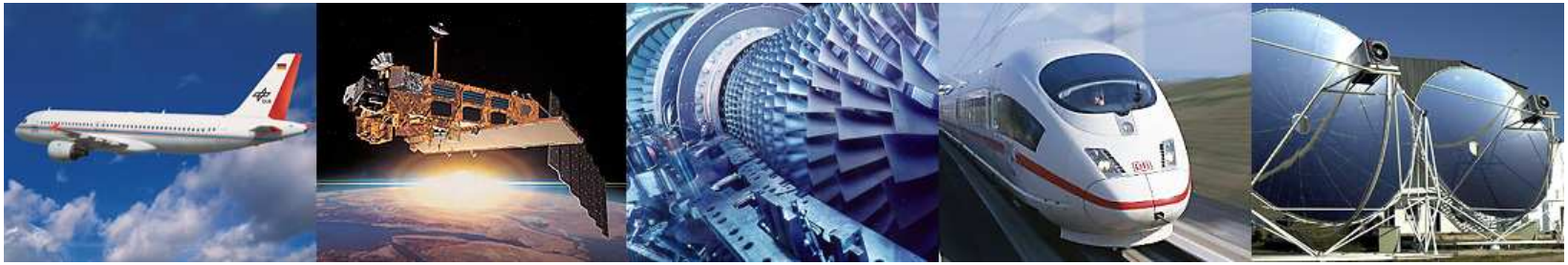
German Aerospace Center (DLR)

DLR_School_Lab Oberpfaffenhofen

Dieter Hausamann

February 28, 2012

DLR
German Aerospace Center



- Research Institution
- Space Agency
- Project Management Agency

Locations and employees

7000 employees across
32 institutes and facilities at
16 sites.

Offices in Brussels,
Paris and Washington.

DLR bodies

General Assembly

Space Committee

Senate
Chairman: State Secretary of the Federal Ministry of Economics and Technology (Homann)

Executive Board

Scientific Technical Council

Chairman	Vice Chairman Administration/Technology Marketing and Project Management Agency	Space Administration	Space Research and Technology	Aeronautics	Energy and Transport
Prof. Dr. Wörner	Hamacher	Dr. Gruppe	Prof. Dr. Dittus	Prof. Henke	Prof. Dr. Wagner

