



Committee on Earth Observation Satellites

CB Activities in EO at DLR

Dieter Hausamann - German Aerospace Center

WGCapD-5 Agenda Item #19

Working Group on

Capacity Building & Data Democracy

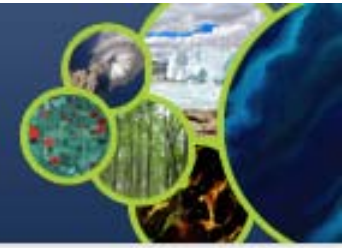
Hampton, Virginia, USA

March 29th – April 1st, 2016





WGCapD-5
Hampton, Virginia, USA
March 29th – April 1st, 2016

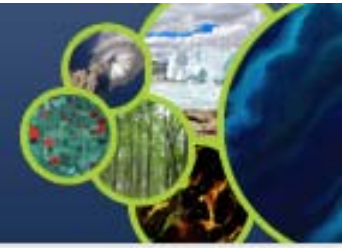


Outline

- The German Aerospace Center DLR
- CB Issues 1: SAR-EDU, TSX & TDX
- CB Issues 2: EOC
- CB Issues 3: K12 Edu



WGCapD-5
Hampton, Virginia, USA
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Outline

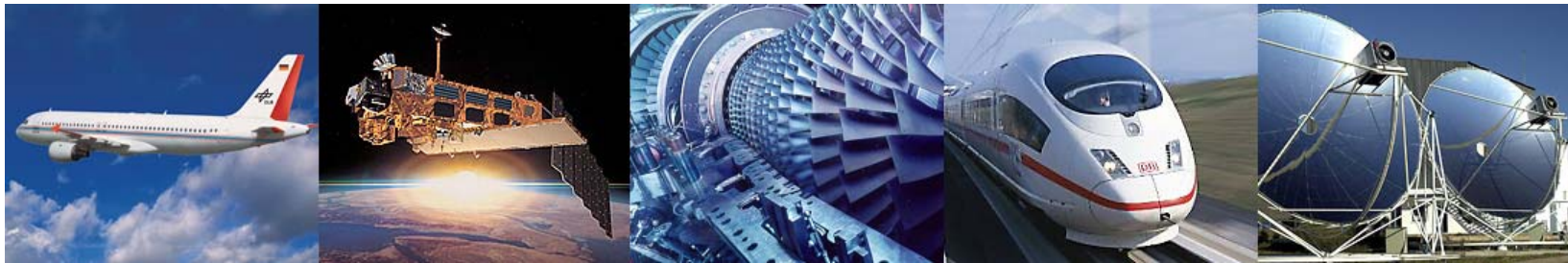
- The German Aerospace Center DLR

- ~~○ CB Issues 1: SAR-EDU, TSX & TDX~~

- CB Issues 2: EOC

- ~~○ CB Issues 3: K12 Edu~~

DLR
German Aerospace Center



- Research Institution
- Space Agency
- Project Management Agency



Locations and employees

8,000 employees across
33 institutes and facilities at

■ 16 sites

■ Space Directorate

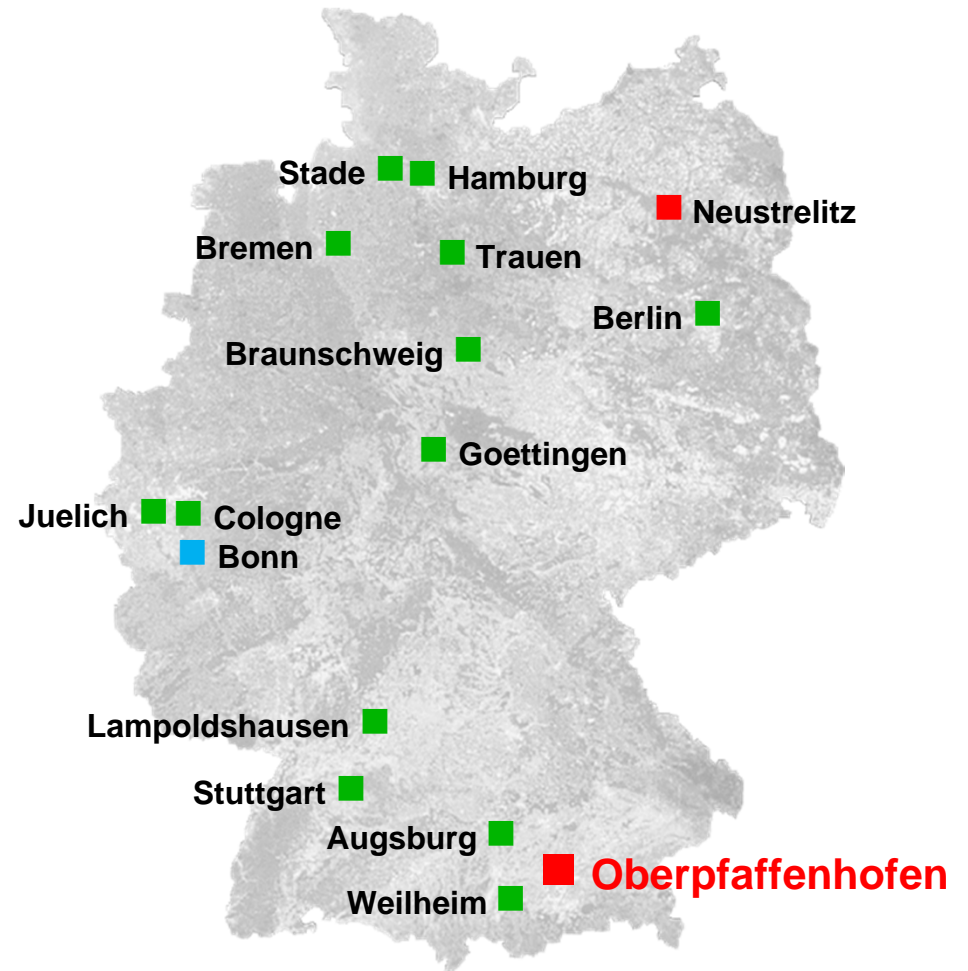
Offices in Brussels, Paris,
Tokyo and Washington.

In Oberpfaffenhofen/Bavaria:

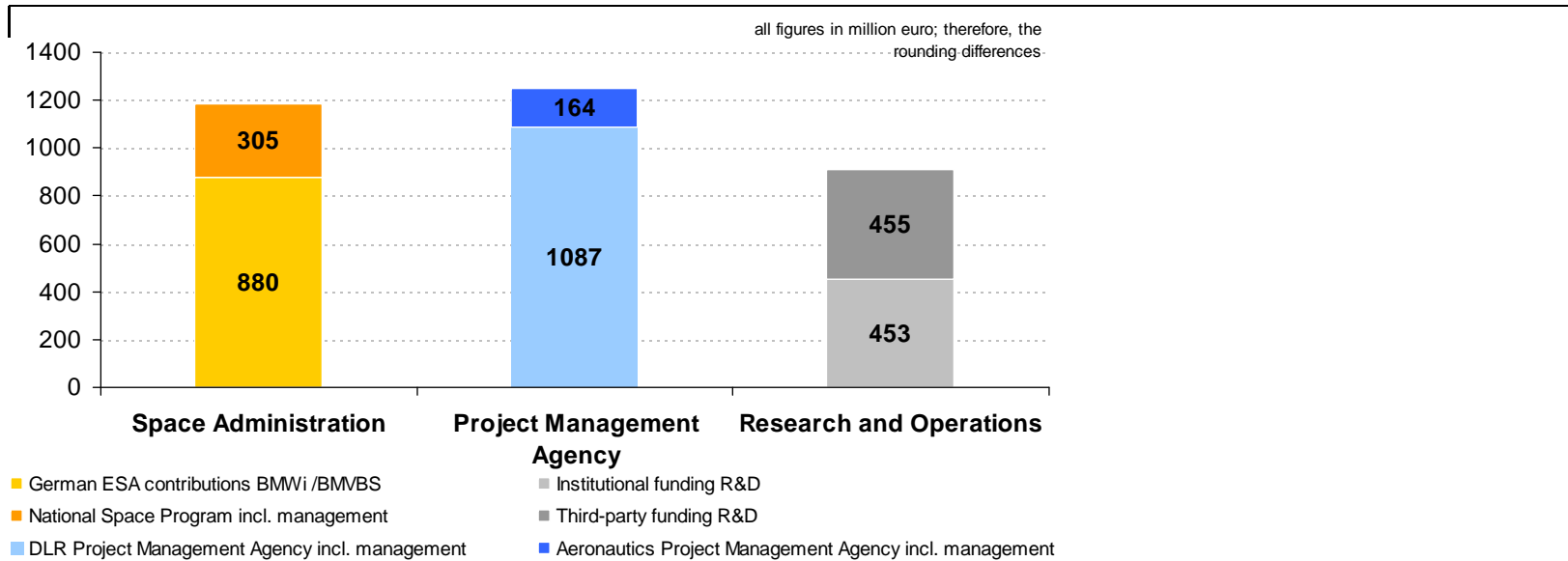
>1,800 employees

10 institutes and facilities

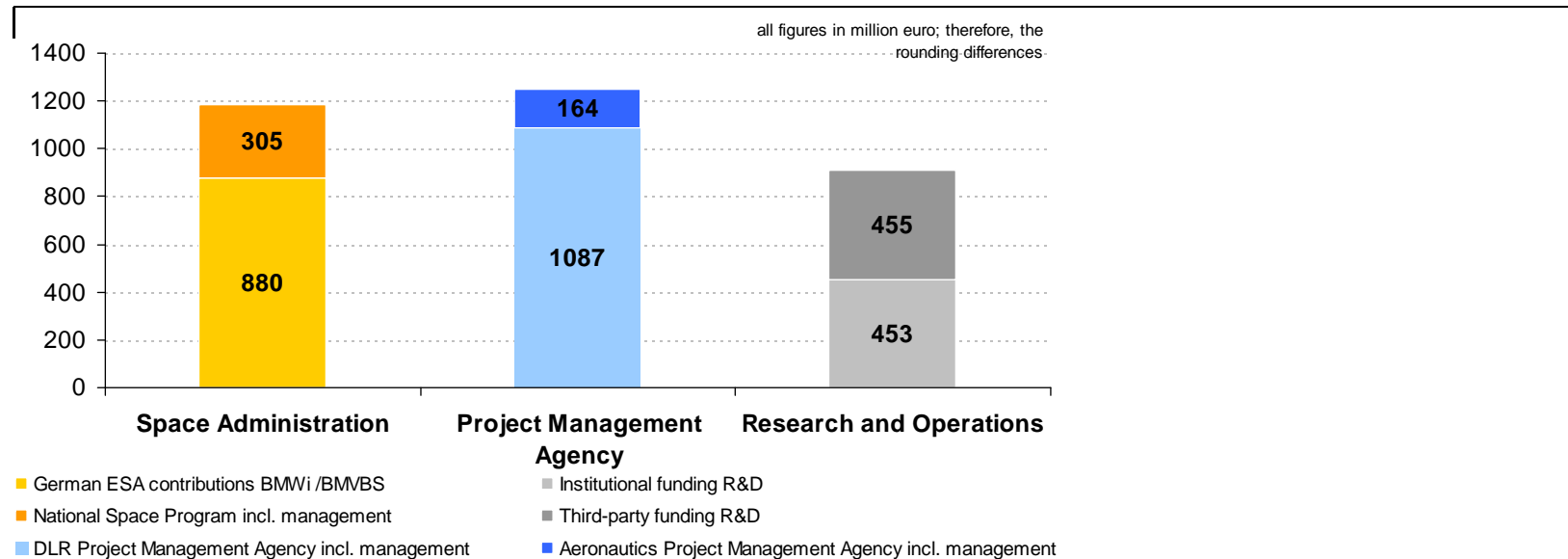
■ EO Sites



Financing of DLR and research funding 2016



Financing of DLR and research funding 2016



DLR is a publicly funded private entity



DLR Site Oberpfaffenhofen

Employees: More than 1,800

Size of site: 245 000 m²

Research institutes and facilities:

- 1. Microwaves and Radar Institute**
2. Institute of Communications and Navigation
- 3. Institute of Atmospheric Physics**
- 4. Remote Sensing Technology Institute**
5. Institute of Robotics and Mechatronics
6. Institute of System Dynamics and Control
- 7. German Remote Sensing Data Center**
- 8. German Space Operation Center**
9. Galileo Control Center
10. Flight Experiments

In RED: involved in CB activities



EOC



2. Earth Observation: Time Matters

for CEOS WGCapD-5 Annual Meeting

Gunter Schreier,

German Aerospace Center (DLR)

Earth Observation Center (EOC)

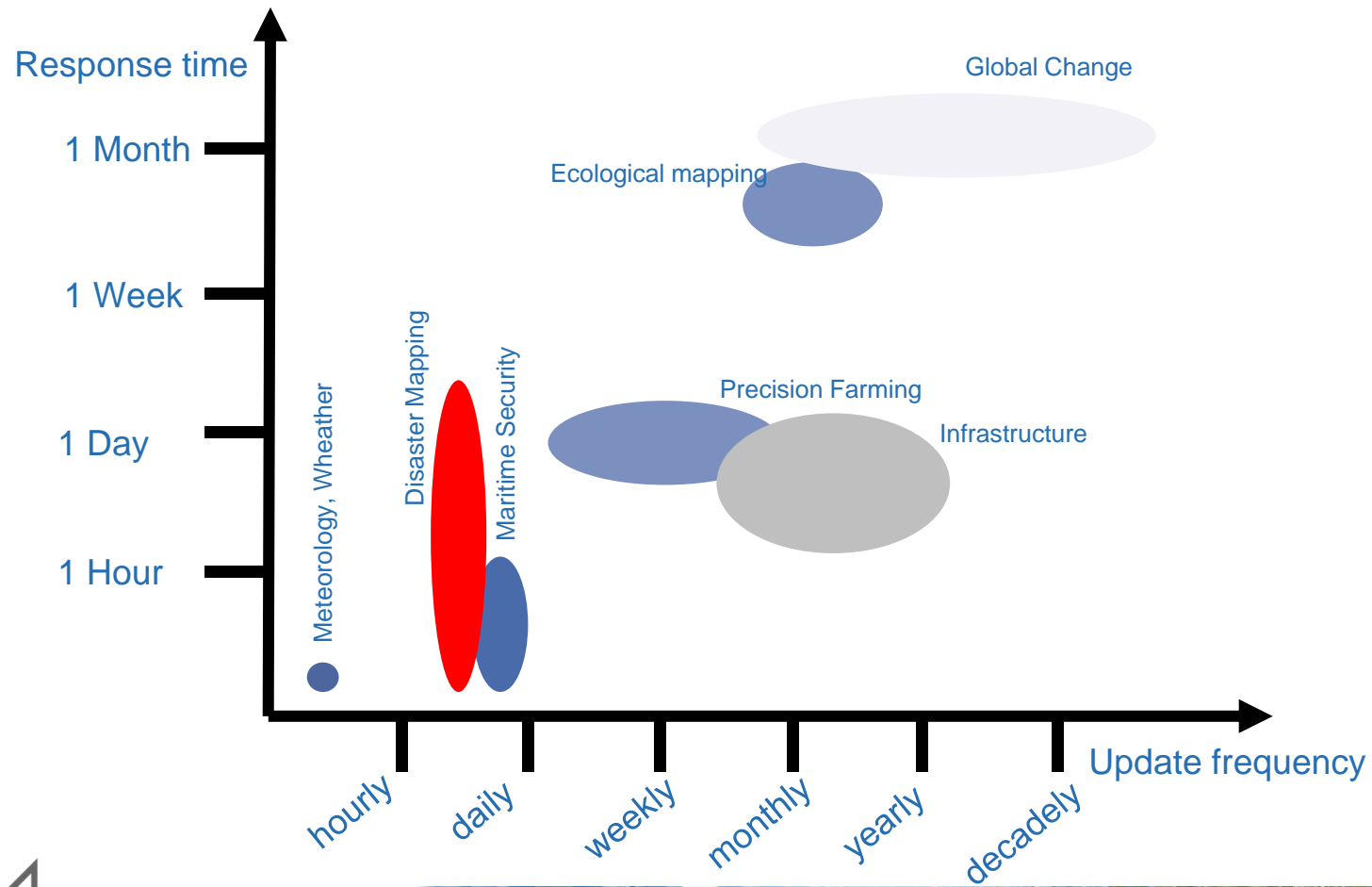
German Remote Sensing Data Center (DFD)

Remote Sensing Technology Institute (IMF)

March 2016



Earth Observation: response time vs. update



Time Scales in Earth Observation

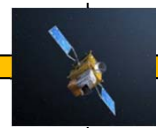
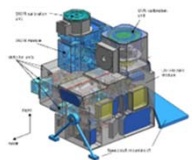
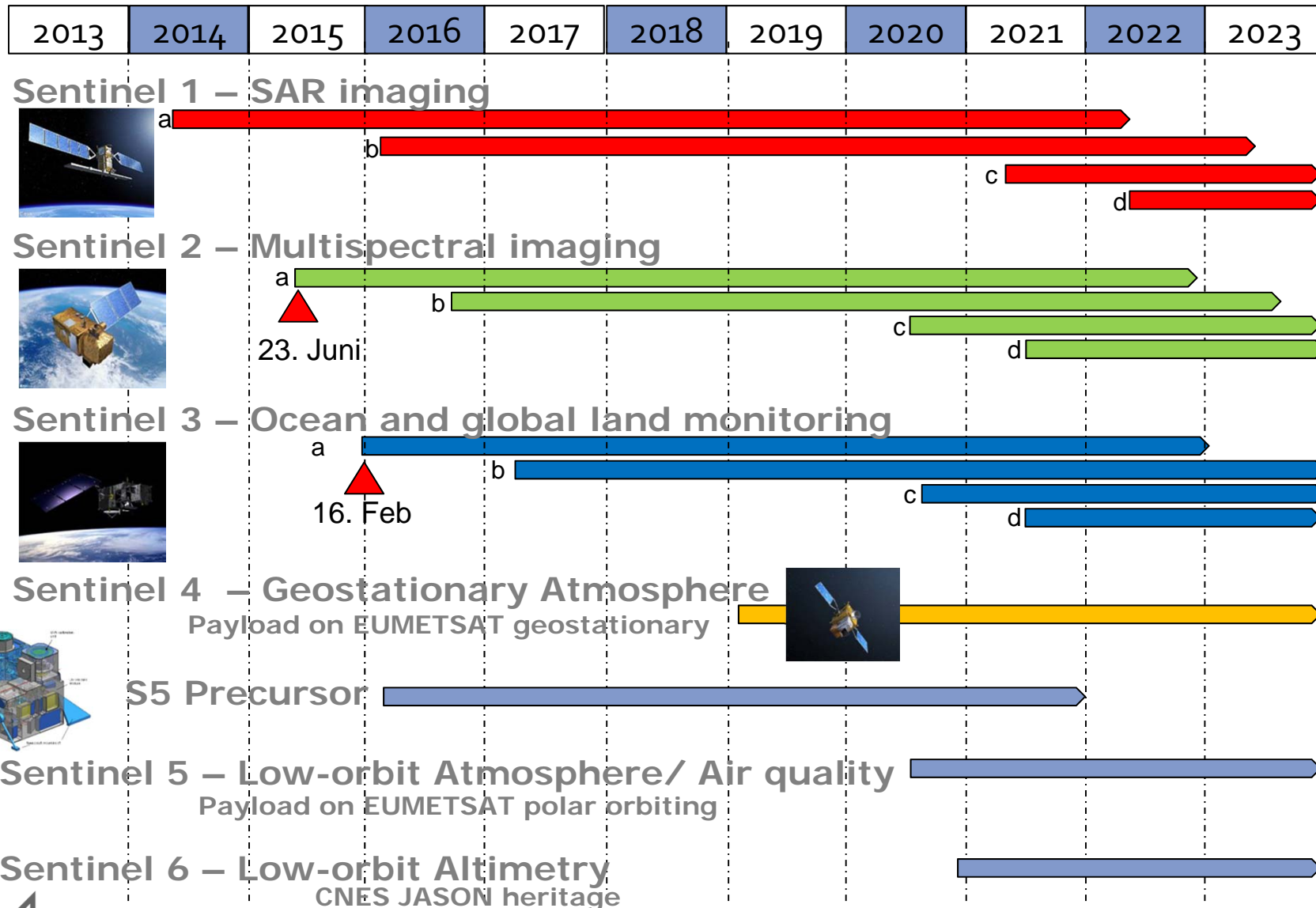
- Programming the data take
 - the next command uplink
 - the next revisit
- Getting the data
 - the next direct access/ dump station
 - relay data from station to processing
- Processing, information extraction
 - ancilliary data
 - process being done
 - manual interaction, visual interpretation
- Long time availability
 - Time series
 - archives

