DLR contributions to global challenges, focussing on humanitarian applications

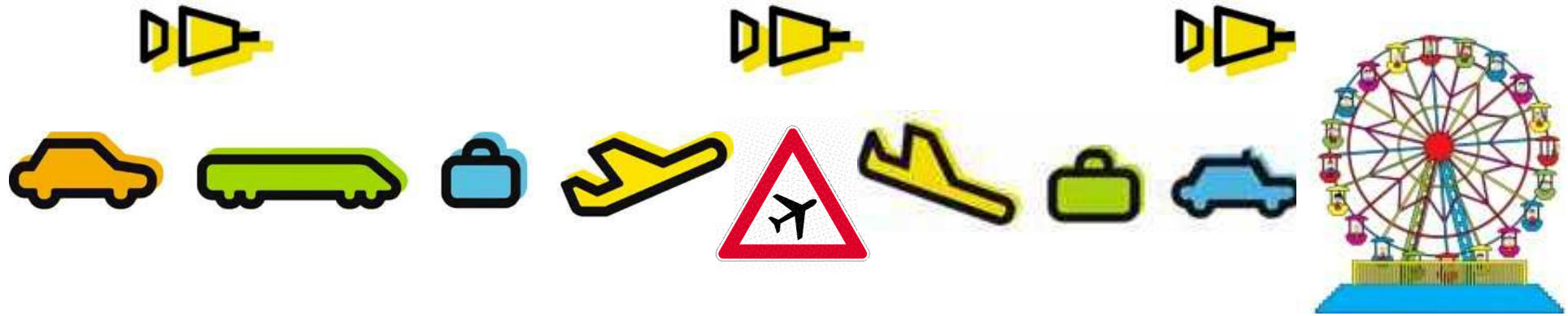
Jan Wörner
German Aerospace Center DLR

UNCOPUOS

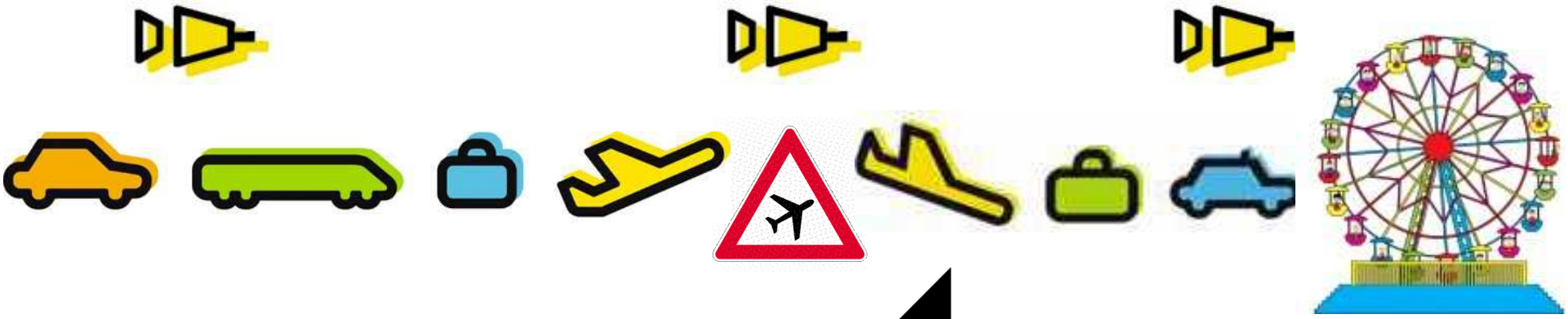
DLR

A Journey to Vienna...

seamless ecological efficient chain of transport



seamless ecological efficient chain of transport



Aeronautic

Space

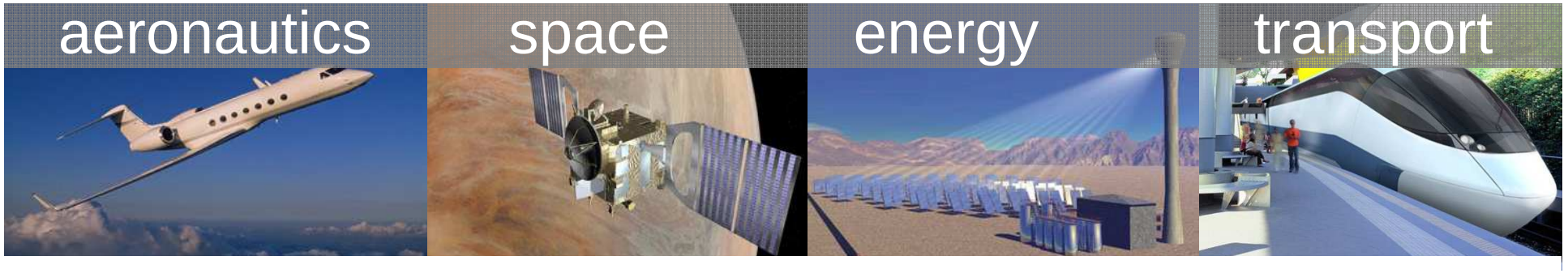
Space

Transport

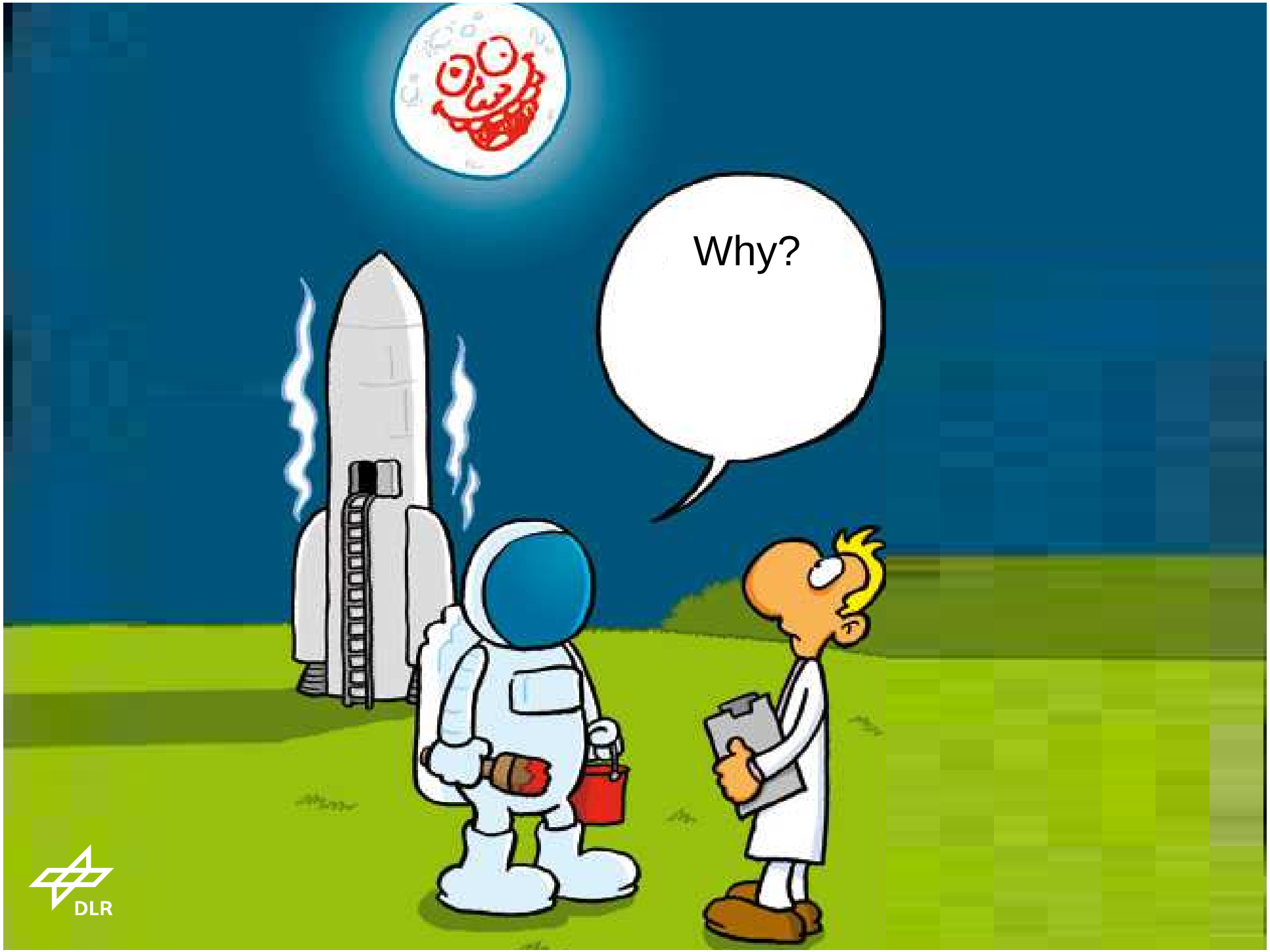
Transport

Security

DLR



Research Center
&
German Space Agency
&
Project Management Office


Why?
DLR

Global challenges

- climatic change
- mobility
- communication
- energy
- shortage of resources
- demographic development
- conflicts and catastrophes
- health
- …curiosity

Societal Challenges of Global Dimension

Climate Change

Environment

Resources

Sustainable Development

Megacities

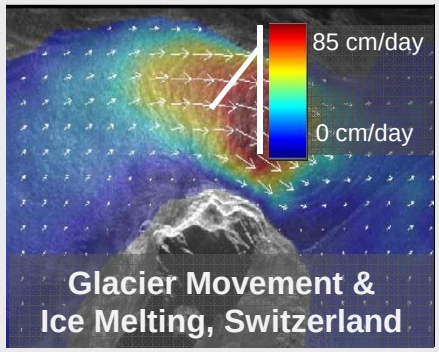
Mobility

Hazards

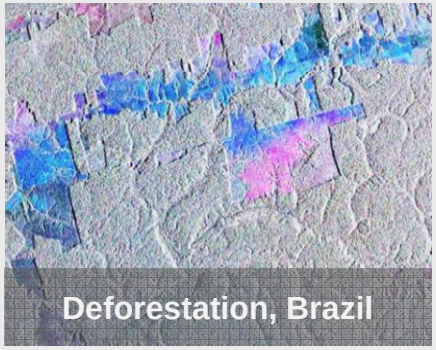
Disaster

DLR

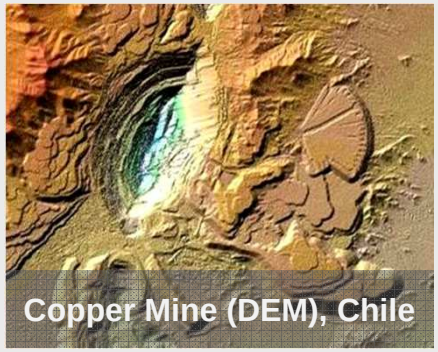
Radar Remote Sensing and Global Societal Challenges



Climate Change



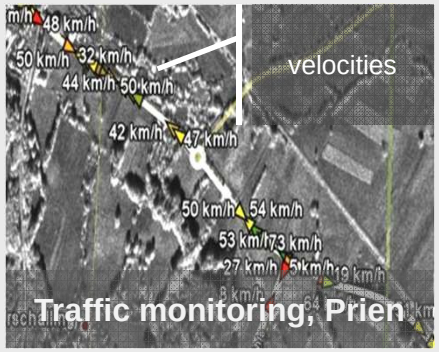
Environment



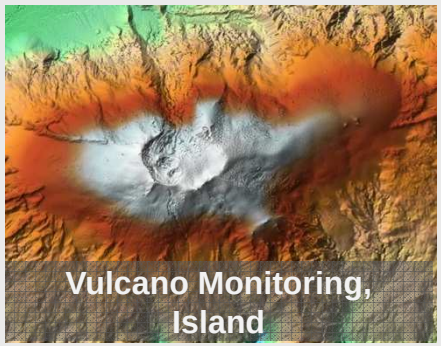
Resources

Sustainable Development

Megacities



Mobility



Hazards

Disaster

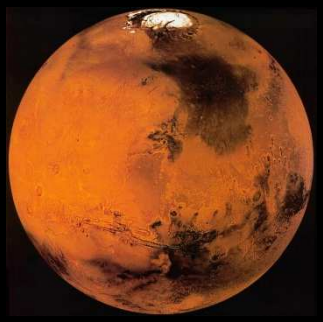
DLR

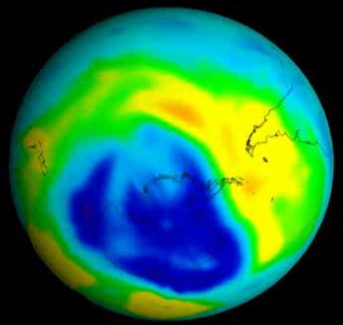
SPACE:

