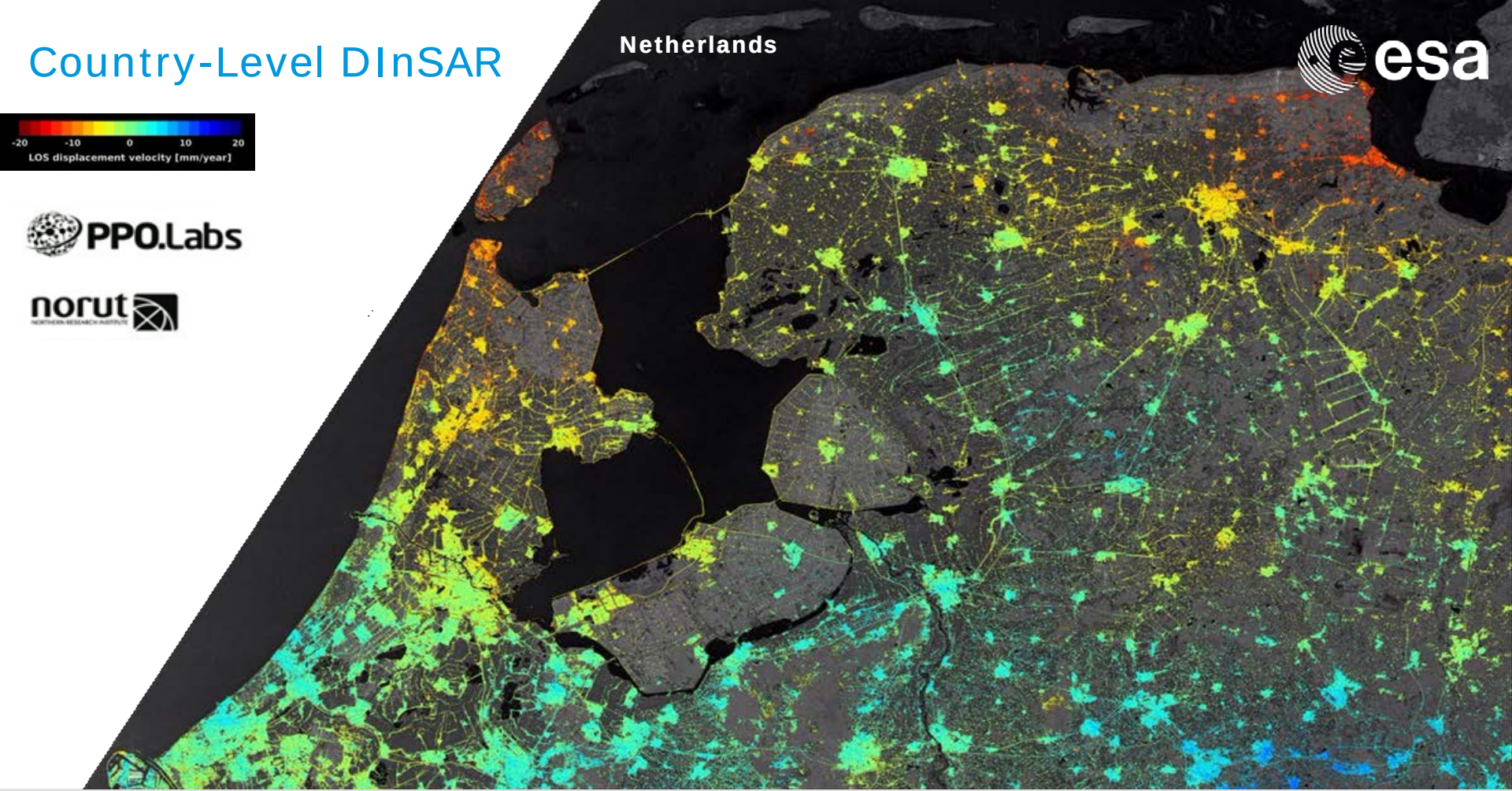


250m



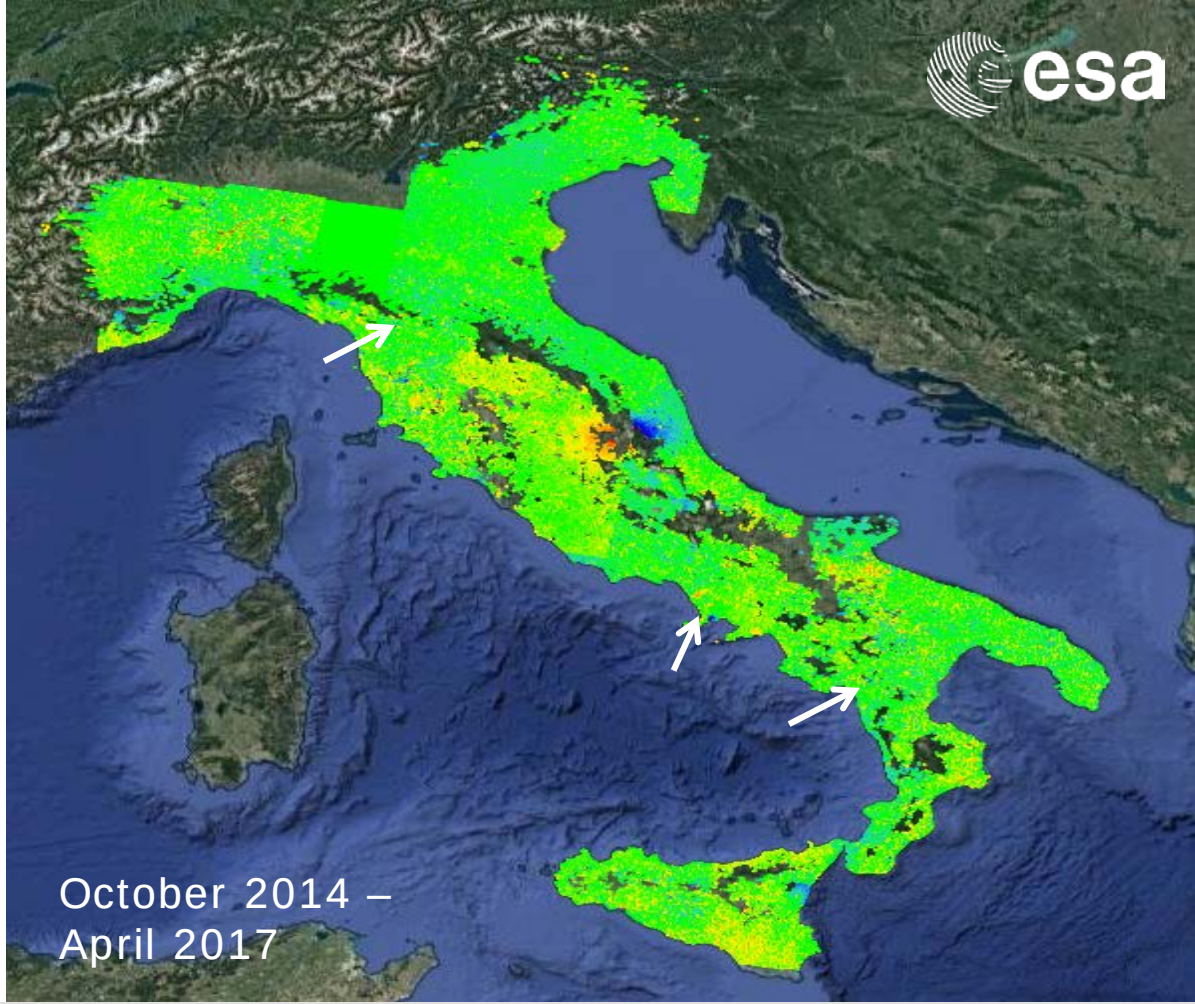
DLR

Country-Level DInSAR



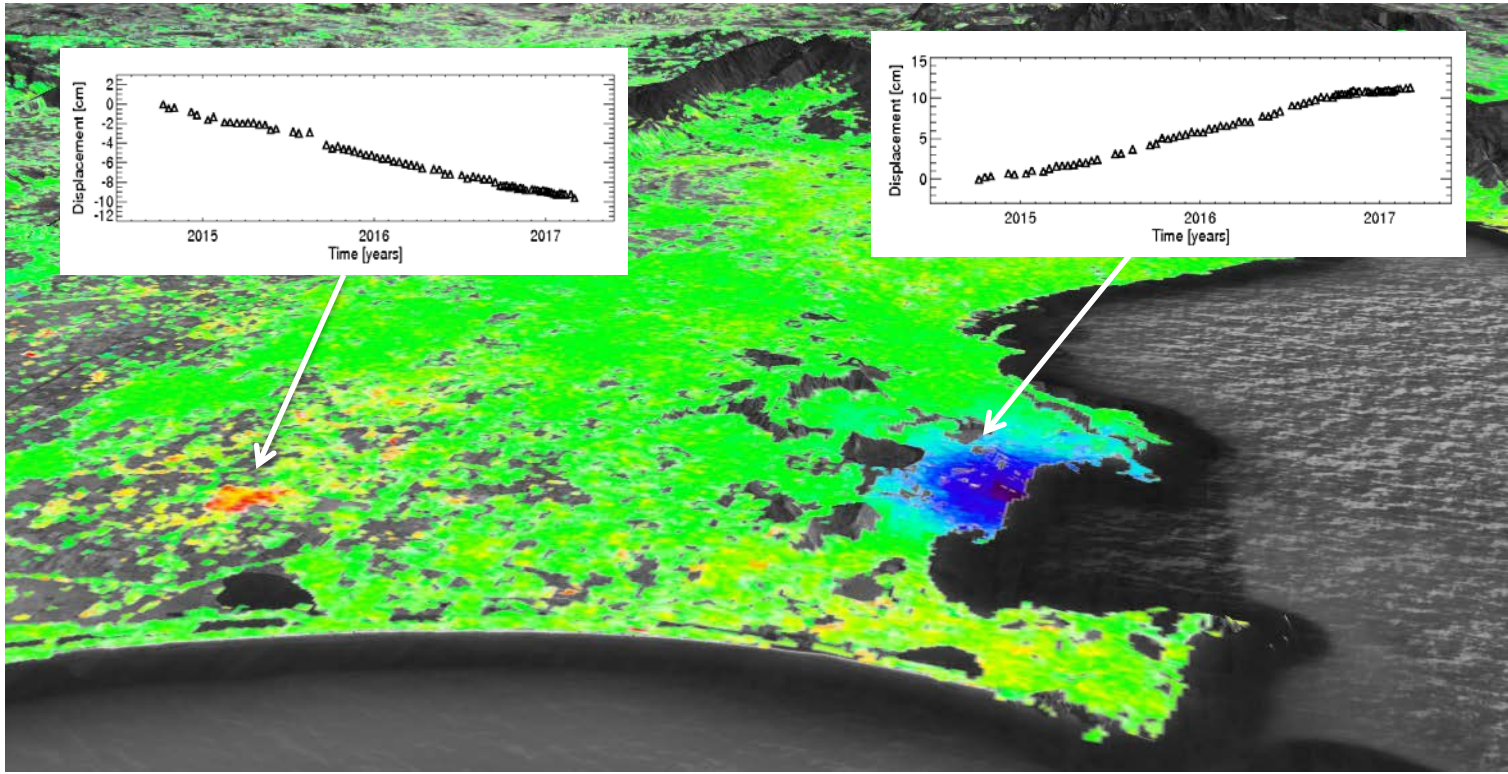
Country-Level DInSAR

Parallel Small BAseline Subset (P-SBAS) DInSAR algorithm: Towards national-scale DInSAR analysis



