Remote Sensing: Why?

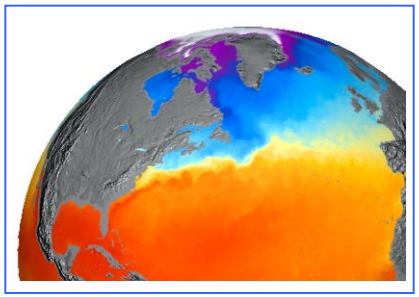
Daniele Cerra, German Aerospace Center (DLR)

What is remote sensing?

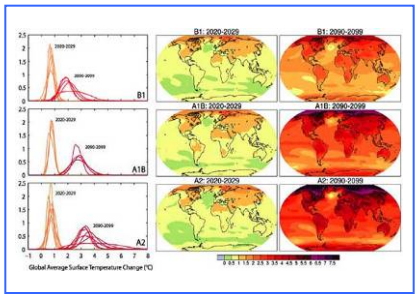
Remote sensing is a technology that measures electromagnetic radiation to extract information on this Earth's land surface, sea, and atmosphere.

- Dr. Nicholas Short

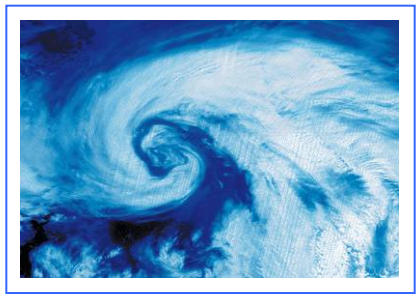
Remote Sensing gives Valuable Information for…



Earth system and environmental sciences

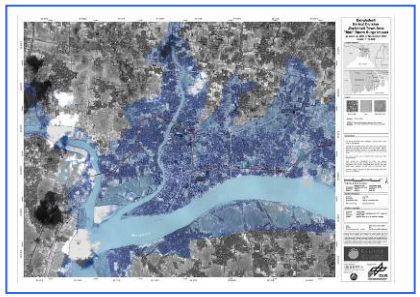


Global change research



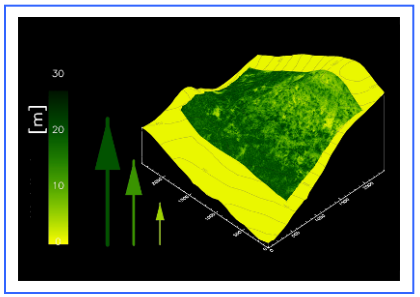
Meteorology

Sustainable development

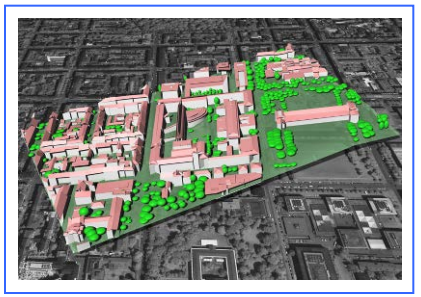


Safety and security

Mobility



Resource management

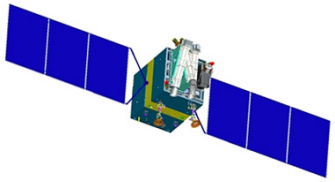


Civil engineering and urban planning

Al Zaatari, Jordanien
13.01.2014
0
500 m

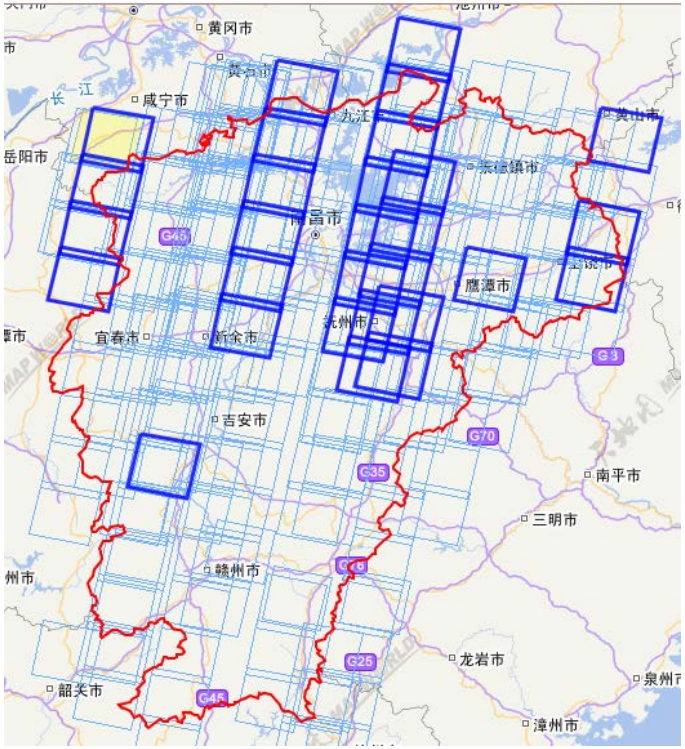
Khao Lak, Thailand, change
2004
DLR

Oktoberfest, Munich, Germany, 21 Sep 2011
WorldView-2 satellite, 50cm image
www.euspaceimaging.com
© European Space Imaging

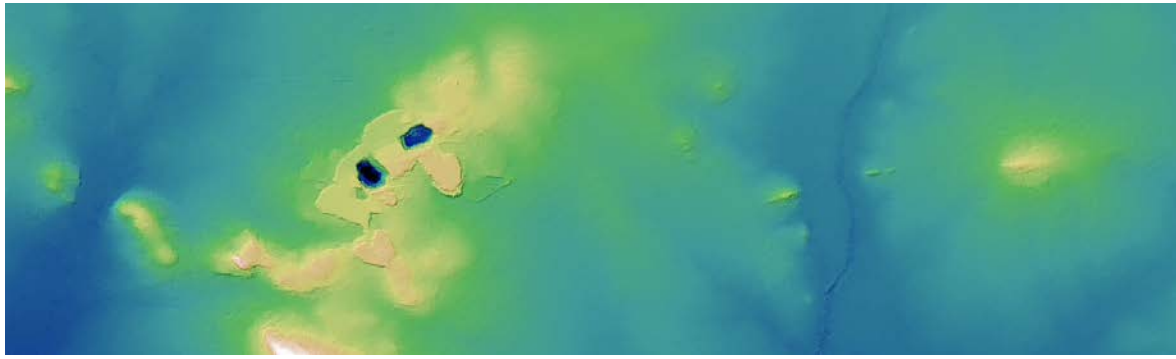


DEM Generation using triple stereo sensor ZY-3

ZY-3 Ground Resolution: B=4m, N=2.5m, F=4m

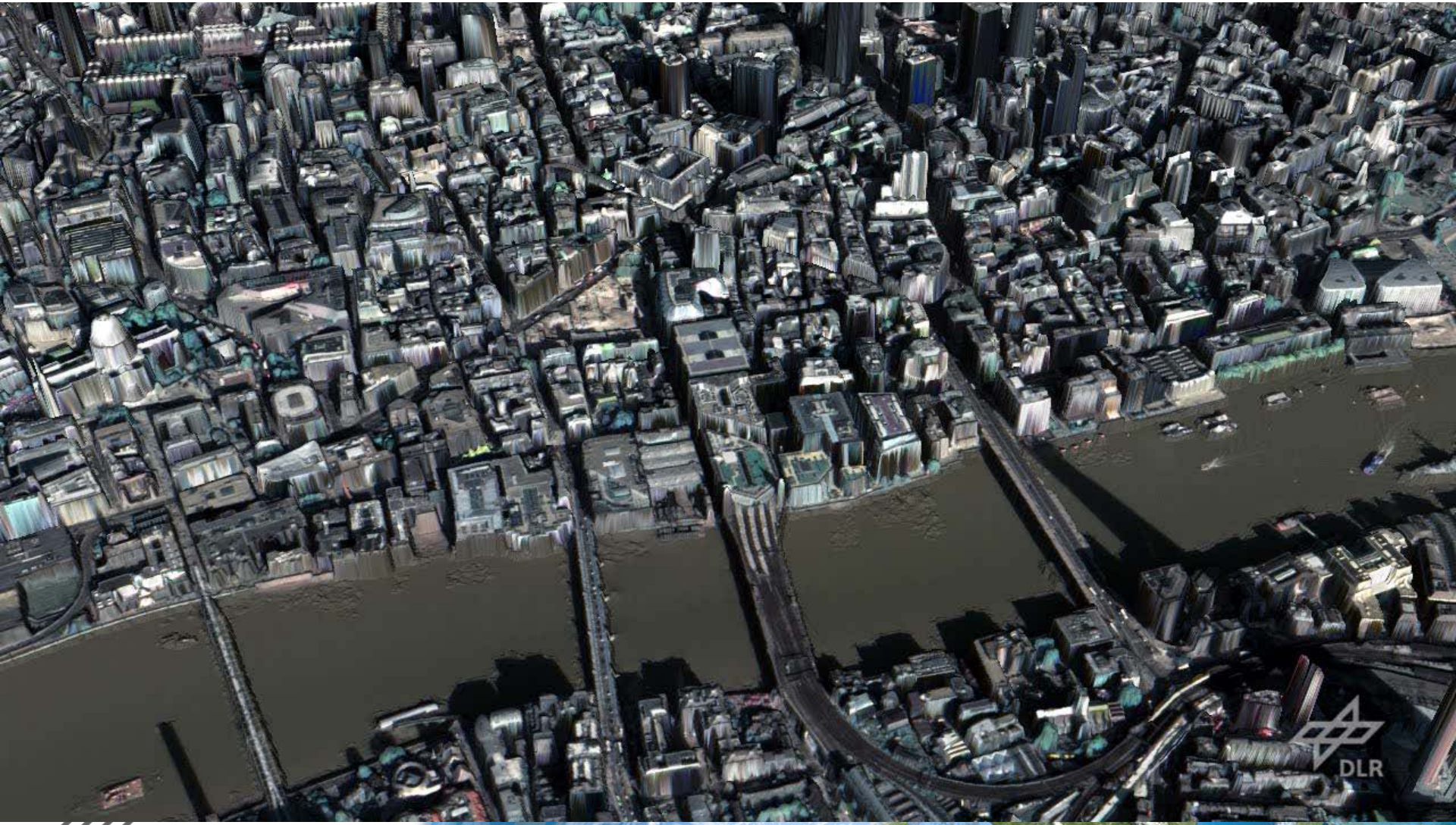


ZY-3 Block of Jangxi Province (>300 Triplets)