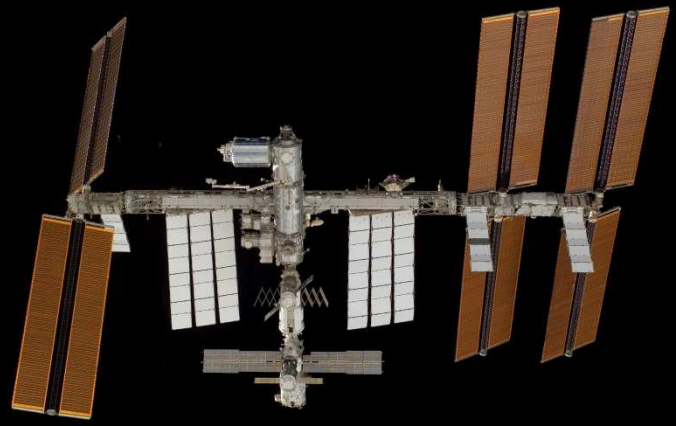
earth observation

communication,
navigation,
µg-research,
technology,
international cooperation…

exploration,
science

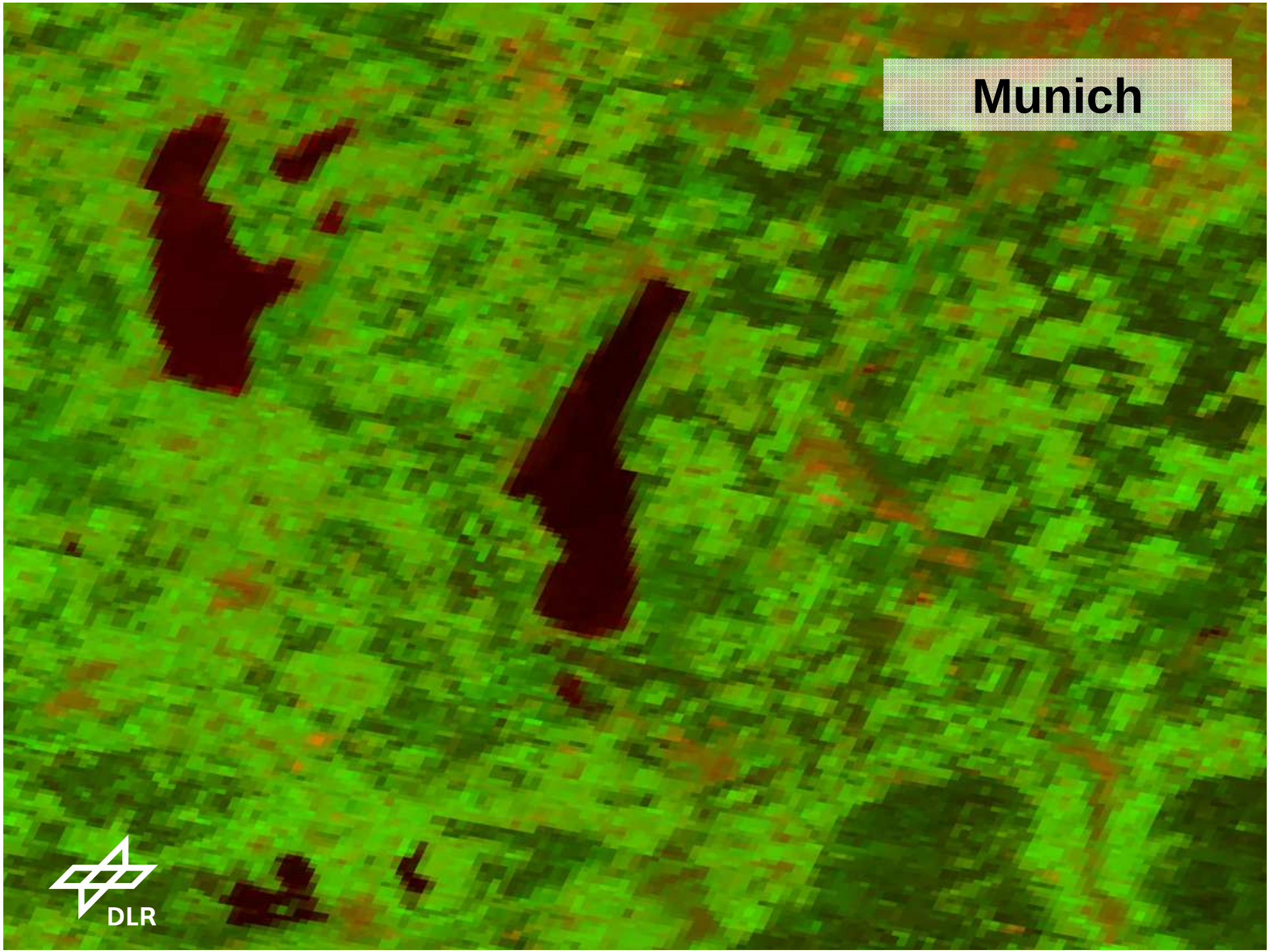




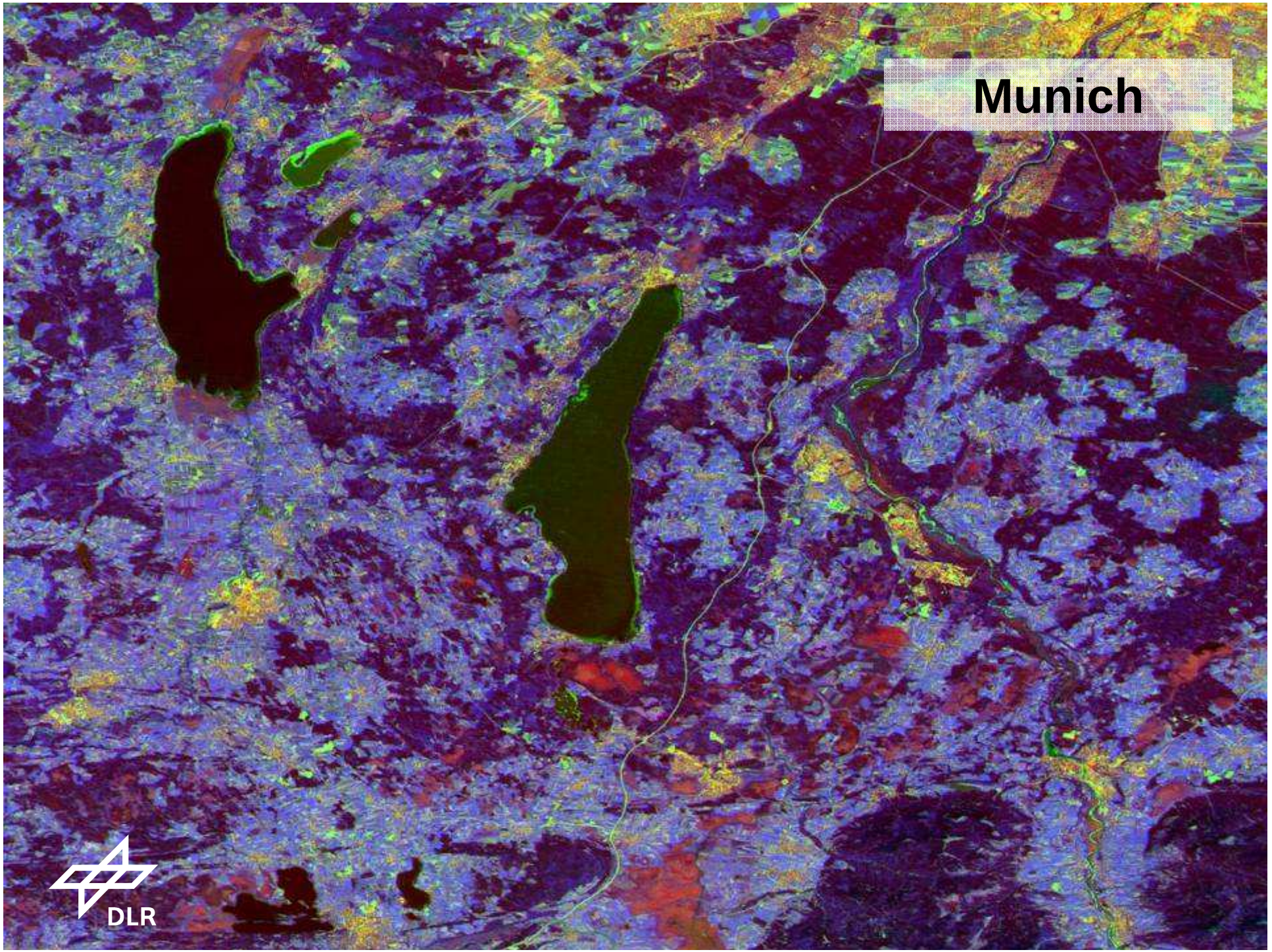


Aug, 01, 2007

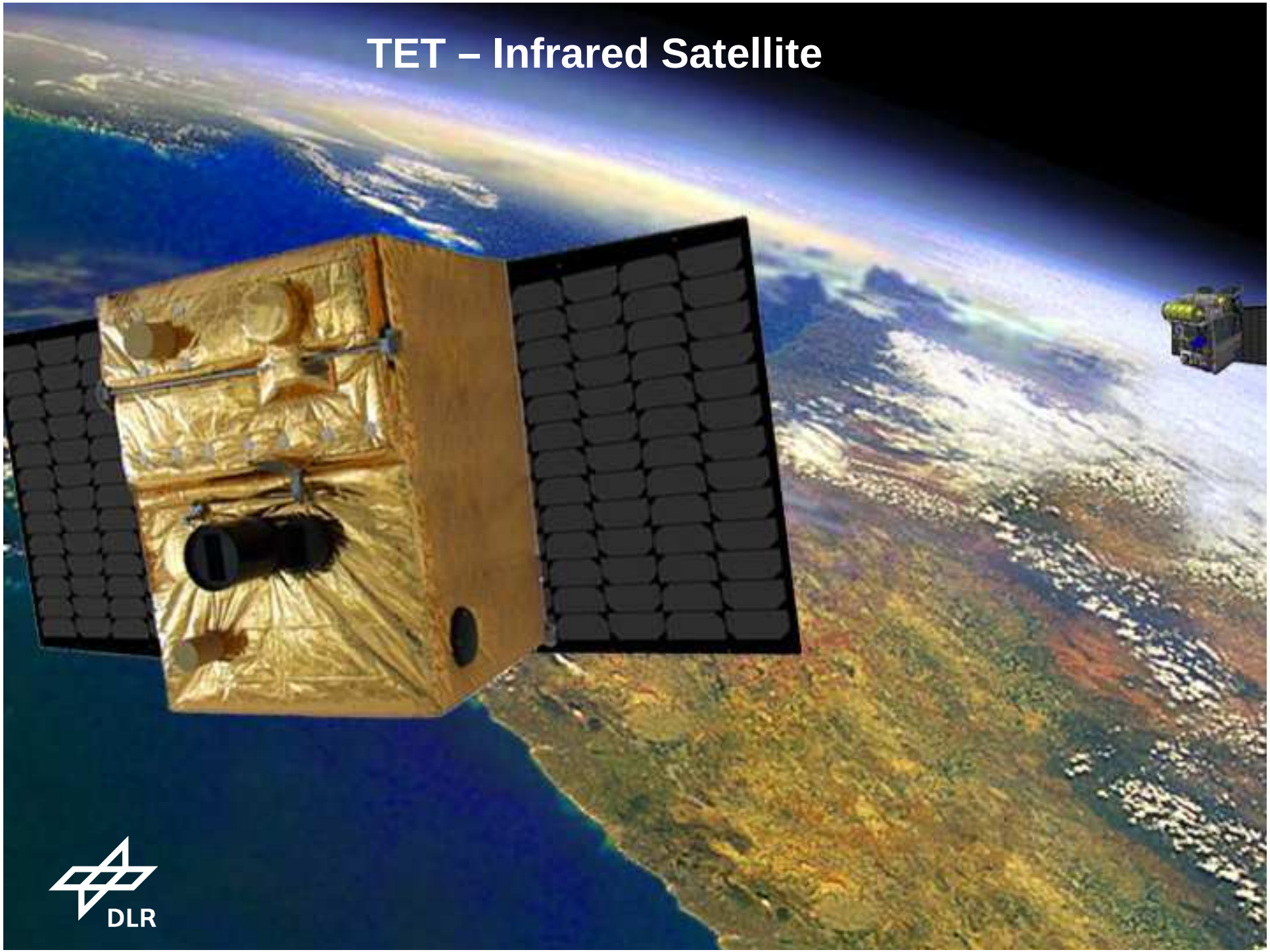
Munich


Munich
DLR

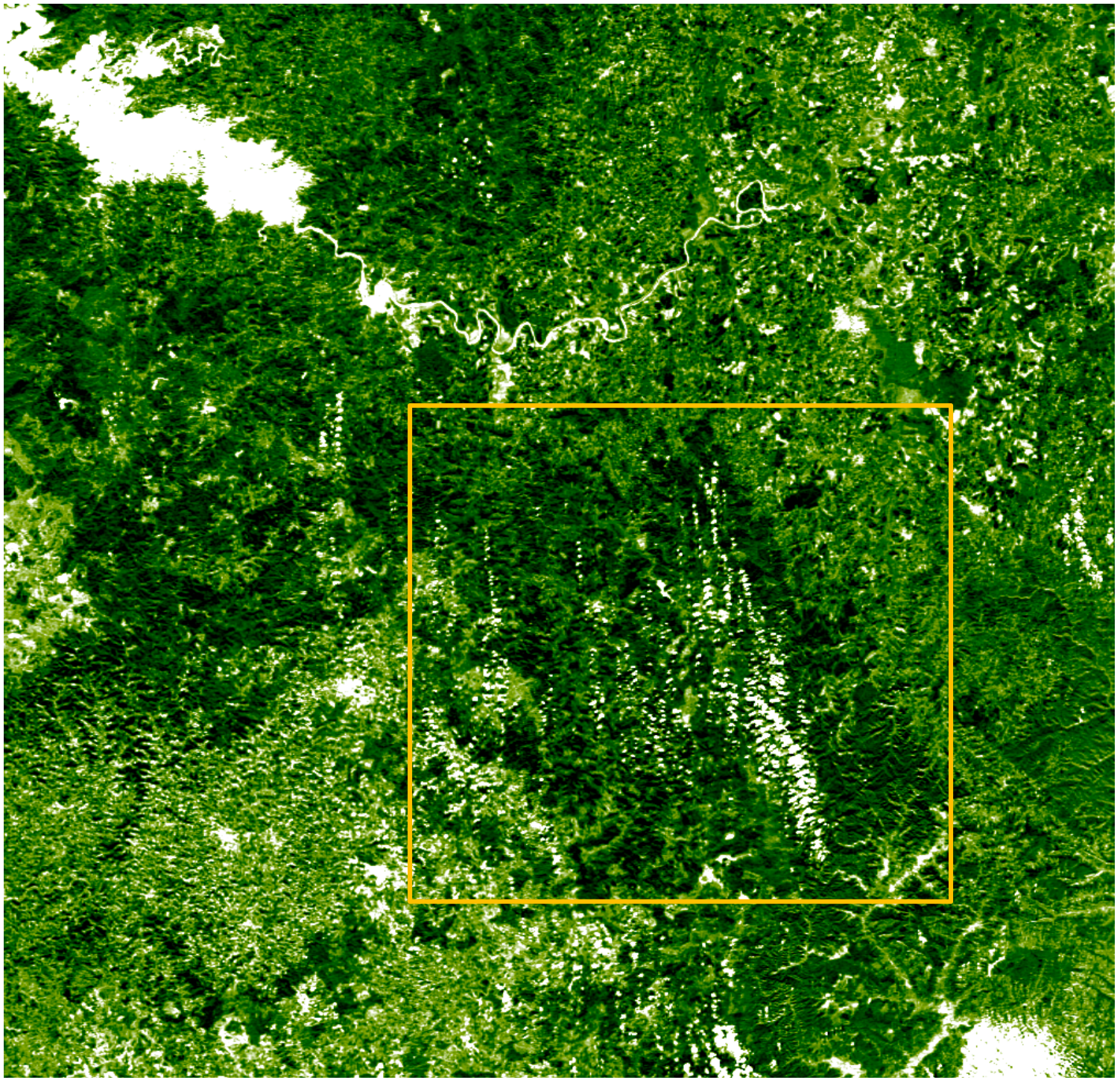

Munich
DLR


Munich
DLR

TET – Infrared Satellite



Vegetation
South of Brasilia

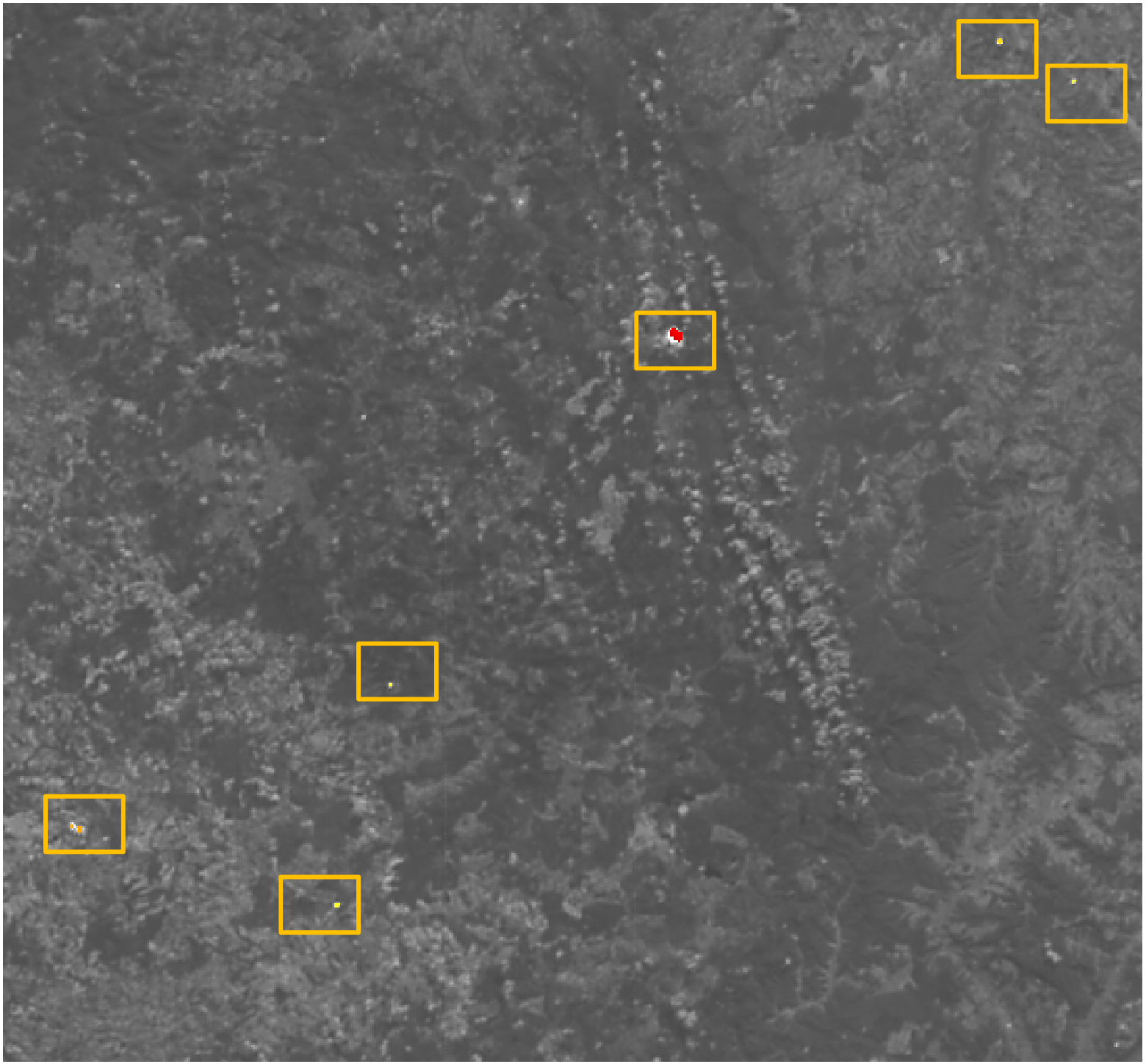


NDVI

0 0.6

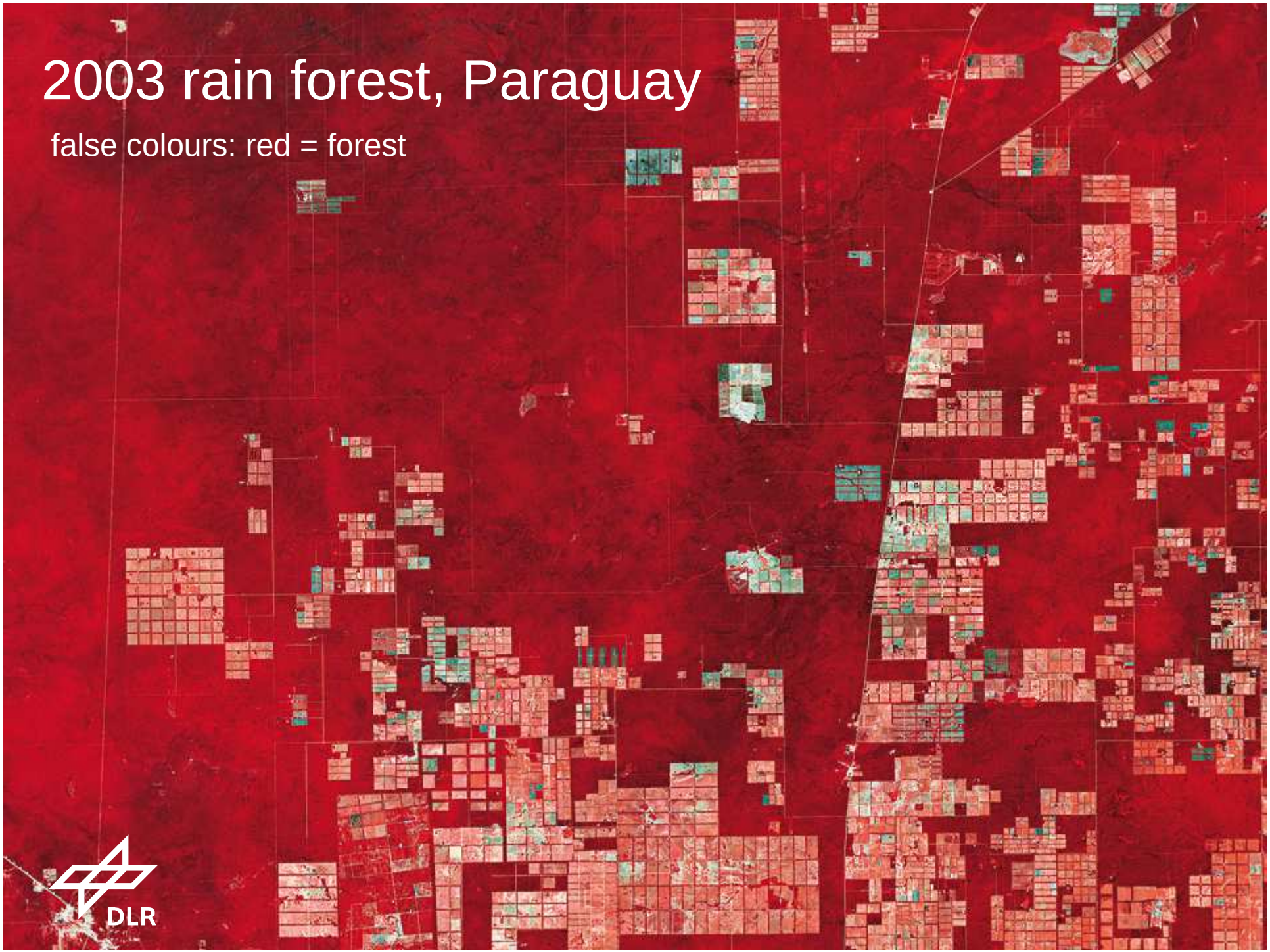
DLR

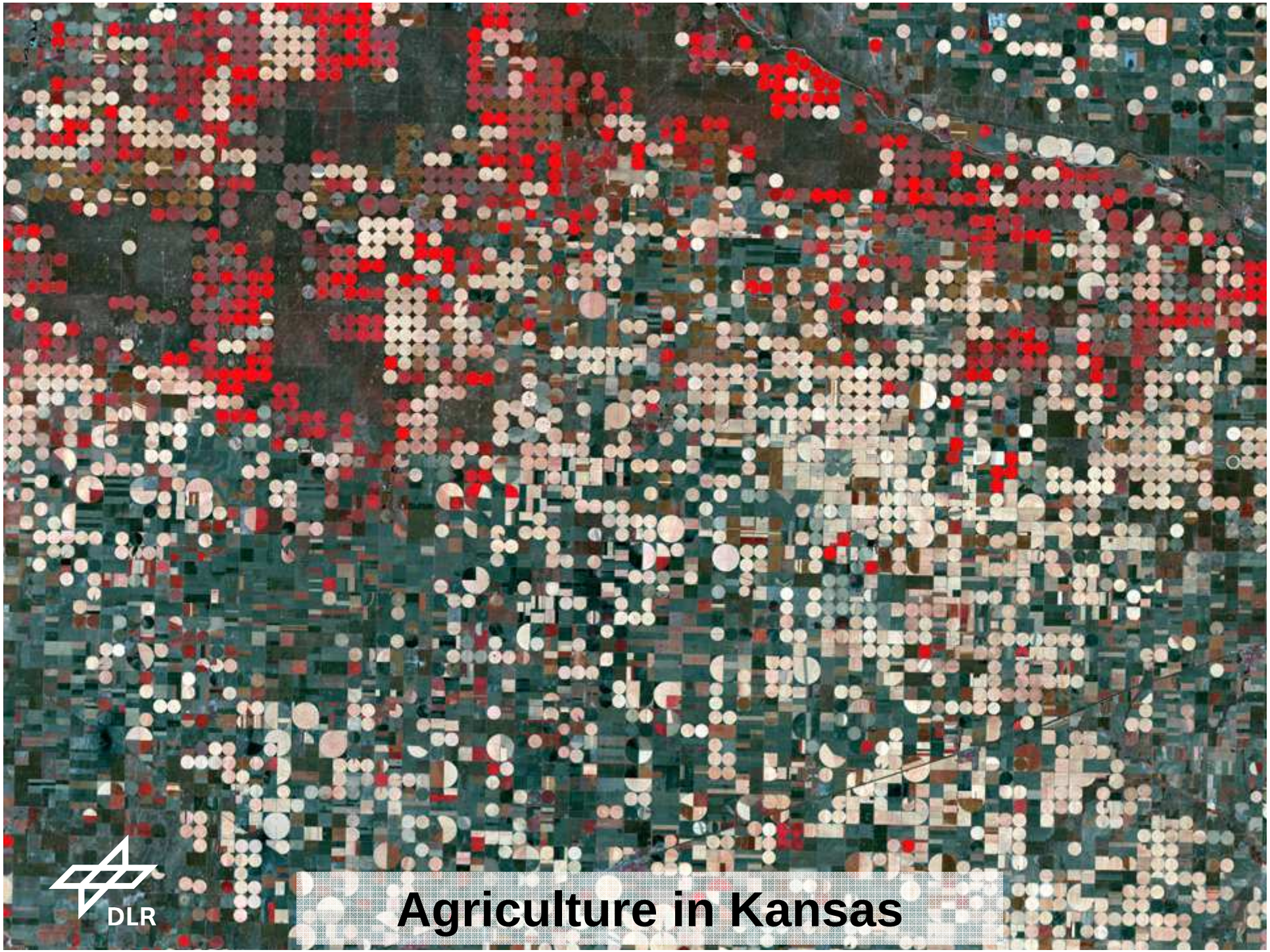
Fire Radiative Power South of Brasilia

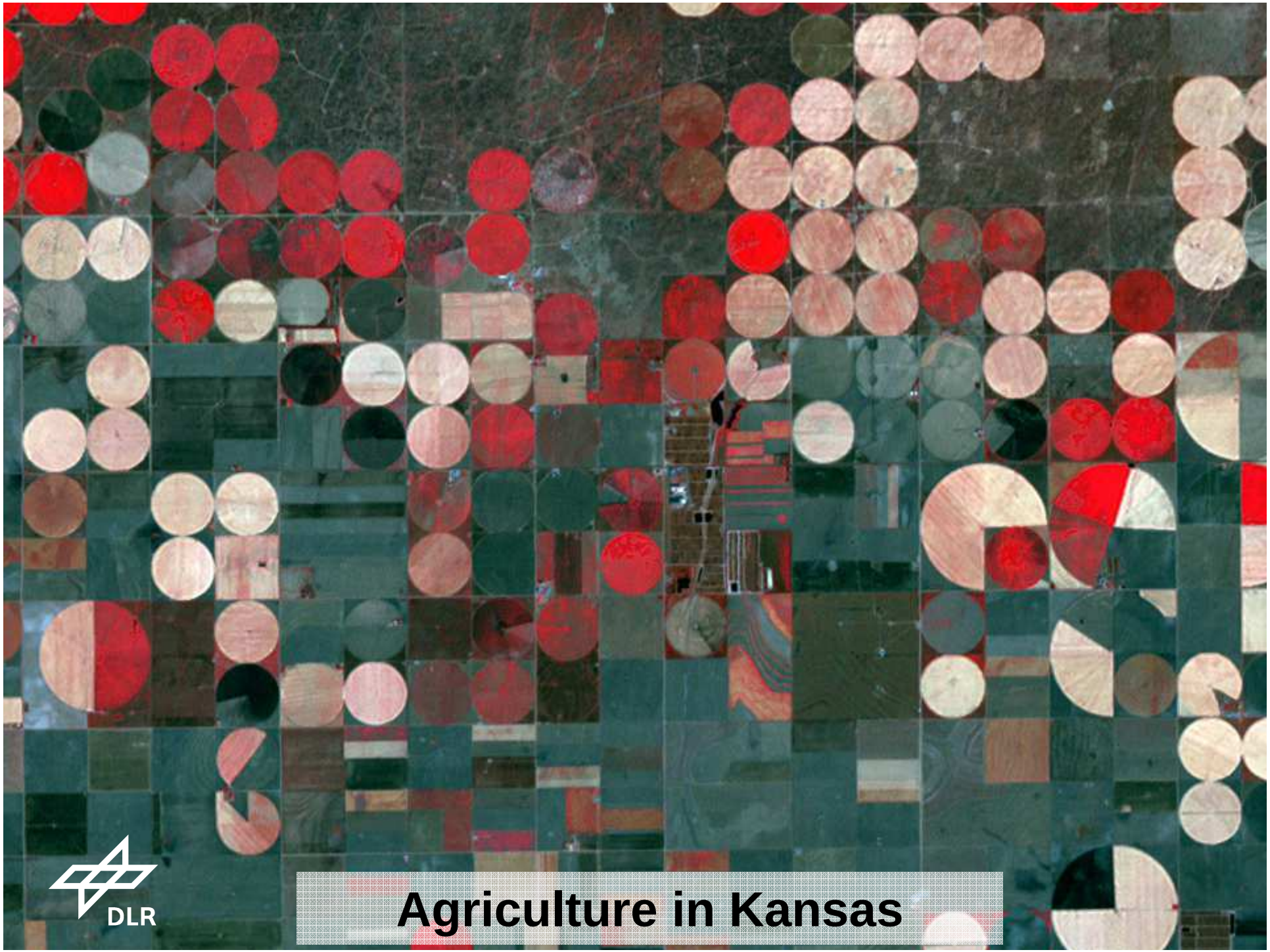