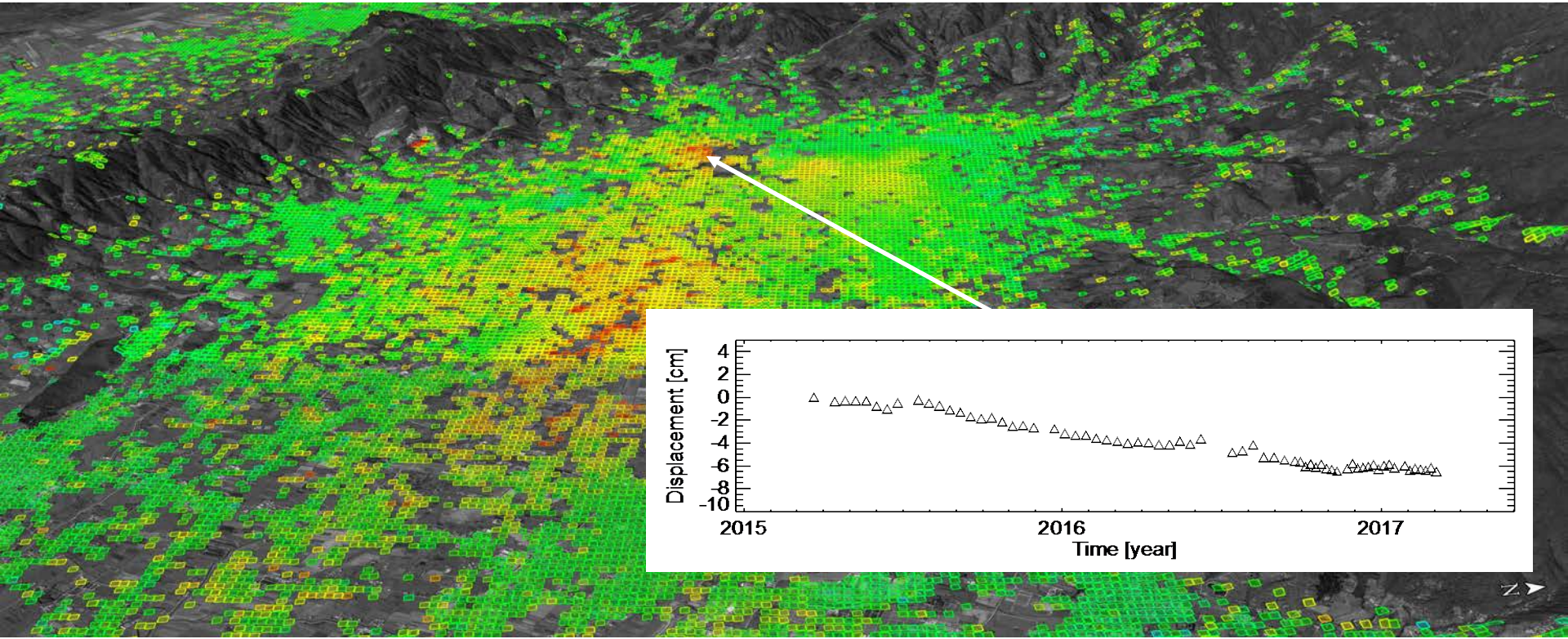
Country-Level DInSAR

Volcanic activity, Campania



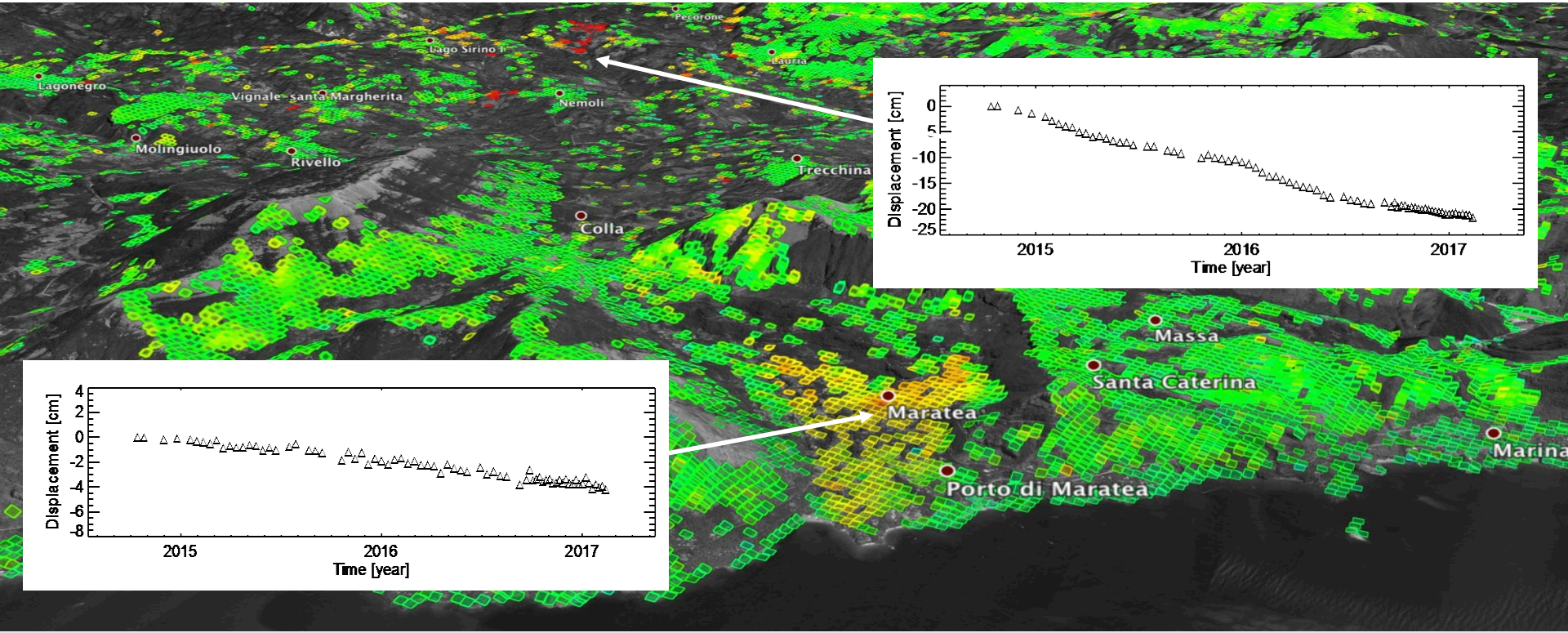
Country-Level DInSAR

Pistoia, Tuscany: Subsidence due to water extraction



Country-Level DInSAR

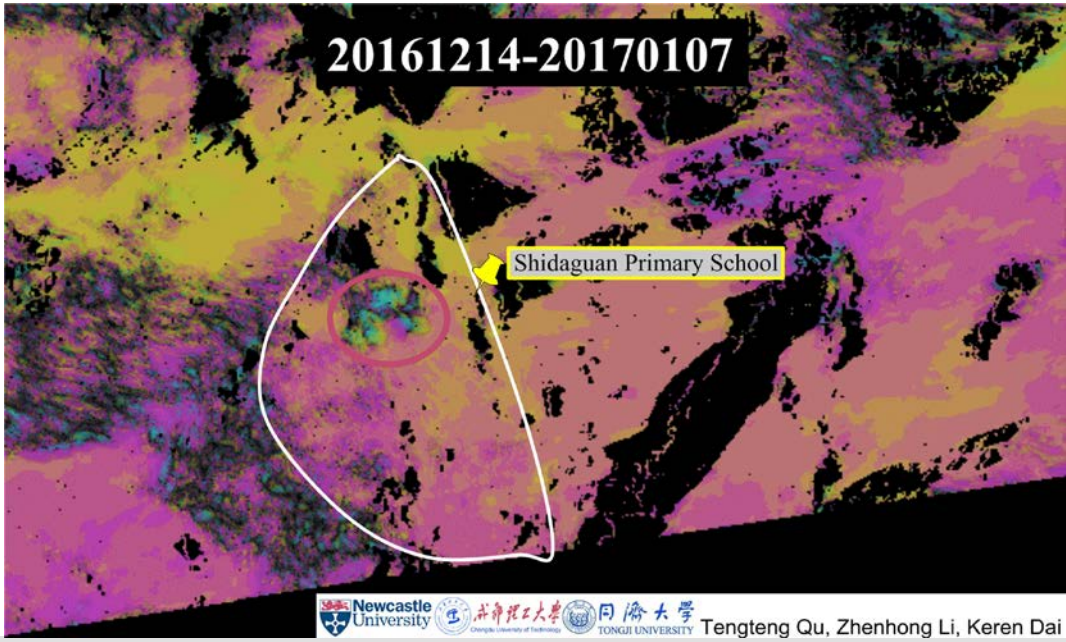
Maratea, Basilicata: Subsidence due to landslides



Sentinel-1 Potentially Saving Lives

Maoxian Landslides, China (24 and 27 June 2017)

Movements detected in the source area during several months before the event



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Can satellites be used as an early warning system for landslides?