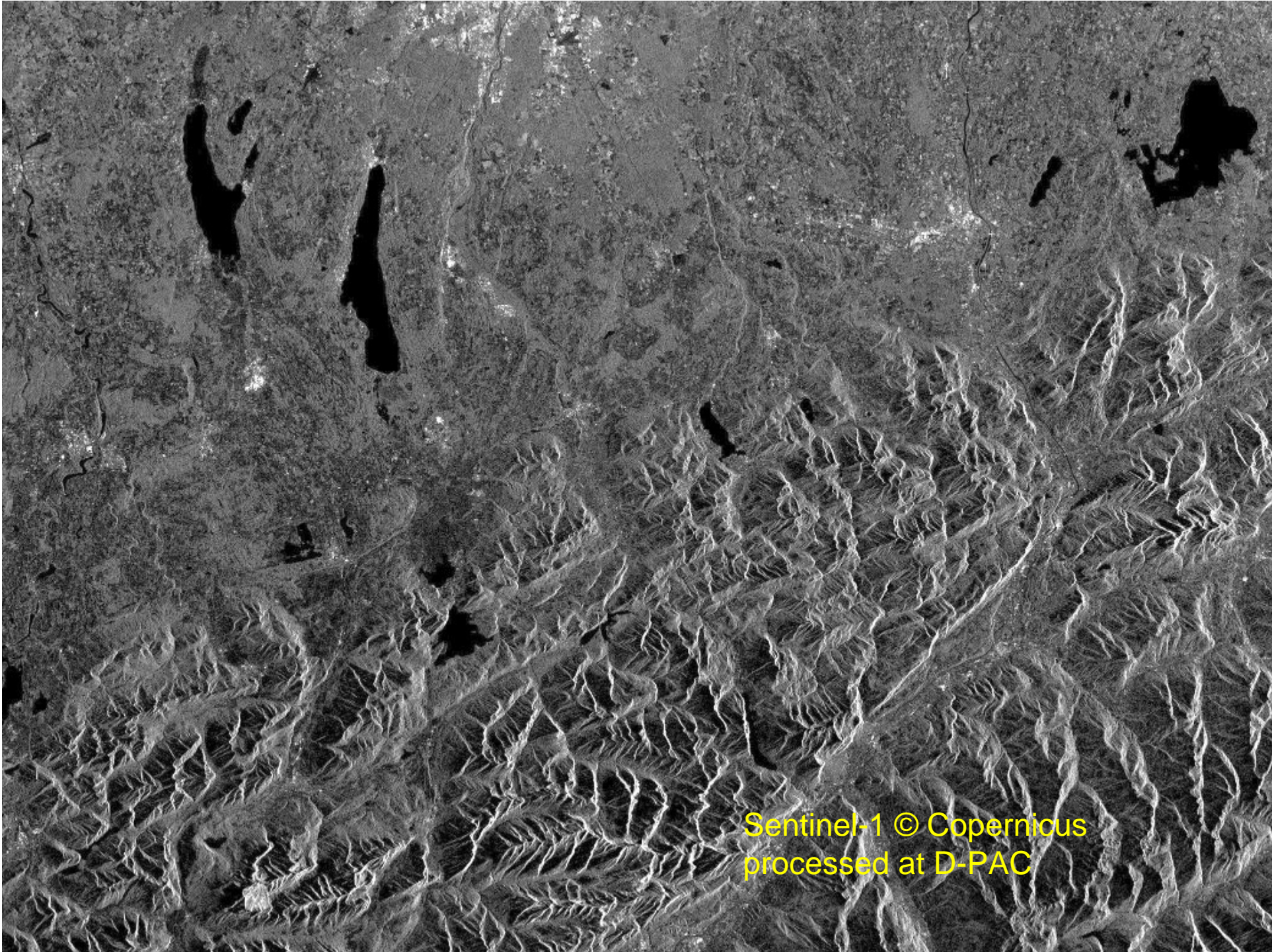


Missions

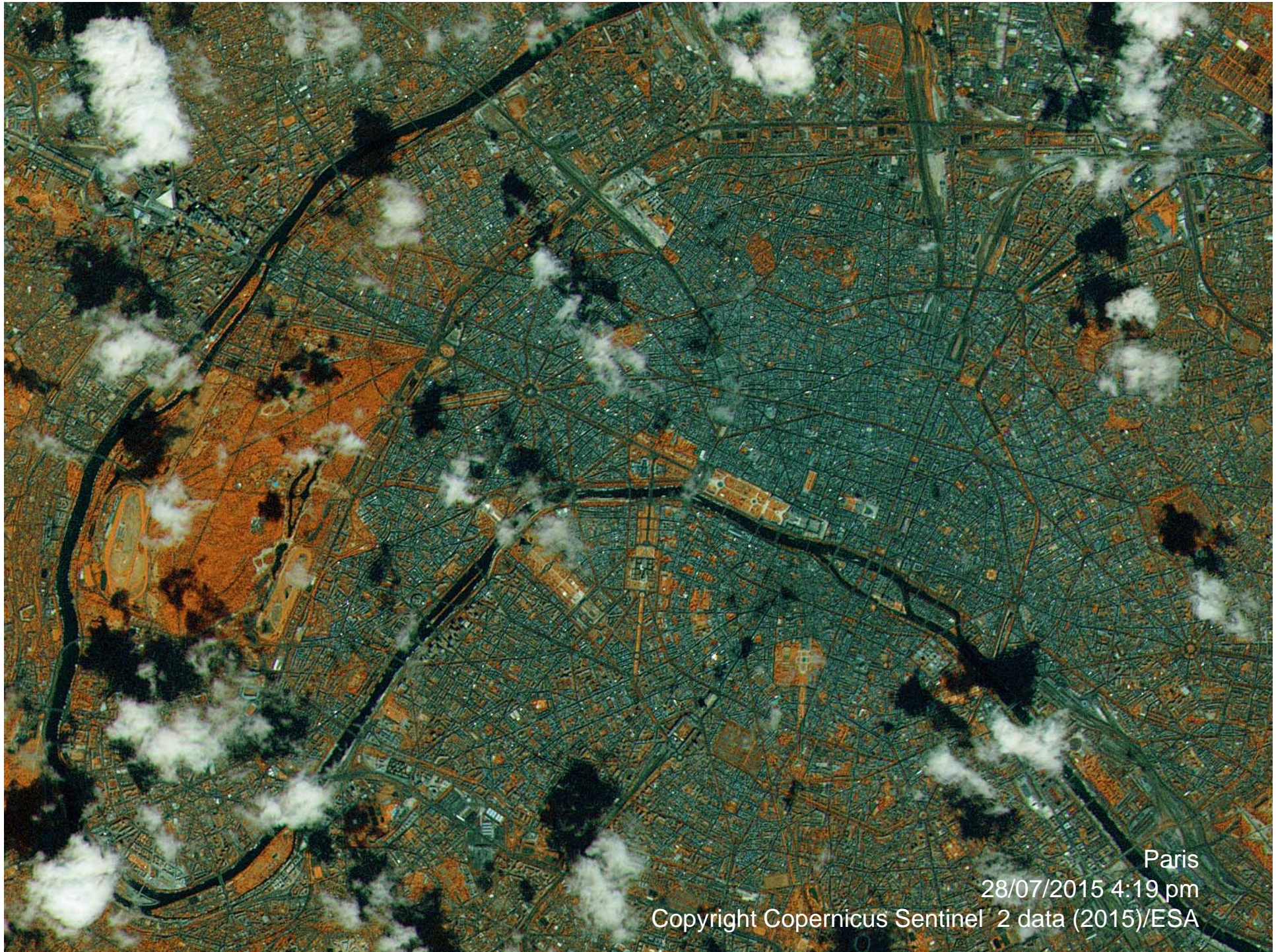


The Sentinel Missions





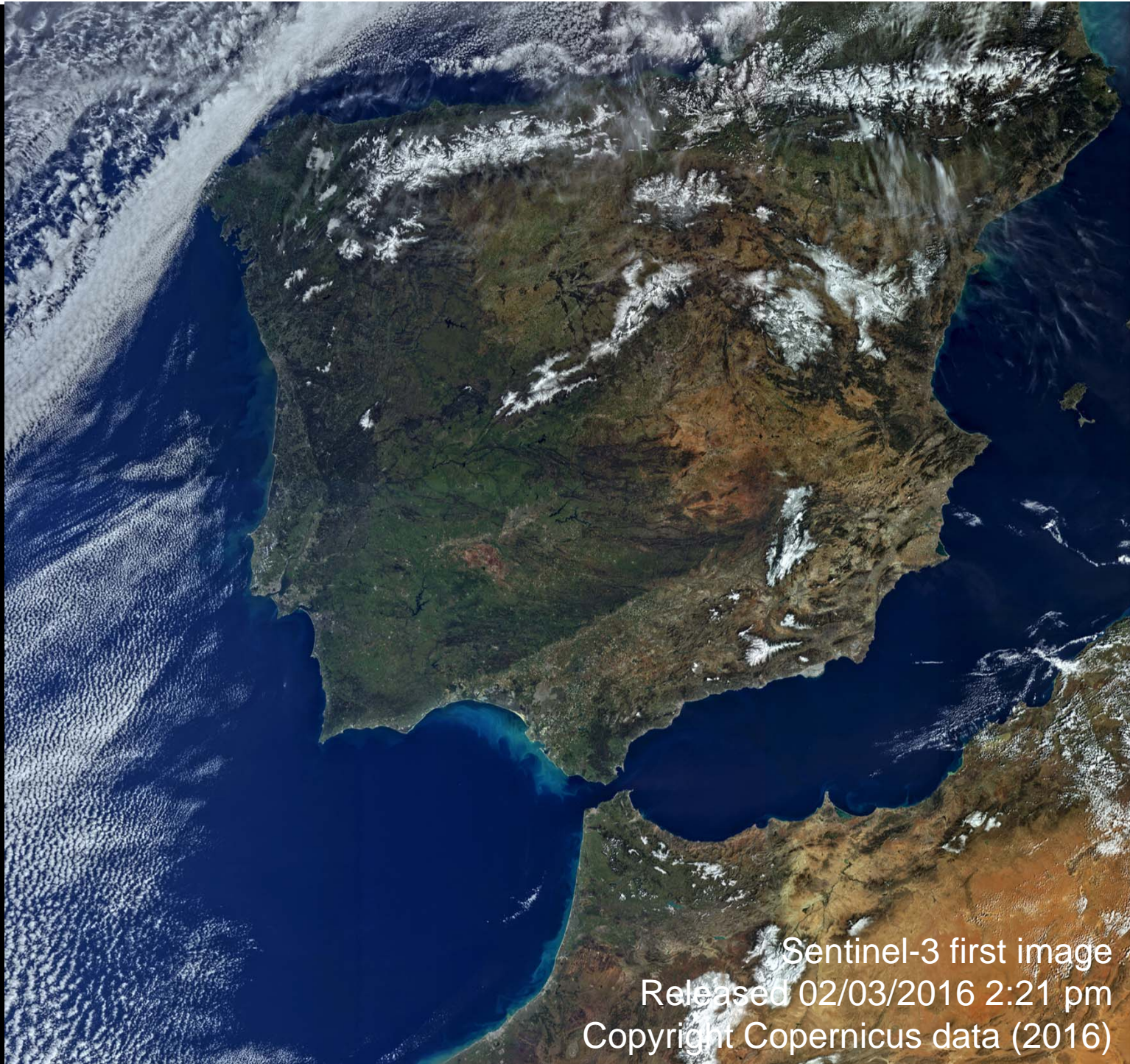
Sentinel-1 © Copernicus
processed at D-PAC



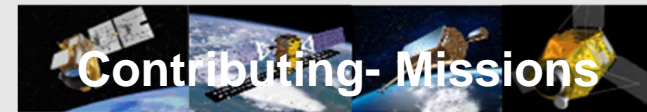
Paris

28/07/2015 4:19 pm

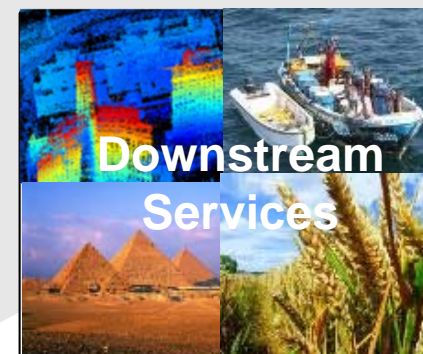
Copyright Copernicus Sentinel 2 data (2015)/ESA



Sentinel-3 first image
Released 02/03/2016 2:21 pm
Copyright Copernicus data (2016)



ESA Data Hub all Sentinels user products	2014	2015	2016	2017	2018	2019	2020
Yearly volume [TB]	180	966	4.490	6.591	7.250	7.469	8.127