Small Mine in Western Australia

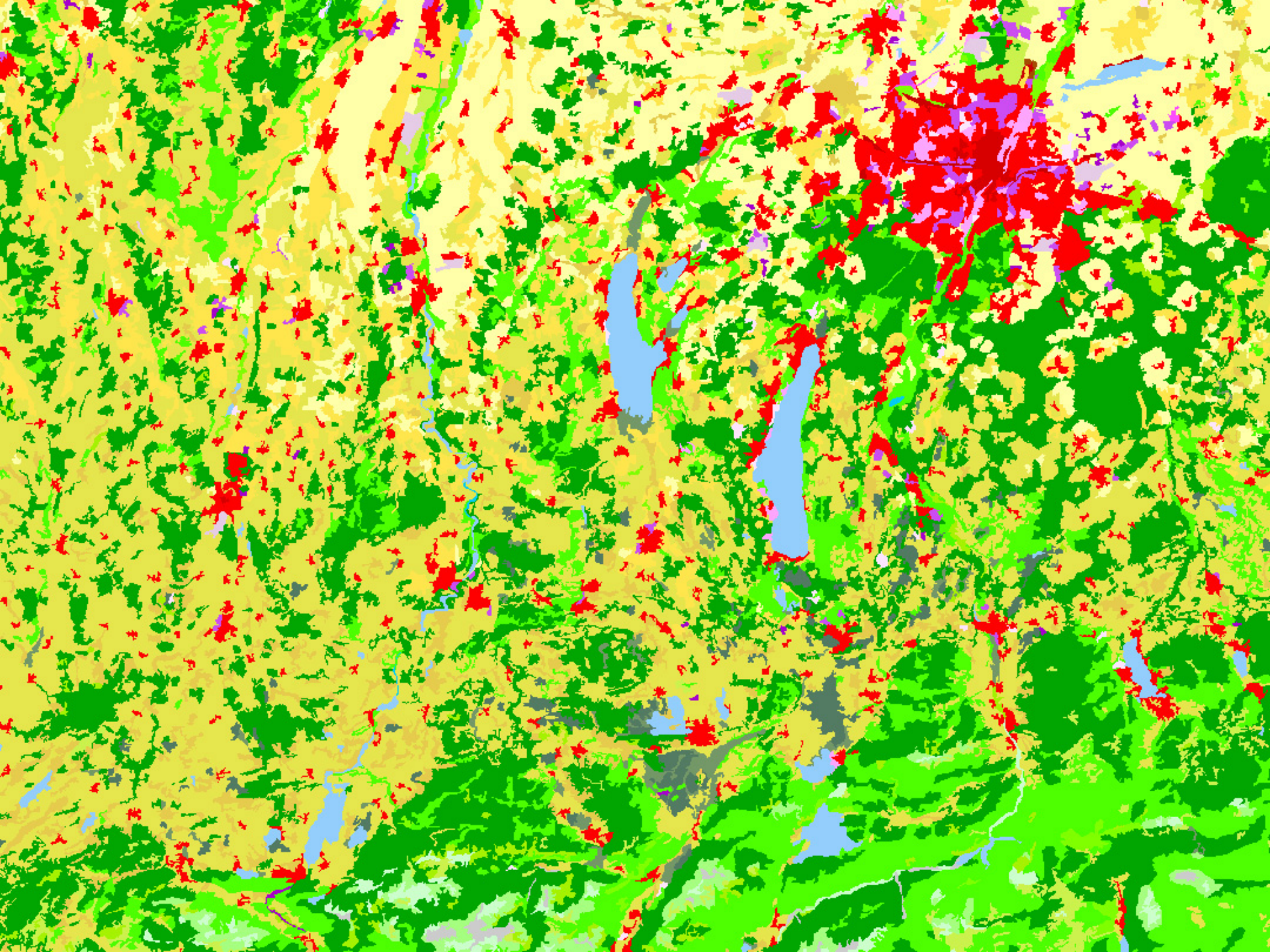
CATENA: Dense Stereo Matching for City DSM



IEEE GRSS Data Fusion Contest of Hyperspectral and LiDAR Data (2013)

- Healthy Vegetation
- Stressed Vegetation
- Synthetic Grass
- Trees
- Bare Soil
- Water
- Residential
- Commercial
- Roads
- Highway
- Railroad
- Parking (empty)
- Parking (full)
- Tennis Courts
- Running Track

Classification map is ranked 3rd place
(OA=93.2%; best one: OA=94.43%)



NPP 2013
[g m-2 y-1]
2000
1000
0
0
500
1.000 km

DLR
Daily snow cover conditions for Europe
EUROPE
SNOW COVER 2008 SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG
420 km

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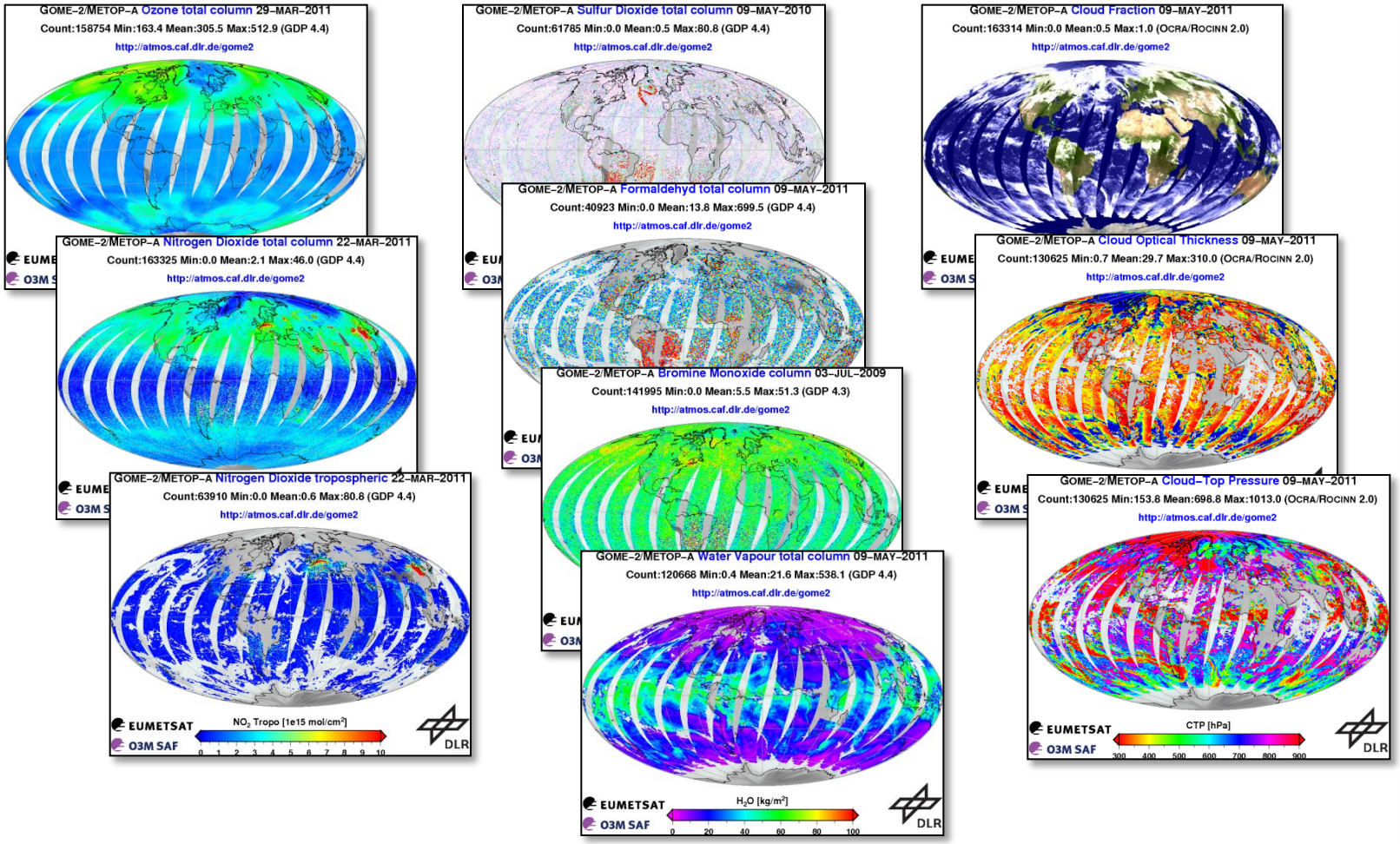
GOME-2 and Basic GMES Atmospheric Products