Management

Program Coordination
Security Research

Human Resources, Finance and Corporate Organization

Infrastructure

Quality Assurance

Internal Auditing and Joint Venture Management

Technology Marketing

Information Technology

Project Management Agency

Project/ Program Directorates

National-/ ESA Program

Integrated Space Program

Budget Officer Space Administration

Institutes and Facilities

Program Directorate

Programs

Projects

Technology Transfer

Institutes and Facilities

Program Directorate

Programs

Projects

Technology Transfer

Approved Design Organization

Institutes and Facilities

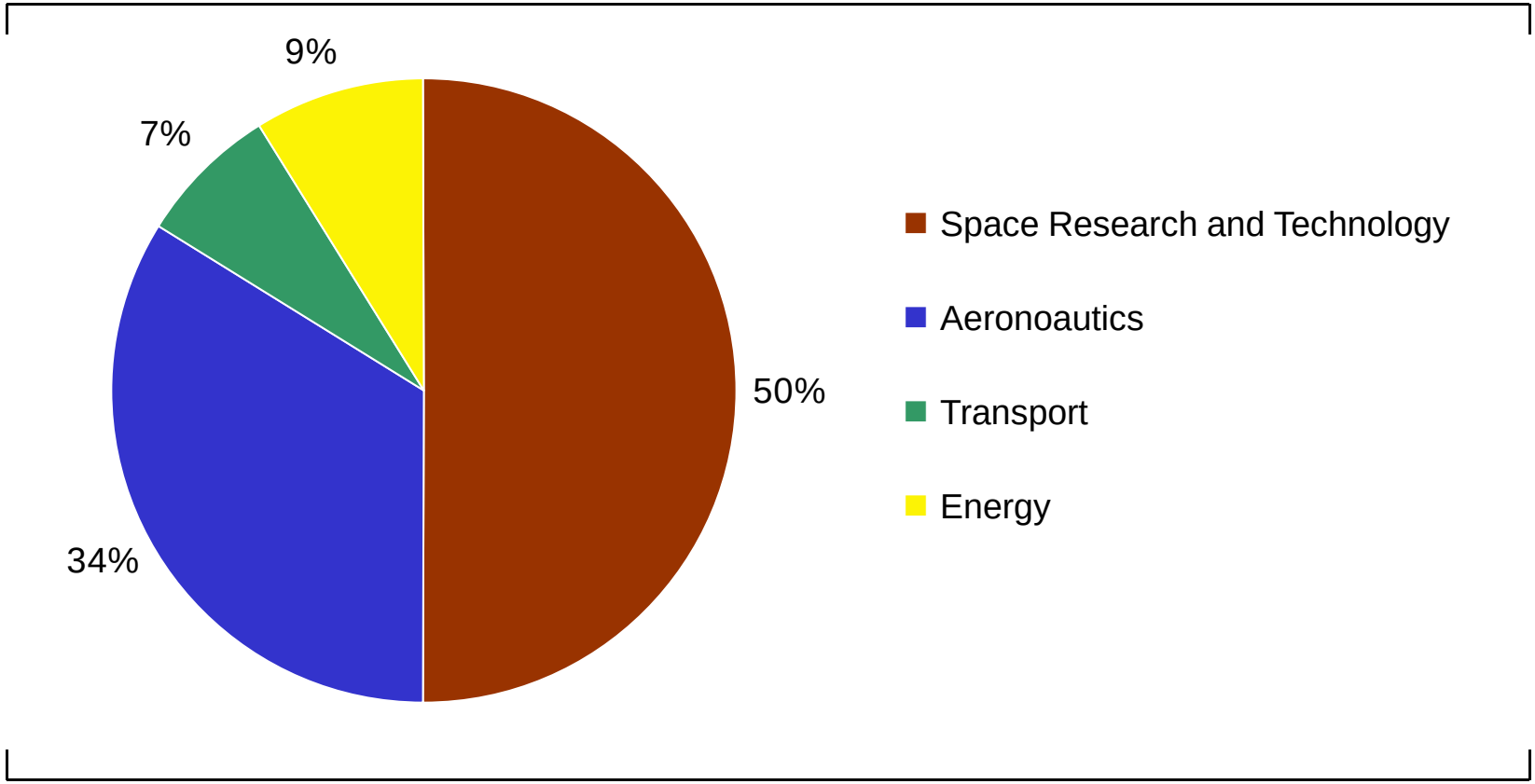
Program Directorates

Programs

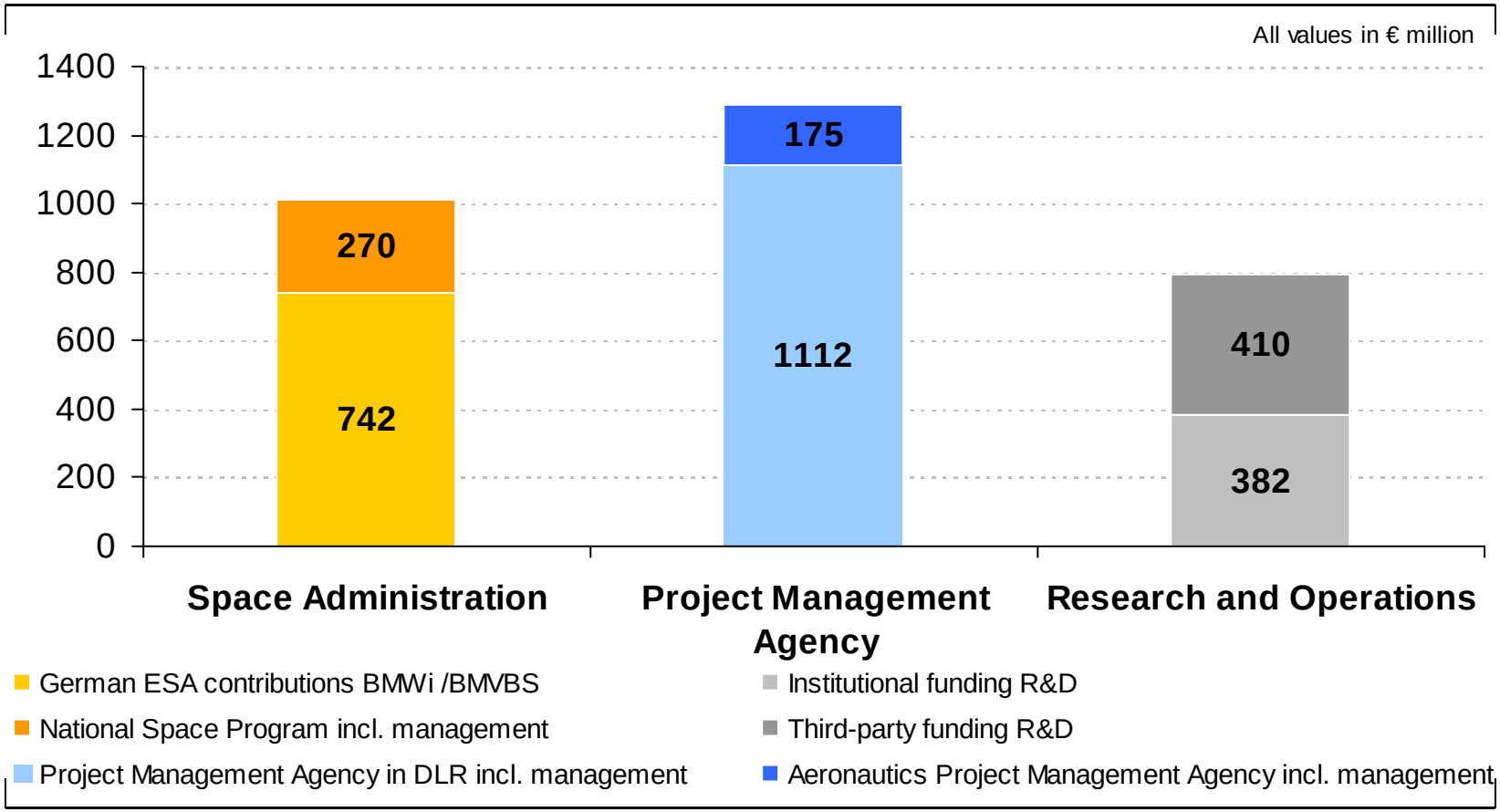
Projects

Technology Transfer

Percentage of overall income from research and operations 2010



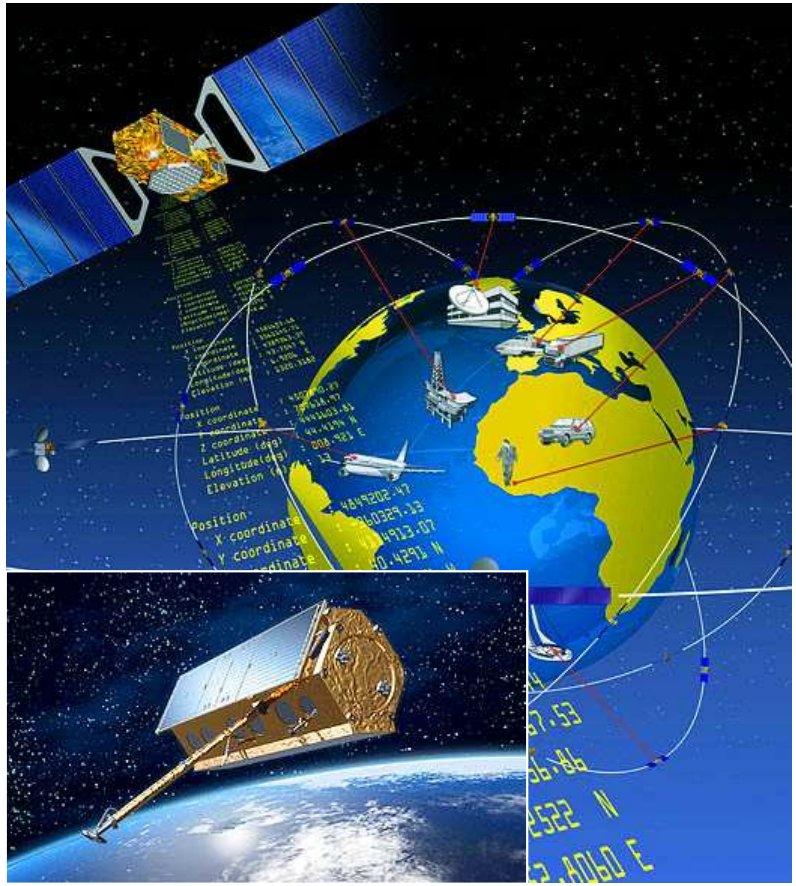
Financing of DLR and research funding 2012 (planned)