Average Data Rate [Mbit/s]	194	257	1.194	1.753	1.928	1.987	2.162





COPERNICUS

A Big Data Challenge

Copernicus Contributing Missions from Germany

(all with EOC involvement)

TerraSAR-X/TanDEM-X (DLR-Airbus-PPP)

- Ground Segment development and operations

Resourcesat; Indian Satellites (GAF)

- Ground Segment Operations & improvement

WorldView-2/3, (EUSI) Skybox (Google)

- Ground Segment Operations & improvement

RapidEye (Blackbridge/PlanetLabs)

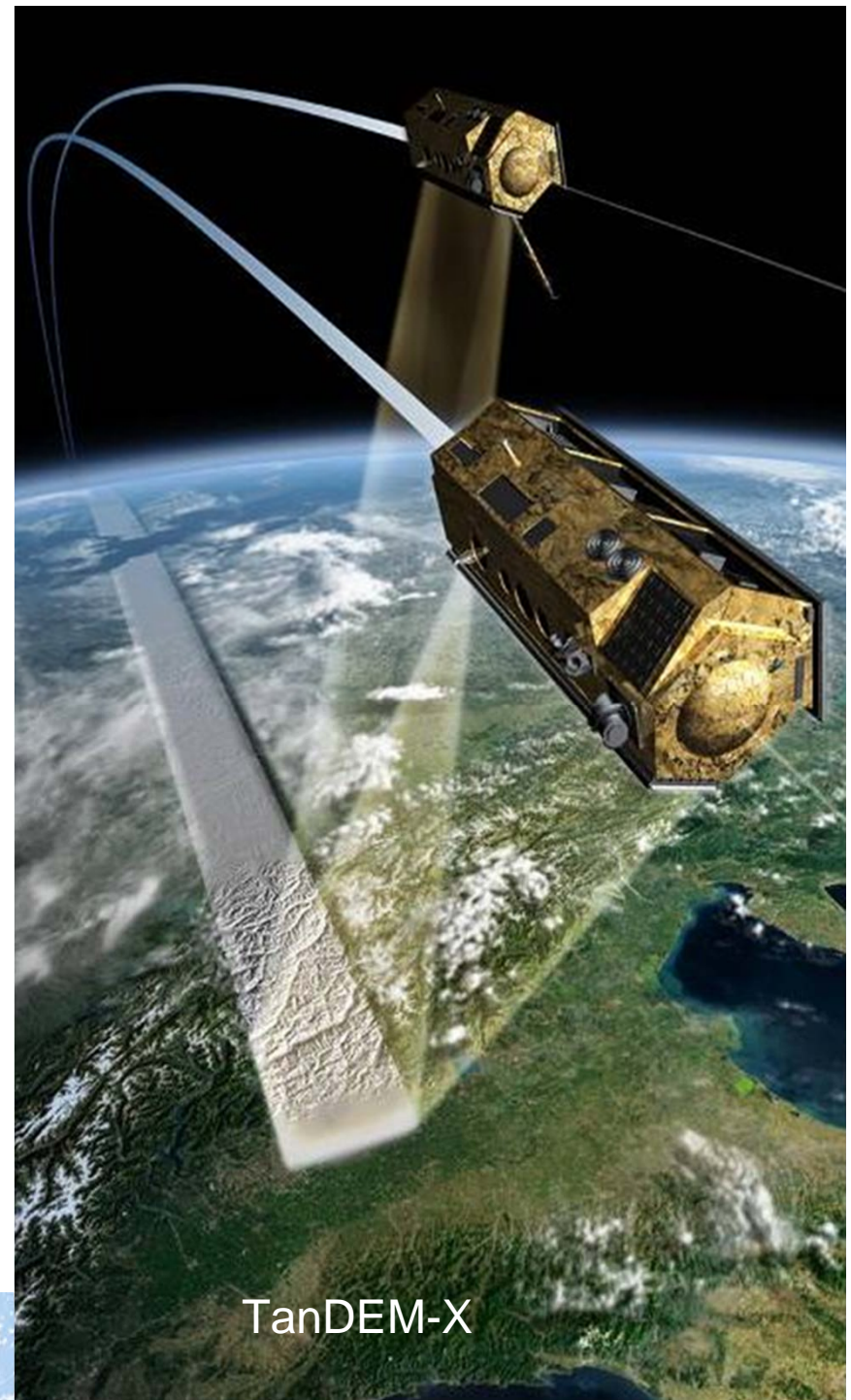
- Science Data support/ Archive

Korean Kompsat Missions (VHR optic & SAR)

- data acquisition, support to KARI

EnMAP (DLR)