O3M SAF



Products
24/7
2h NRT

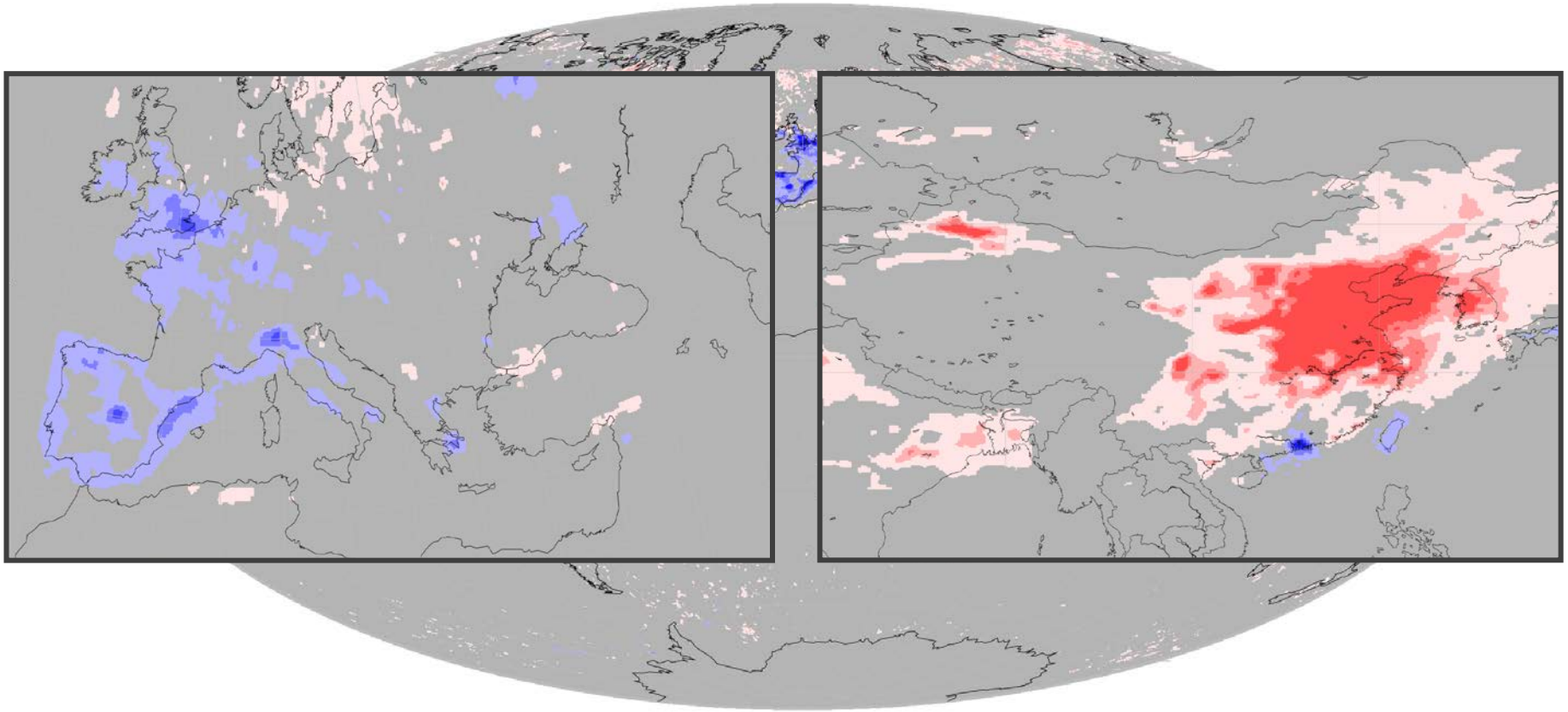
2007 - 2012

- O_3 tot.
- NO_2 tot.
- NO_2 trop.
- SO_2
- HCHO
- BrO
- H_2O
- Clouds

DLR

opernicus
The European Earth Observation Programme

Air Quality: NO_2 difference 2013 to 2007

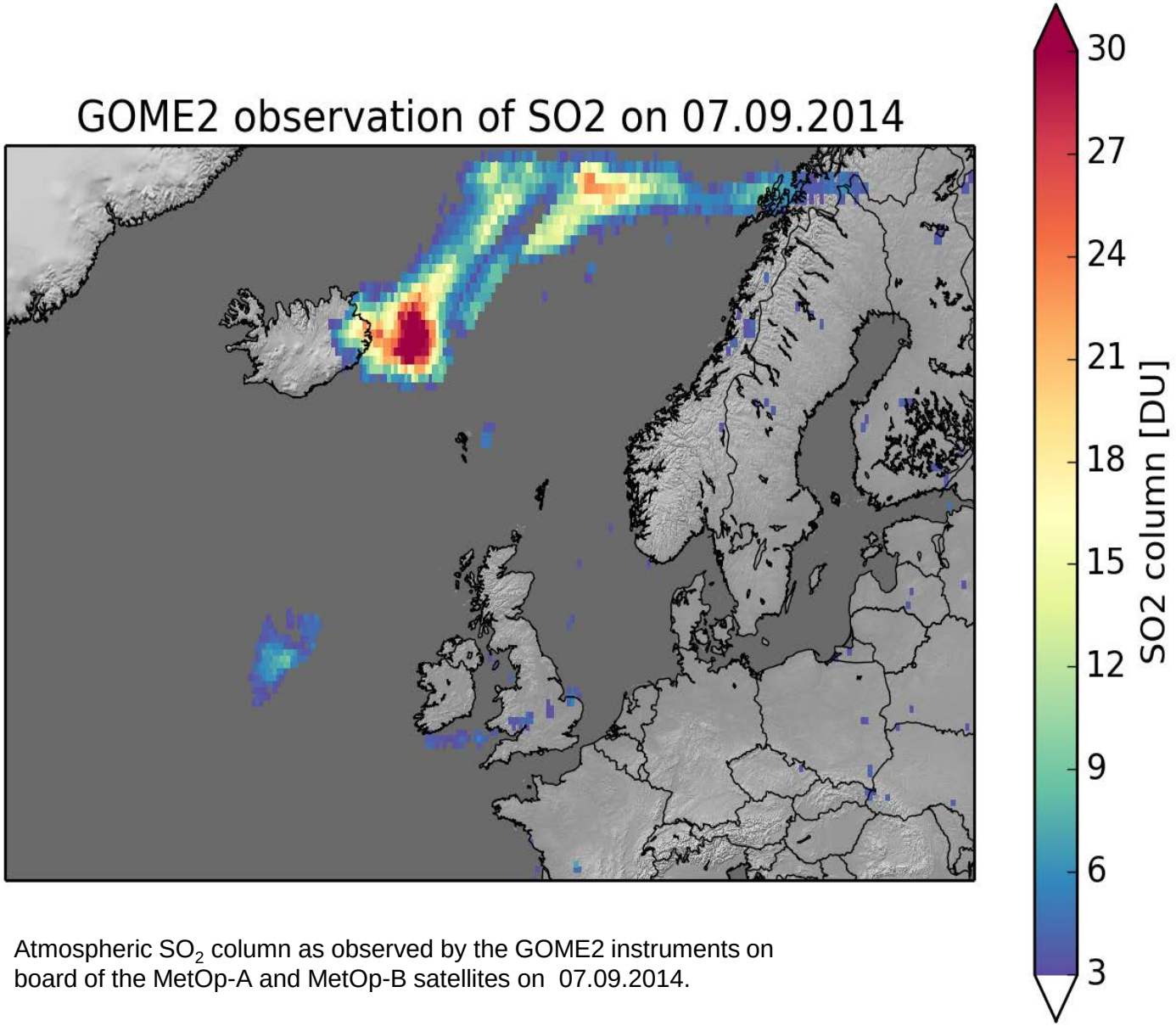


NO_2 Differenz [10^{14} Moleküle/cm²]

-15 -10 -5 0 5 10 15

based on MetOp/GOME-2 data

Island Barðarbunga Volcano



Atmospheric SO_2 column as observed by the GOME2 instruments on board of the MetOp-A and MetOp-B satellites on 07.09.2014.

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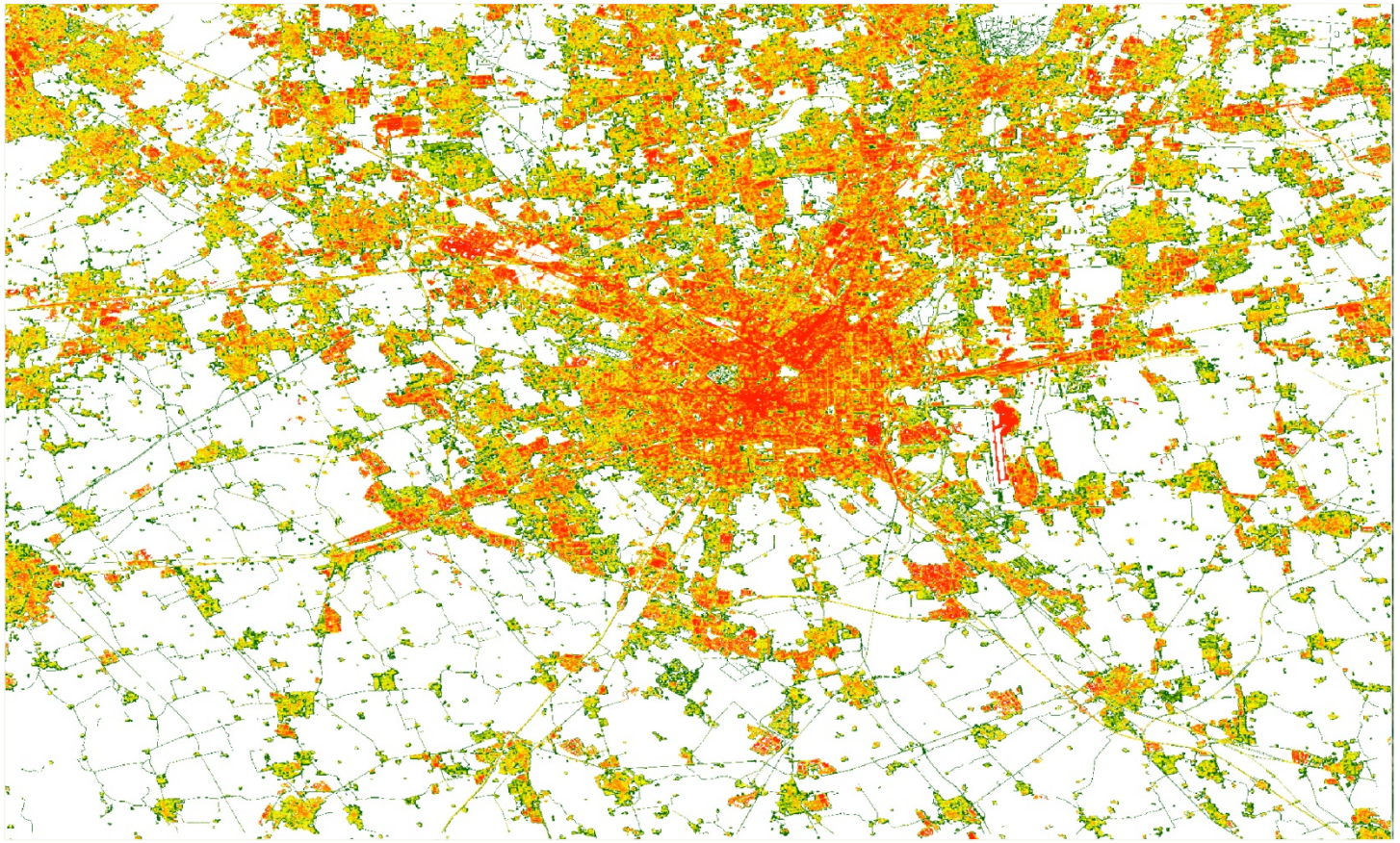
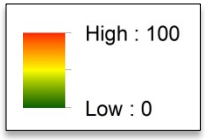
Thematic Processing Chains for Optical Satellite Images