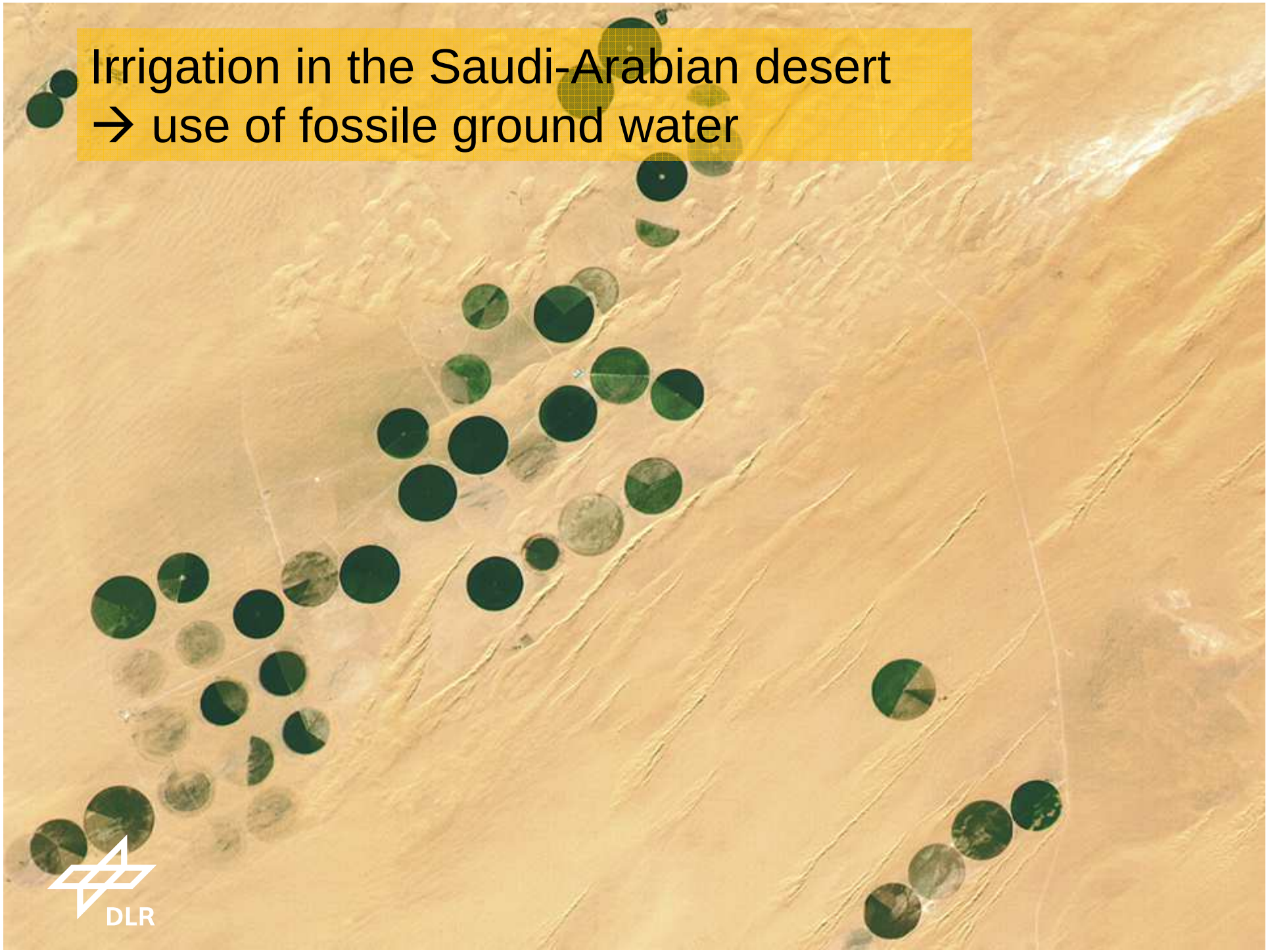
1985 rain forest, Paraguay

false colours: red = forest


2003 rain forest, Paraguay
false colours: red = forest
DLR


DLR
Agriculture in Kansas


DLR
Agriculture in Kansas

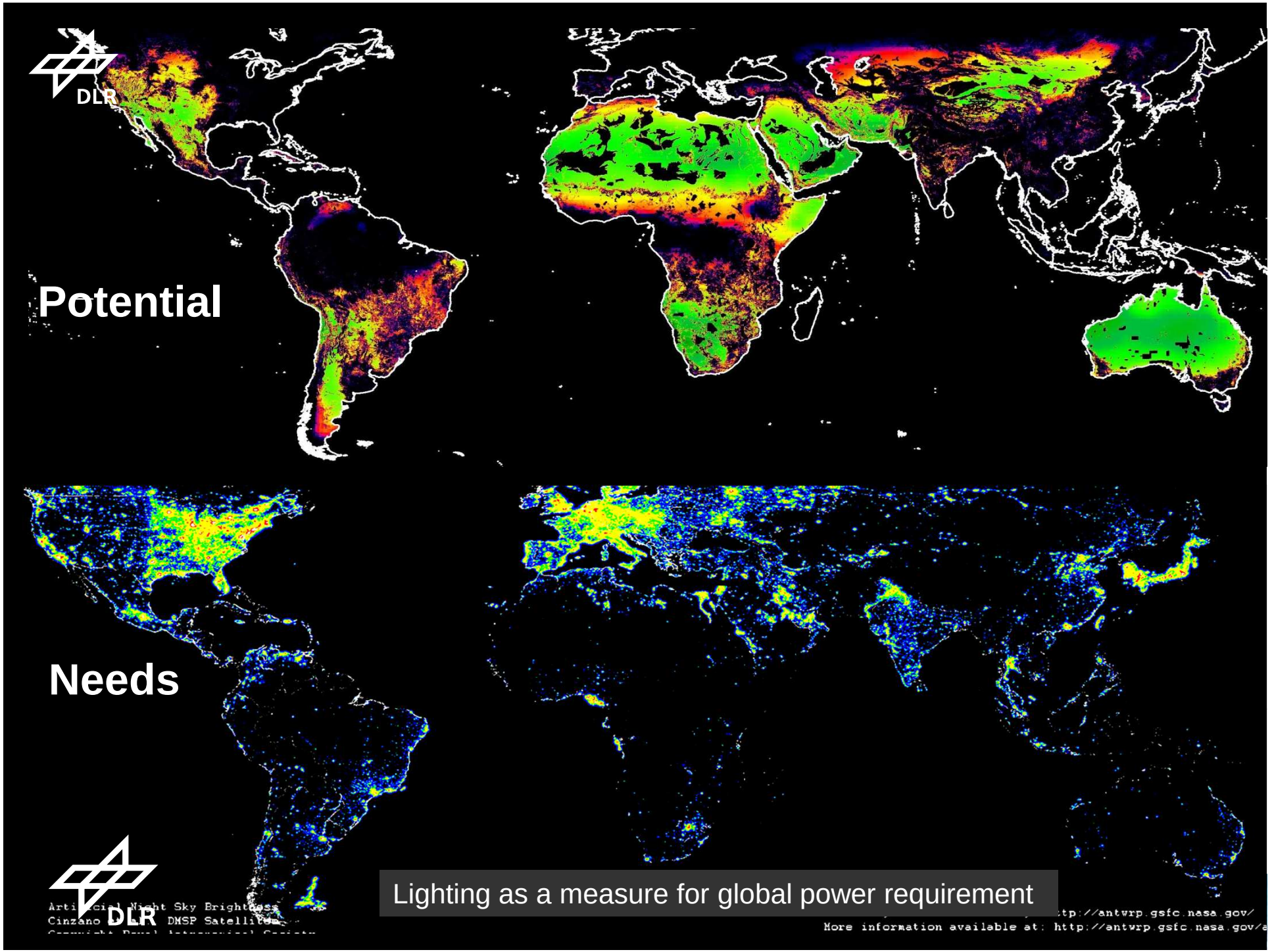

Irrigation in the Saudi-Arabian desert
→ use of fossile ground water
DLR

Precision Farming

DLR

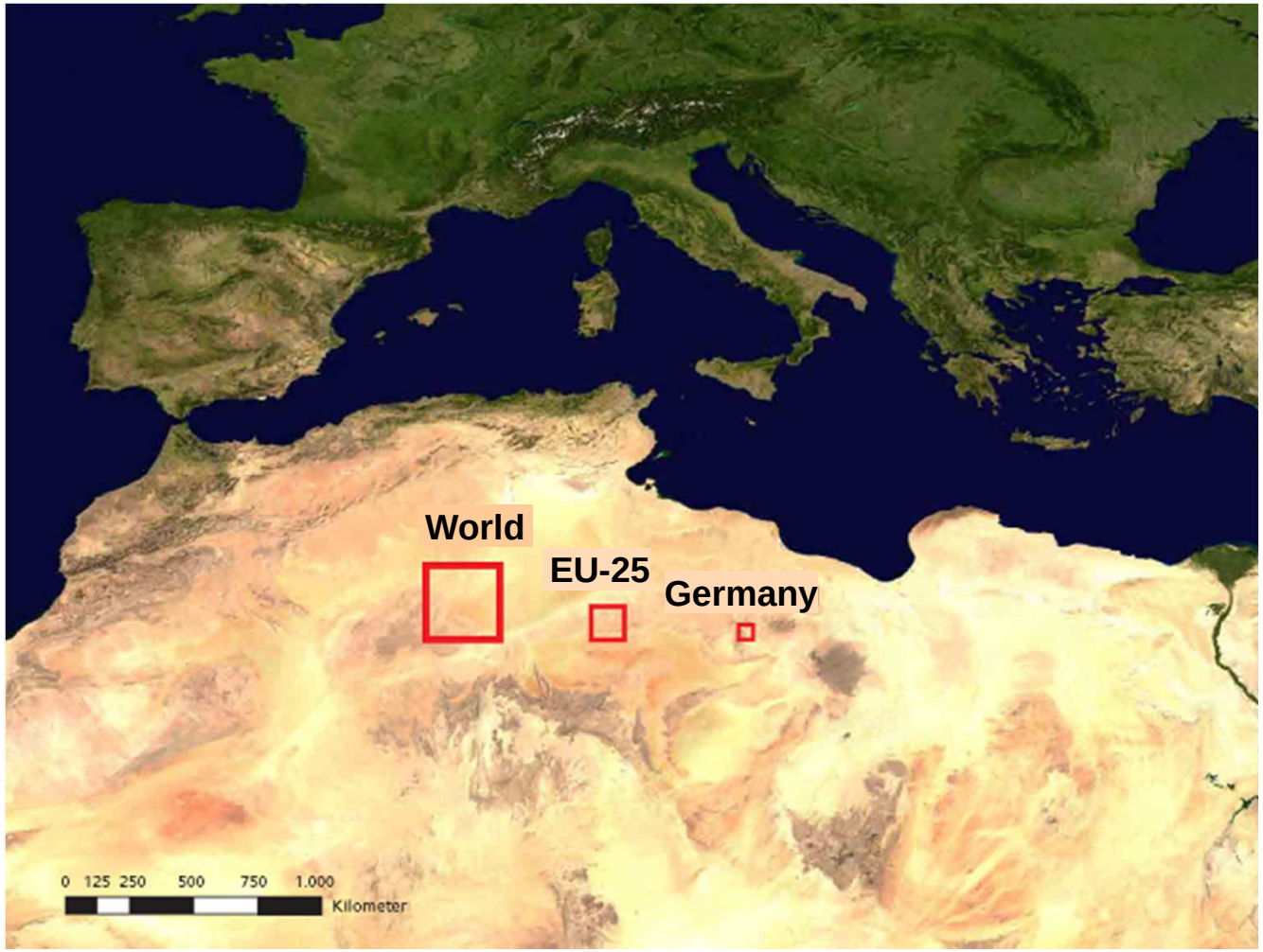
opernicus
The European Earth Observation Programme

GALILEO


DLR
Potential
Needs
DLR
Lighting as a measure for global power requirement
More information available at: http://antwrp.gsfc.nasa.gov/

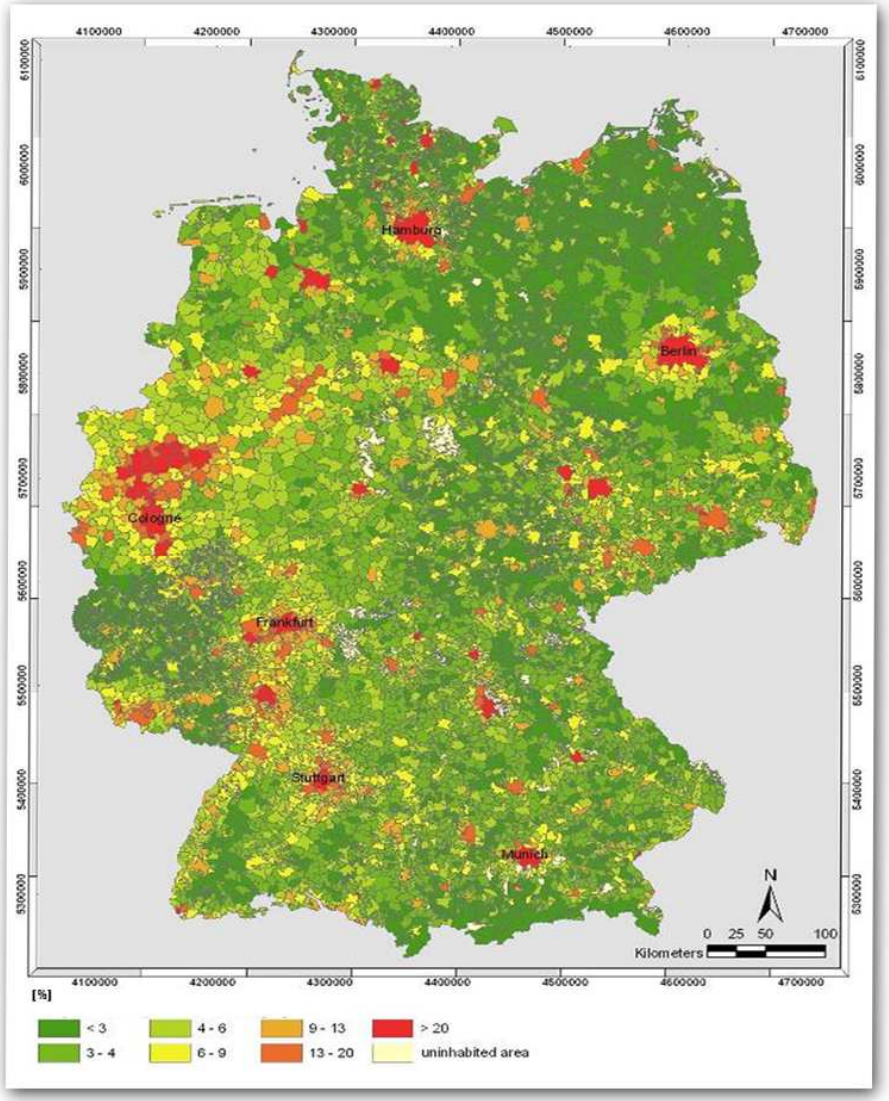
Required desert area for the sustainable supply of electricity