- Ground Segment development and operations



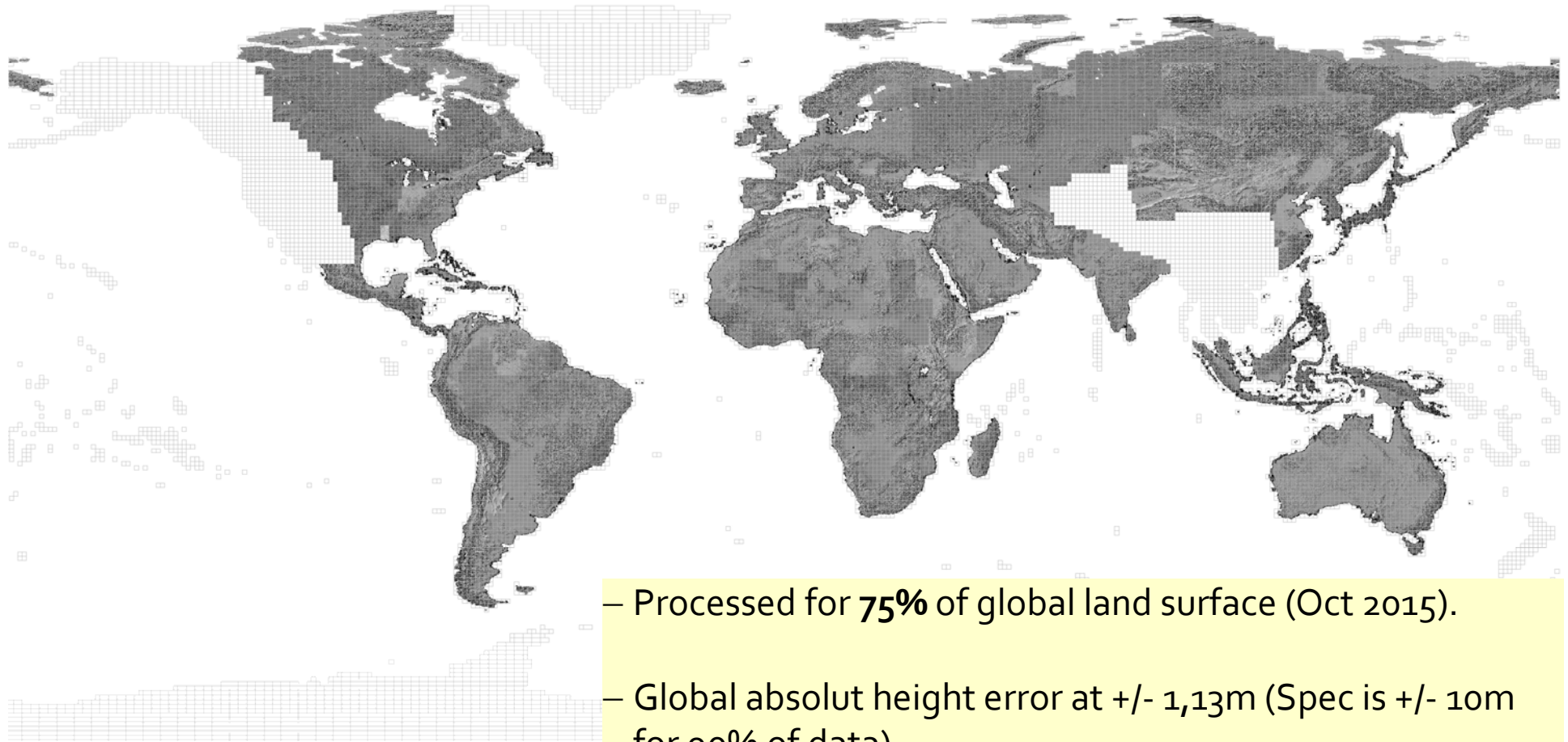
3 - Sendai Airport:
Parts of the runways of Sendai airport are flooded or covered by mud and debris. Many of the nearby buildings disappeared.



SENDAI change map
TerraSAR-X, March 12, 2011
(c) DLR - ZKI



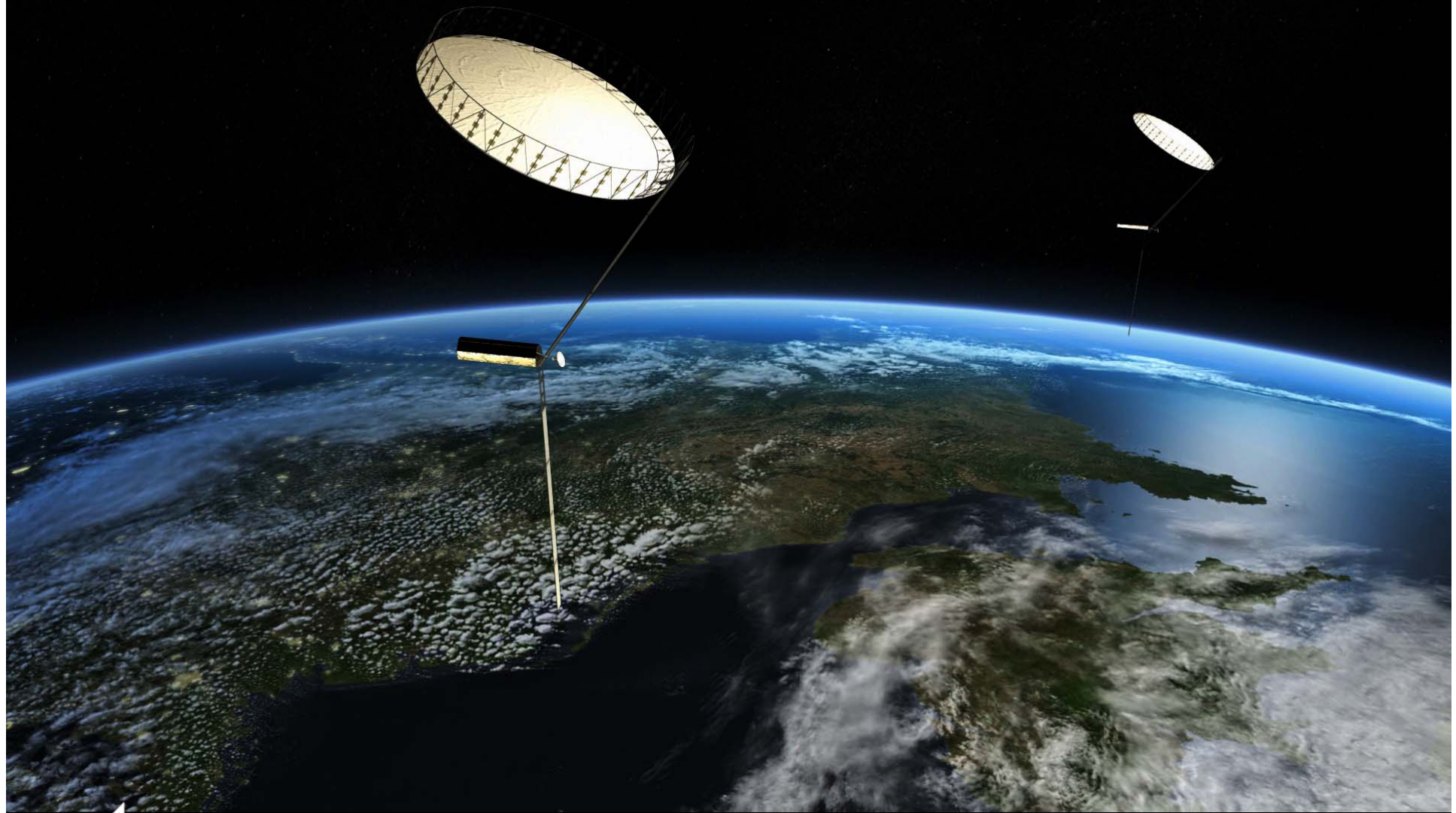
Final TanDEM-X DEM Product ($1^{\circ} \times 1^{\circ}$ Tiles with 12 m resolution)



- Processed for **75%** of global land surface (Oct 2015).
- Global absolute height error at $\pm 1,13\text{m}$ (Spec is $\pm 10\text{m}$ for 90% of data)
- **98,6%** of tiles meet all quality/accuracy criteria



Tandem-L-Formation



Comparison of Imaging Capacity

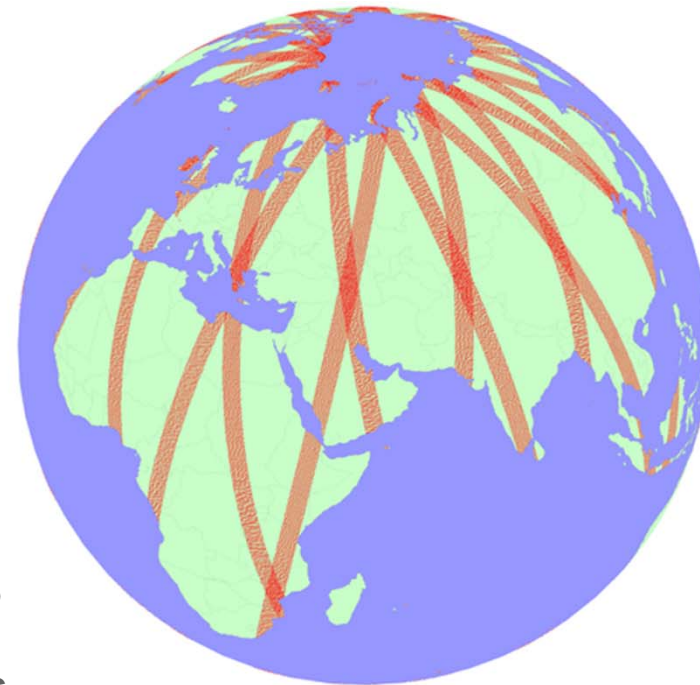
State of the Art (z.B. TerraSAR-X)

1 global coverage / year



Digital Beamforming (Tandem-L)