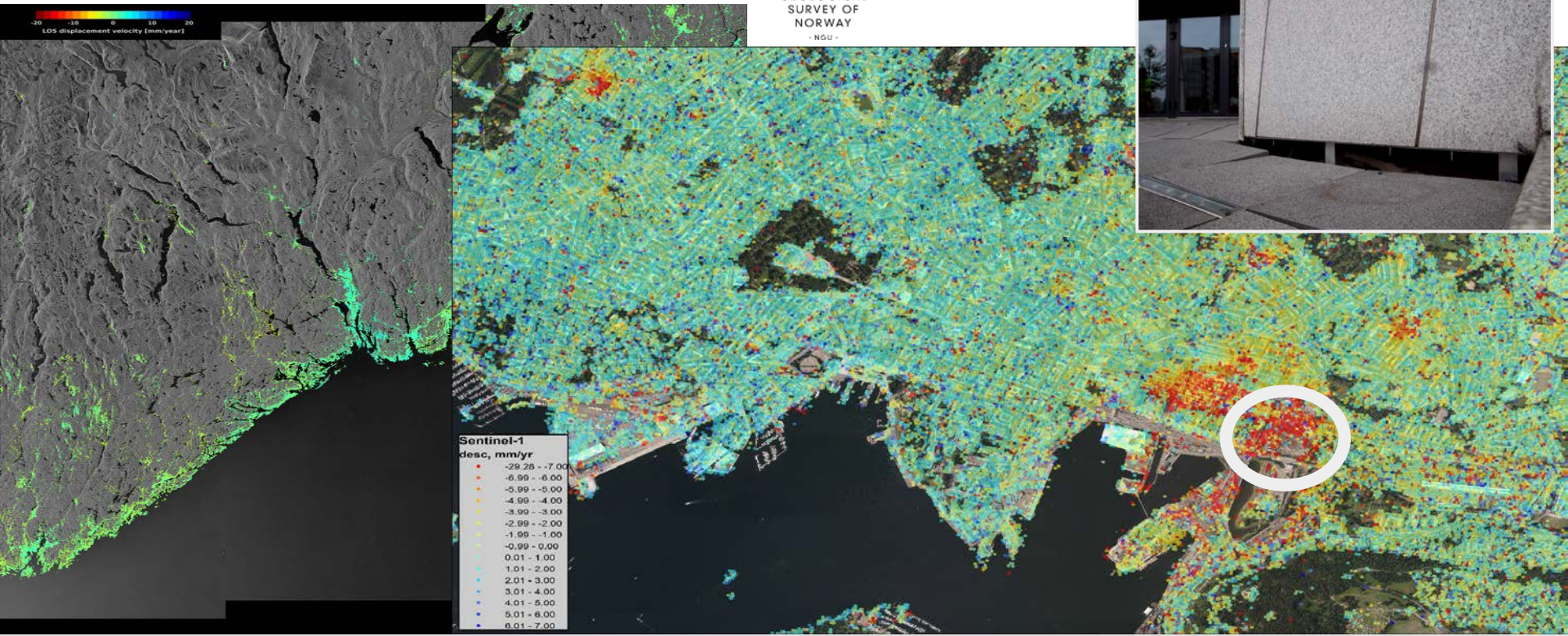
Published on: 3 July 2017

Researchers are working hard to use satellite data to accurately map the movement of the earth before a landslide in a bid to develop a life-saving early warning system.

Country-Level DInSAR

Greater Oslo area, Norway.