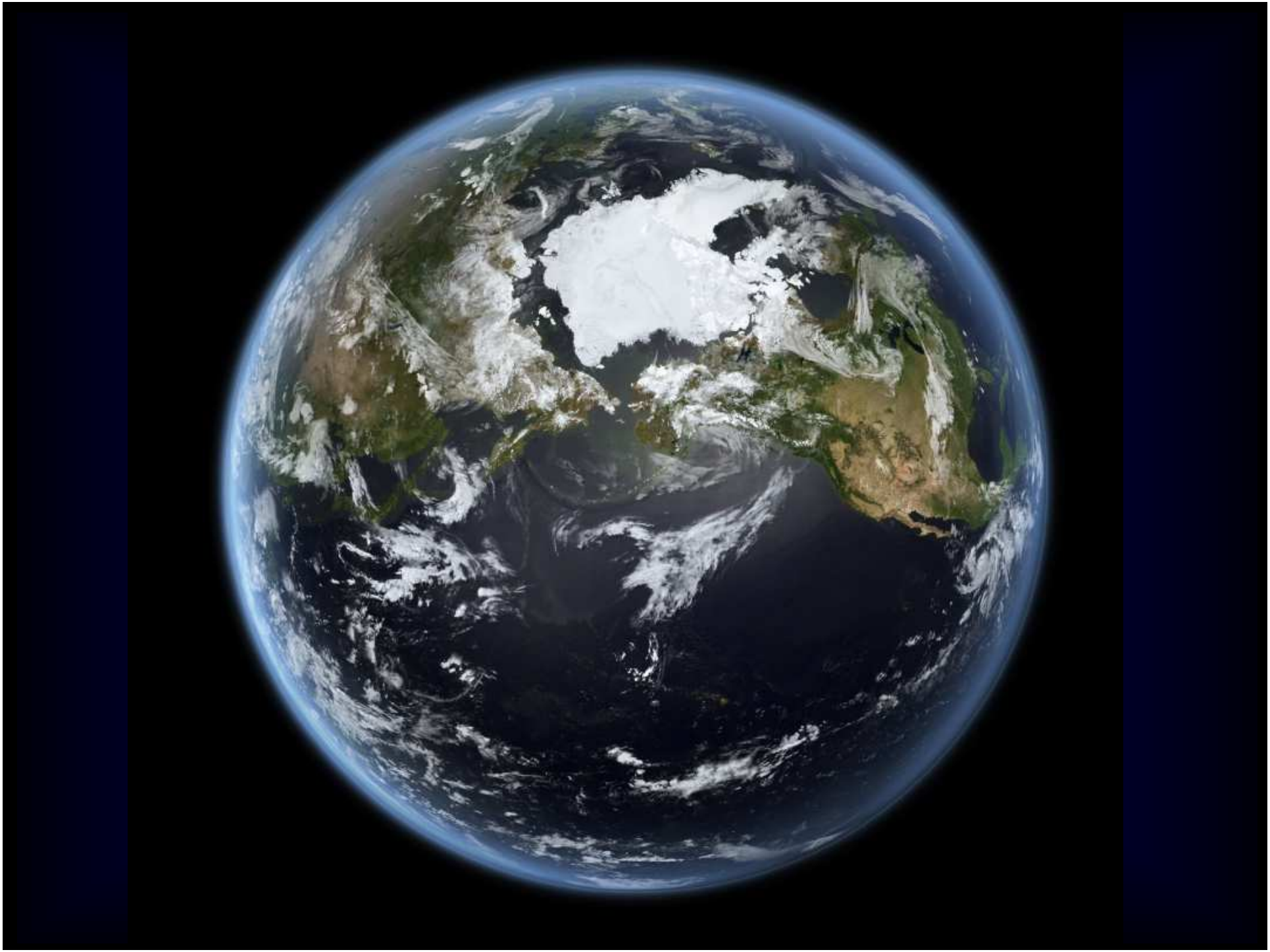


without settlement of cross-financing

DLR's tasks as the National Space Agency

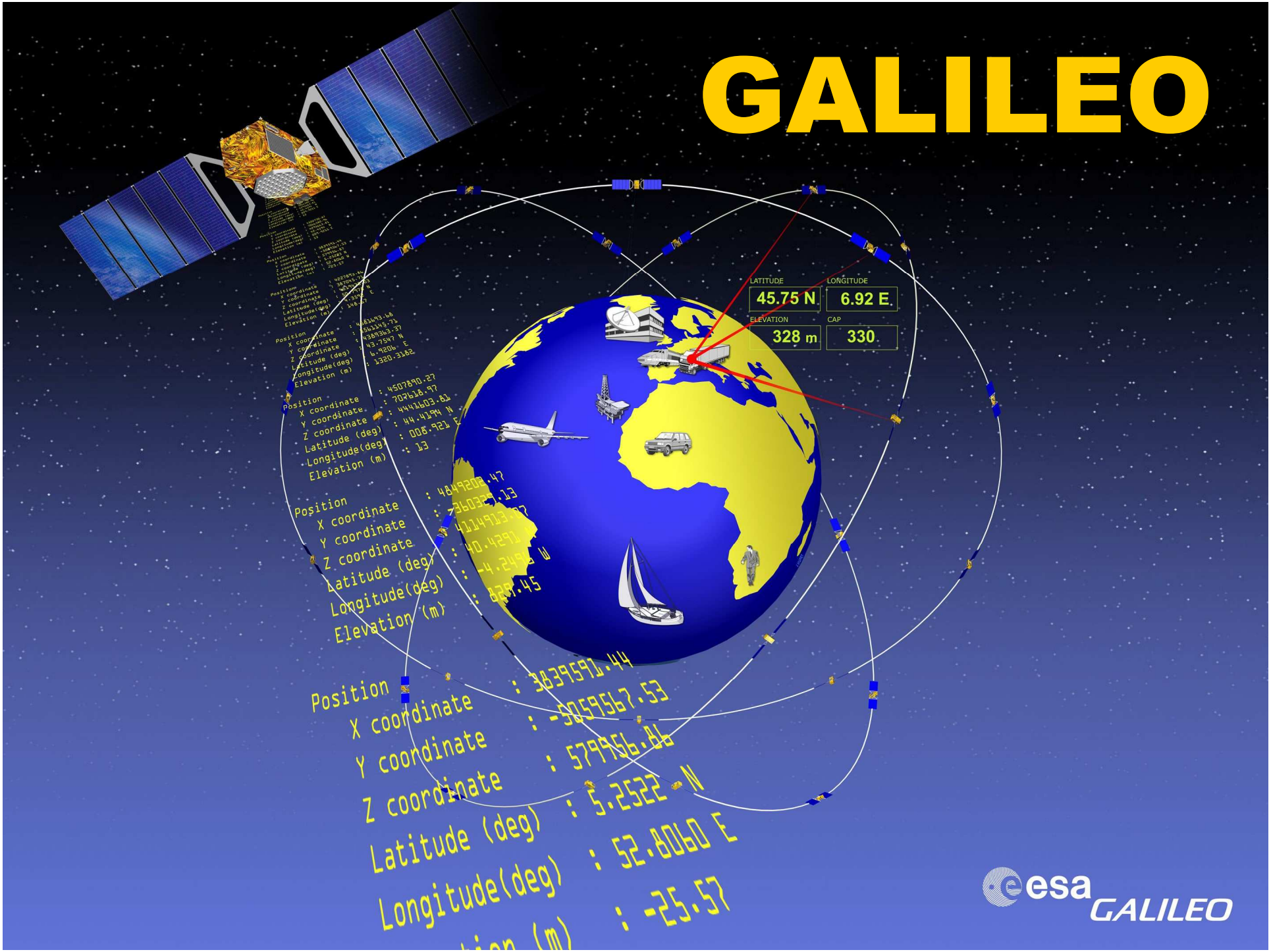
- Defining German space planning on behalf of the federal government
- Representing German space-related interests in the international arena, in particular in ESA
- Tendering, award and support of space projects in the context of the National Space Program