2 global coverages / week



1

Days



Ground Segment



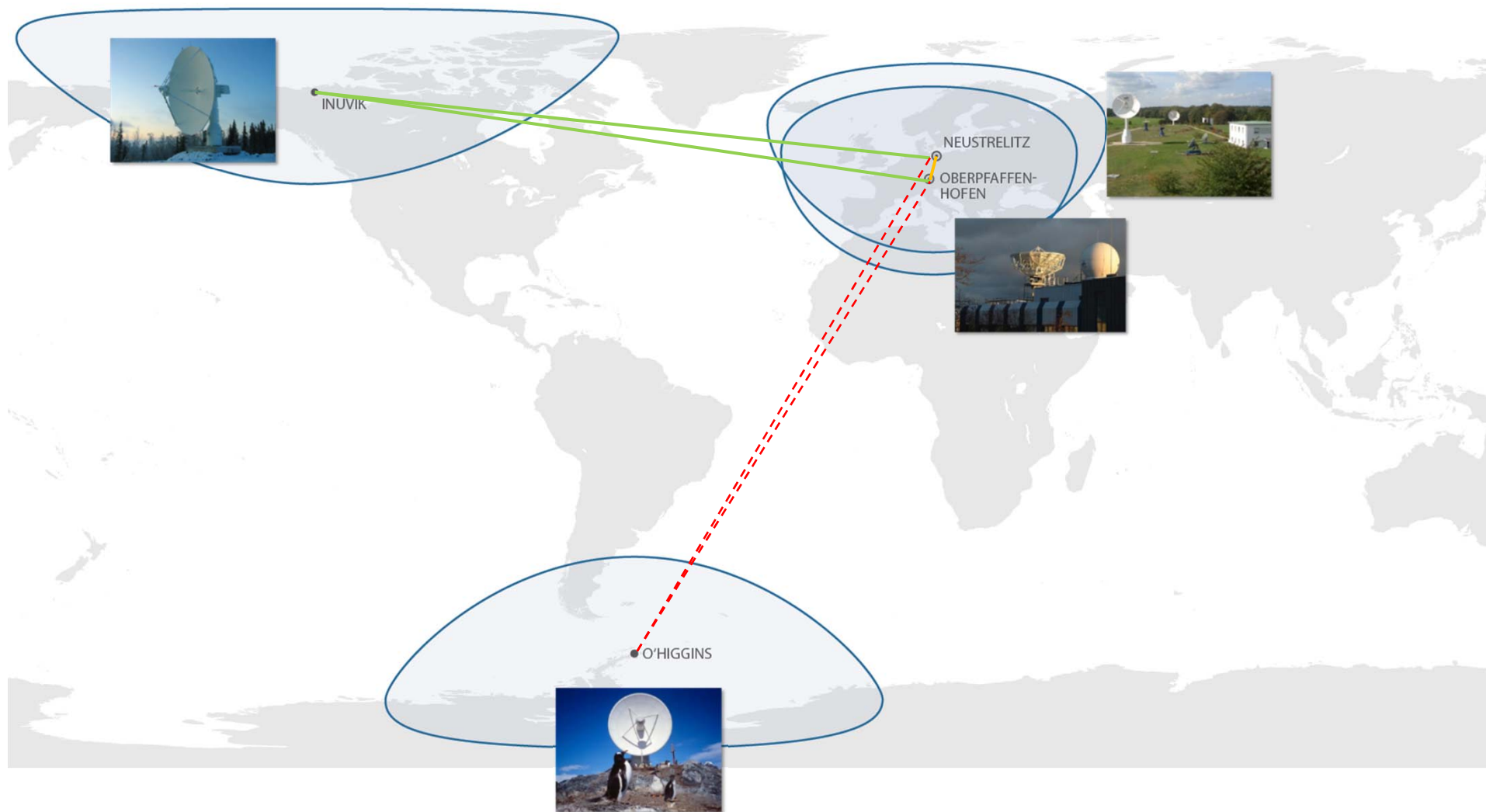
Copernicus Collaborative Ground Segment and national Services at EOC



- Near/Quasi Real Time Data Access
- Marine Services
- Emergency Response
- Civil Security
- Atmosphere
- Land
- Urban
- ... and more
- Big Data in Copernicus
- Data Access



Global Station Network of DLR-DFD



ISSF: Inuvik Satellite Station Facility

- 13 m DLR Antenna
- 13 m SSC/CNES Antenna & 2nd 13m Antenna (2016)
- 13 m CCMEQ Antenna (2014)
- .. more
- Fibre connection (2016)
... second line planned
- Copernicus Core Station location (ESA contract to KSAT)
- Site extension for > 30

L/S/X-Band Antenna in Inuvik, NWT, Canada



QRT/NRT Services from DLR Neustrelitz

- Acquisition of SAR satellites
- TerraSAR-X (& follow-ons)/ Sentinel-1/ Radarsat-2/ other
- QRT/NRT SAR product generation: SAR/oil image/Ship detection – wind/wave fields
- New acquisition technologies: AlphaSat, EDRS
- Near real time maritime scenarios
- User training/ facilities



DFD-Department National Ground Segment

- Ground Stations
- Data Management
- Realtime Services
- Maritime Security Lab
- Calibration- and Validation Testsite DEMMIN



German Satellite Data Archive

50 (+33) PetaByte storage capacity

Includes:

Sentinel PAC Archive

~ 1,5 PetaByte of product data per year per Sentinel



DLR-EO Issues:

- Disaster Response
- Maritime Security
- Urbanization
- ...
- Water Management





Disaster Response
one hour to few days

Helfer vor Ort

Satellite Based Crisis Mapping

www.DLR

.de •

03

Crisis or Disaster

- triggering process
- situation briefing

① Mobilization



- satellite tasking
- archive search
- auxiliary data

② Data acquisition



- geometric correction
- image enhancement

③ Pre-Processing



④ Analysis



- data fusion
- information generation

⑤ Map Production



- quality control
- maps (printed; online)
- GIS-ready geodata
- information dossiers

Integration in collaborative platform

⑥ Dissemination



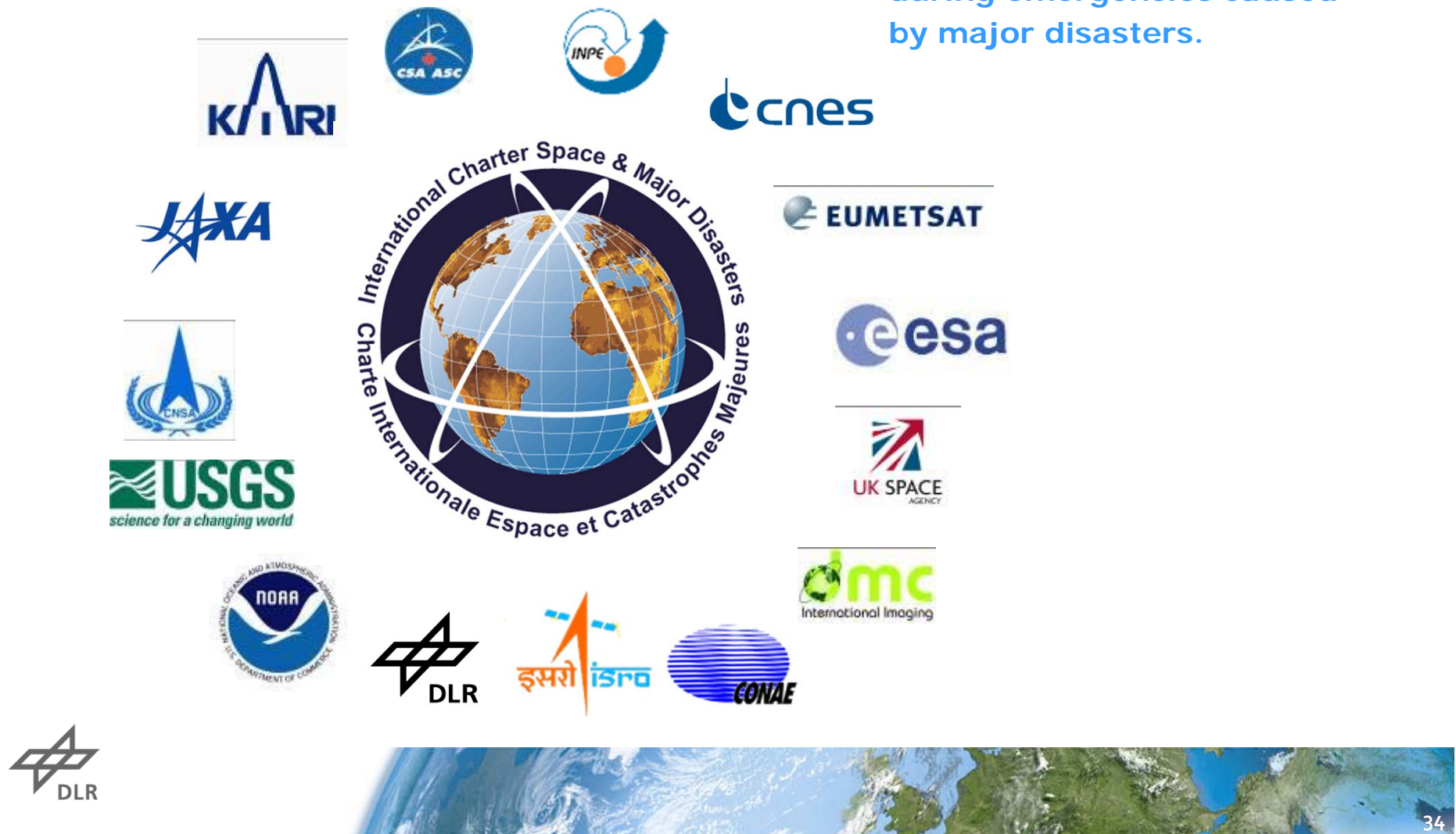
Planning and Decision Support

- Cooperation with national/local authorities
- Relief organisations, NGOs
- Public,...



International Charter on Space and Major Disasters

An International agreement among participating Space Agencies to provide space-based data and information in support of relief efforts during emergencies caused by major disasters.





