





→ 8th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

10–14 September 2018 University of Leicester | United Kingdom

Sentinels for Science and Applications

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ESA-DEVELOPED EARTH OBSERVATION MISSIONS



Sentinels: A New Generation of Data Source

- Copernicus European space flagship programme, led by the EU
- Designed to monitor various elements of the Earth System in a fully operational manner, via six main services and a free, full and open data policy
- ESA is responsible for space component (six types of Sentinel satellites and their ground segments), Sentinel development and procurement, operation of some Sentinels, data acquisition from other partners, system evolution









Sentinel-1 Results

European Space Agency

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





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

Subsidence Monitoring





http://insarap.org



Subsidence Monitoring





SAR Tomography

Mexico City





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



Mean LOS Velocity (cm/year) <-5

>5



Volcanic activity, Campania

> Mean LOS Velocity (cm/year)







Post-Earthquake Ground Displacement, 30 October 2016 Central Italy Earthquake

Based on interferogram generated with:

- Sentinel-1B acquisition 2016 Oct 26
- Sentinel-1A acquisition of 2016 Nov 1



European Space Agency

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Pistoia, Tuscany: Subsidence due to water extraction





Maratea, Basilicata: Subsidence due to landslides







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European Space Agency

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Mapping Built-Up Areas







standard deviation

2.5 5

10 km

Mapping Built-Up Areas: Global Urban Footprint

DLR



Zhelin reservoir

50 km



Poyang.

11 July 2015

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Nanchang

Cesa 🌔

Offshore Winds

esa

Sentinel-1A, 2015 Apr 25, Denmark

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Global Near-Real Time Swell Tracking

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





European Space Agency

esa

Glacier Flow

Pine Island Glacier, Antarctica Sentinel-1B 2014-2017 Pine Island Glacier

es

S-PIG ice shelf

Amundsen Sea

2014-10-10

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N-PIG ice shelf

20 km

#Sentinel1 @steflhermitte

Ice Sheet Monitoring



Routine observations of ice sheet margins (surface velocity)



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







Sea Ice Concentrations



High resolution sea ice concentration, early September 2017



The Copernicus Marine Environment Monitoring Service provides daily highresolution sea ice concentrations derived from Sentinel-1

Oil Spill Detection and Monitoring





European Space Agency

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Sentinel-2 Results

Sentinel-2 for Systematic Observations

Sentinel-2A/B: Since 17 February 2018: Global acquisitions with at least Global acquisitions interval 5-day revisit interval



0 days 00 hours 00 minutes

Global Land Cover

- Advanced land cover classification strategies to exploit the new capabilities of Sentinel-2 in view of generating global land cover maps
- Instrumental in:
 - mapping changes in land use
 - managing natural resources
 - conserving biodiversity
 - modelling climate change extent and impacts

180.000 Sentinel-2A images,

Dec 2015 - Dec 2016









Crop Classification and Statistics







Revolutionising the EU Common Agricultural Policy (CAP): Technology Meets Policy



"Copernicus will significantly **reduce** the number of **field inspections**... thus benefitting public administrations, by **reducing the costs of controls** and checks."

"It is thus a **win-win for farmers and administrators**."

Phil Hogan European Commissioner for Agriculture and Rural Development 25 May 2018











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Revolutionising the EU Common Agricultural Policy (CAP): Technology Meets Policy



Crop type mapping for crop diversification monitoring - Netherlands, 2017



Mali Food Security: National Statistics, Crop Damage









RESEARCH PROGRAM ON Climate Change, Agriculture and

Food Security

Research Regions Publications Tools

CGIAR

CCAFS

Climate Services and Salery Nets West Africa

PARTNERS

ICRISOT RENATIONAL CEOPS RESEARC

Mali: Monitoring the Growth of Cotton





Mount Etna Eruption, March-April 2017





Water Quality Monitoring



Lake Turkana, Ethiopia









S-2 Maximum Chlorophyll Index [dl]

Wetland Inventory



Senegal vegetated wetlands pre-inventory



Sentinel-2: Monitoring Infrastructure



Yavuz Sultan Selim Bridge, Istanbul

Sentinel-2A, Jul 2015 – Aug 2016





Supporting Large-Scale Geological Mapping





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Wildfires





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Wildfires, Fire Damage





Moguer, Spain Moguer Detail01 - SPAIN Fire - Situation as of 29/06/2017 29 June 2017 Copernicus Emergency Management Service Rapid Mapping

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1+1

Ecosystem Destruction



Kalimantan, Indonesia Summer 2015, Sentinel-2A





Conflict Zones, "Fragile States"

Burning oil wells, Al Qayyarah, Iraq

2016 Nov 3, Sentinel-2A



Coral Reef Monitoring



Marquesas Islands, French Polynesia

February 2017

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

European Space Agency

OWRANCE

HDS

+

BHB

Shallow Water Bathymetry



Lizard Island, Great Barrier Reef



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Sentinel-3 Results



Sentinel-3A, 2017 Oct 15

R, G, B = 17, 6, 3

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Monitoring Chlorophyll Index





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Monitoring Heatwaves





Snow Cover





Global Water Quality

0.01



Sentinel-3 OLCI Level 2 products were released in July 2017 simultaneously by Eumetsat (for ocean) and ESA (for land)



Wave Height, Sea Surface Temperature



30°C





Since July 2017, the Copernicus Marine Environment Monitoring Service (CMEMS) provides a **real-time global wave product** based on satellite altimeter data (**Sentinel-3A** and Jason-3). After assimilation into the numerical real-time models, it allows CMEMS to provide wave forecasts with better accuracy.

Sea Surface Temperature, 2017 Sep 6



CMEMS also provides daily Mediterranean Sea surface temperature consisting of **merged multisensor data** to which **Sentinel-3A SLSTR** contributes.

18°C







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Earth Explorers for Science and Applications

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