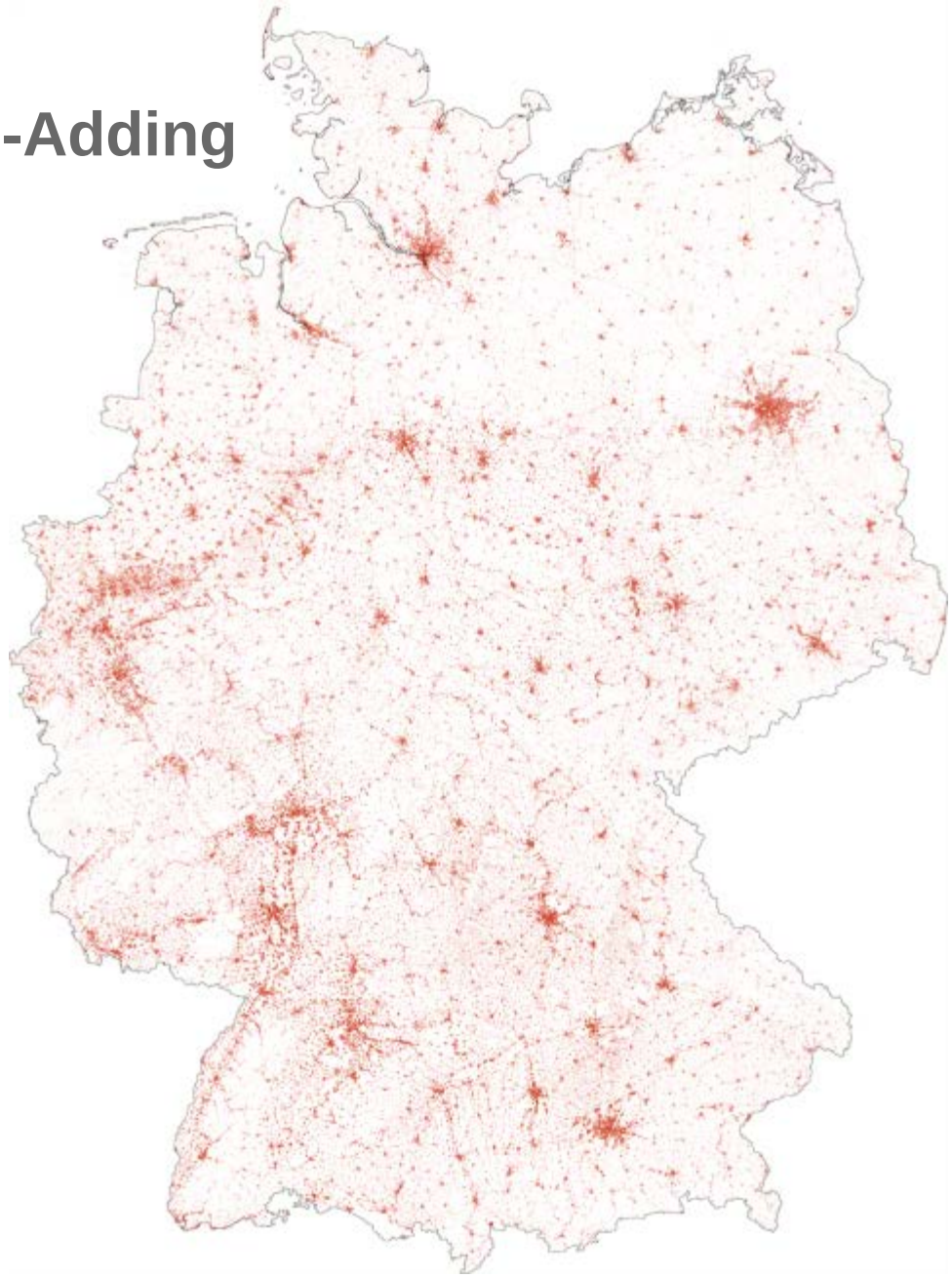


Period on seasonality, Rmean 8 DBC/Gmax 0.50, Rmean 180 Vh

Landsat-8: Enhanced Value-Adding

- Generation of thematic masks

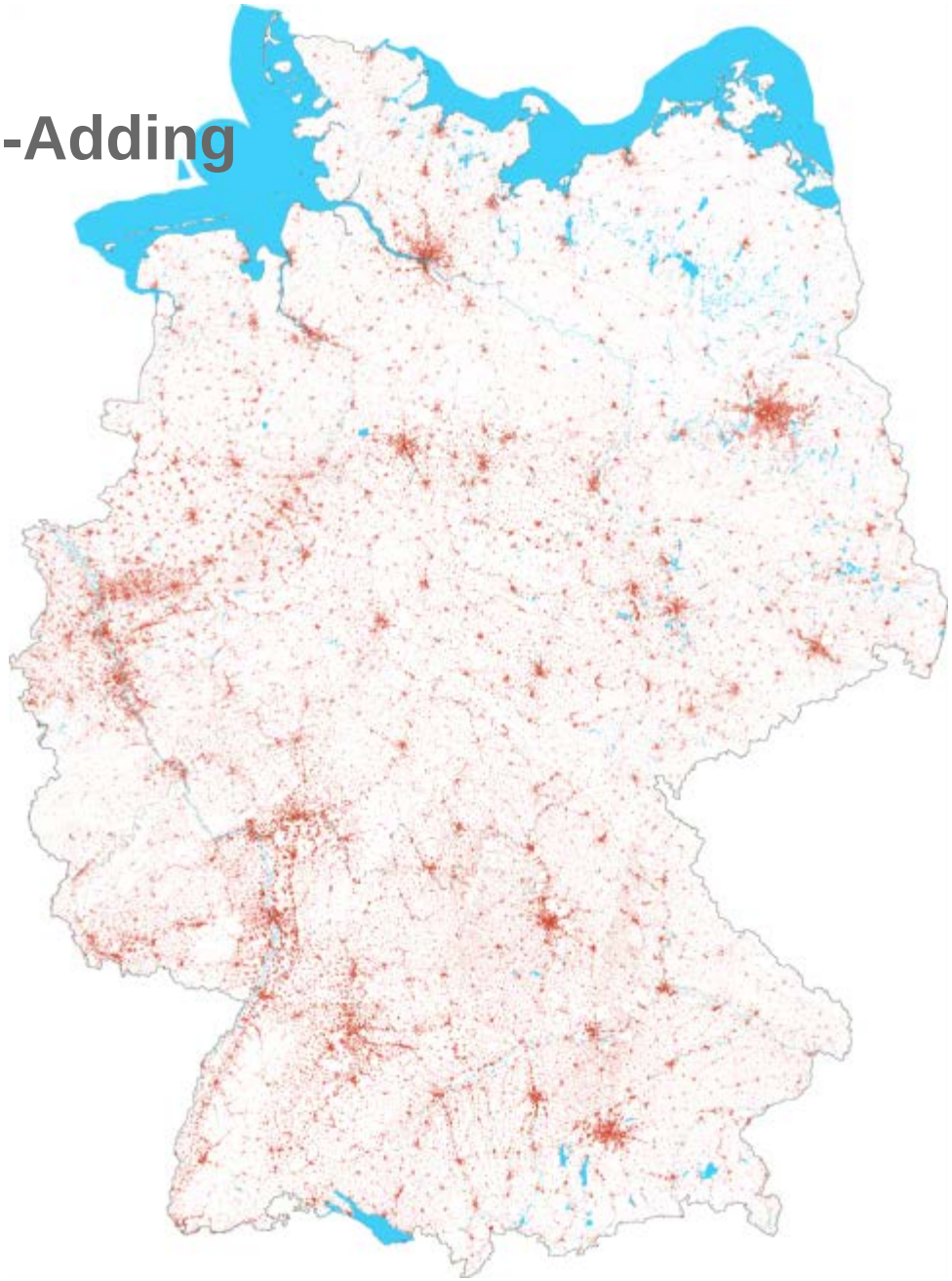
Urban



Landsat-8: Enhanced Value-Adding

- Generation of thematic masks

Urban
Water

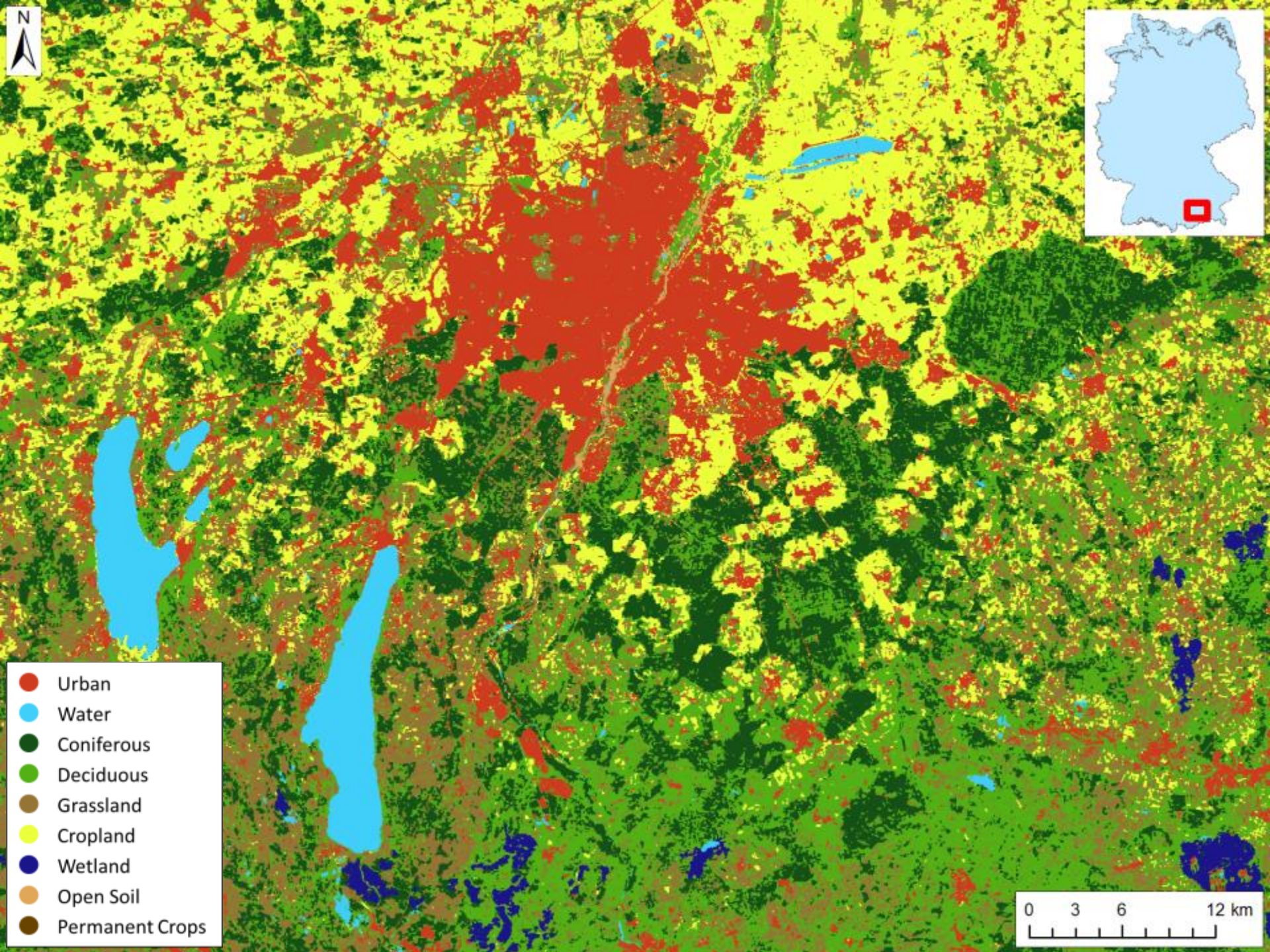


Landsat-8: Enhanced Value-Adding

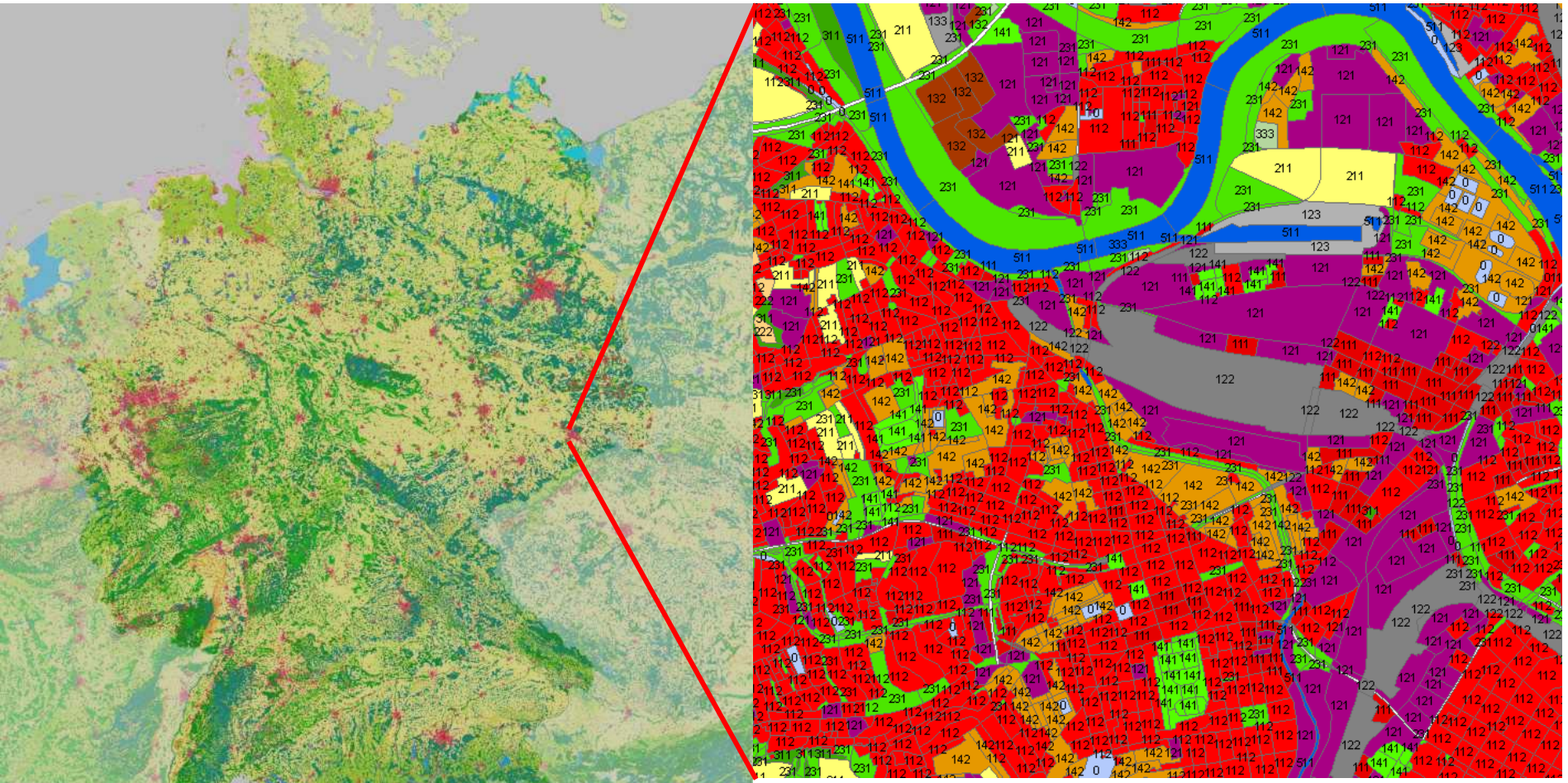
- Generation of thematic masks

Landsat-8: Enhanced Value-Adding

- Generation of thematic masks


N
Urban
Water
Coniferous
Deciduous