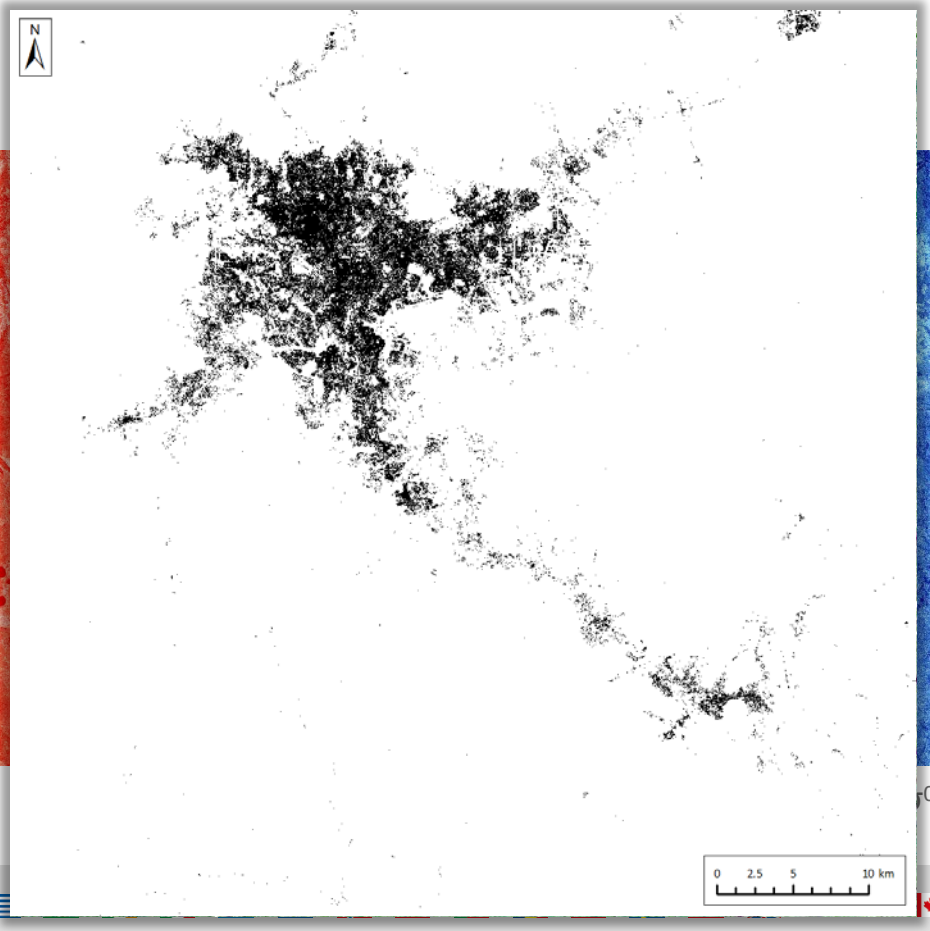
GEOLOGICAL SURVEY OF NORWAY
- NGU -

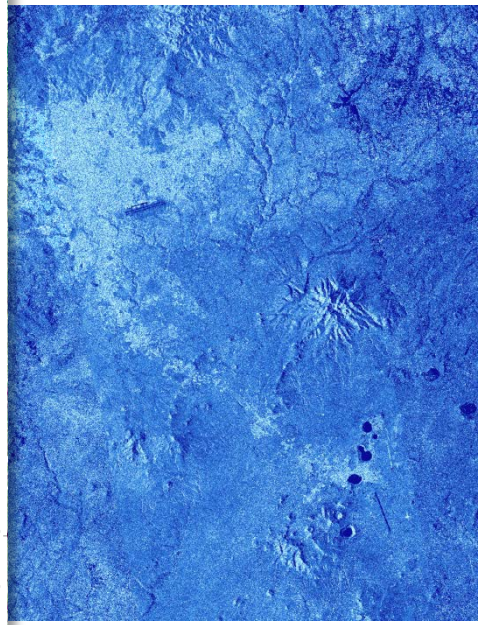


Global Urban Footprint

Addis Ababa, Ethiopia

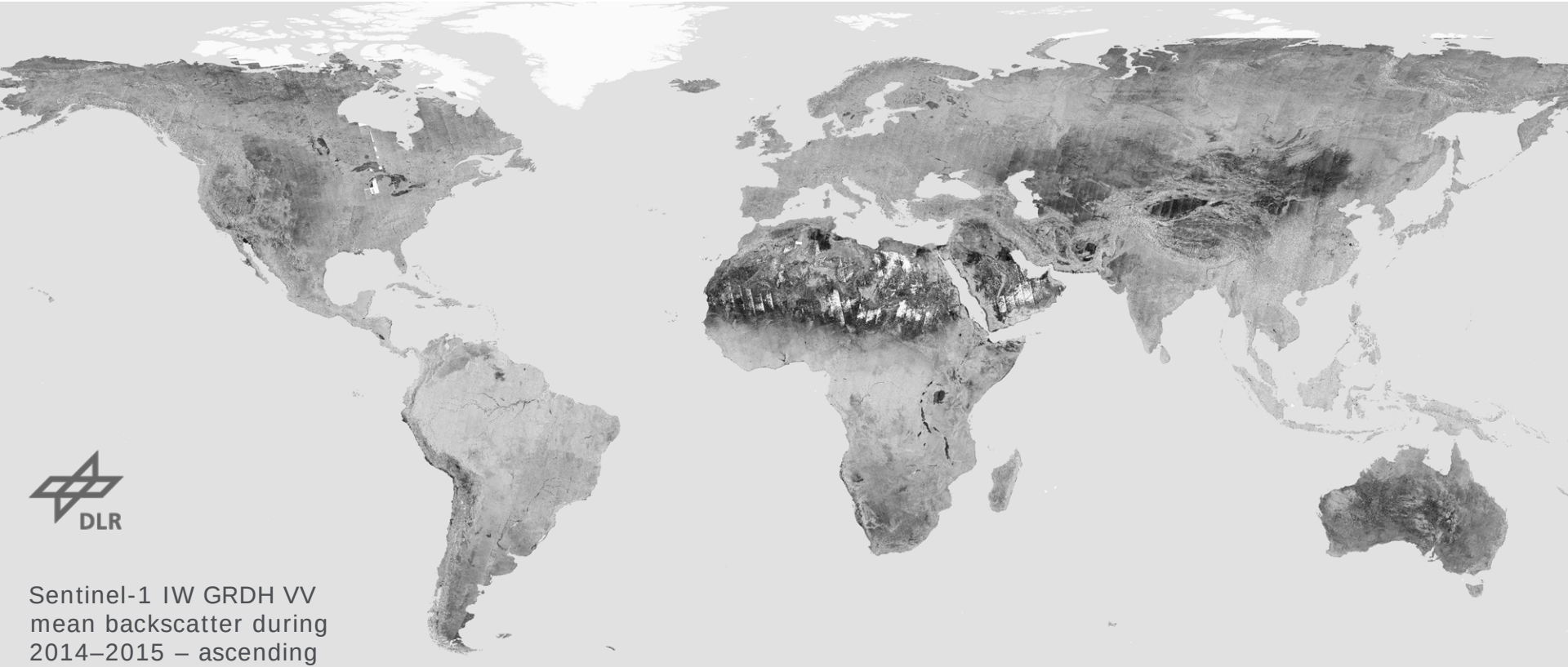
σ^0 max





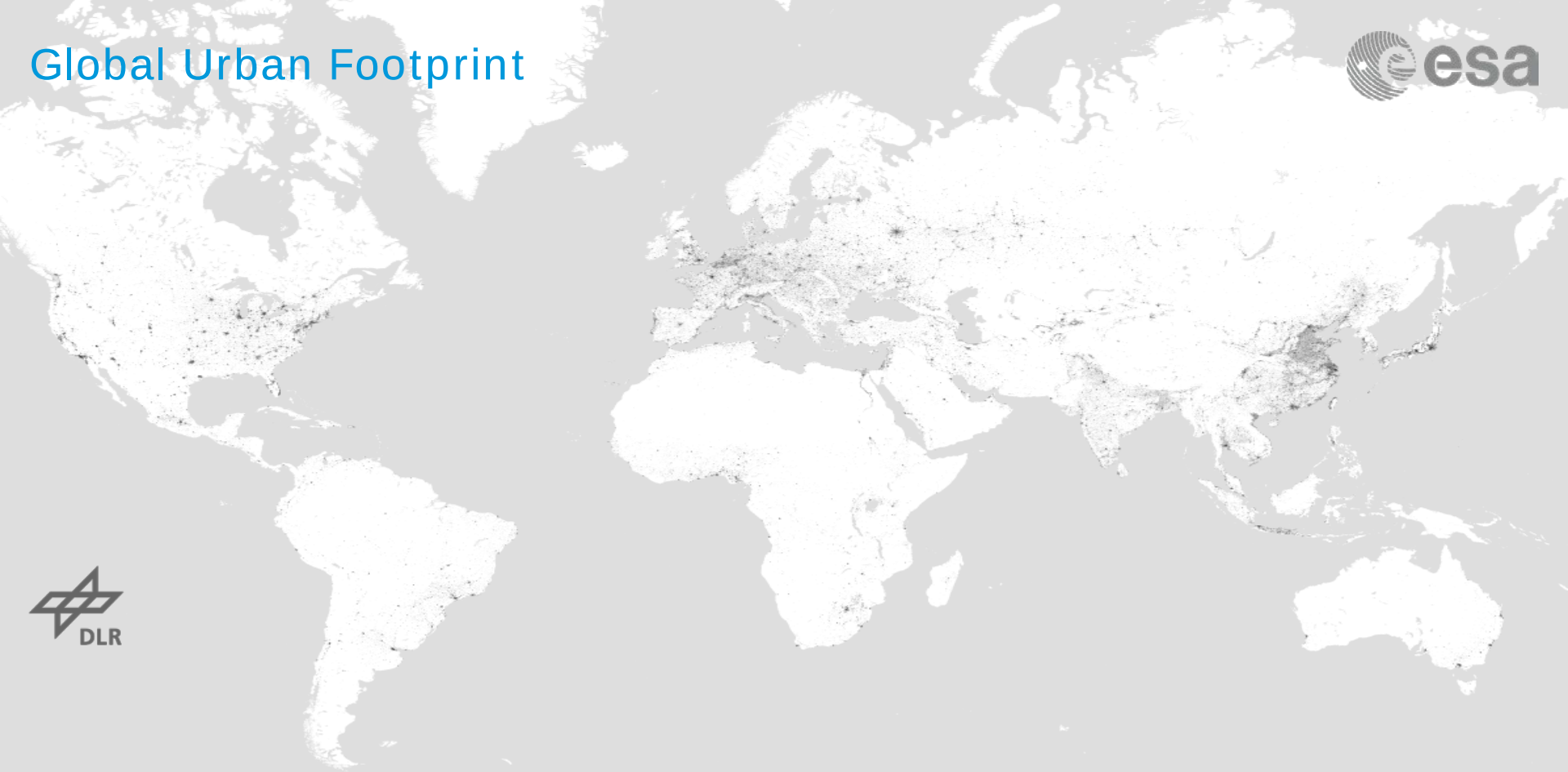
σ^0 standard deviation

Global Urban Footprint



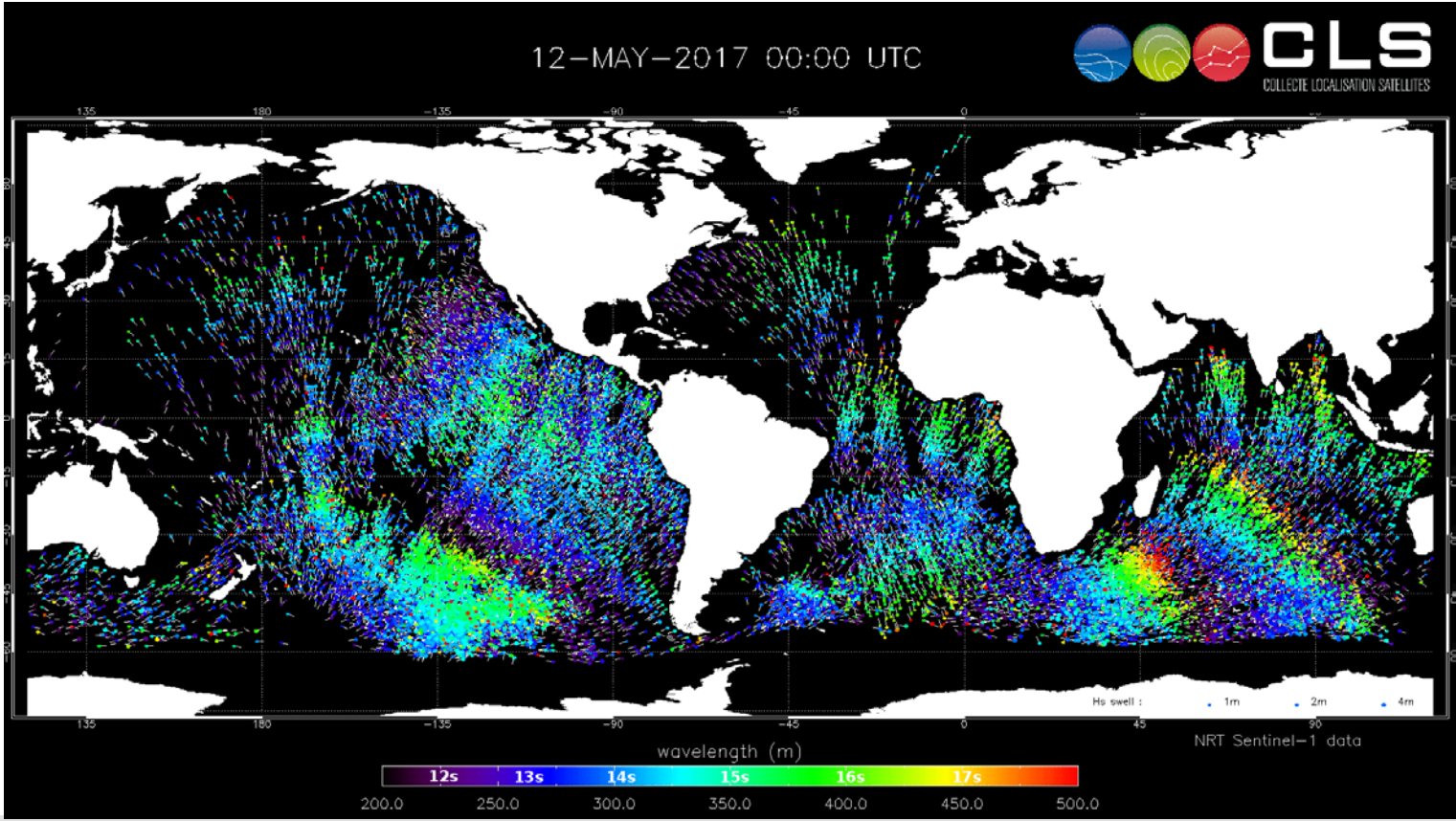
Sentinel-1 IW GRDH VV mean backscatter during 2014–2015 – ascending + descending

Global Urban Footprint



Global Near-Real Time Swell Tracking

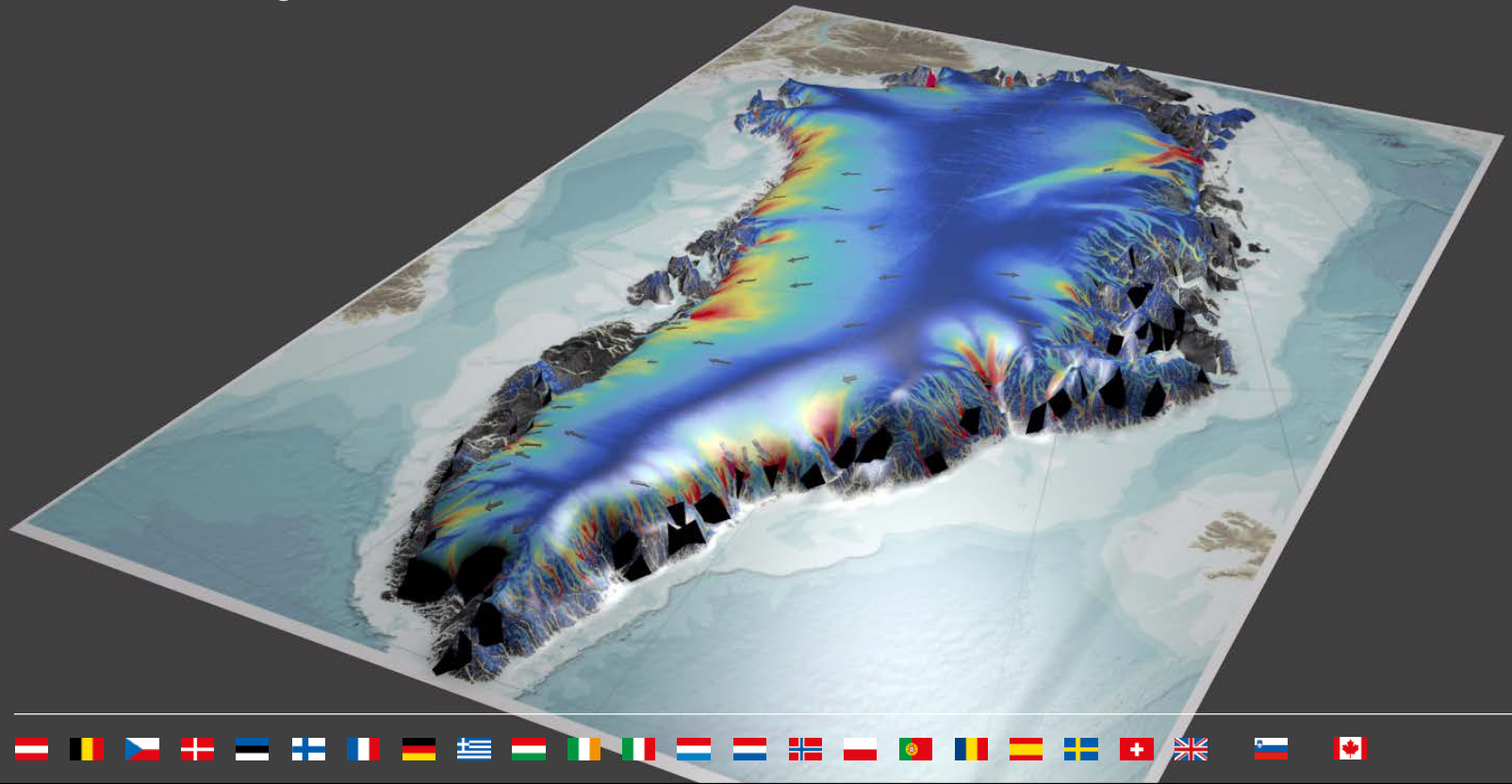
Sentinel-1A and Sentinel-1B Wave Mode over 10 days