German Aerospace Center (DLR)
Oberpfaffenhofen
82234 Wessling
Germany


GCC


GALILEO
LATITUDE
45.75 N
LONGITUDE
6.92 E.
ELEVATION
328 m
CAP
330
Position
X coordinate : 3839591.44
Y coordinate : -5059567.53
Z coordinate : 579956.86
Latitude (deg) : 5.2522 N
Longitude(deg) : 52.8060 E
: -25.57
esa GALILEO

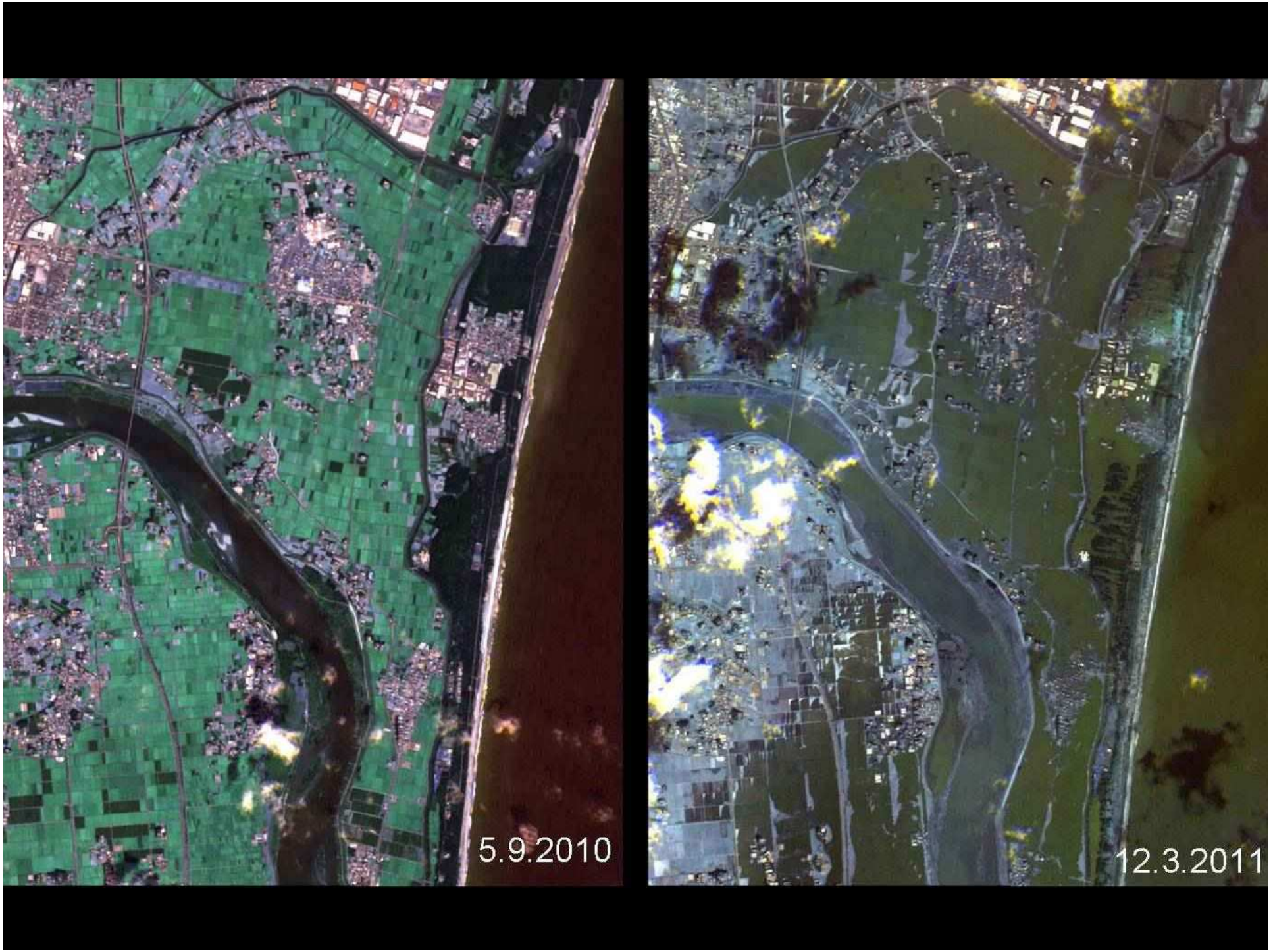
→ BIRTH OF THE EUROPEAN SATELLITE NAVIGATION CONSTELLATION

Galileo In-Orbit Validation


GALILEO
IOV

Indonesia/Lho‘Nga - Pre/Post-Disaster mapping

DLR


5.9.2010
12.3.2011


-MODIS 26.08.07
Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –
a service of DFD
DLR