World 300 x 300 km^2
EU-25 150 x 150 km^2
Germany 50 x 50 km^2



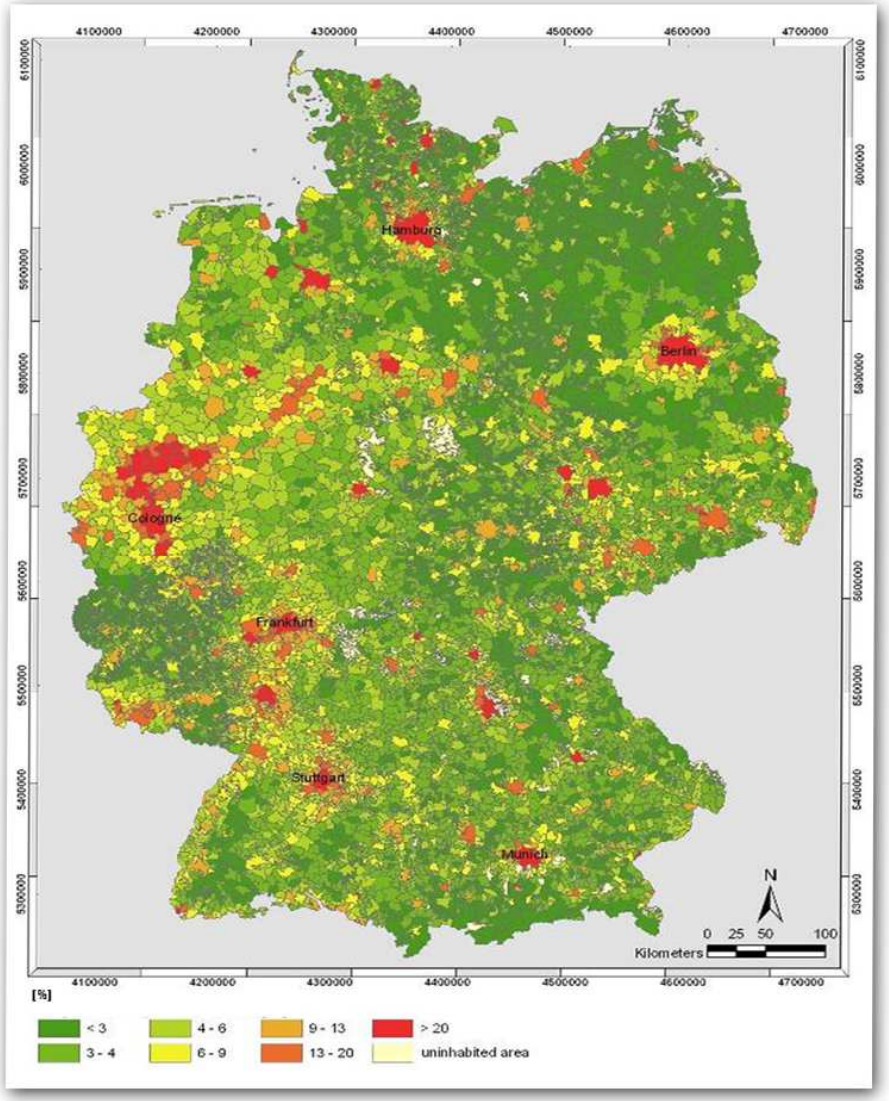
DLR

Land-planning: „sealing“ of ground

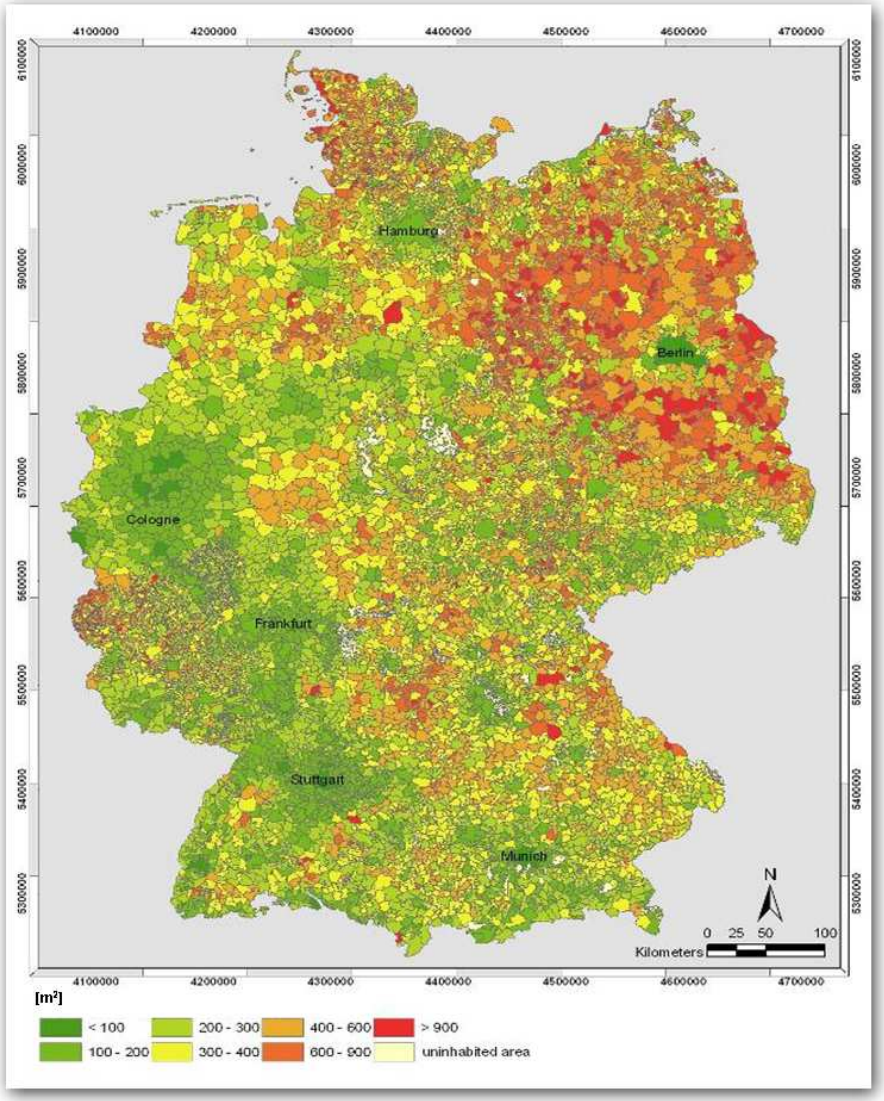


absolute

Land-planning: „sealing“ of ground



absolute

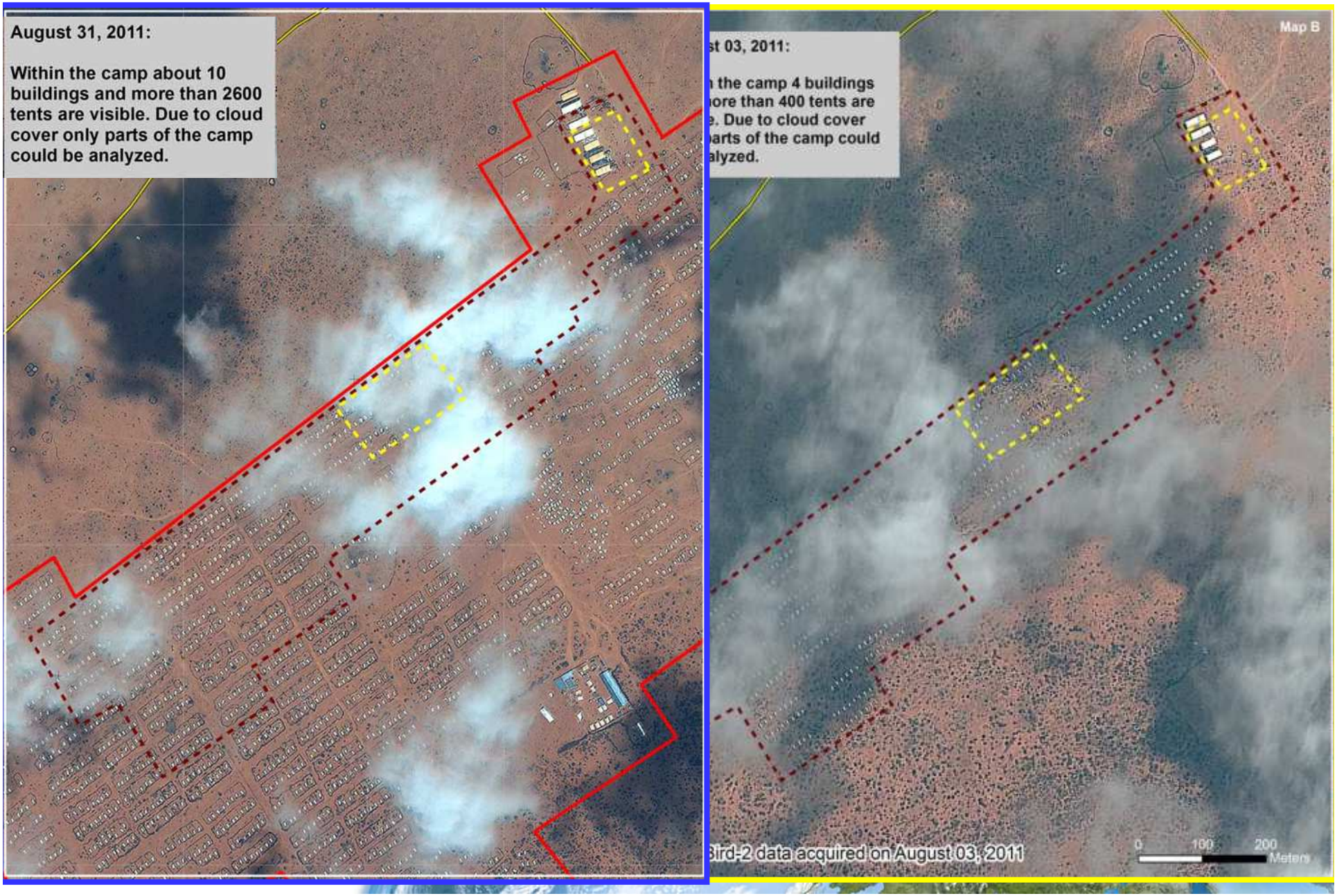


per citizen

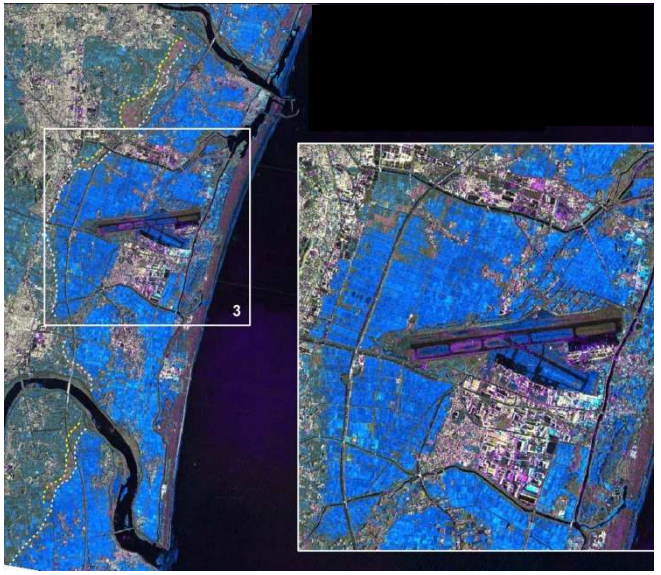
DLR


UNHCR
UNHCR
UNHCR
UNHCR
DLR
UNHCR
N Refugee Agency
© THW

Supporting Relief Work during Ethiopia Famine , August 2011



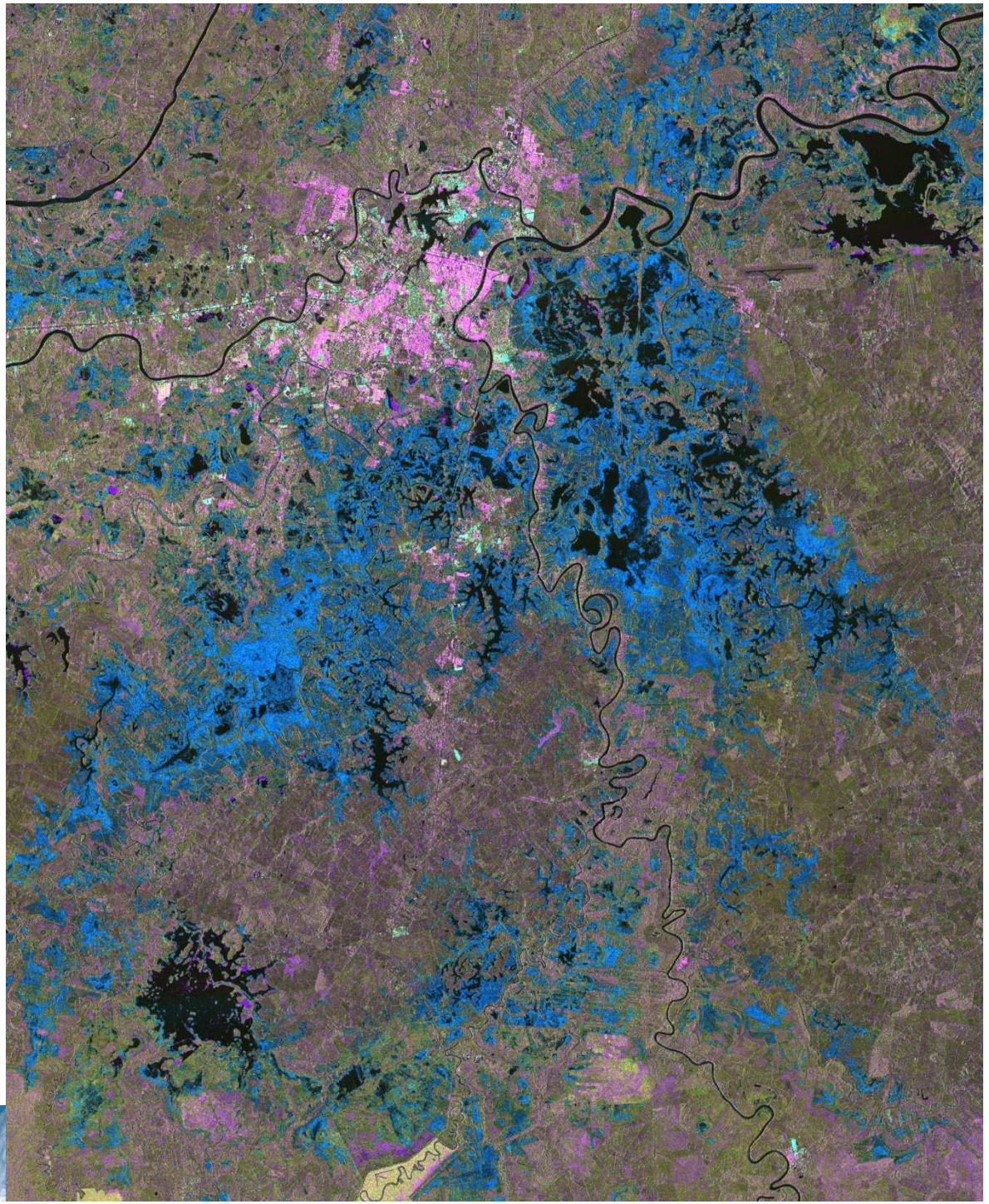
International Charter Space and Major Disasters

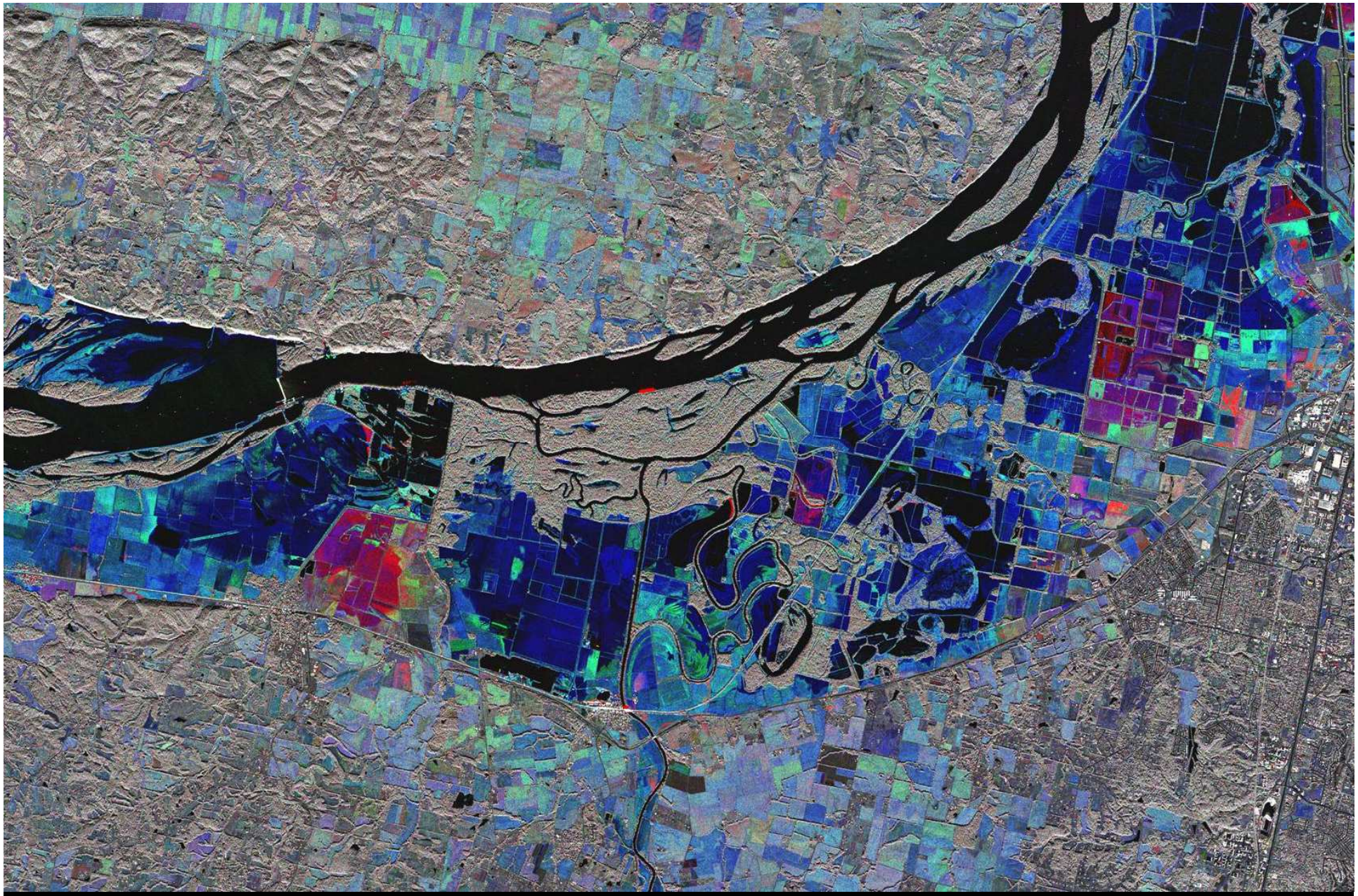


Flooding

Mexico

Villahermosa
8. November 2007 and
2. December 2007





DLR

Mississippi, USA - Flooding

TERRA SAR X

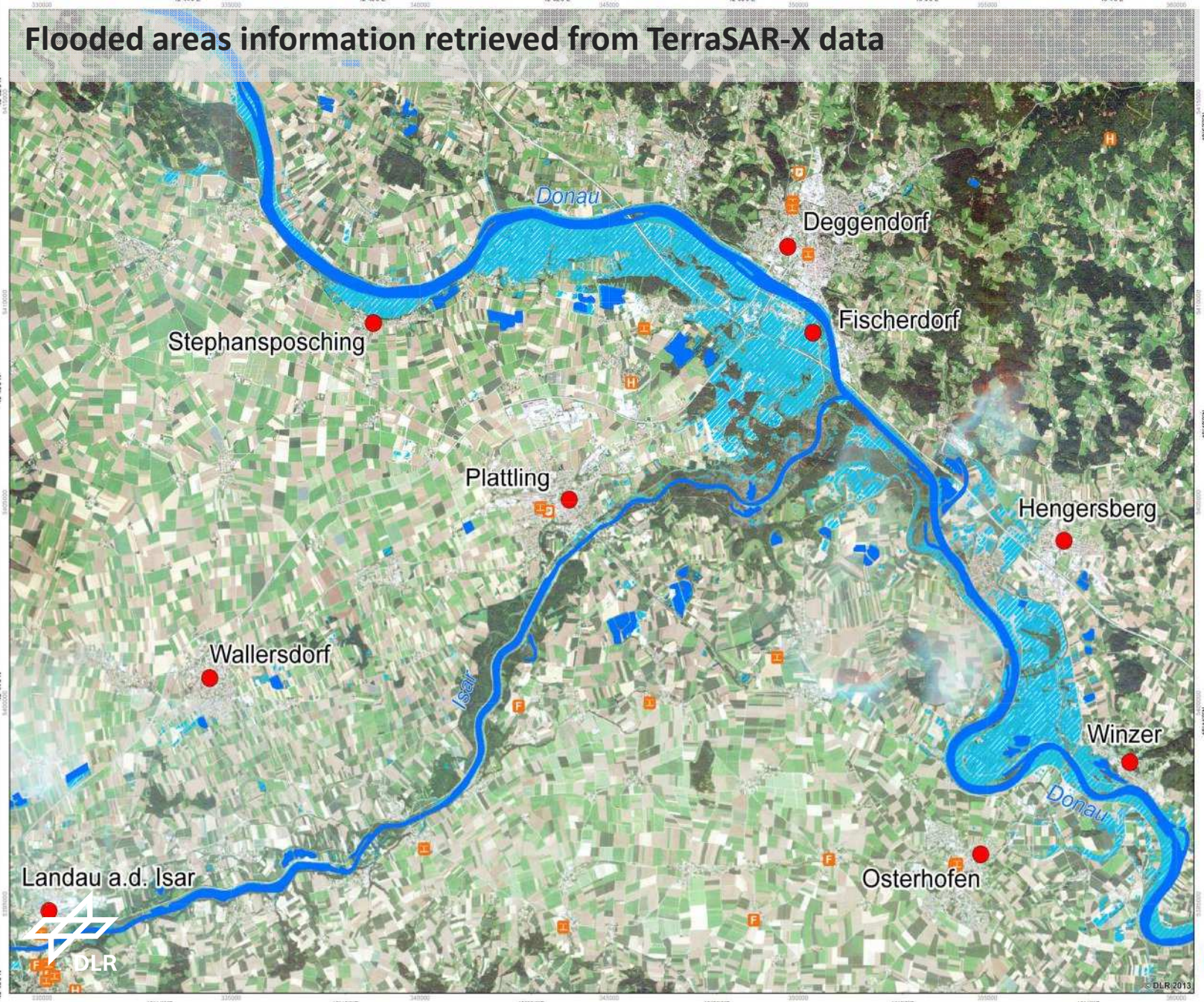
DEUTSCHLAND - Deggendorf

Hochwassersituation am 7. Juni 2013 - Betroffene Fläche - Übersicht

1: 45.000

ZKI-DE Aktivierungsnr. 005
Produktnr. 18
Versionsnr. 01

Flooded areas information retrieved from TerraSAR-X data



Legende

Siedlung | Wald | Ackerfläche

Kritische Infrastruktur: Feuerwehr, Polizei, Krankenhaus, Schule

Bevölkerung: Stadt

Analyse:
- Referenzwassermaske DLM250
- Beobachtete Wasserausdehnung am 7. Juni 2013

Interpretation

Anhaltende Regenfälle haben in den vergangenen Tagen zu starken Überschwemmungen in weiten Teilen Deutschlands geführt. Die lokalen Einsatzkräfte werden von Bundespolizei, der Bundeswehr sowie dem Technischen Hilfswerk unterstützt.
Die Lage bleibt aufgrund sehr langsam sinkender Pegelstände weiter angespannt. Es besteht weiterhin Gefahr aufgrund der durchweichten Dämme. In den nächsten Tagen ist weiterer Niederschlag möglich.
Die in der Karte dargestellten Wasserflächen wurden aus einer TerraSAR-X-Szene mit einer räumlichen Auflösung von 3m abgeleitet, die am 07. Juni 2013 um 7:16 MEZ aufgenommen wurde. RapidEye Daten mit einer räumlichen Auflösung von 5m dienen als Hintergrundbild.