oceandatalab

Ice Sheet Monitoring

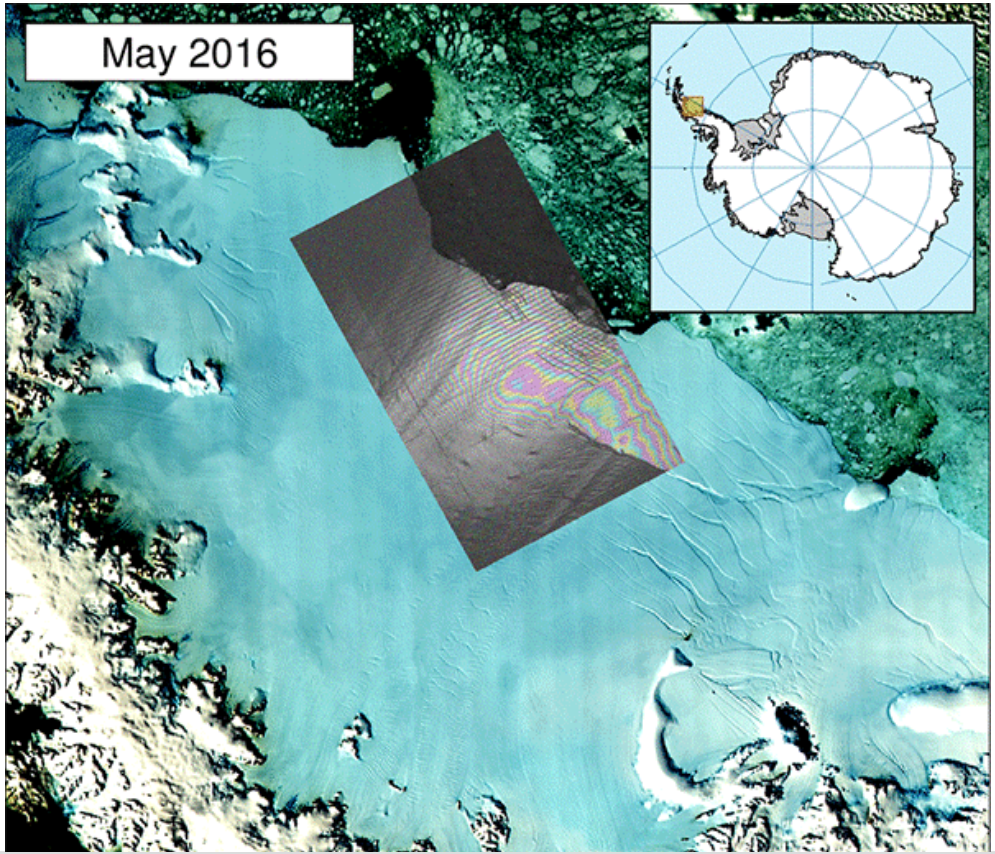
Routine observations of
ice sheet margins



enveo

Ice Shelf Monitoring: Larsen-C

- Seemed relatively stable until January 2016
- In January 2017 alone it travelled 20 km, reaching a total length of about 175 km
- As the crack grew, it branched off towards the edge of the shelf
- On July 12 part of the ice shelf had finally broken away

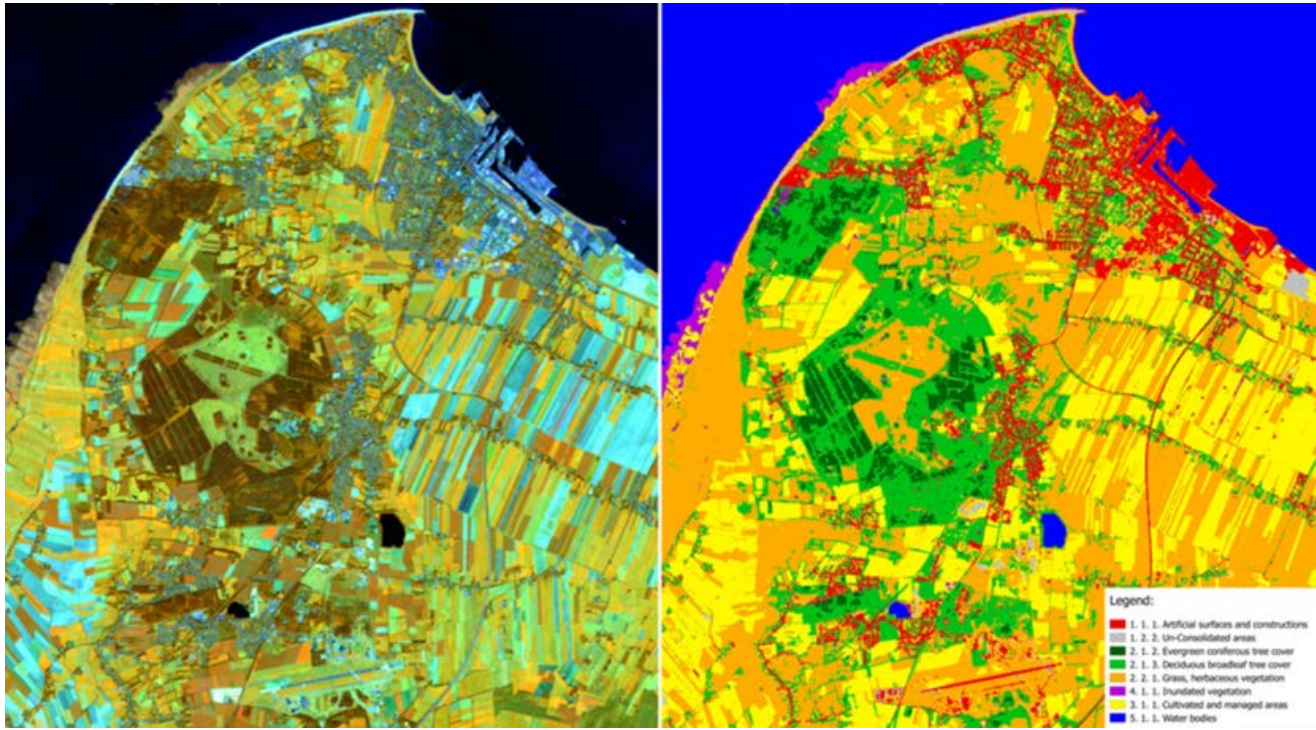


Swansea University
Prifysgol Abertawe

Sentinel-2 Results

Global Land Cover

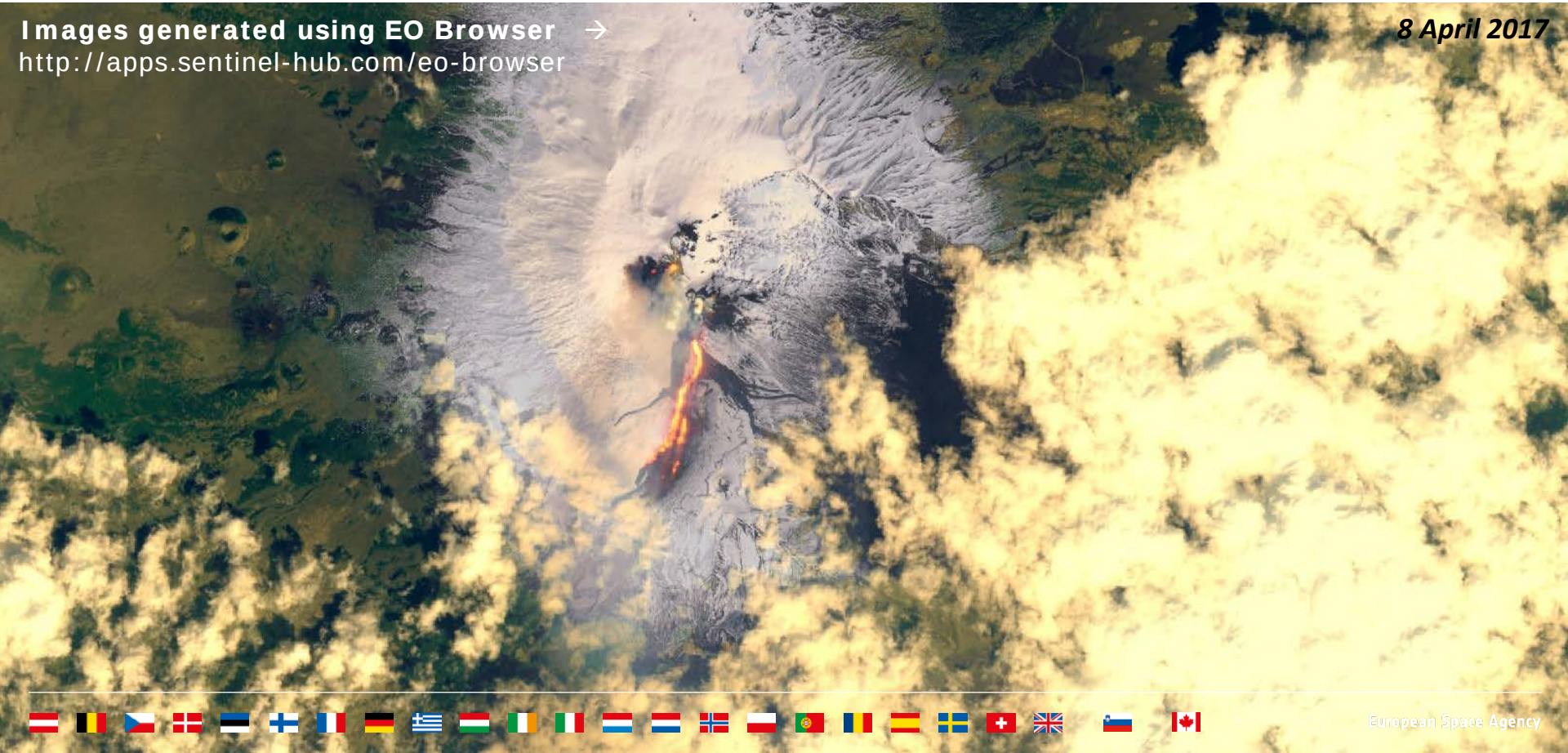
- Advanced land cover classification strategies to exploit the new capabilities of Sentinel-2 in view of generating global land cover maps