Grassland
Cropland
Wetland
Open Soil
Permanent Crops
0 3 6 12 km

Land Cover and Land Use



Subarea of Dresden - DLM-DE data set with 1 ha minimal mapping unit resolution using IMAGE2006

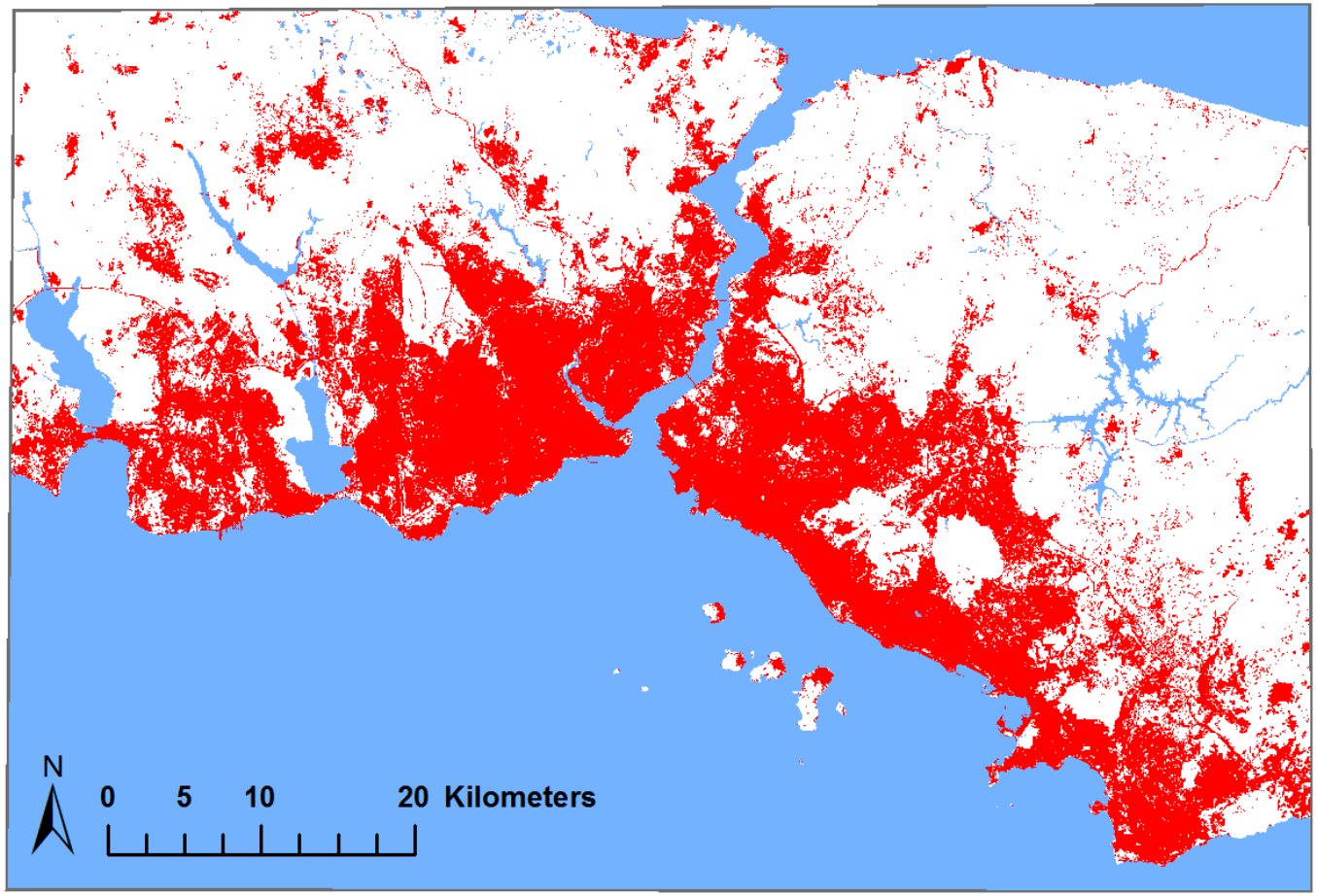
Städtisches Wachstum

Istanbul 1975

Istanbul 1990

Istanbul 2000

Istanbul 2010



Credits: NASA

Geostationary Satellites

A geostationary satellite is one of the satellites which is getting remote sense data and located satellite at an altitude of approximately 36000 kilometres and directly over the equator.