Kartographische Information

0 2 4 Kilometer

Projektion: UTM Zone 33N, Datum: WGS 1984
Geographische Projektion: Lat/Lon (DMS), Datum: WGS 84
Maßstab: 1: 45.000 für DIN A1

Datenquellen

Hintergrund	© RapidEye www.rapideye.com
TerraSAR-X (3.0m)	© 2013 German Aerospace Center, 2013 Astrium Services /Infoterra GmbH
Wassermaske	© DLR 2013
Vektordaten	© GeoBasis-DE / BKG 2007_12 (www.bkg.bund.de) © OpenStreetMap - Mitwirkende

Rahmenbedingung

Die im Rahmen dieser Kartierung erstellten Produkte sind nach unserer besten Fähigkeit und neuestem Kenntnisstand realisiert worden.
Alle geografischen Informationen unterliegen Einschränkungen hinsichtlich des Maßstabes, der Auflösung, des Aufnahmedatums und der Interpretation der Ausgangsdaten. Durch den Produzenten wird keinerlei Haftung für die Inhalte oder deren Nutzung übernommen.
Die Krisenprodukte werden regelmäßig aktualisiert. Bitte besuchen Sie unsere Webseite (http://www.zki.dlr.de), um die aktuellste Version dieses Produktes zu erhalten.

Erstellungsdatum 07. Juni 2013
© DLR 2013
zki@dlr.de
http://www.zki.dlr.de

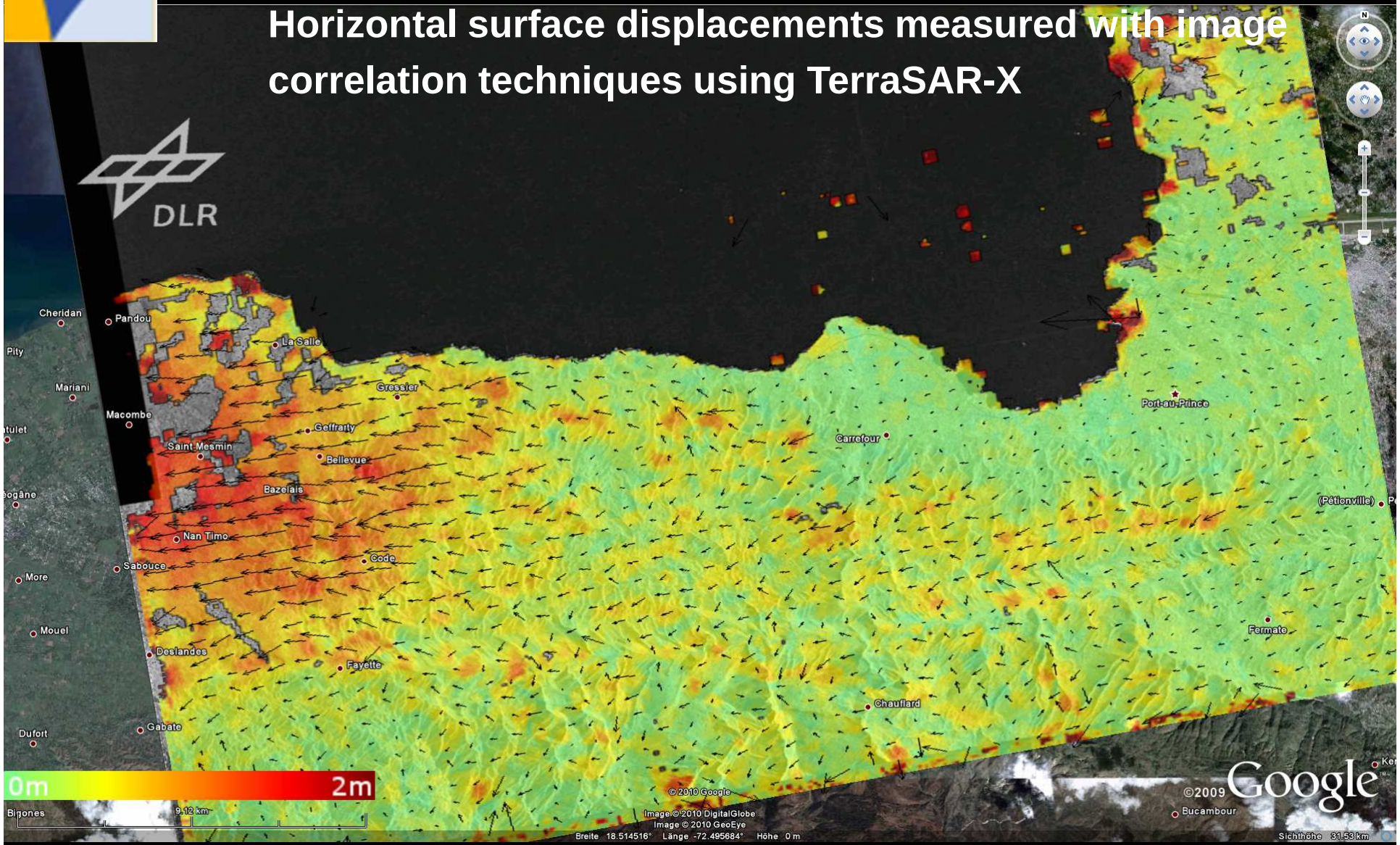
Zentrum für satellitengestützte Krisenintelligenz
– Notfallkartierung & Katastrophenmonitoring –

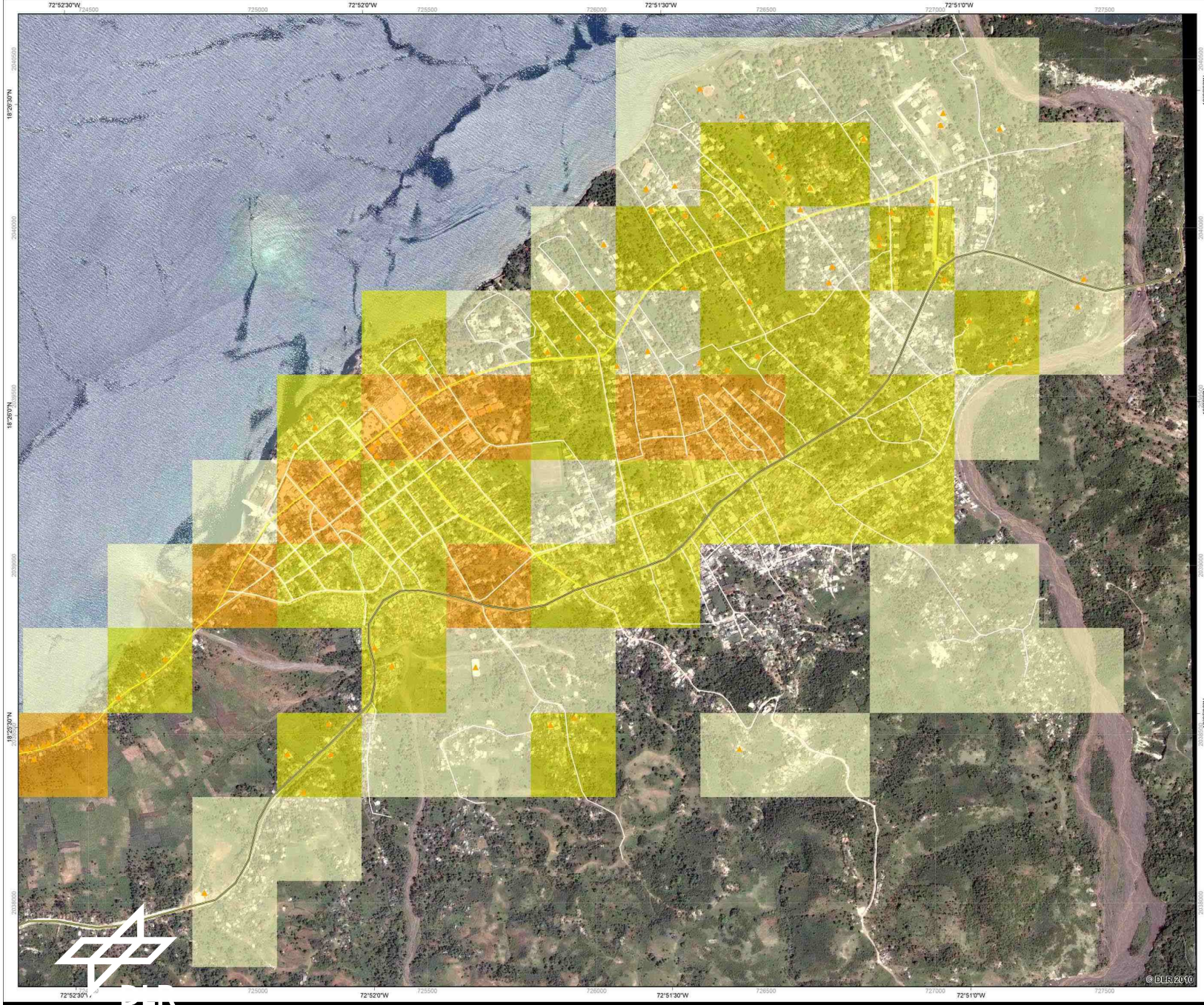
Deutsches Fernerkundungsdatenzentrum
Deutsches Zentrum für Luft- und Raumfahrt
DLR

Forest fire Greece

Haiti M7.0 EQ, 12.01.2010

Horizontal surface displacements measured with image correlation techniques using TerraSAR-X





Charter Call ID 288, SAFER Action No. 24
Glide No. EQ-2010-000009-HTI
Product N° 29

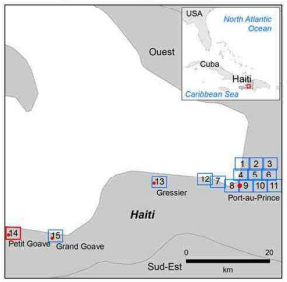
HAITI - Petit Goave Earthquake

Satellite Image Damage Assessment

January 13, 2010 - Sheet 14

Scale 1:5,000

Location Diagrams



Legend

Damage Assessment

Estimated percentage of damaged buildings per grid cell as detected by satellite image interpretation:

- < 10 %
- 10 - 40 %
- > 40 %

Points of interest

- Airport
- Hospital
- Sports field
- Potential gathering area
- Totally damaged building

Transportation

- Highway
- Secondary road
- Local road

Borders

- Extent of post-disaster imagery

Interpretation

On January 12, 2010 a major earthquake of magnitude 7.0 and depth of 10 km struck southern Haiti at 21:53 UTC. The earthquake was followed by a series of strong aftershocks of magnitudes up to 5.9. The capital Port-au-Prince was hit severely. The map shows the percentage of structural damage per 250 m grid cell in the town of Petit Goave and was derived by visual interpretation of high resolution pre-disaster satellite data (GoogleEarth) and post-disaster GeoEye-1 (acquired on January 13, 2010) imagery. This interpretation has to be handled with caution. DLR-ZKI produced this map in cooperation with the United Nations Cartographic Section.

Cartographic Information

0 100 200 300 400 500 Meters

N

Local projection: UTM Zone 18 North, Datum: WGS 84
Geographic projection: Lat/Lon (DMS), Datum: WGS 84

Scale: 1:5,000 for A1 prints

Data Sources

Damage classes derived from GeoEye-1 (0.5 m) acquired on January 13, 2010 - © DLR 2010
Roads provided by United Nations Cartographic Section, extended by DLR derived from ESRI Standard Online Service and on post-disaster GeoEye imagery - © MINUSTHA GIS 2010; © DLR 2010
Point vector data provided by SERTIT and derived from GeoEye data by DLR - © SERTIT 2010; © DLR 2010
Satellite images - © GeoEye 2010, © 2009 ESRI®, i-cubed, GeoEye; © DigitalGlobe 2010

Framework

The products elaborated for this Rapid Mapping Activity are realised to the best of our ability, within a very short time frame, during a crisis/exercise, optimising the material available. All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. No liability concerning the content or the use thereof is assumed by the producer.

Map produced on January 18, 2010 by ZKI
Updated on January 19, 2010 by ZKI
© DLR 2010

zki@dlr.de
http://www.zki.dlr.de

GMES European Commission Service and Applications For Emergency Response
safer
Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –
a service of DFD

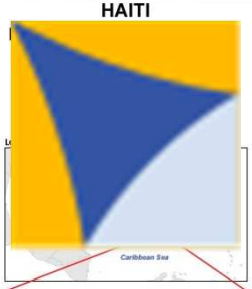
sertit

DLR

Support on site

Charter Call ID 288, Product N° 33
Glide No. EQ-2010-000009-HTI

HAITI



Legend

Built-Up Area
Forest

Points of interest
Location of German Red Cross Field Hospital

Transportation
Highway
Secondary road
Local road

Interpretation

On January 12, 2010 a major earthquake of magnitude 7.0 and depth of 10 km struck southern Haiti at 21:53 UTC. The earthquake was followed by a series of strong after-shocks of magnitudes up to 5.9. The capital Port-au-Prince was hit severely. The map shows the location of the German Red Cross Field Hospital. Post-disaster Aerial images provided by Google acquired on January 17, 2010 serve as backdrop.

All interpreted features are captured with best effort but in some cases may not be complete.

0 50 100 150 200 m

N

Projection & Grid Information

	Reference Grid	*Geographic Grid*
Projection:	UTM Zone 18 North	Geographic (DMS)
Spheroid:	WGS 84	WGS 84
Datum:	WGS 84	WGS 84

Aerial Image Information

Pixel Size:	0.15 m
Acquisition Date:	17th January 2010
Georeferencing:	Orthorectification
Estimated Positional Accuracy:	Unknown

Credits & Copyright

• Vector data	© DLR 2010, UNCS 2020
• Aerial Images	© Google 2010
• Street names	© Open Street Map

Date:	January 23, 2010
Edition:	1.0
Print Dimensions @ 1:3,000	ISO A1 size (841 x 594mm)

RESPOND
GMES Services Supporting

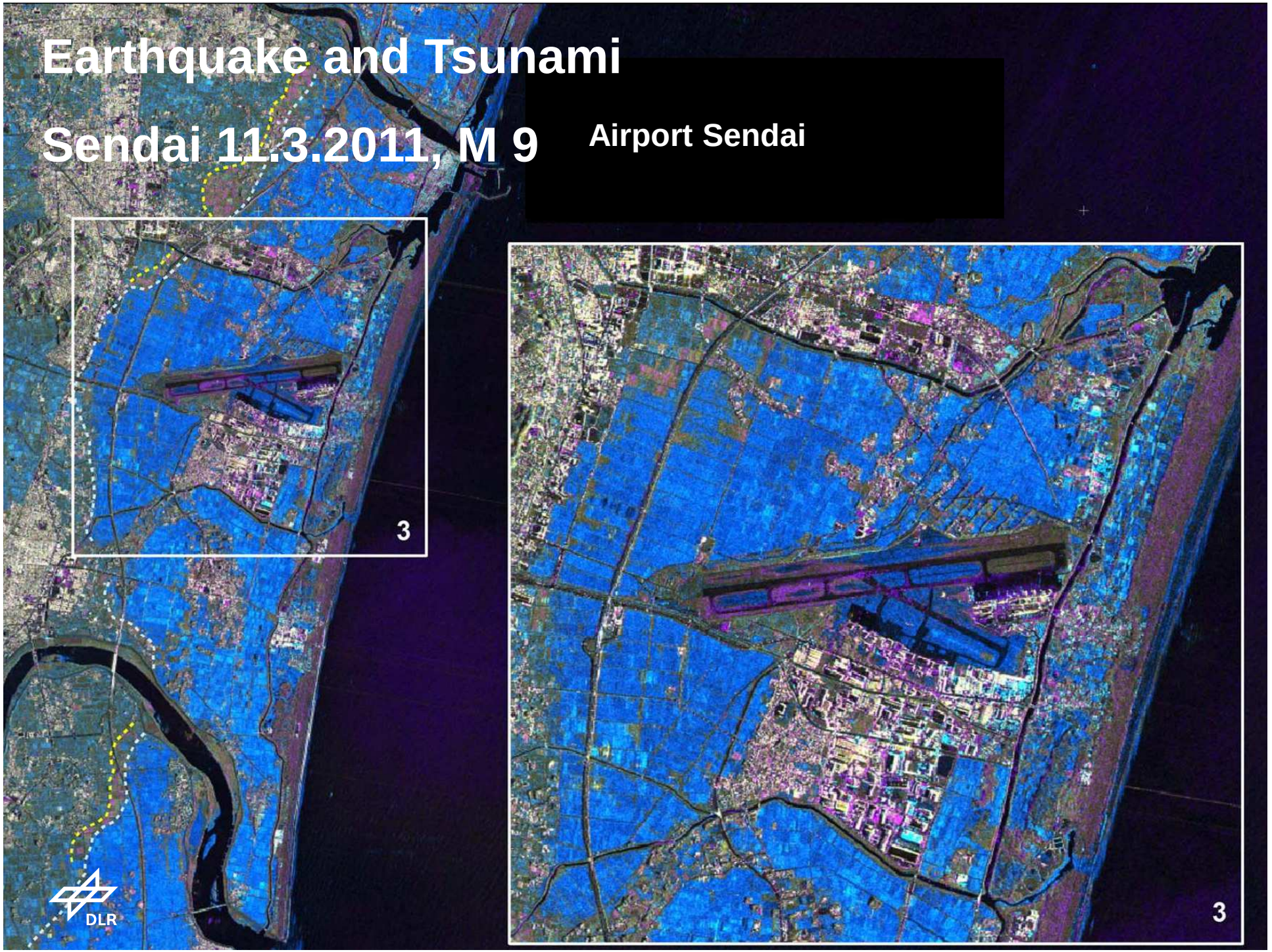
User coordination and map production
Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –

Data provision
DLR

Earthquake and Tsunami

Sendai 11.3.2011, M 9

Airport Sendai



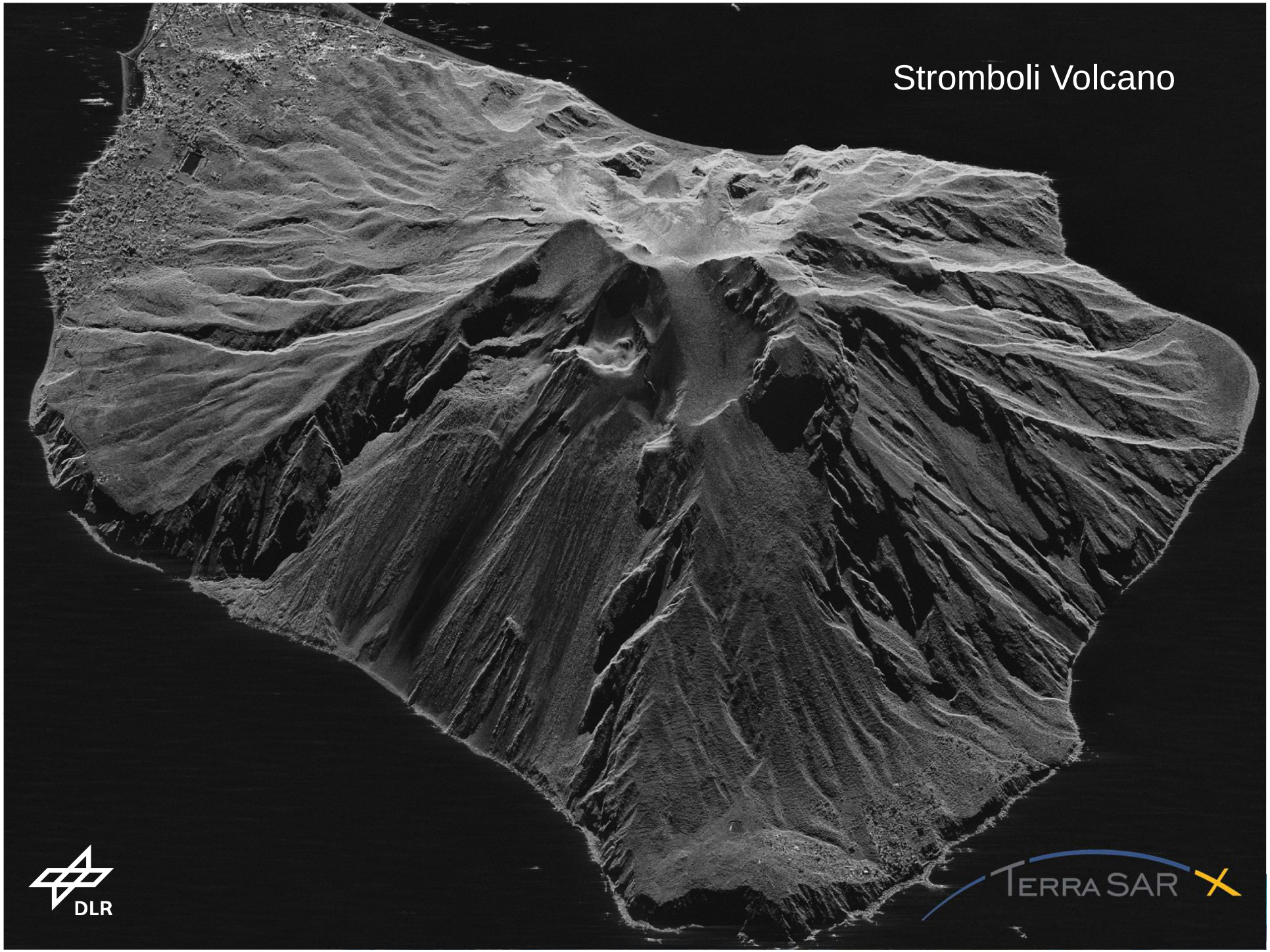

Tsunami 2004 – Lho'Nga, Indonesia
DLR
December 29, 2004

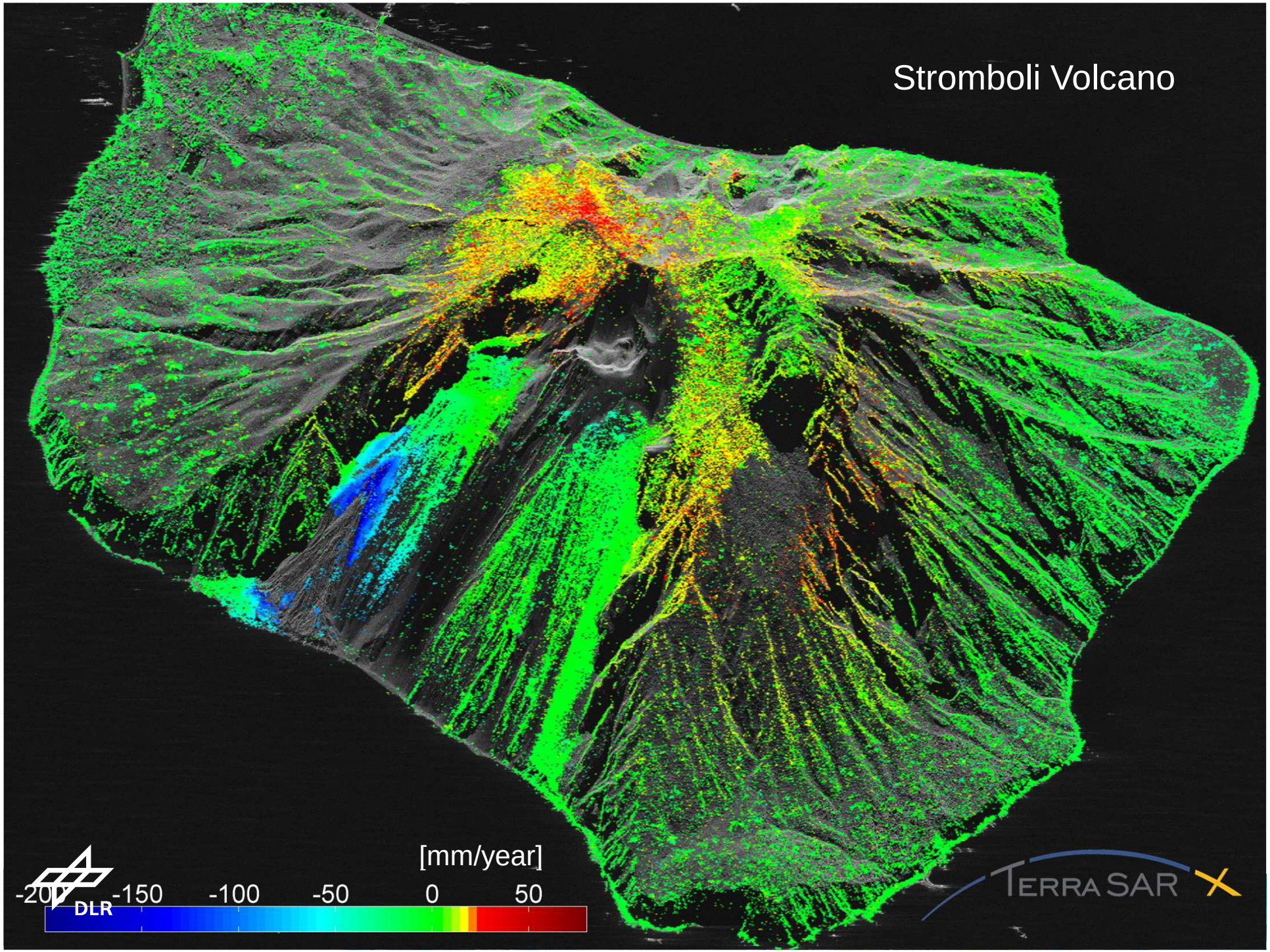
Decision support system Jakarta

Decision support system Jakarta

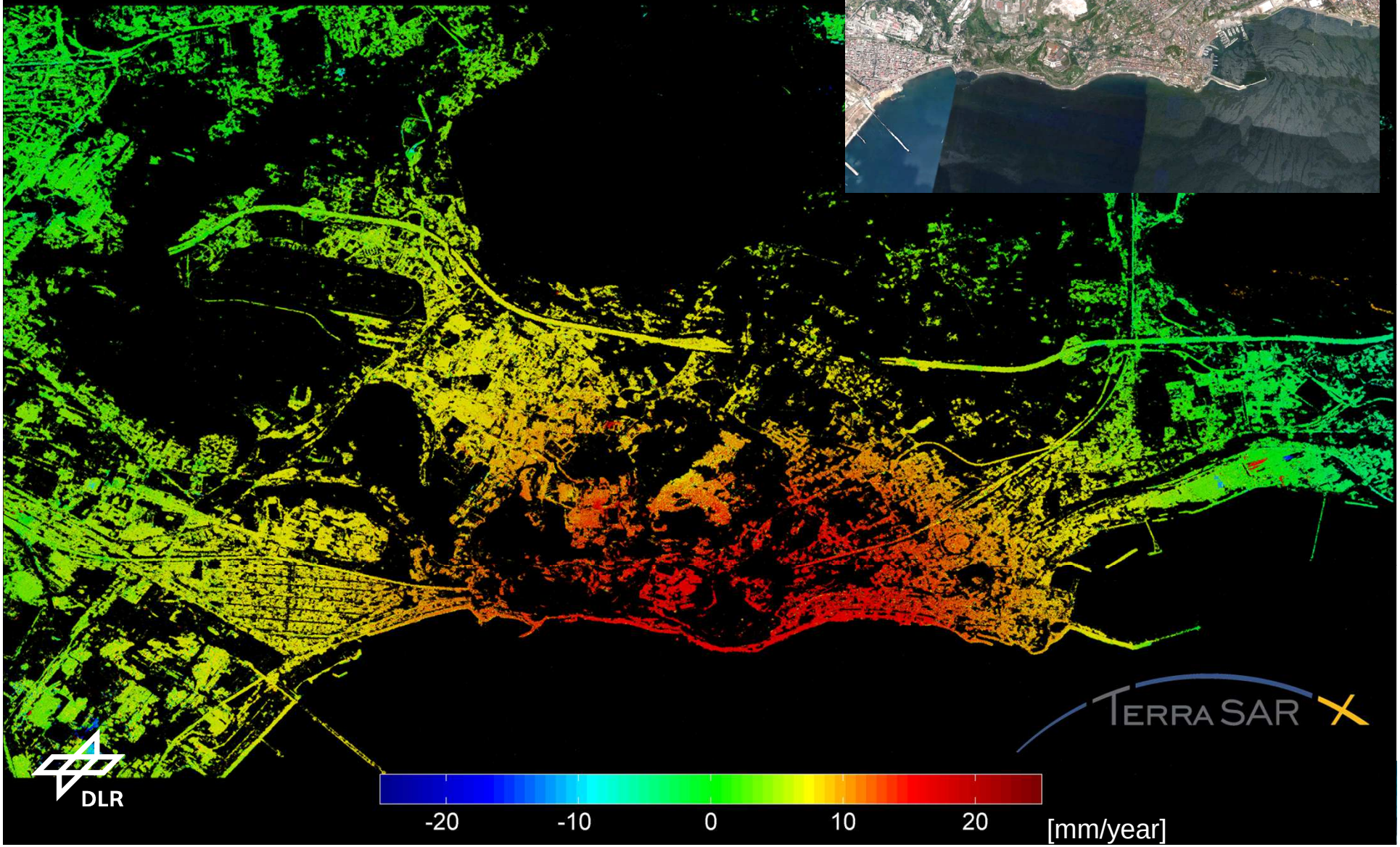
DLR

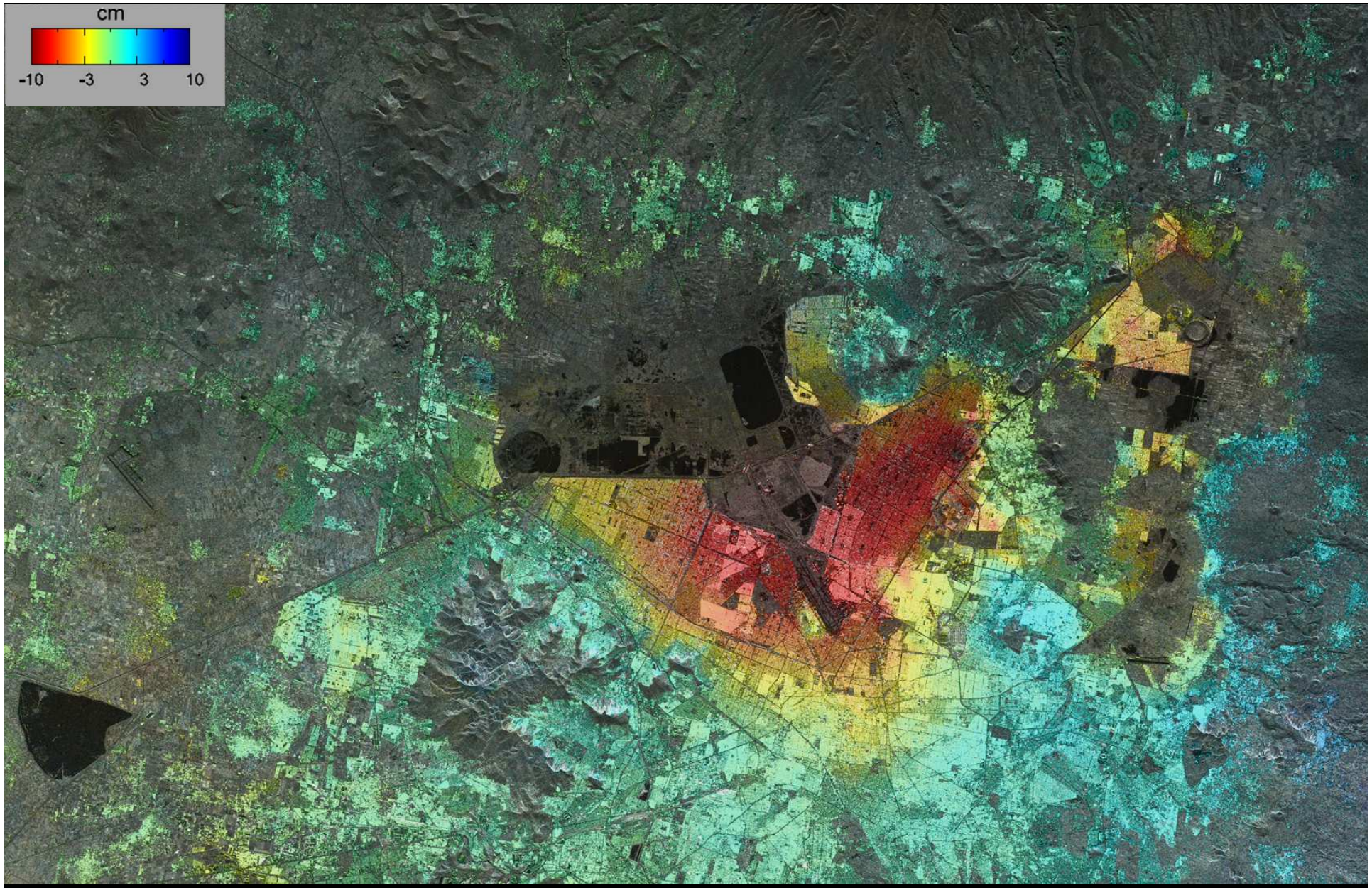
Decision support system Jakarta


Stromboli Volcano
DLR
TERRA SAR X


Stromboli Volcano
[mm/year]
-200
-150
-100
-50
0
50
DLR
TERRA SAR X

Uplift of Campi Flegrei, Italy
→„Supervolcano“



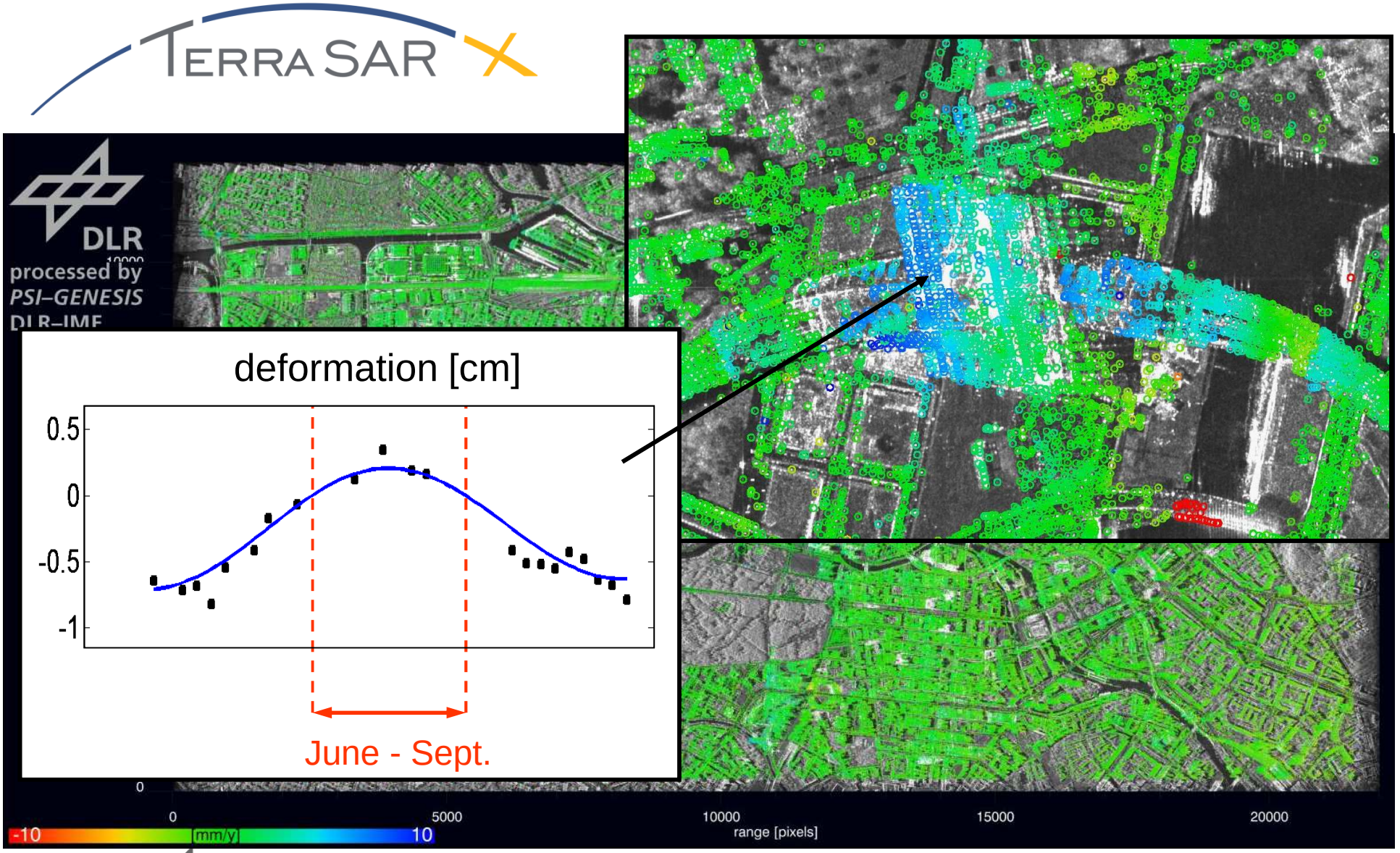


DLR

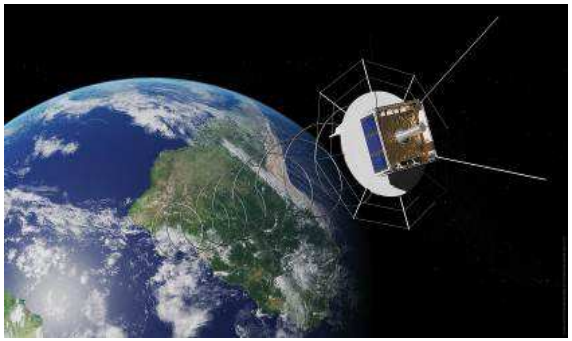
Mexico – Subsidence
→ ground water pumping