Space Research Centre
Polish Academy of Sciences

CBK

Mount Etna Eruption, March–April 2017



Endorsement of Copernicus for Use within the CAP

- Commissioner P. Hogan:
  "…already Paying Agencies using data of the Sentinels … In the near future satellite monitoring of parcels could replace most of the OTSC – this kind of simplification is very much in my plans…"

sen4cap
common agricultural policy

esa

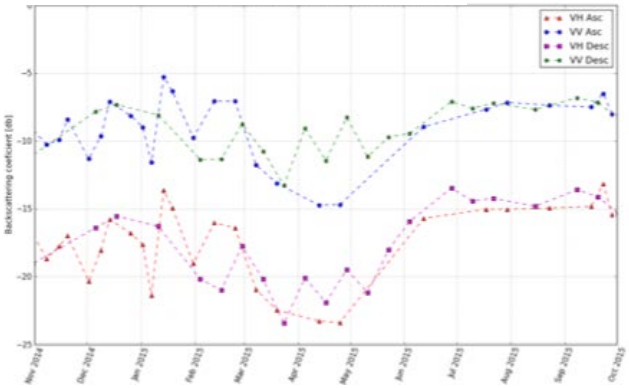
European Commission

Copernicus

Dynamic National Crop Type Mapping

- *Sen4CAP* – S-1/2 time series for Land Parcel Identification System of the Czech CAP – machine learning

Sentinel-1 time series



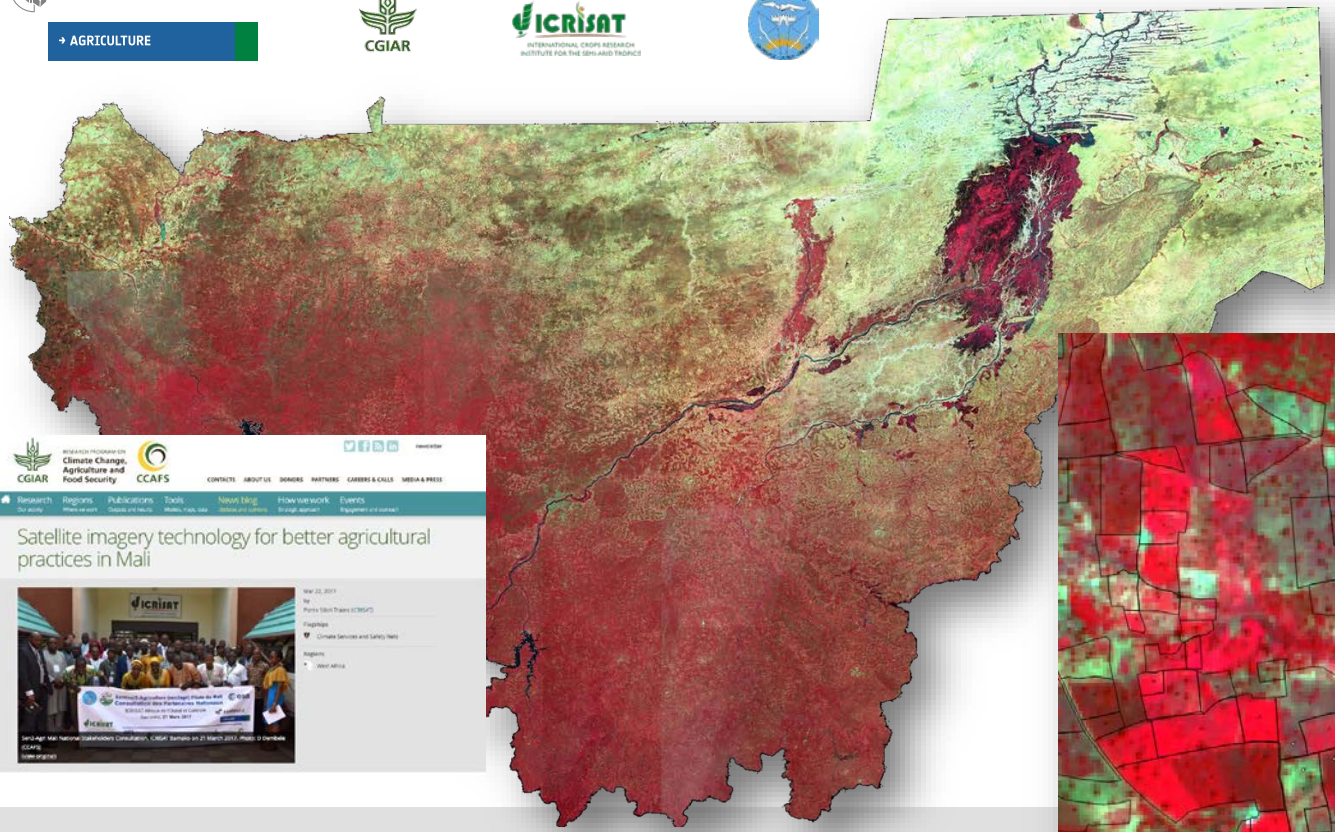
Mali Food Security: National statistics, Crop Damage