Desaster-Monitoring Environmental Research

Oil catastrophy “Deepwater Horizon” Gulf of Mexico

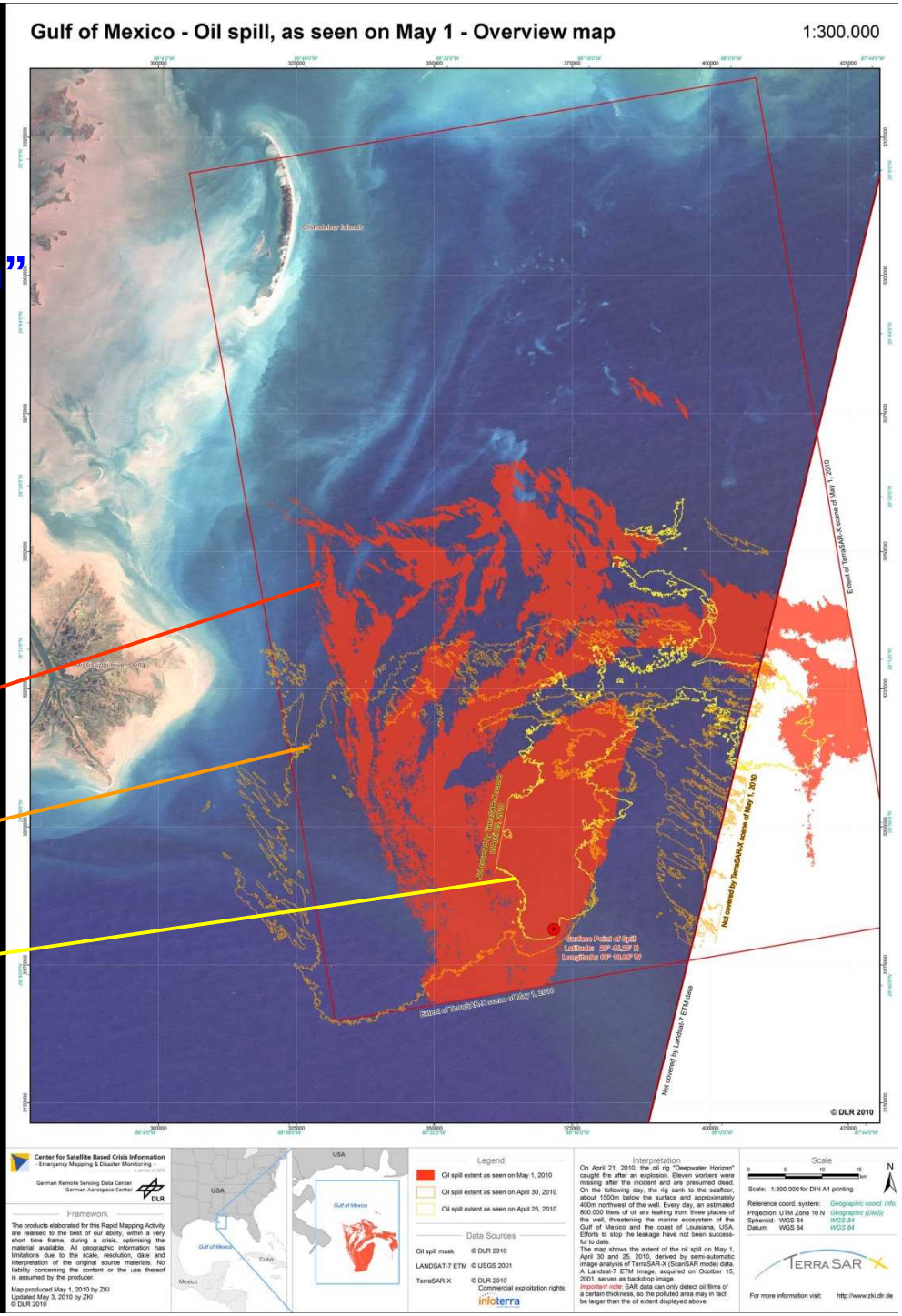
Oil detection: TerraSAR-X (ScanSAR)