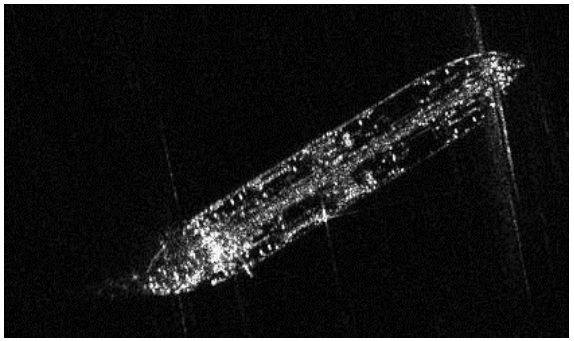
TERRA SAR X

Deformation Berlin Main Station



Maritime Security and respective Services





DLR

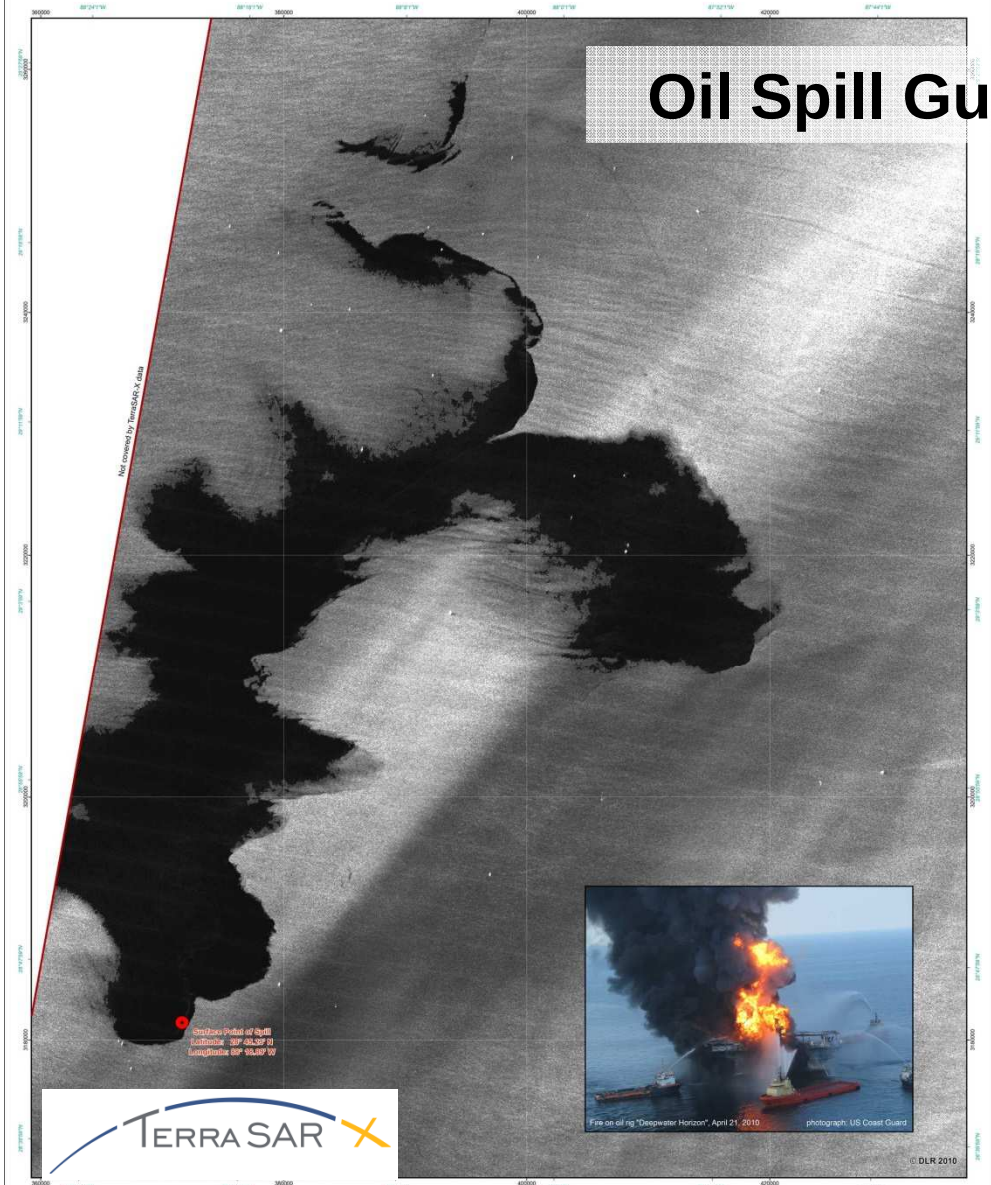


DLR

Oil Spill Gulf of Mexico

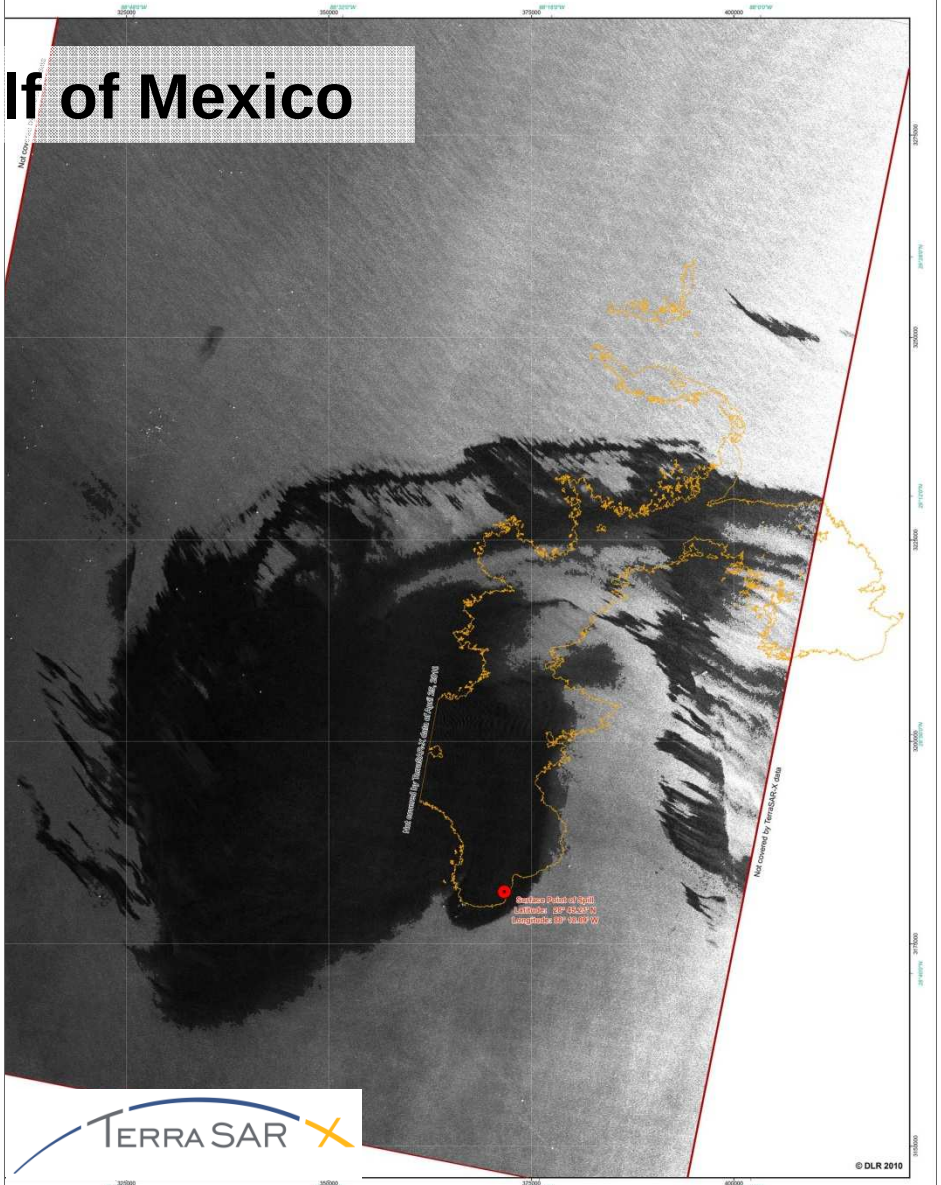
Gulf of Mexico - Oil spill, as seen on April 25, 2010

1:150.000



lf of Mexico - Oil spill, as seen on April 30, 2010

1:225.000



Center for Satellite Based Crisis Information
- Emergency Mapping & Disaster Monitoring -
German Remote Sensing Data Center
German Aerospace Center

Framework

The products elaborated for this Rapid Mapping Activity are realised to the best of our ability, within a very short time frame, during a crisis, optimising the material available. All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. No liability concerning the content or the use thereof is assumed by the producer.

Map produced April 28, 2010 by ZKI
© DLR 2010

Legend

Oil | Ship | Water

Data Sources

TerraSAR-X © DLR 2010
Commercial exploitation rights:
infoterra

Interpretation

On April 21, 2010 an explosion occured on the oil rig "Deepwater Horizon" and it caught fire. 11 workers were missing after the incident and are believed to be dead. On the following day the rig sank to the seafloor about 1500 m below the surface and approximately 400 m northwest of the well. Every day an estimation of 160.000 litres of oil are leaking from two places of the well and threaten the marine ecosystem of the Gulf of Mexico and the coast of Louisiana, USA. Efforts to stop the leakage have not been successful to date.
During its pass over the Gulf of Mexico on April 25, 2010, the German TerraSAR-X Satellite acquired a radar image showing an extensive oil spill, caused by the oil rig disaster. The extent of the oil spill shown on the map is about 80 km in north-south direction and 50 km in west-east direction. Ships are visible as very bright objects.

Scale

0 2.5 5 7.5 10 km

Scale: 1:150.000 for DIN A1 printing

Reference coord. system: Geographic coord. info:
Projection: UTM Zone 16 N Geographic (DMS)
Spheroid: WGS 84 WGS 84
Datum: WGS 84 WGS 84

For more information visit: http://www.zki.dlr.de

Legend

Oil | Ships | Water

Oil spill extent as seen on April 25, 2010

Data Sources

TerraSAR-X © DLR 2010
Commercial exploitation rights:
infoterra

Interpretation

On April 21, 2010 an explosion occured on the oil rig "Deepwater Horizon" and it caught fire. 11 workers were missing after the incident and are believed to be dead. On the following day the rig sank to the seafloor about 1500 m below the surface and approximately 400 m northwest of the well. Every day an estimation of 800.000 litres of oil are leaking from three places of the well and threaten the marine ecosystem of the Gulf of Mexico and the coast of Louisiana, USA. Efforts to stop the leakage have not been successful to date.
During its pass over the Gulf of Mexico on April 30, 2010, the German TerraSAR-X Satellite acquired a radar image showing an extensive oil spill, caused by the oil rig disaster. The map also shows the extent of the oil spill on April 25, 2010. It was derived by semi-automatic analysis of TerraSAR-X data. Ships are visible as very bright objects.

Scale

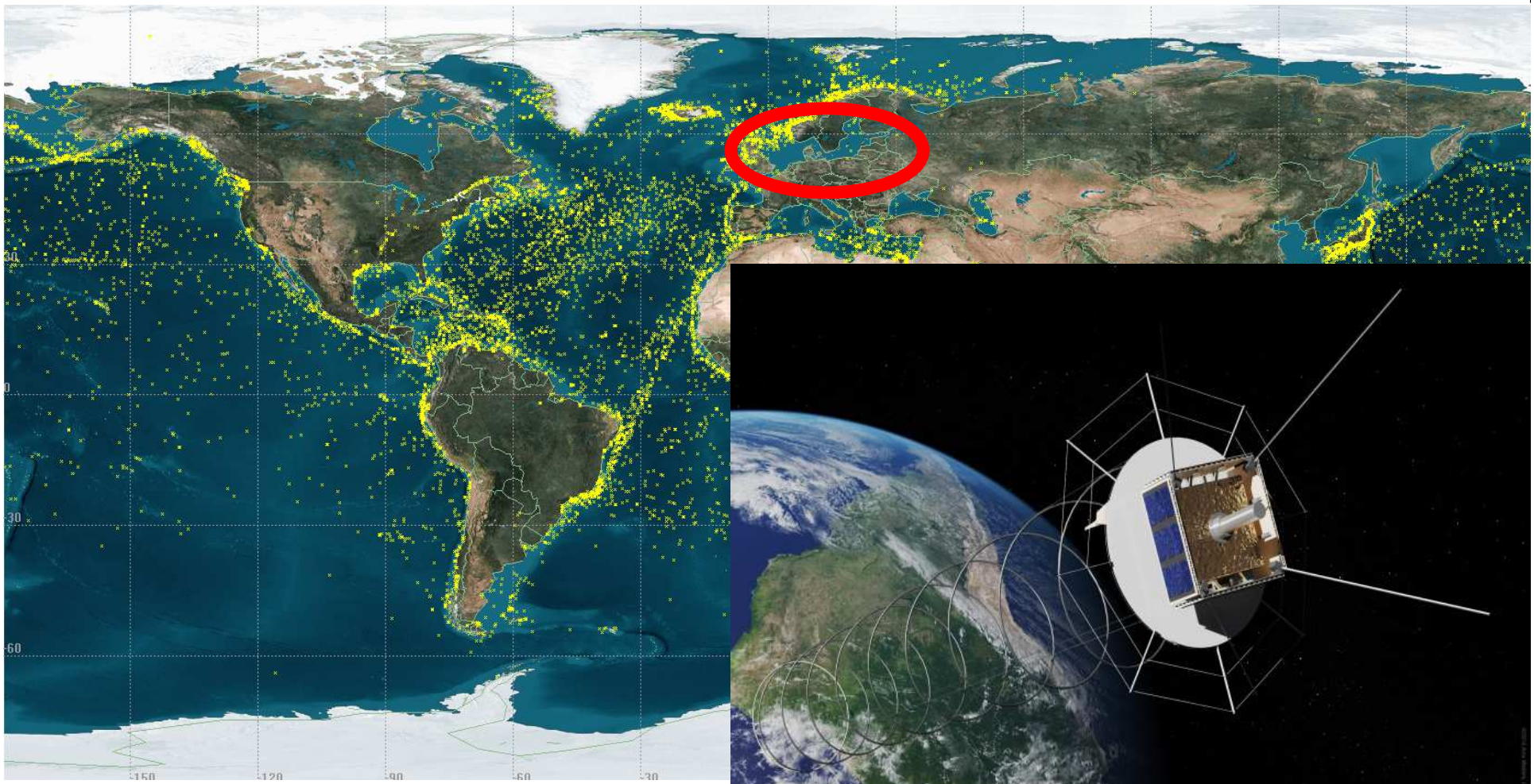
0 5 10 15 km

Scale: 1:225.000 for DIN A1 printing

Reference coord. system: Geographic coord. info:
Projection: UTM Zone 16 N Geographic (DMS)
Spheroid: WGS 84 WGS 84
Datum: WGS 84 WGS 84

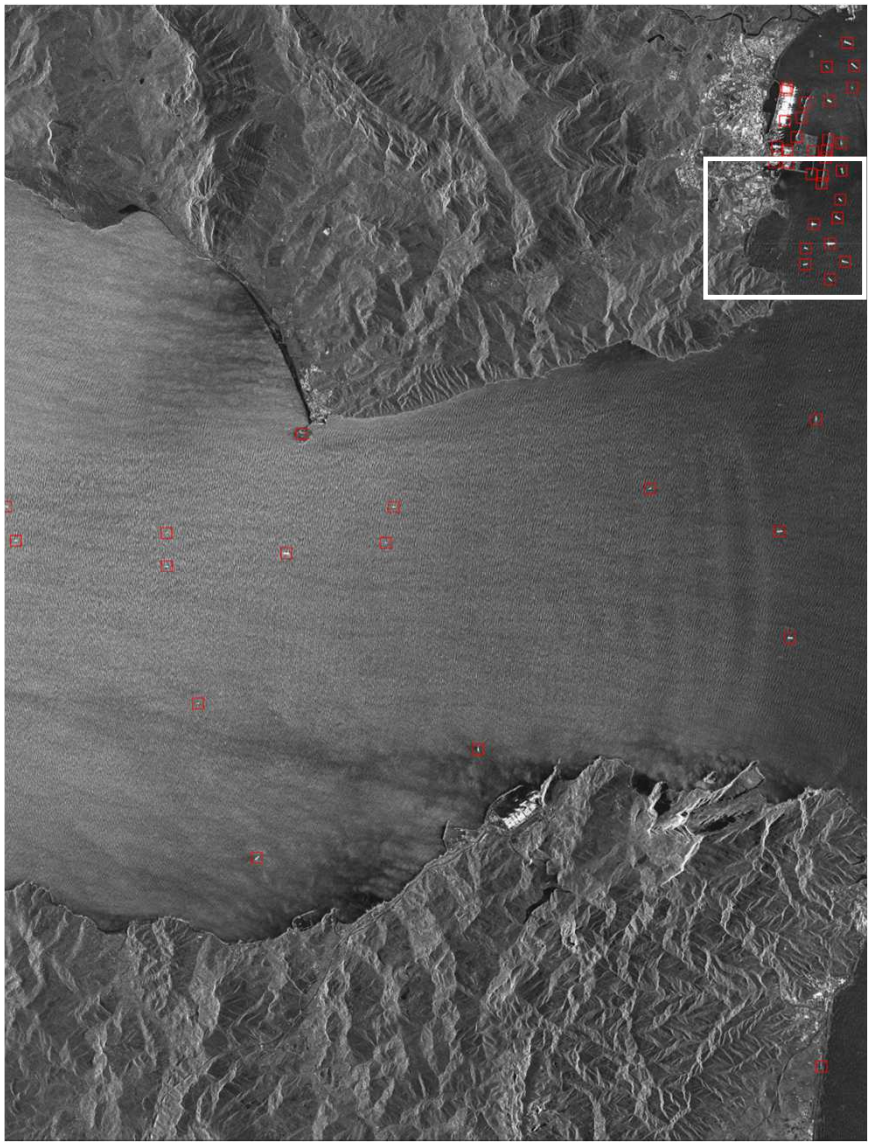
For more information visit: http://www.zki.dlr.de