Center for Satellite-based Crisis
Information - ZKI
National Service ZKI-DE

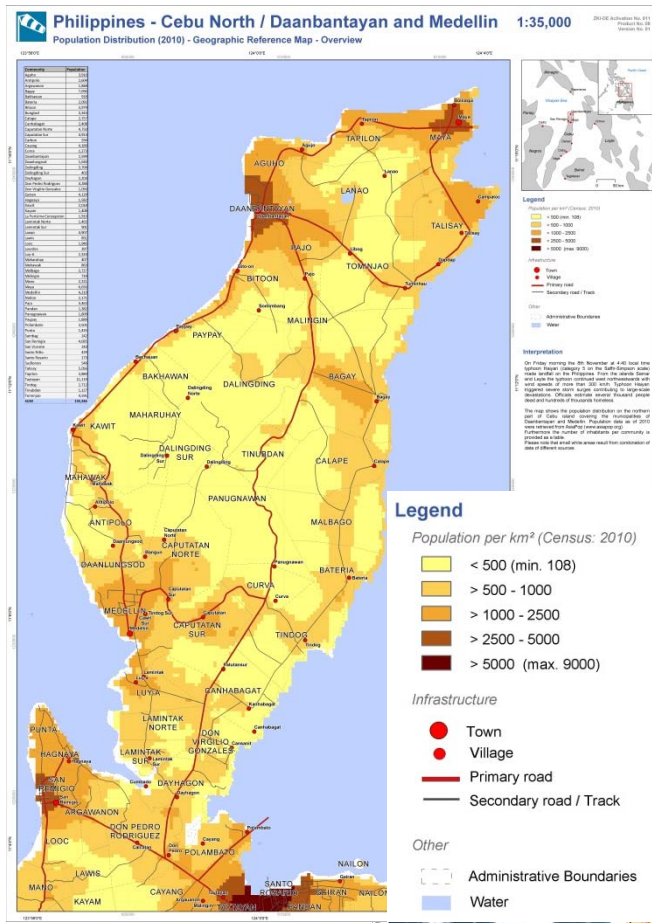


Taifun, Philippines, November 2013

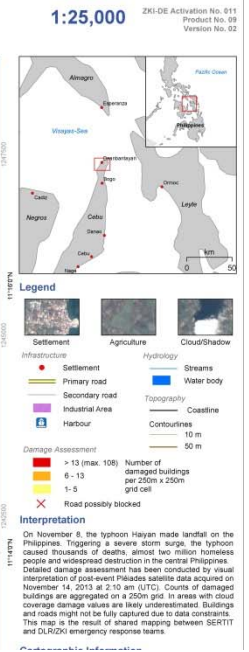
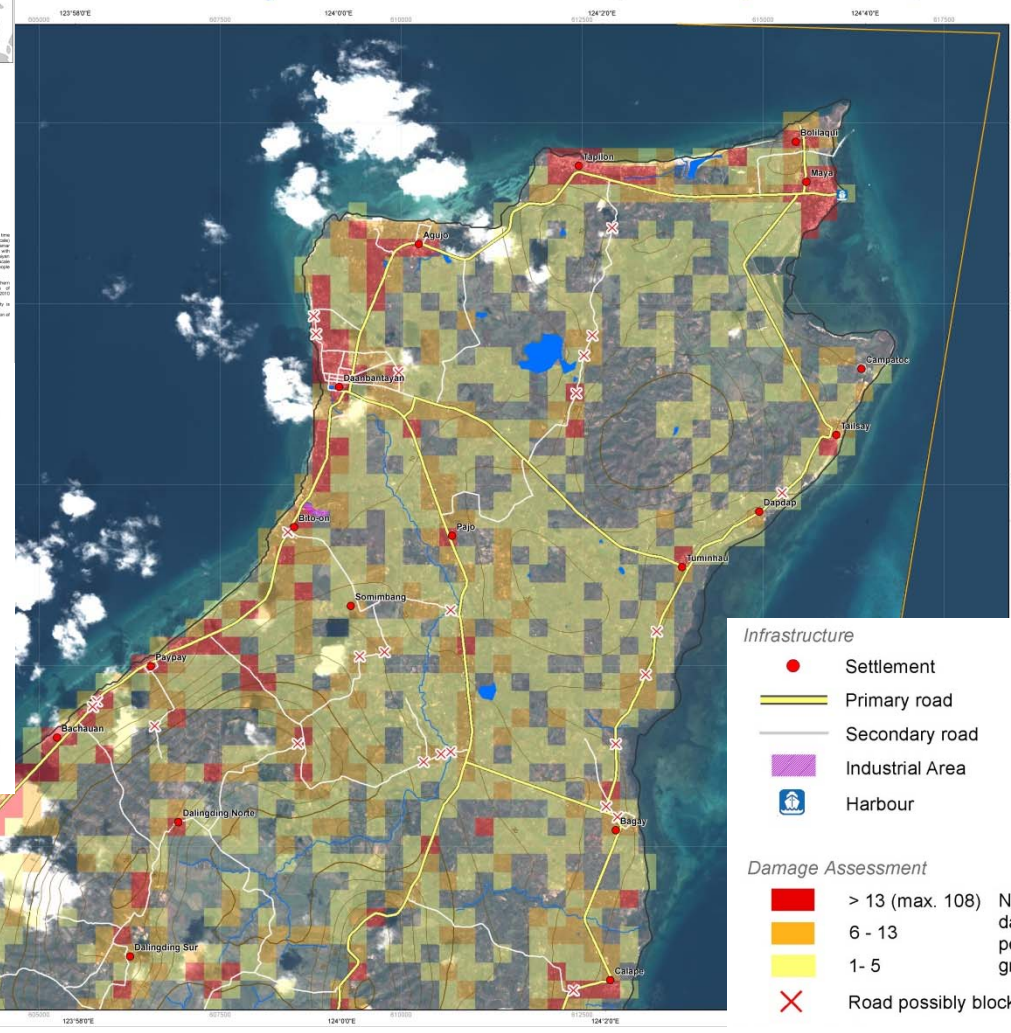


© Charism Sayata/AFP/Getty Images



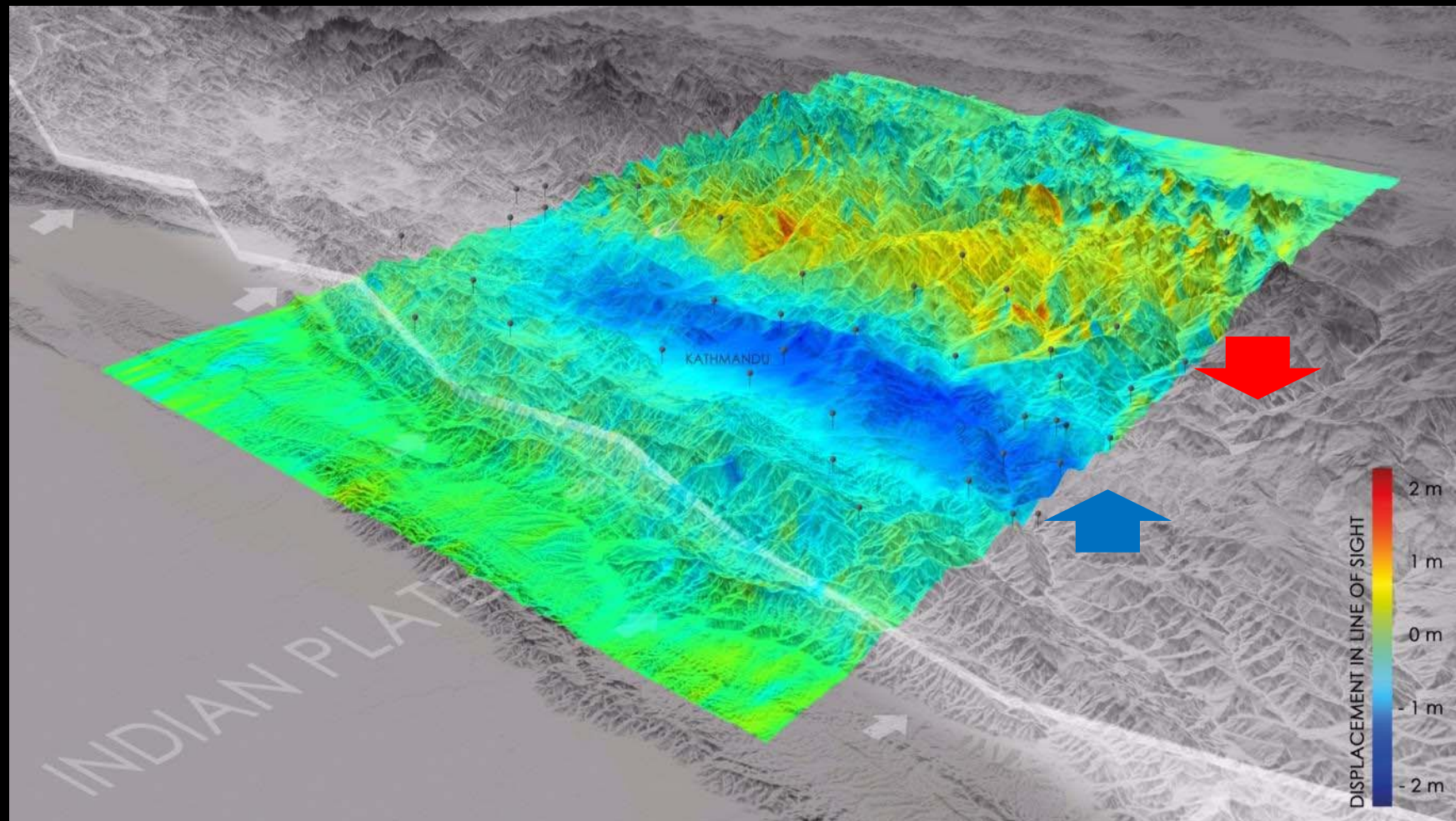


Cebu / Daanbantayan Situation as of November 14, 2013 - Damage Assessment Map



Differential Ground Movement

Earthquake Nepal (April 2015 – Sentinel 1)