Background image: Landsat 7 ETM

1. May 2010

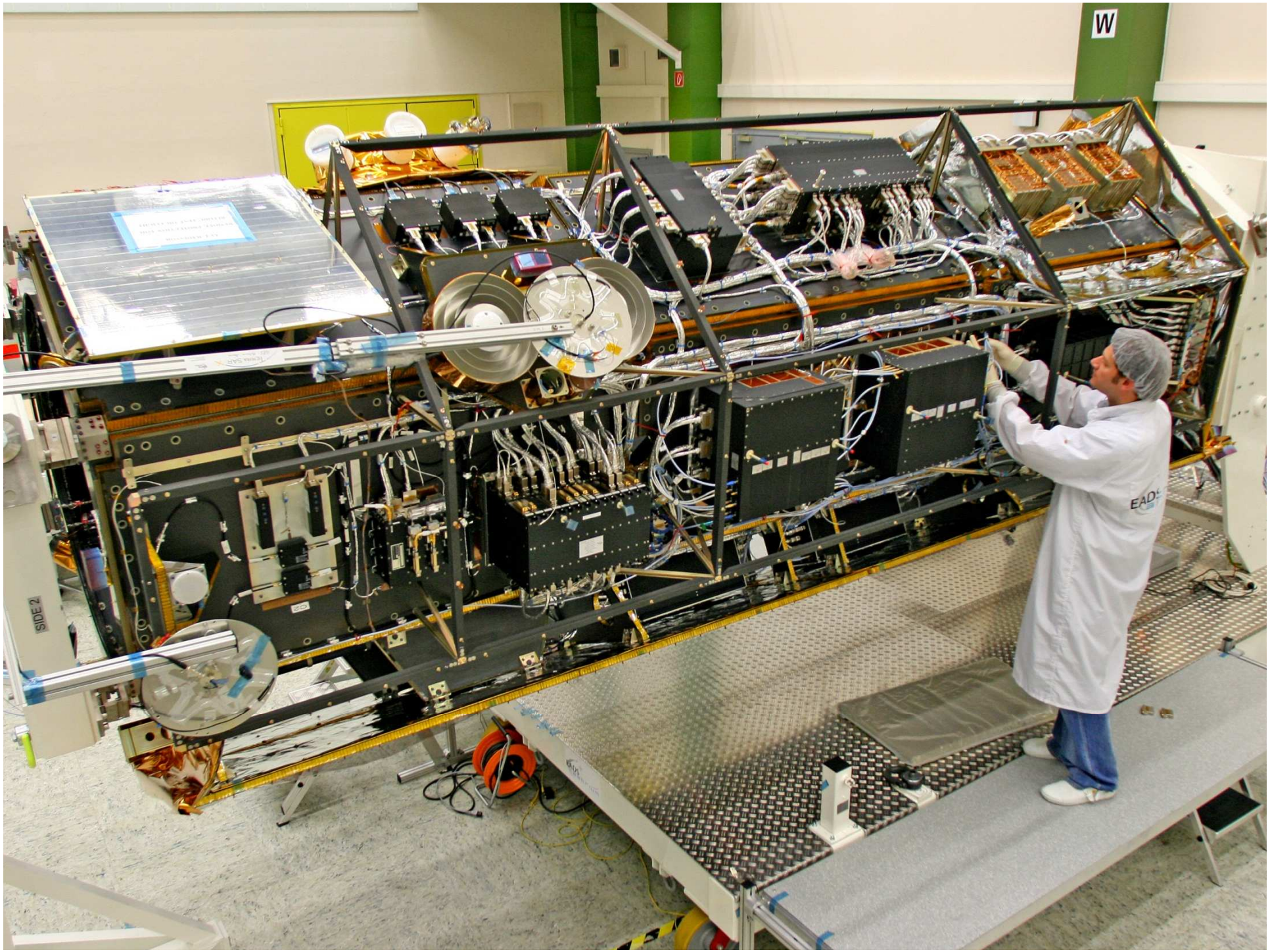
30. April 2010

30. April 2010

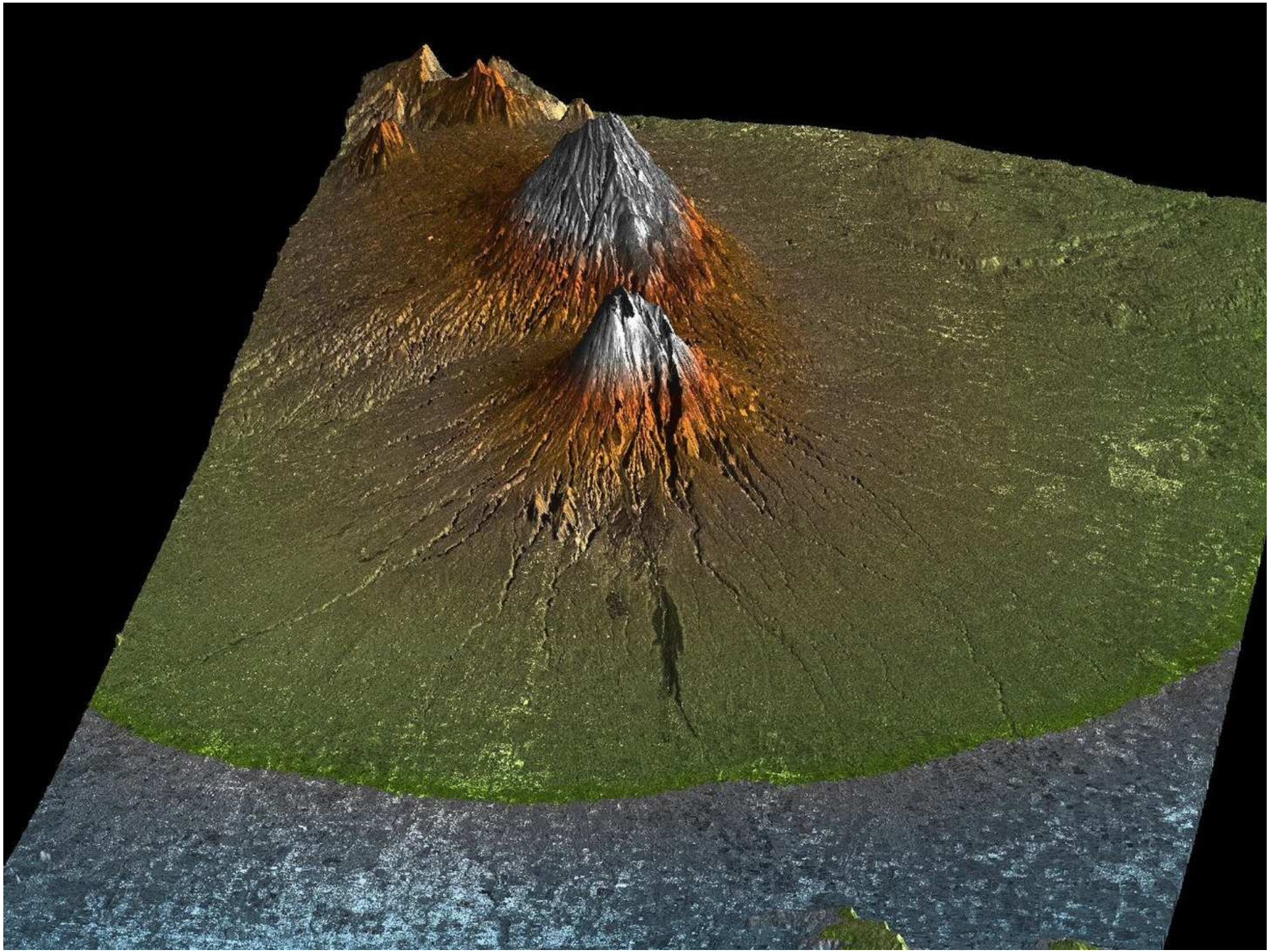


DLR

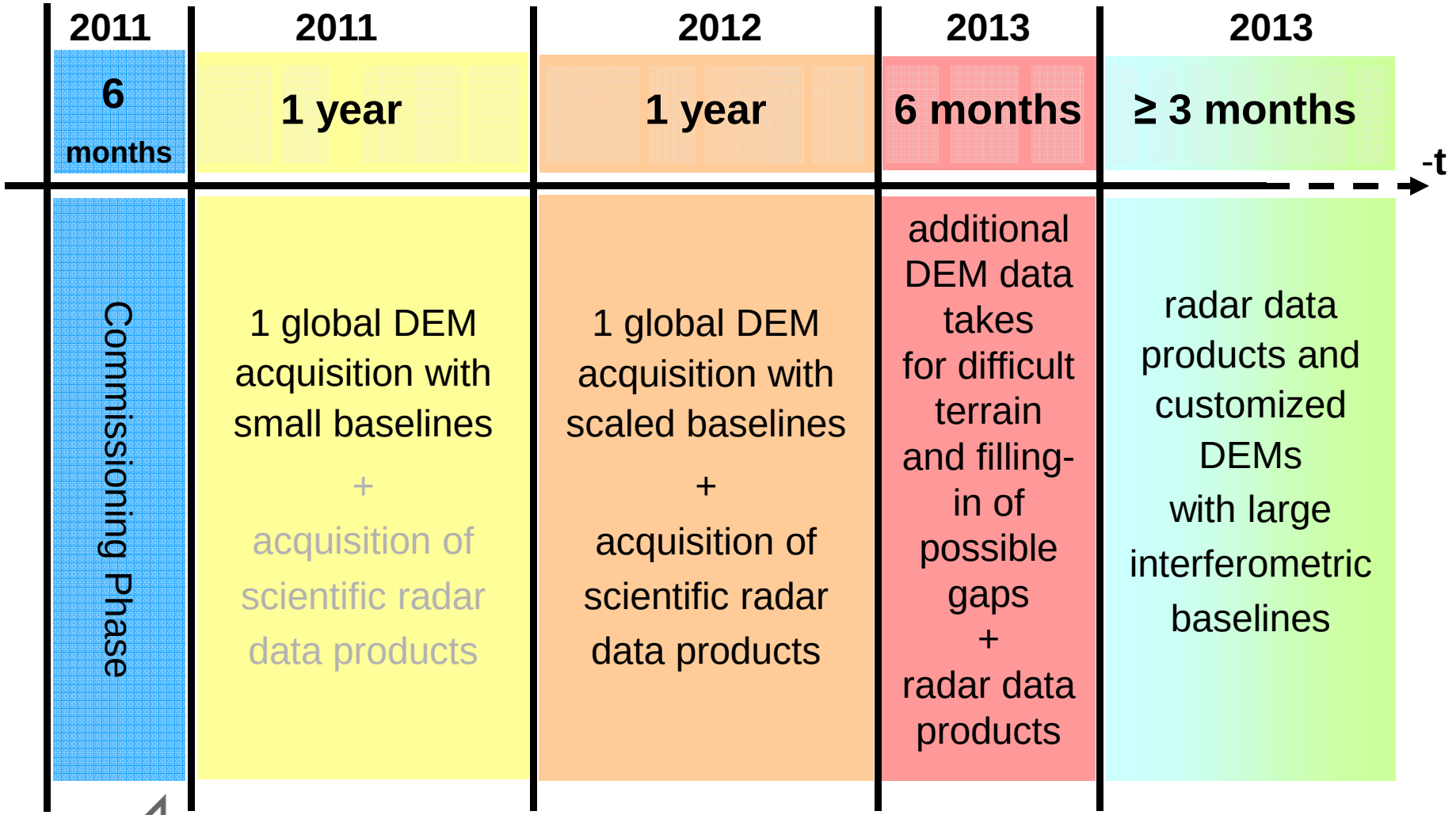
Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –
a service of DFD