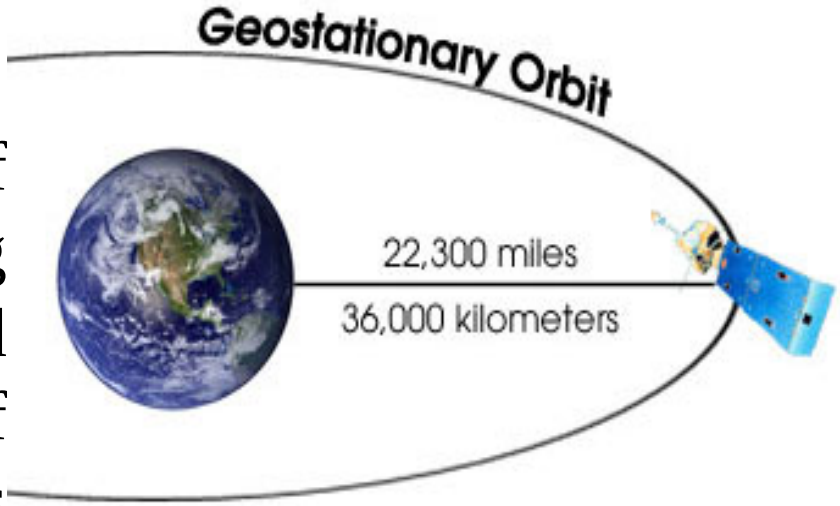
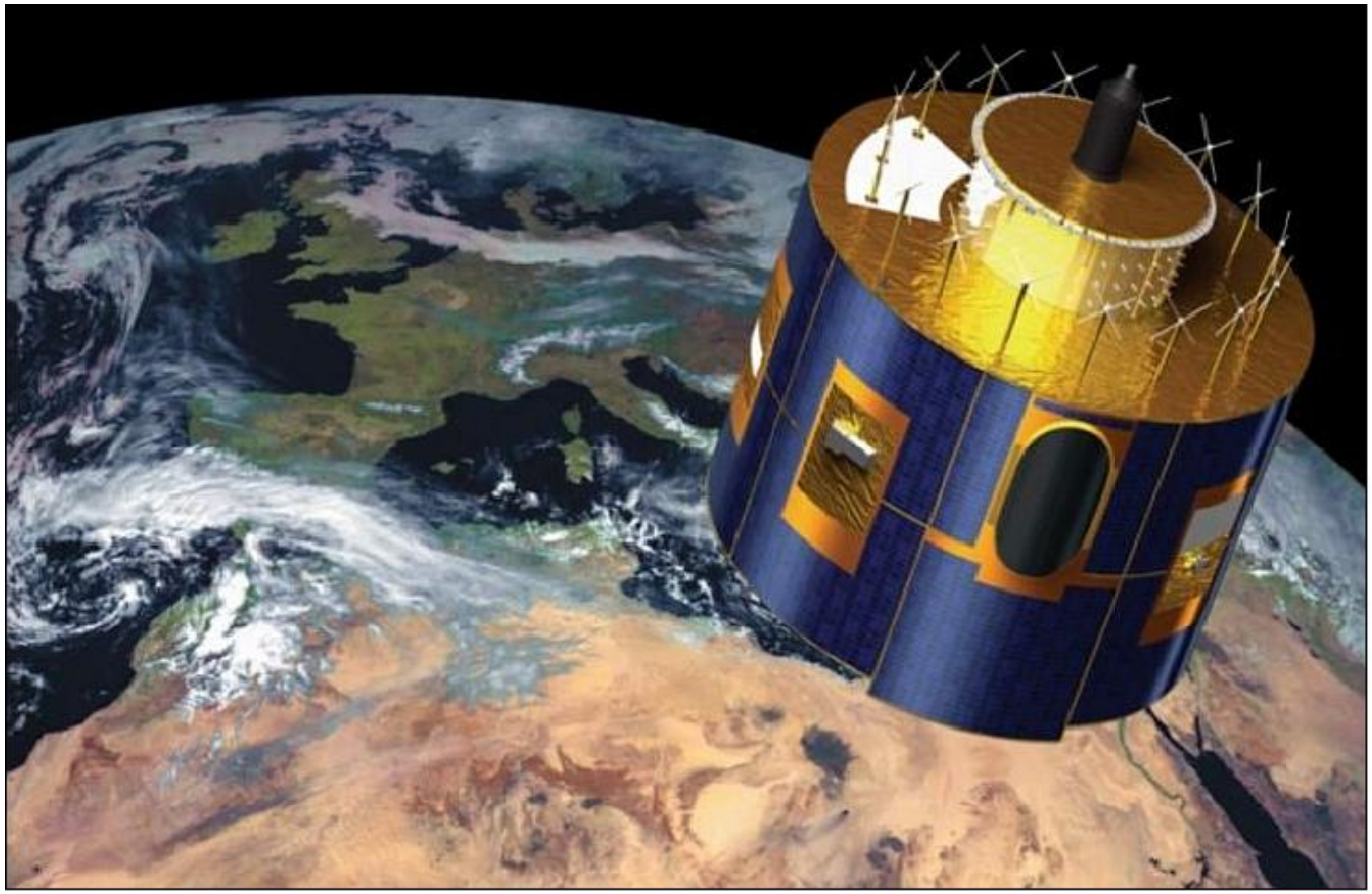


Image Source: cimss.ssec.wisc.edu



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Polar-Orbiting Satellites

Most of EO satellites follow this orbit

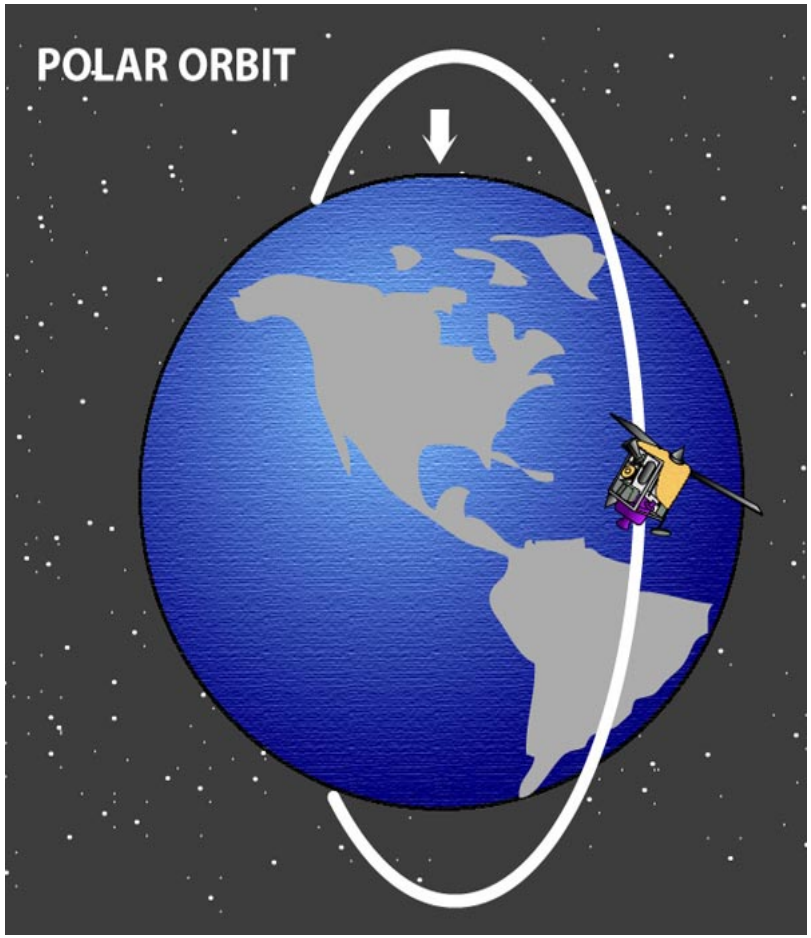
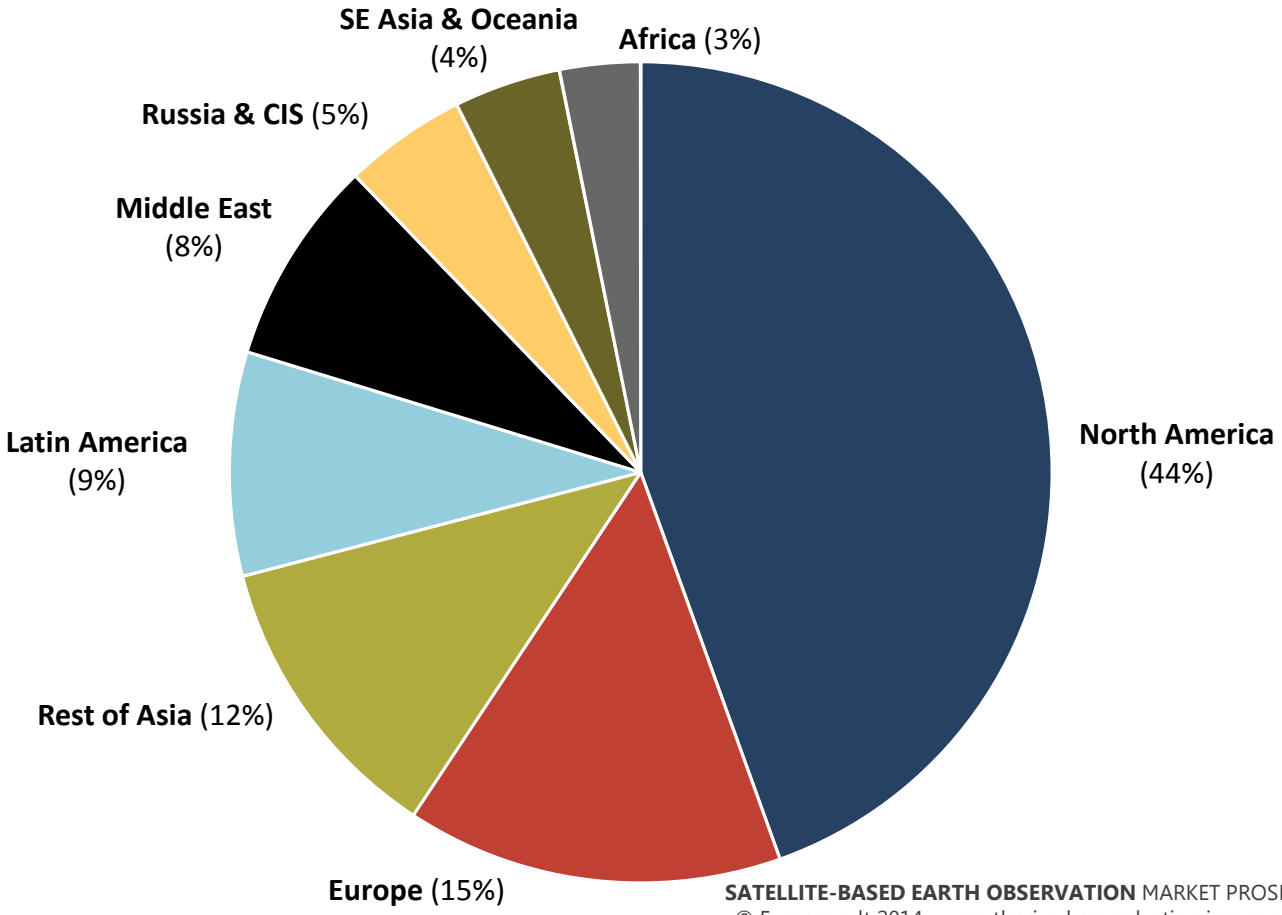