sentinel-2

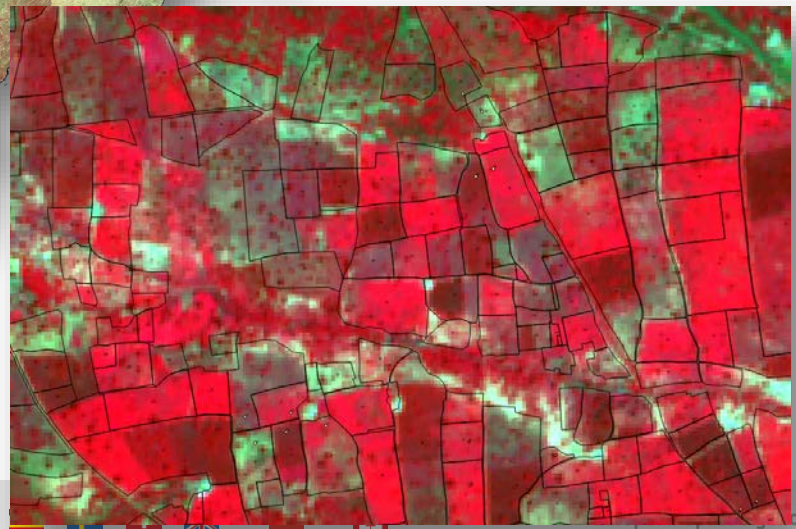
→ AGRICULTURE

CGIAR

ICRISAT
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS



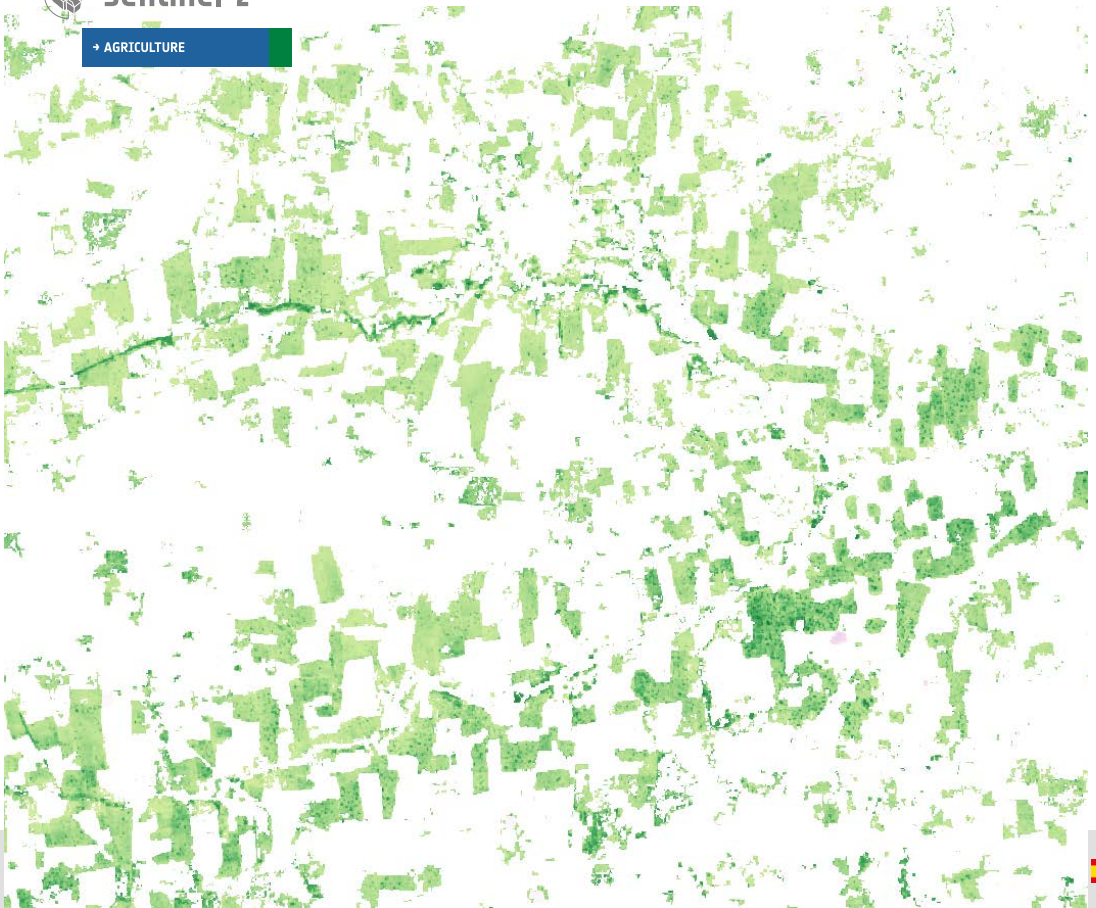
2016 Oct 5–Nov 25

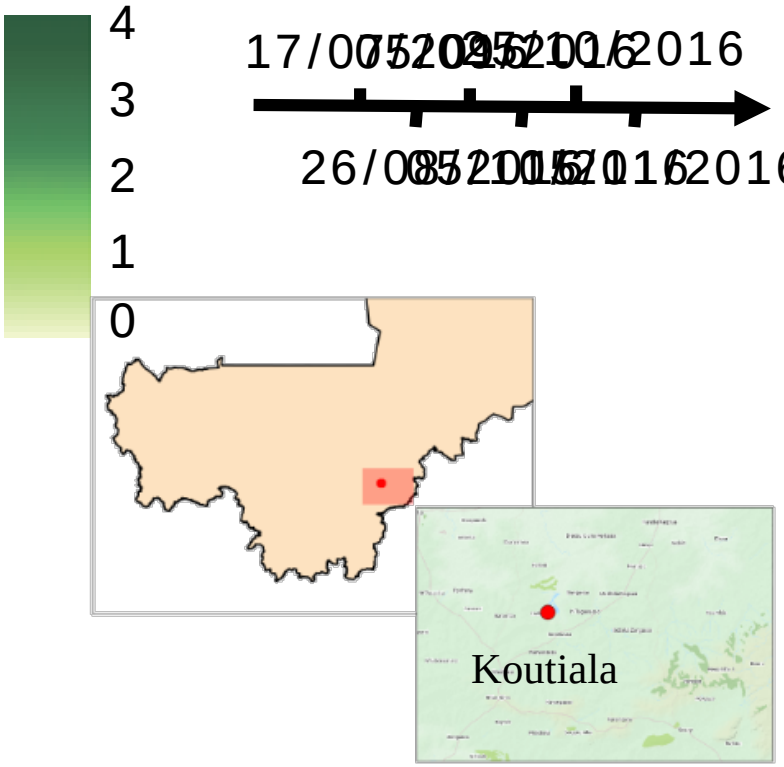


Mali: Monitoring the Growth of Cotton

sentinel-2

→ AGRICULTURE

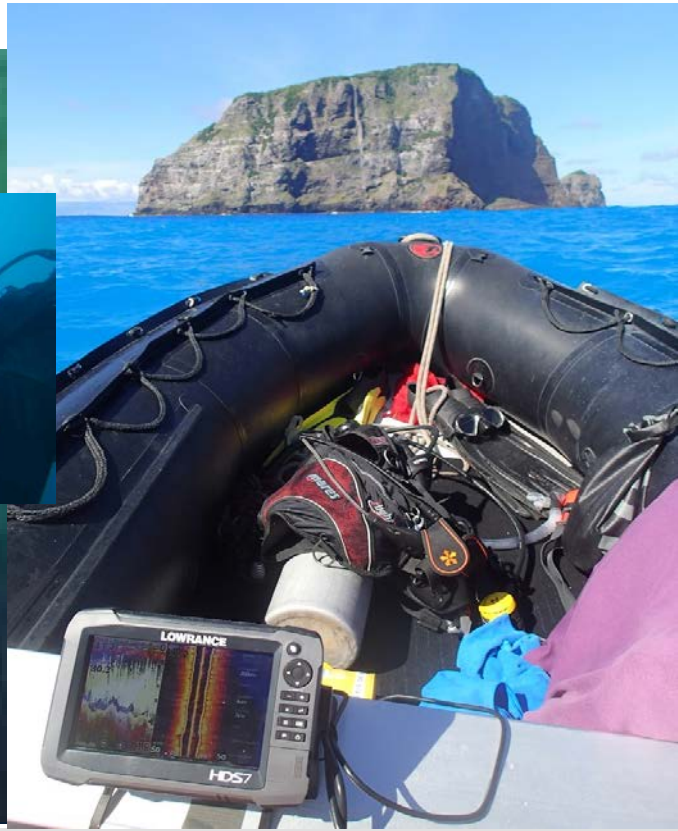




Coral Reef Monitoring

Marquesas Islands, French Polynesia

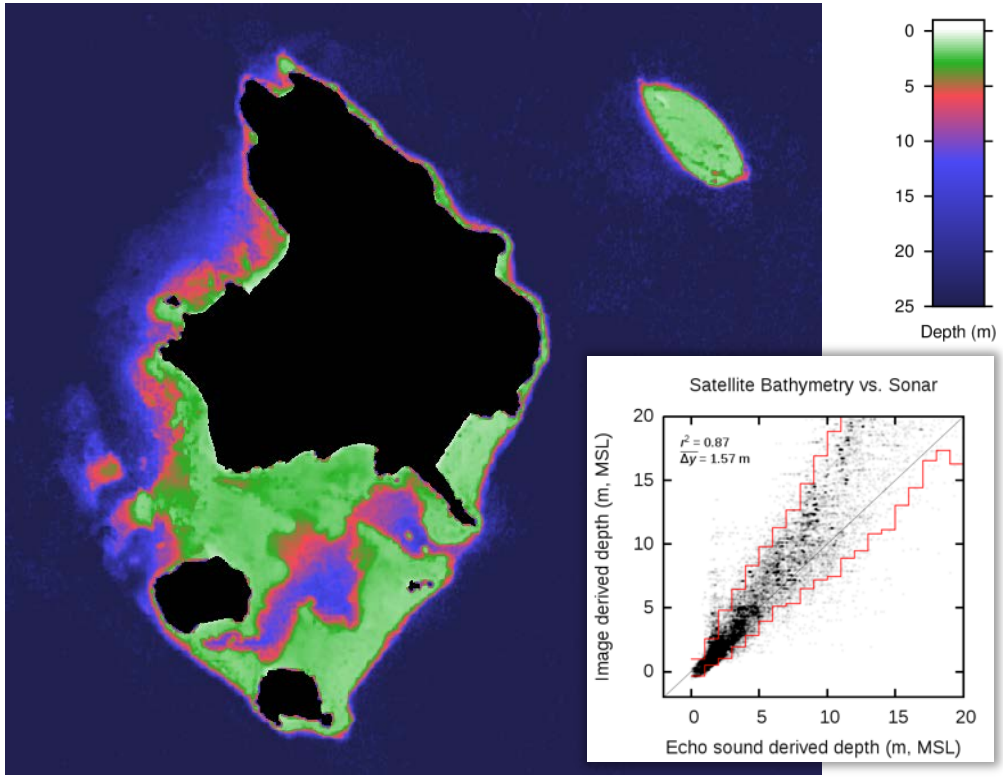
February 2017



Contains modified Copernicus Sentinel data [2017],
Sen2Coral project, Dr. John Hedely