W
SIDE 2
EADS


TanDEM-X

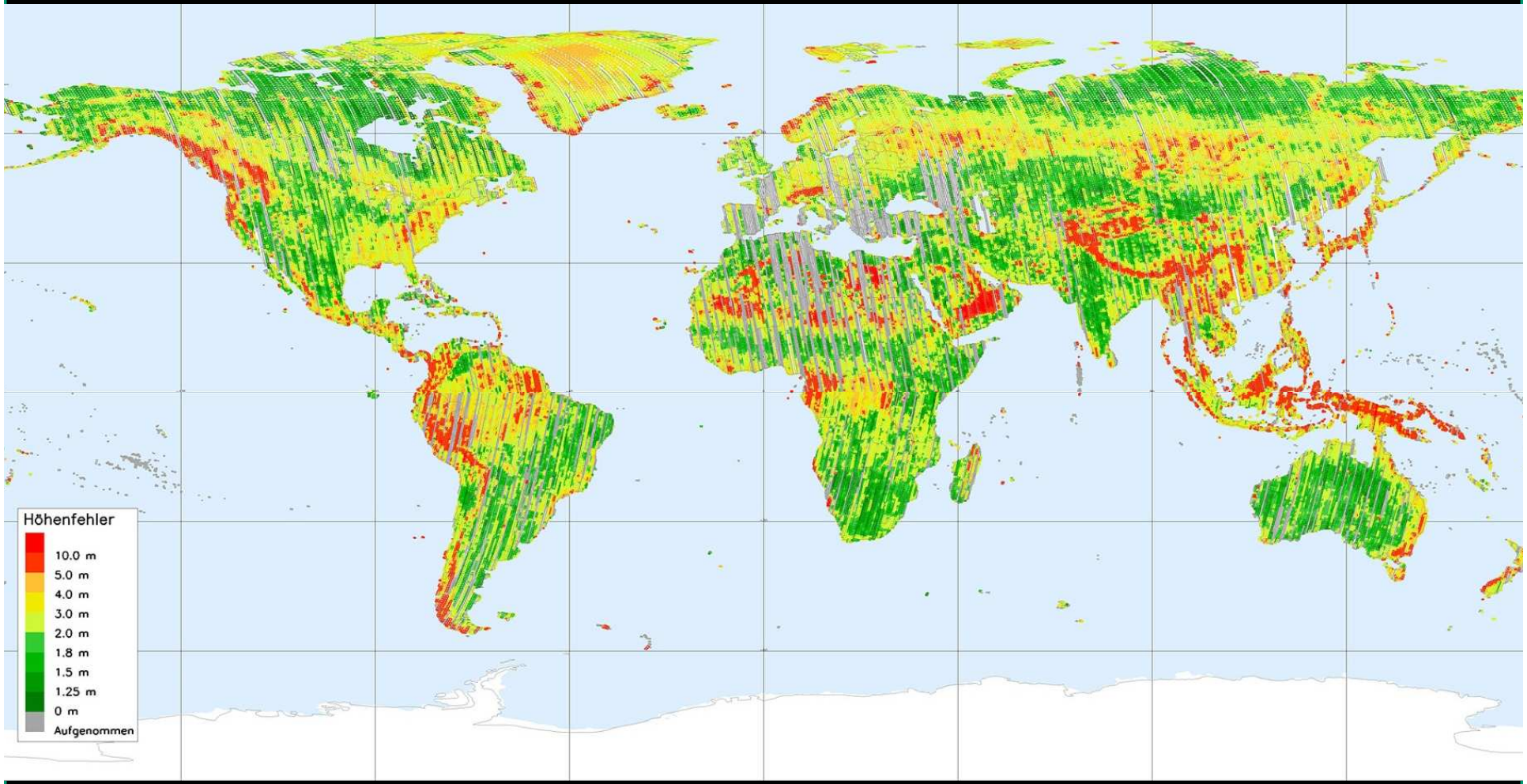


General Outline of the Data Acquisition Plan



DLR

Mission TanDEM-X: Status End 2011



Earth Observation Center EOC – 20.07.2010

1.500.000.000.000.000 Bytes

DLR

DLR_School_Lab

Oberpfaffenhofen

DLR

Mathematics

Informatics

Natural Sciences

Technology

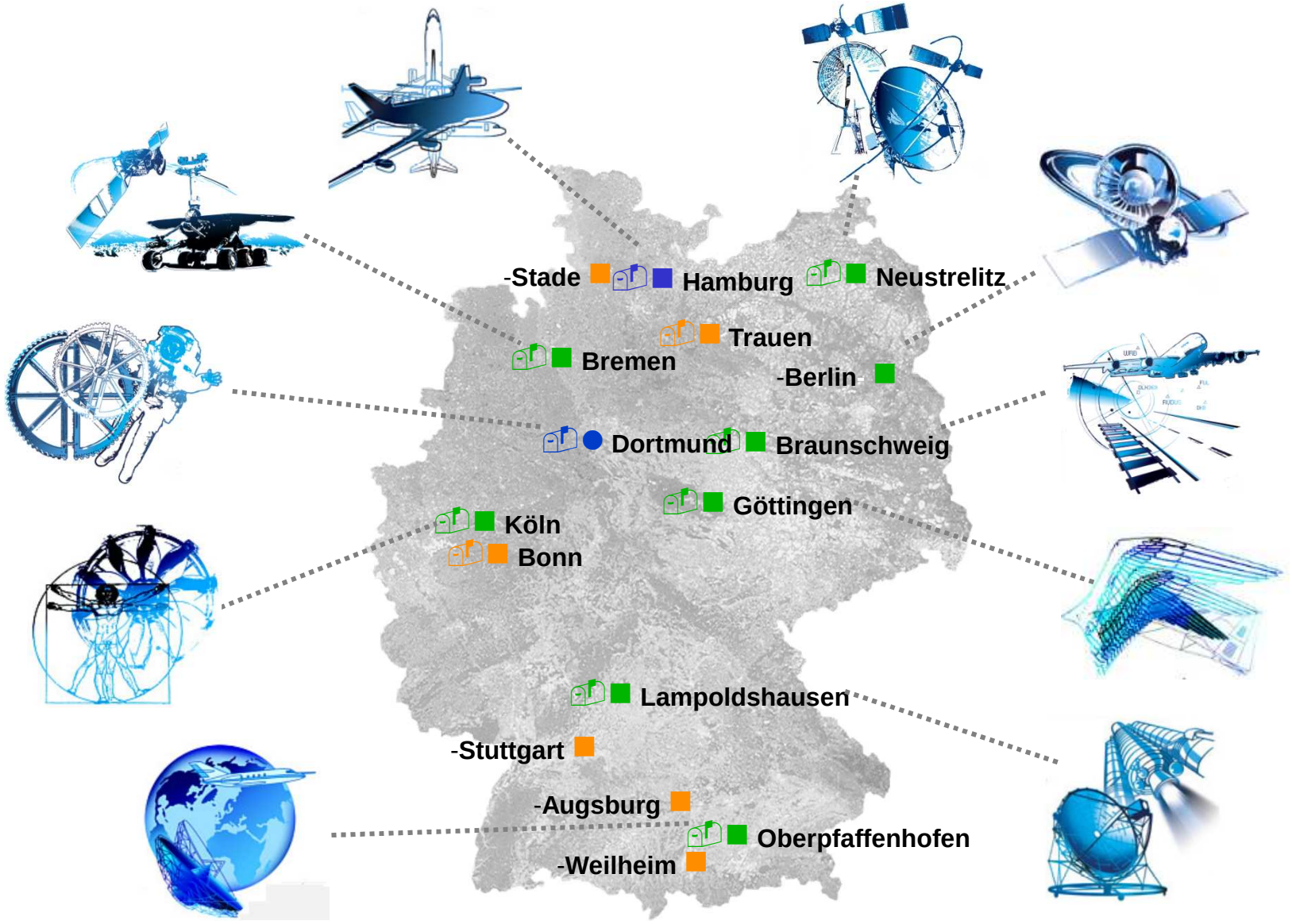
MINT

Lack of Engineers in Germany in Dec 2011: 80.000