Done by DLR- EOC –
IMF



Al Zaatari, Jordan
13.01.2014

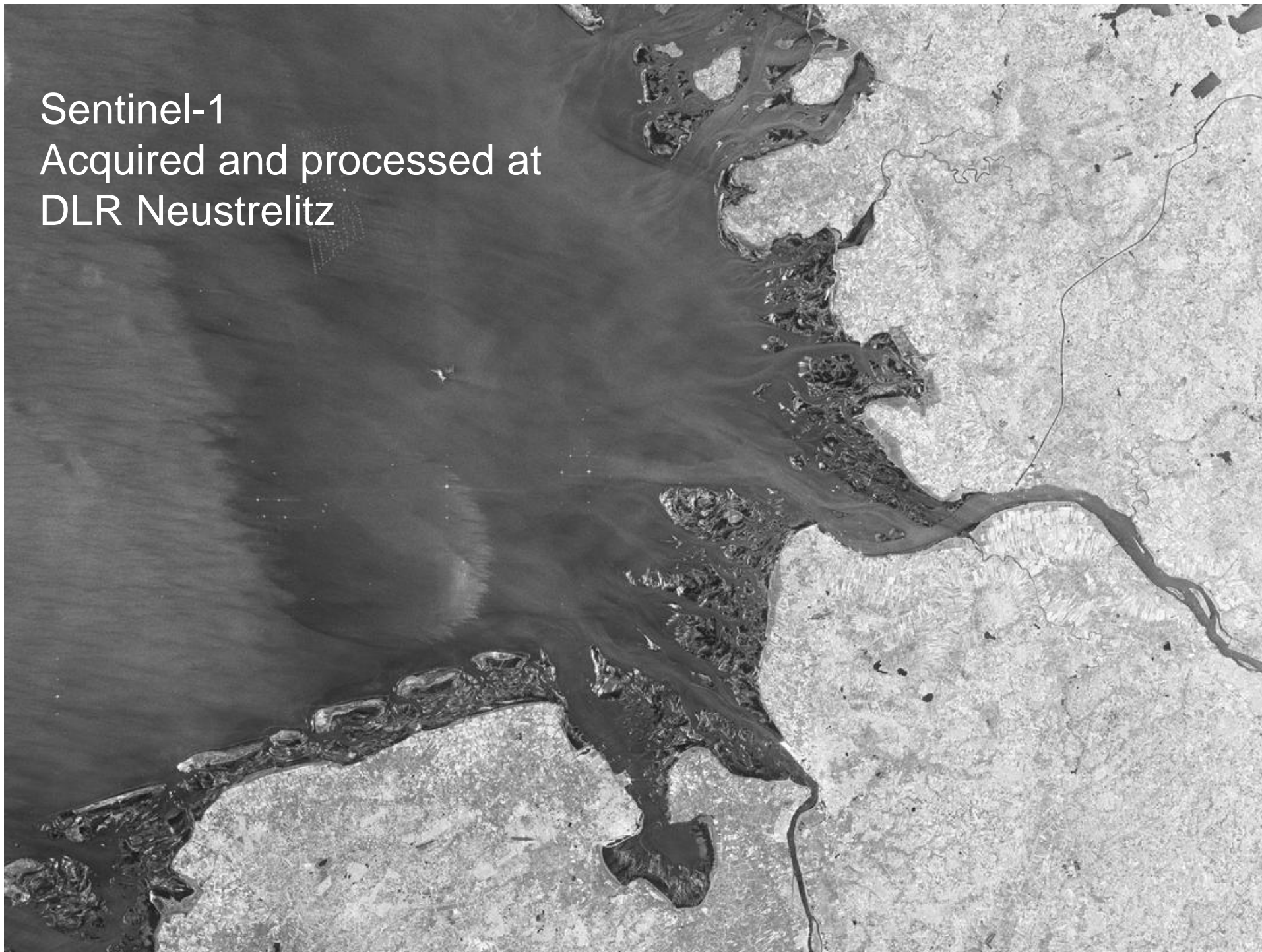
0 500 m

A satellite image showing a coastal town on the left and a large cruise ship, the Costa Concordia, at night on the right. The town has many lights, and the ship is brightly lit. The sea is dark, and there are some smaller boats visible in the distance.

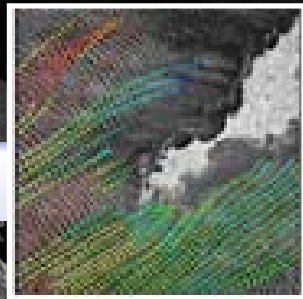
Maritime Security ... better than one hour

WV2 acquisition of the Costa Concordia.
(19 Jan 2012)
(c) DigitalGlobe, provided by European Space Imaging

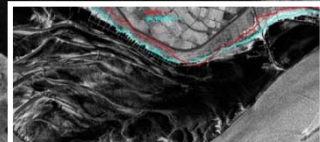
Sentinel-1
Acquired and processed at
DLR Neustrelitz



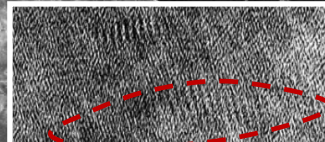
Research and Application Development for the Maritime Situational Awareness



Bathymetry



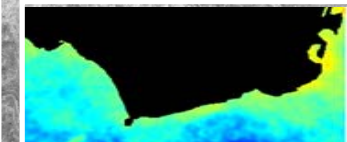
Land-Water Line



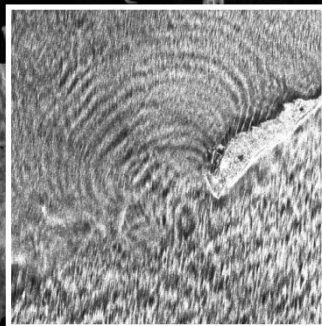
Wave groups
& Forecast



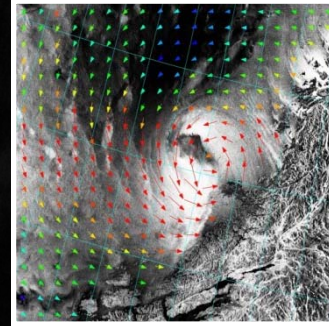
Wave breaking



Surface Currents



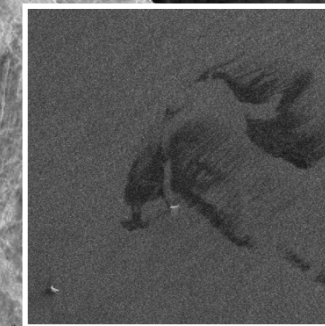
Sea State



Wind



Ship-detection



Oil Spills

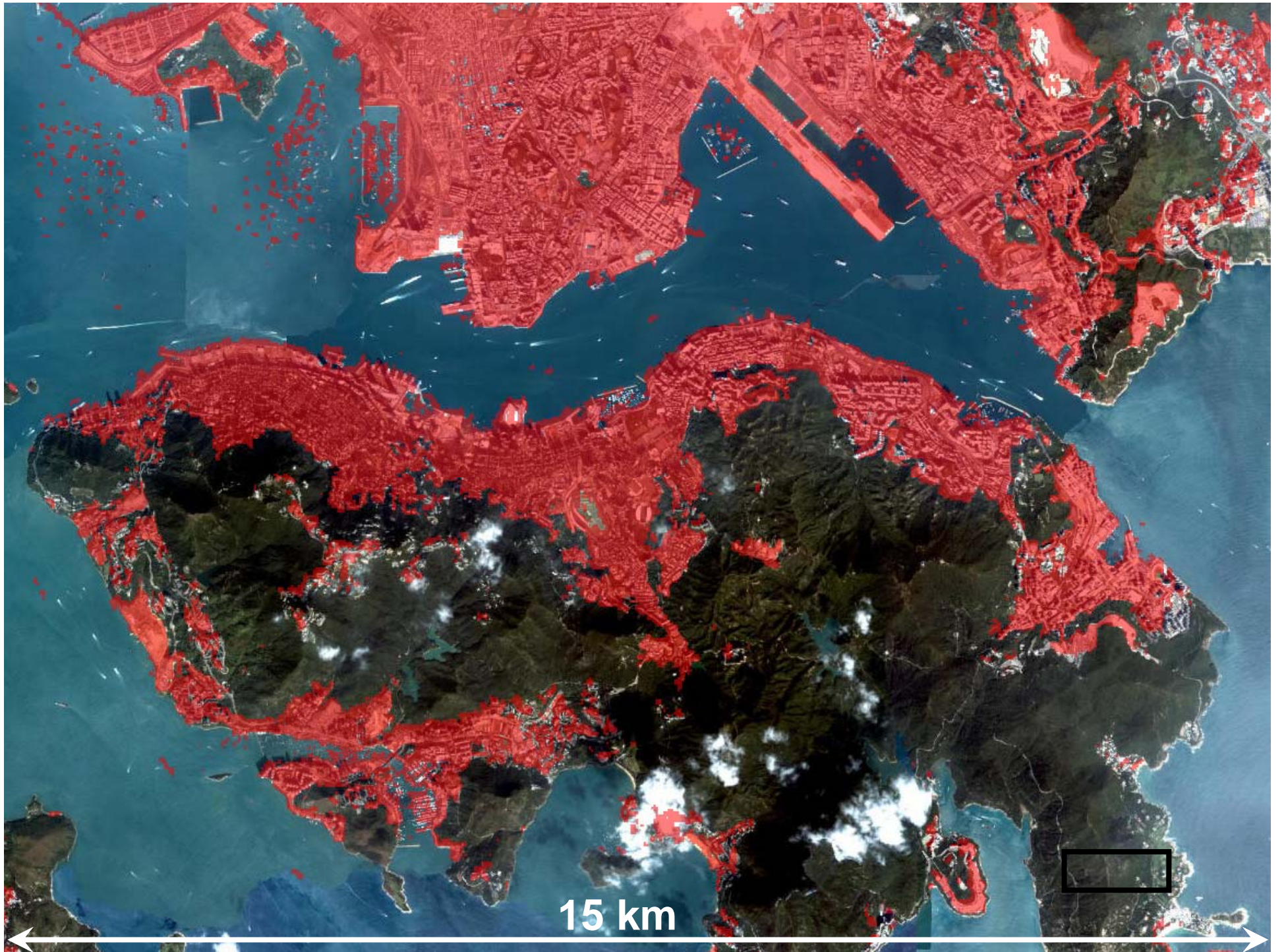


Iceberg-detection,
Ice classification



Urbanisation ... decades of observation

Hong-Kong – Kowloon





3. WaMaPro – Water Mask Processor DFD – DLR German Remote Sensing Data Center