Image Source: globalmicrowave.org

EARTH OBSERVATION COMMERCIAL DATA: DEMAND BY REGION (WORLD, 2013)

Total market: $1.5 billion



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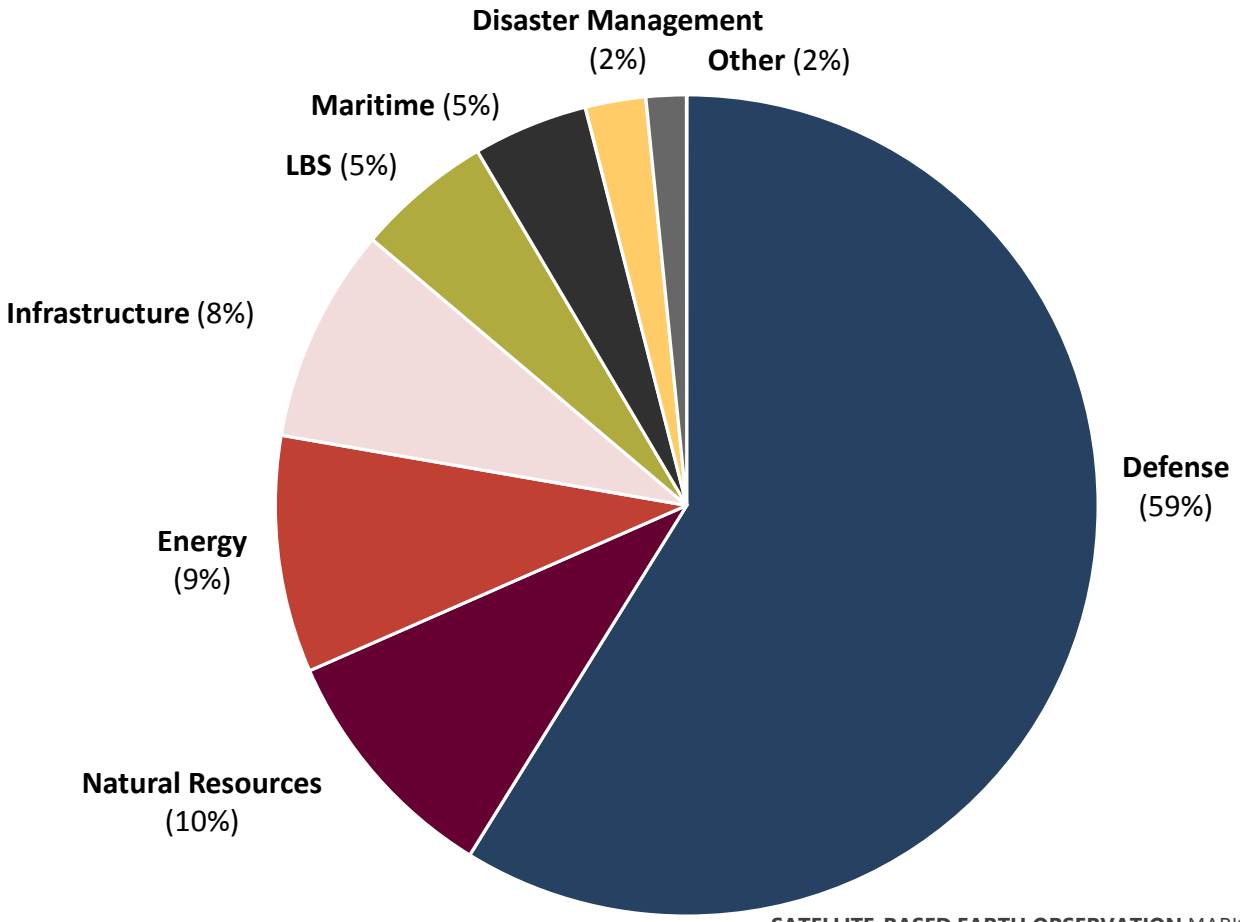
EARTH OBSERVATION COMMERCIAL DATA: DEMAND BY SECTOR (WORLD, 2013)

Total market: $1.5 billion



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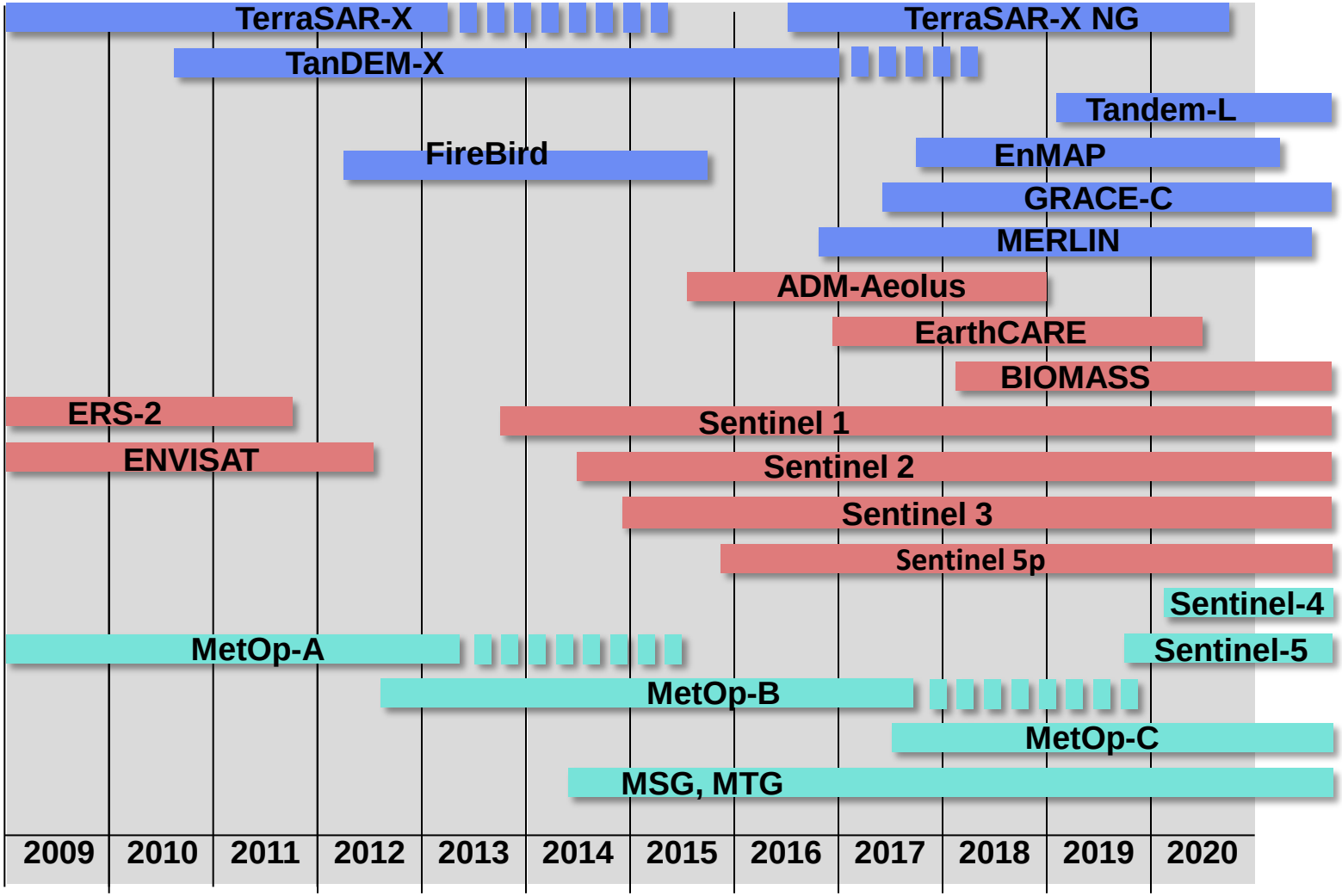
Relevant EO Missions (Selection)



German Aerospace Center, DLR*

Germany's national research center for aeronautics and space.

- Space Administration
- Project Management Agency
- Aeronautics
- Space
- Energy
- Transport
- Security

* Deutsches Zentrum für Luft- und Raumfahrt

Locations and employees

8000 employees across
32 institutes and facilities at 16 sites
Offices in Brussels, Paris,
Tokyo and Washington.