Shallow Water Bathymetry

Lizard Island, Great Barrier Reef



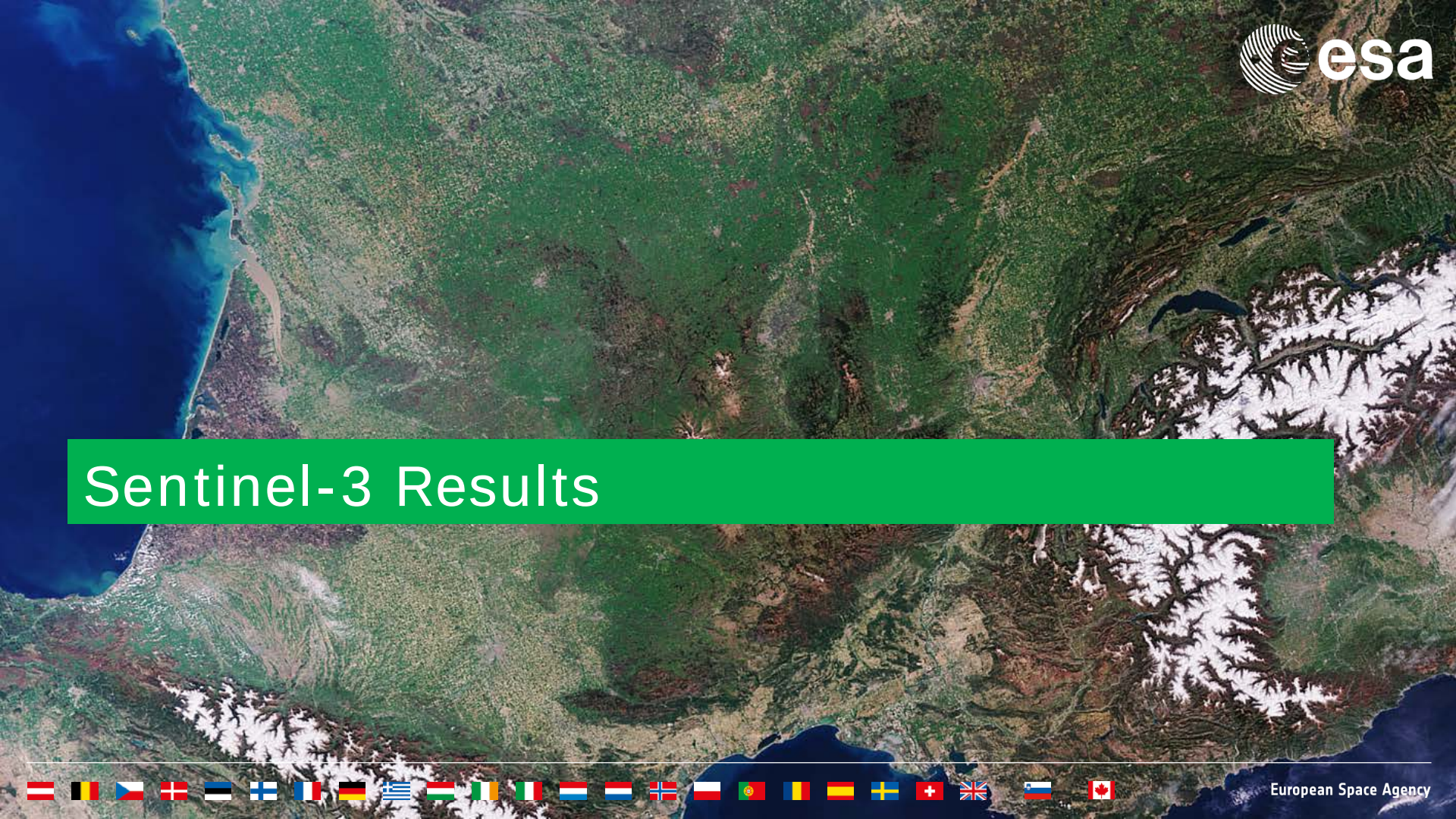
Water Quality Monitoring

Lake Turkana, Ethiopia

innovators sponge

UNEP United Nations Environment Programme

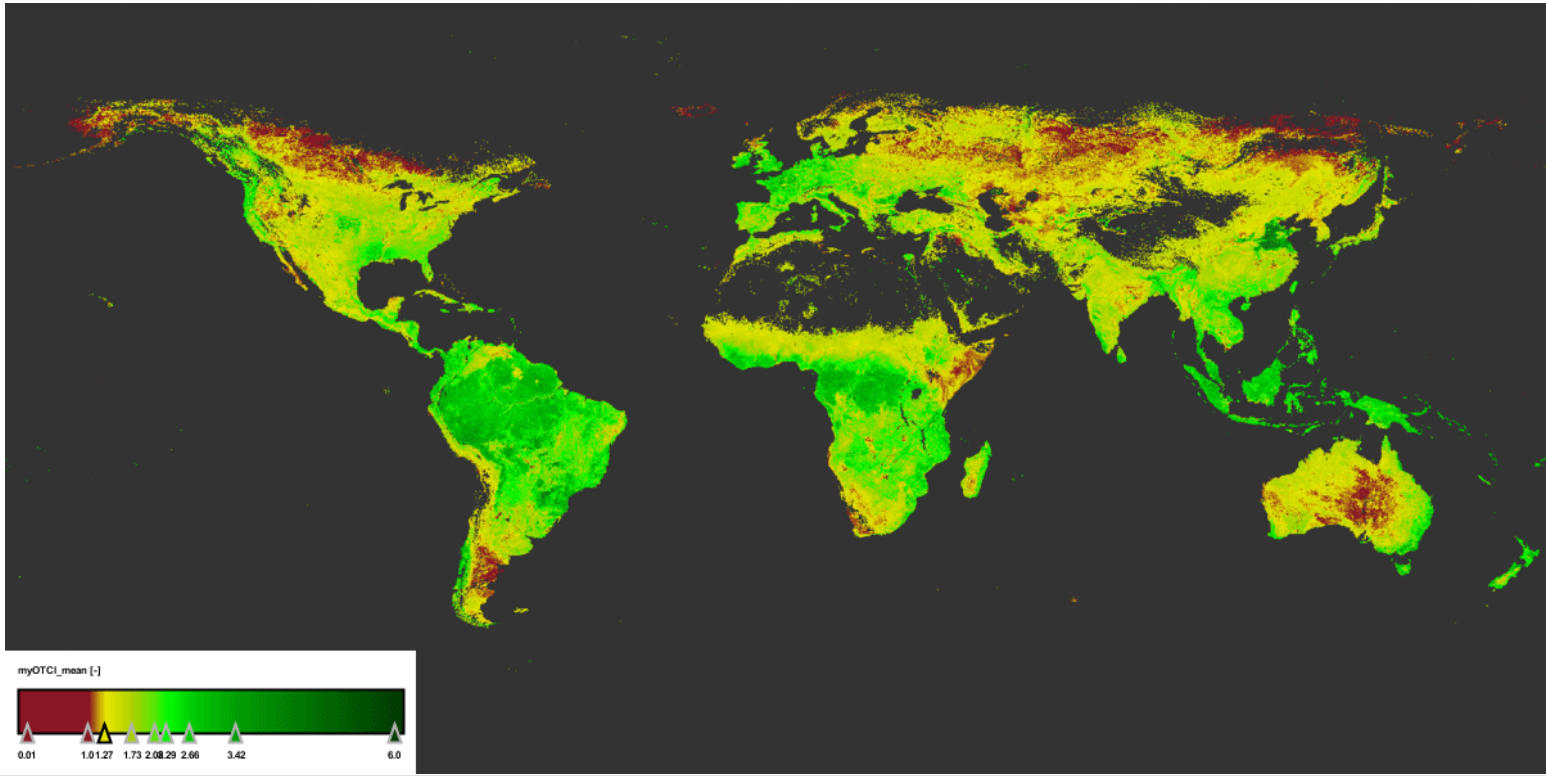
GEMS Water



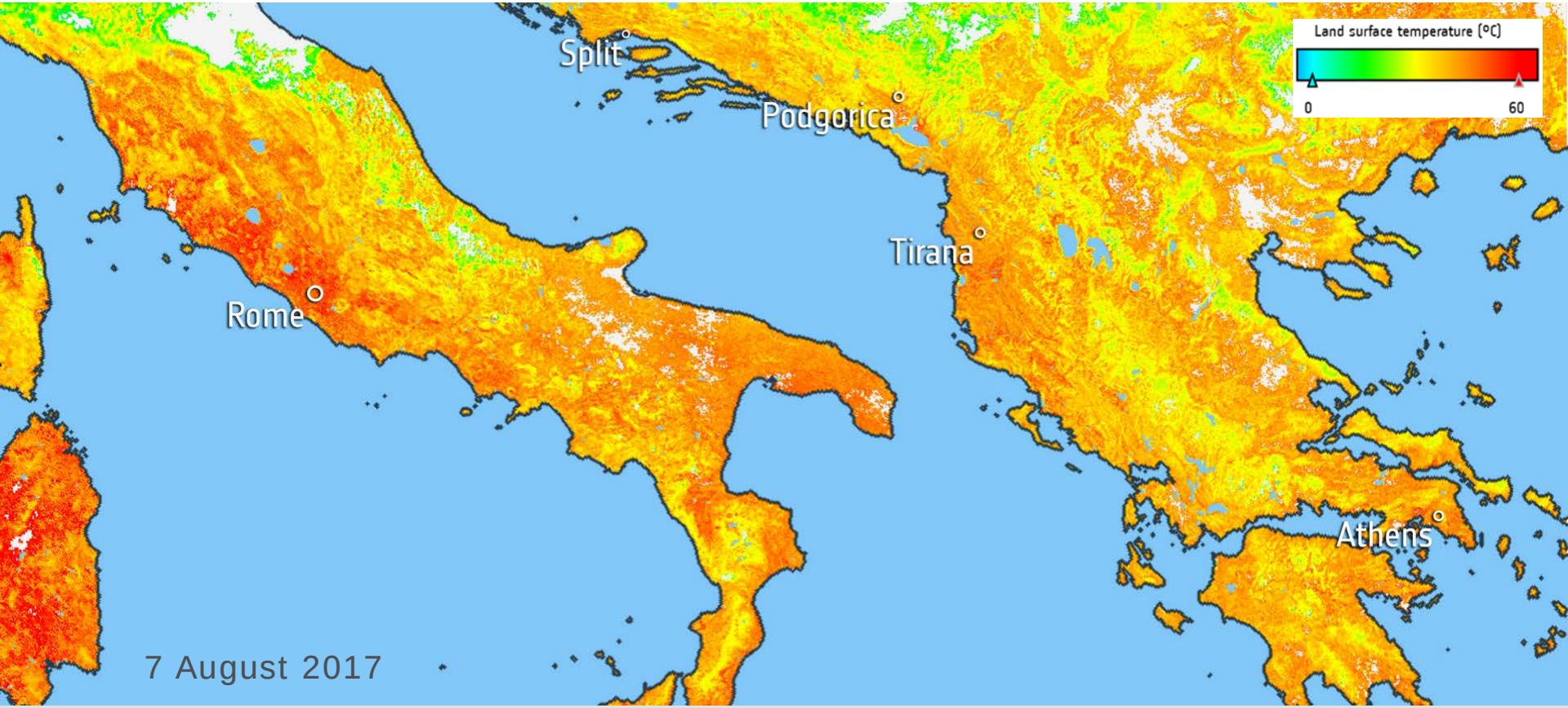
Sentinel-3 Results

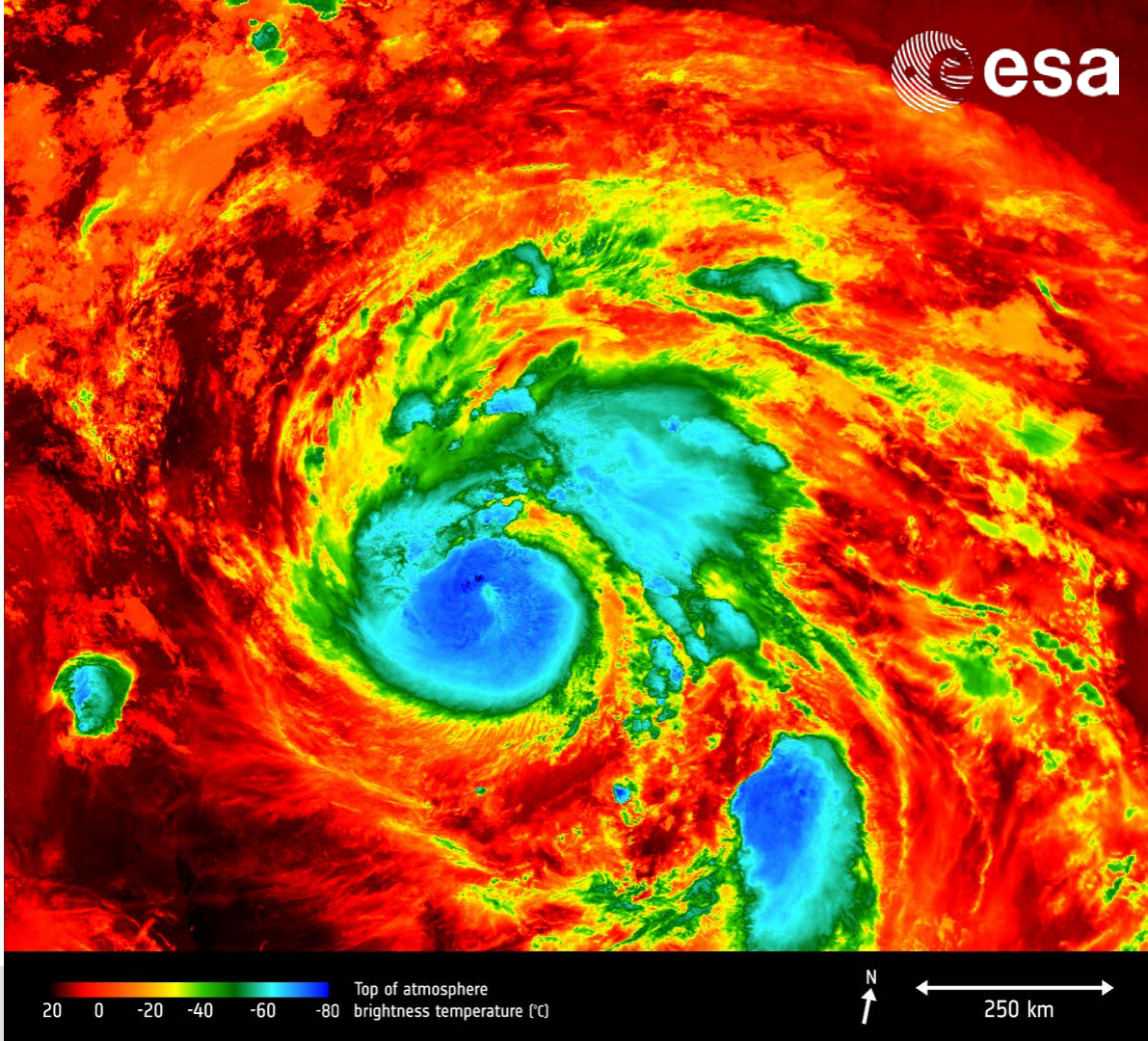
Monitoring Chlorophyll Index

1 April–27 May 2017



Monitoring Heatwaves



Hurricane Harvey

25 August 2017