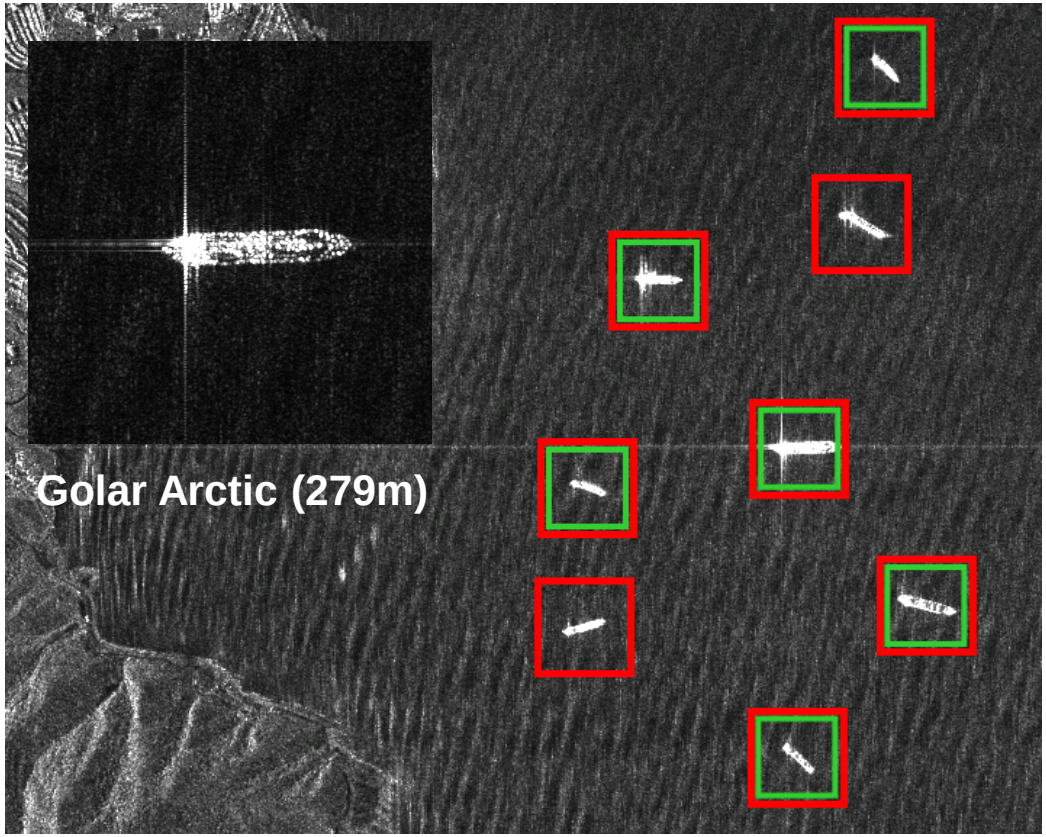
AISat



DLR

SAR-Ship Detection



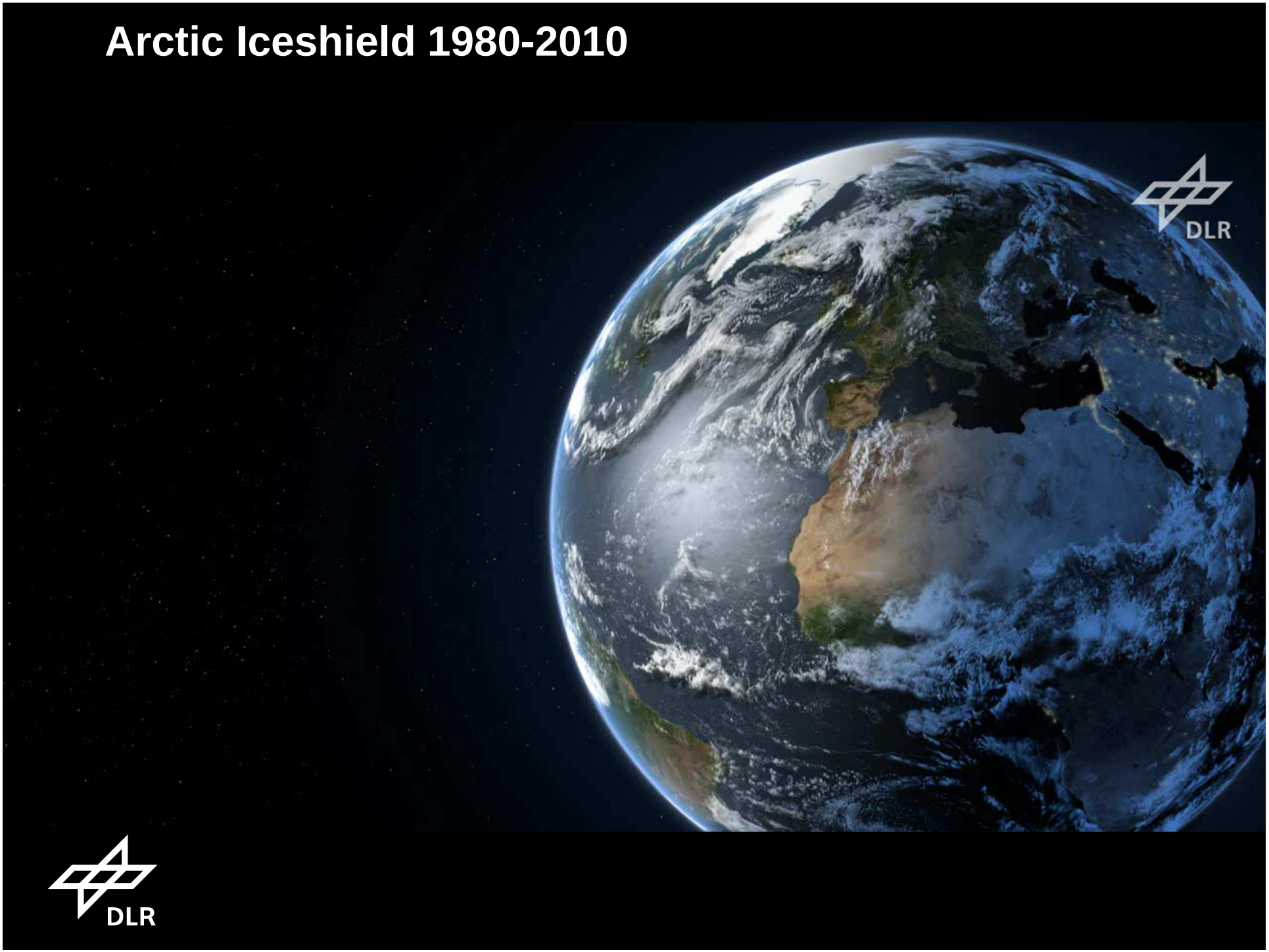


TerraSAR-X

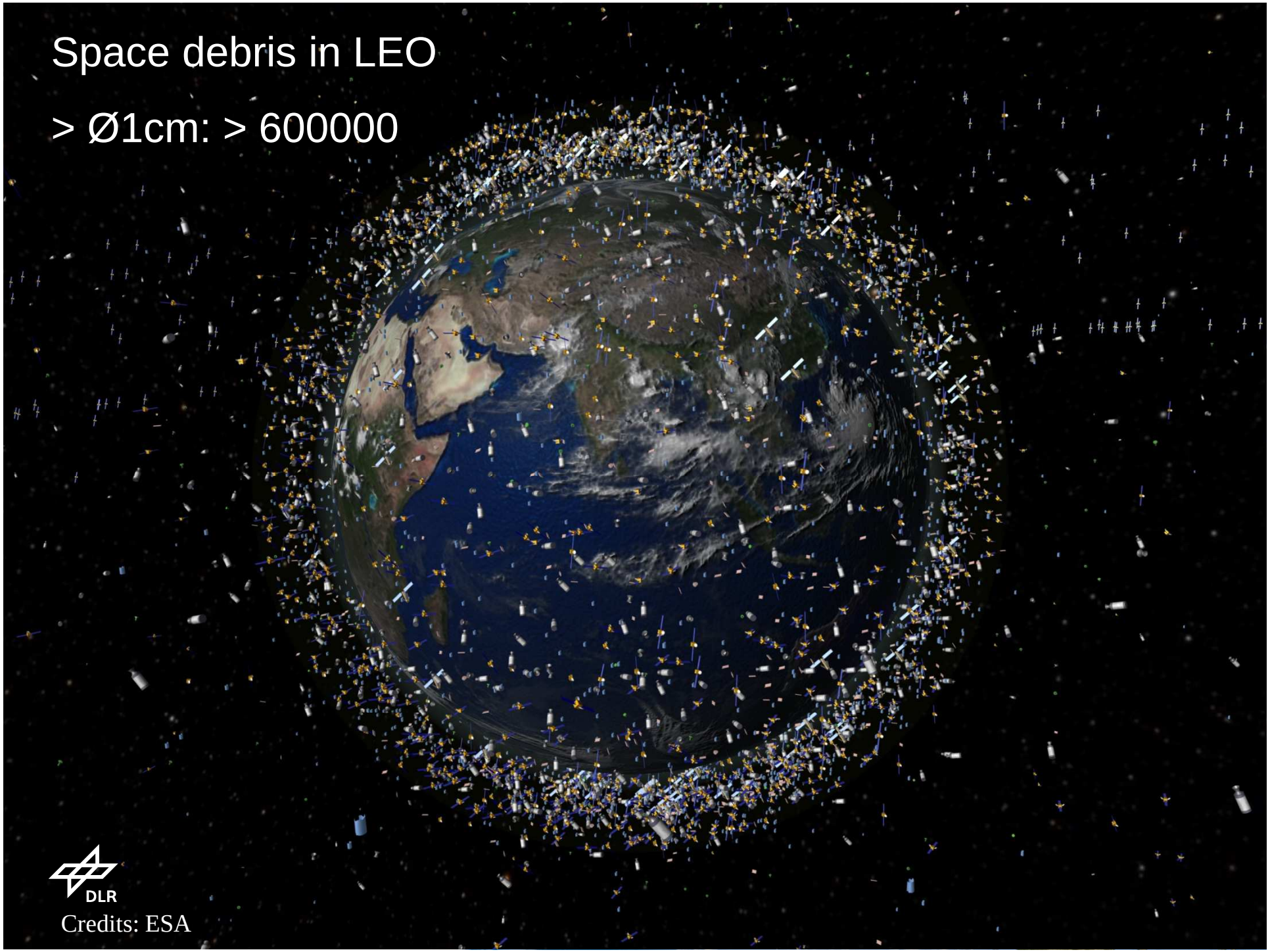
terrestrial AIS

DLR

Arctic Iceshield 1980-2010

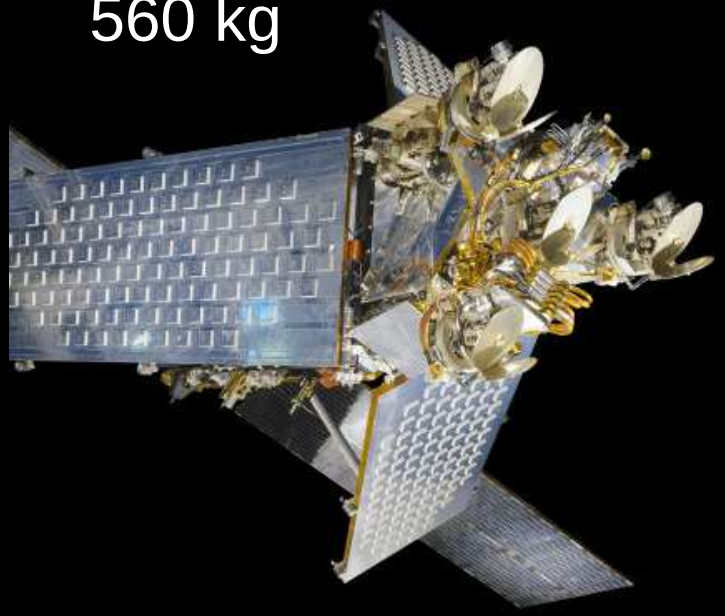


Modelled sea ice extent in 2070


Space debris in LEO
> Ø1cm: > 600000
DLR
Credits: ESA

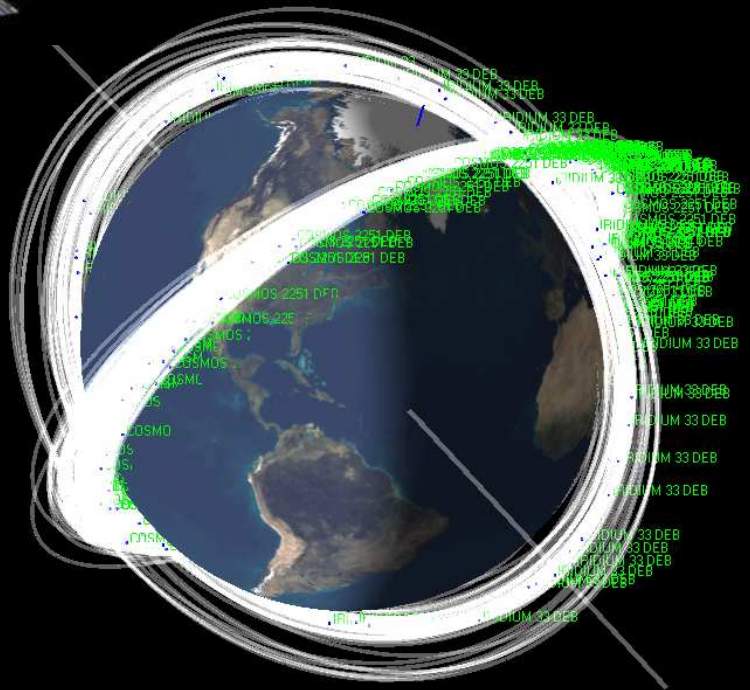
Meteorite Tscheljabinsk Feb. 15th 2013
~1500 injuries

Iridium 33
560 kg

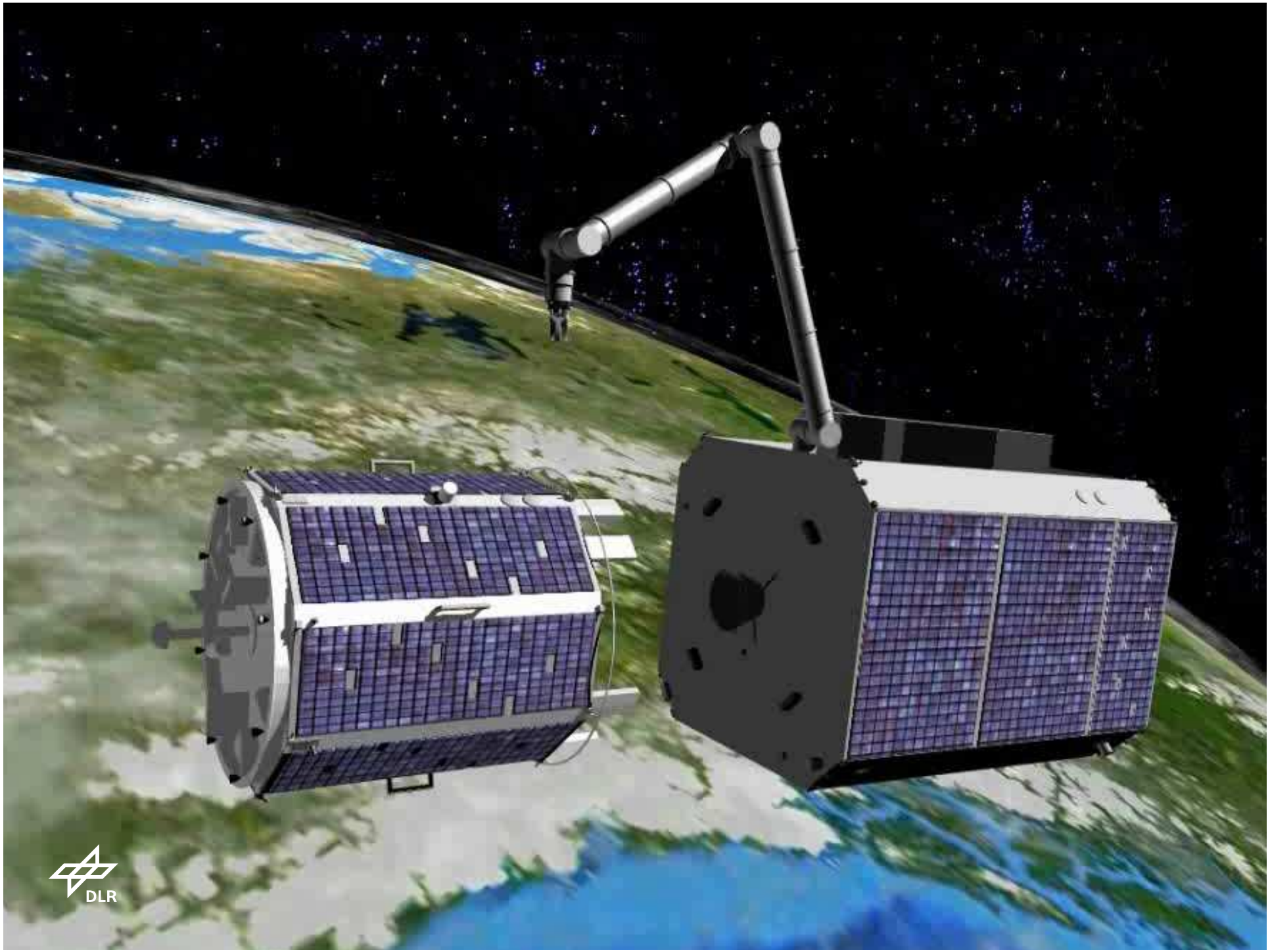


Kosmos 2251
900 kg

Collision
10.2.2009

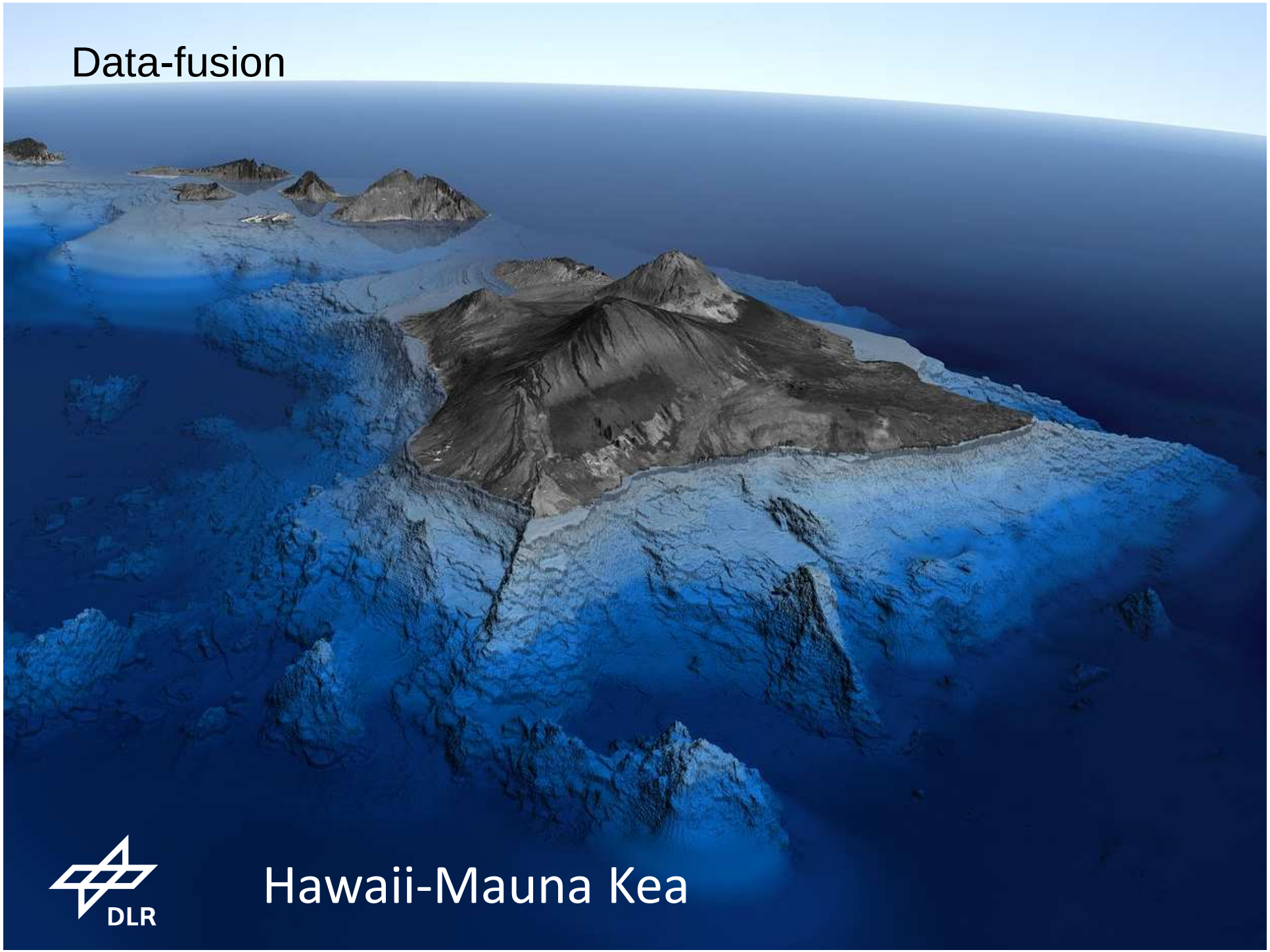


DLR


DLR

DLR Technology and Innovation for humanitarian tasks

- monitoring of developments
  - cities / regions / camps
  - agriculture / water management…
  - energy / mobility…
- telecommunication e.g. refugee camps
- crisis monitoring, early detection and warning
- post crisis/disaster needs assessment
- registration of refugees
- support for delivery of helping goods
- fleet management / logistics (last mile, airport, etc.)
- sustainable energy supply
- big data analysis, data fusion and visualisation


Data-fusion
Hawaii-Mauna Kea


The „pale blue dot“
deserves
GLOBAL COOPERATION!
DLR

Knowledge for
Tomorrow

DLR