DLR Executive Board

Pascale Ehrenfreund - Chair

Klaus Hamacher - Vice Chairman
Administrative and technical management

Gerd Gruppe – Space Administration

Hansjörg Dittus – Space Research and Technology

Rolf Henke – Aeronautics Research

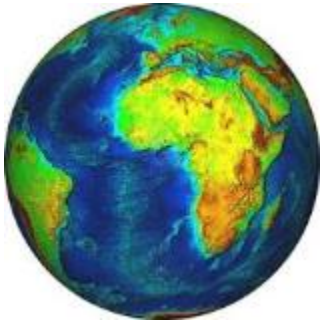
DLR: Space Applications

Space science
Launcher systems
International Space Station (ISS)

Space robotic

Satellite communication

Satellite navigation

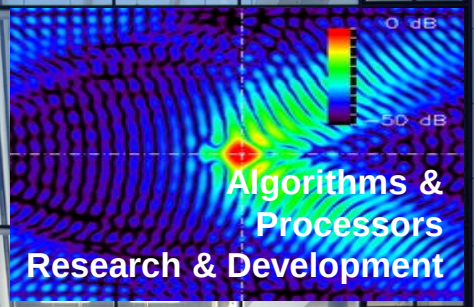


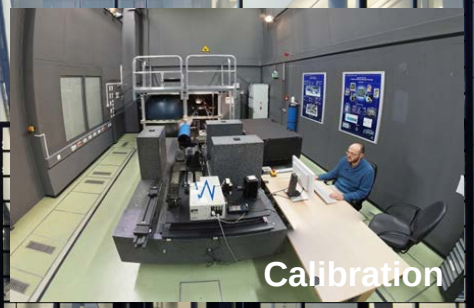
Earth observation

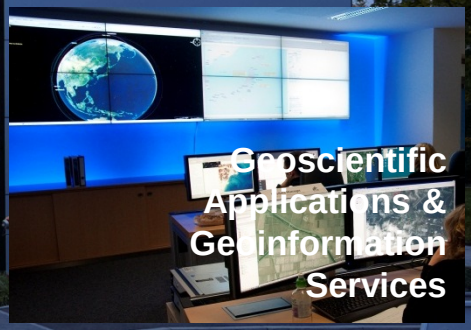
Earth Observation Center, EOC

Core of DLR‘s remote sensing activities

- ca. 330 employees in 2 research institutes and 12 departments at 3 sites
- ca. 30 employees in 2 University Departments
- ca. 250 scientists from more than 25 nations
- ca. 60 PhD students
- ca. 20 guest scientists
- ca. 45% third party funding







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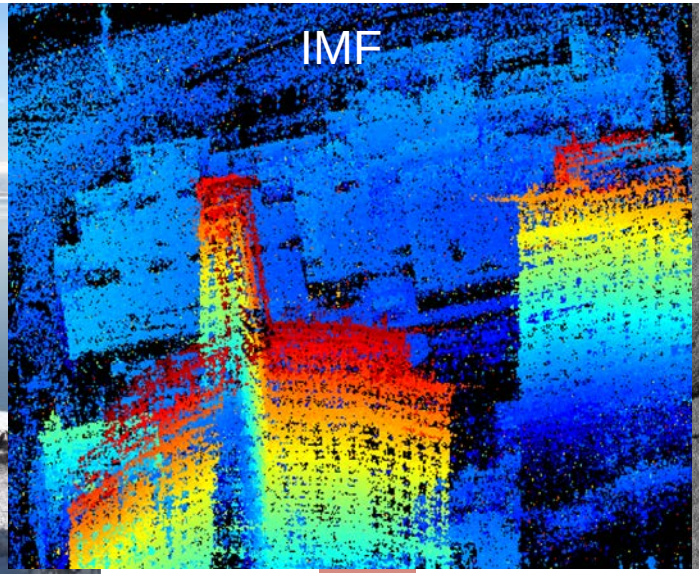
Remote Sensing Technology Institute (IMF)
German Remote Sensing Data Center (DFD)

Earth Observation Center - Core Duties

Ground Segment

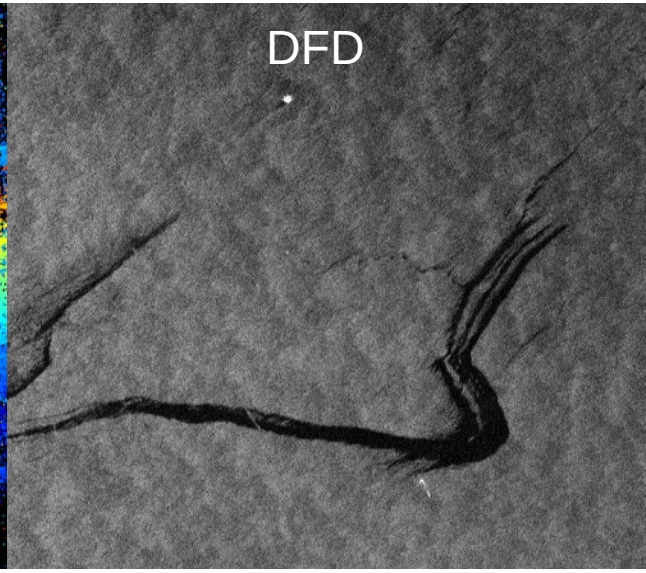
Acquisition, processing, archiving, distribution of Earth observation data and derived Information

Algorithms & Processors



R &D on algorithms and processors to derive and improve geophysical parameters from satellite data in 2-, 3- and 4 dimensions

Science and Applications



Geoscientific research, development of geo-information products, research projects

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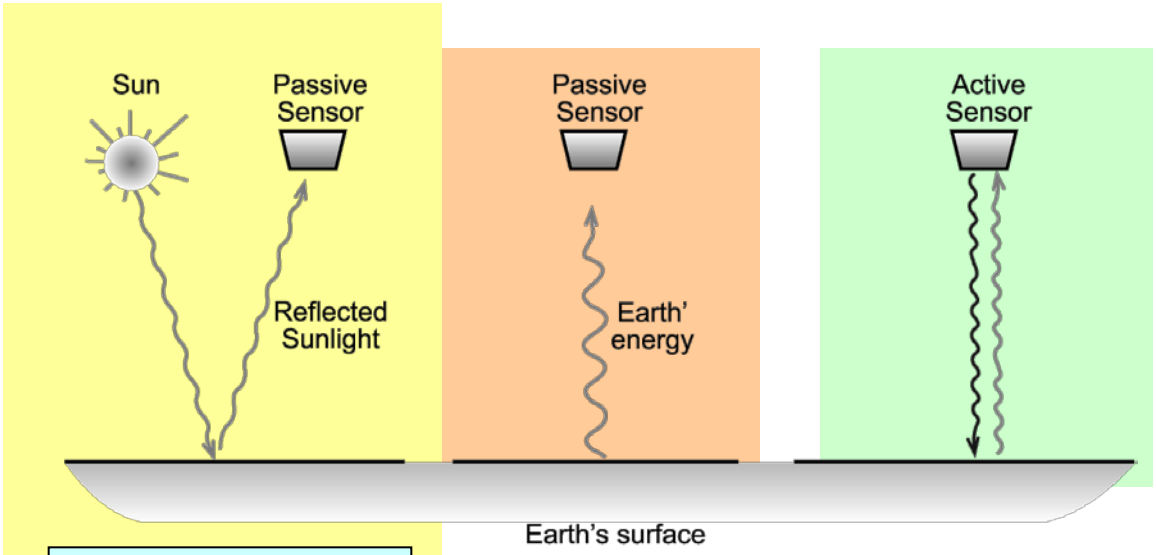
How many Sensors / kinds of images / datasets in RS?



Optical Passive

Panchromatic

Multispectral

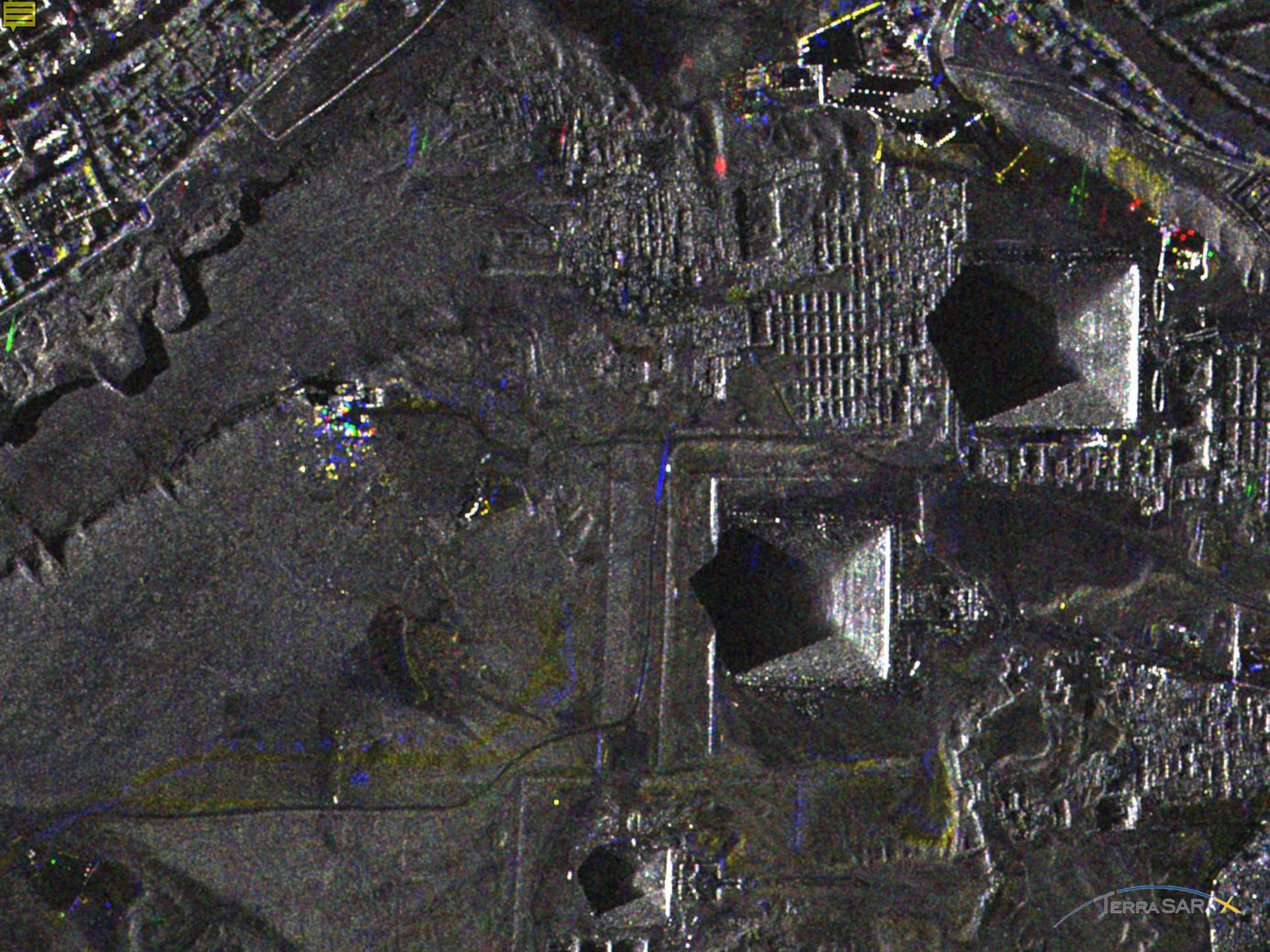
Hyperspectral

Thermal

Radar (SAR)

Lidar

Sonar


TERRASAR-X

Pleiades:
Gizeh

Video