DLR

Promoting the Next-Generation Scientists

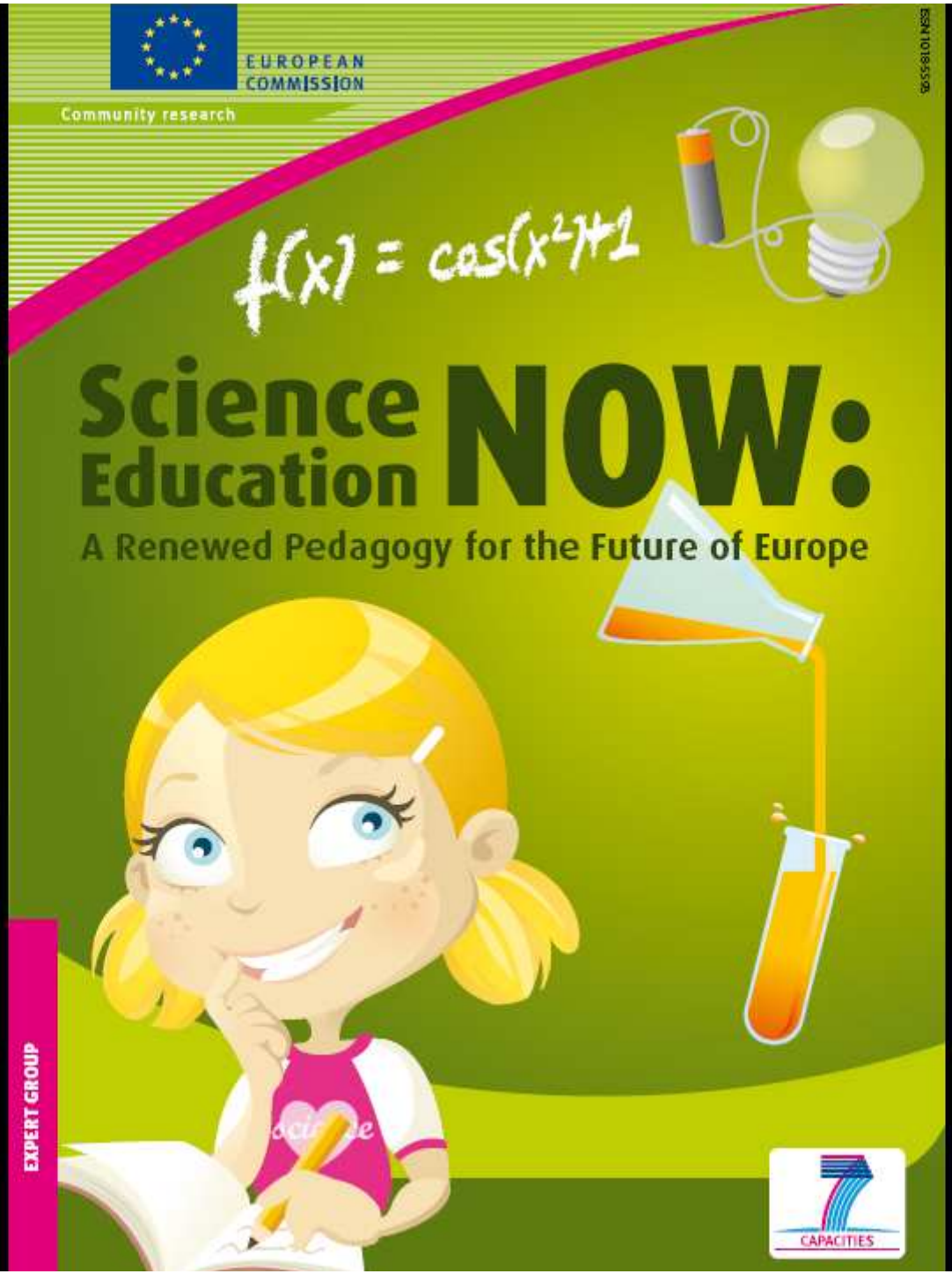
DLR_School_Labs



DLR

IBSE

Inquiry-Based Science Education

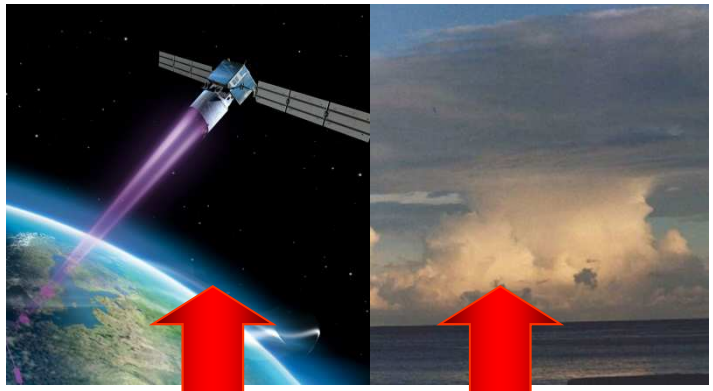


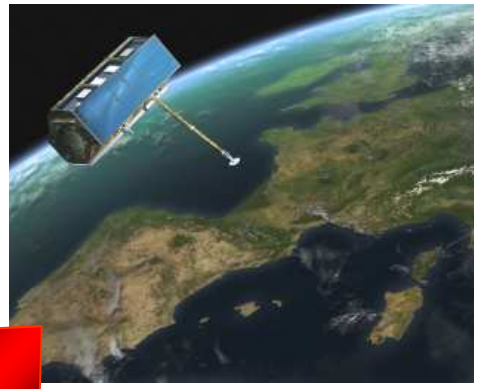
Martin Wagenschein (ca. 1950) ‚Entdeckendes Lernen‘

DLR Site Oberpfaffenhofen

Employees: Approx. 1600
Size of site: 245 000 m²
Research institutes and facilities:

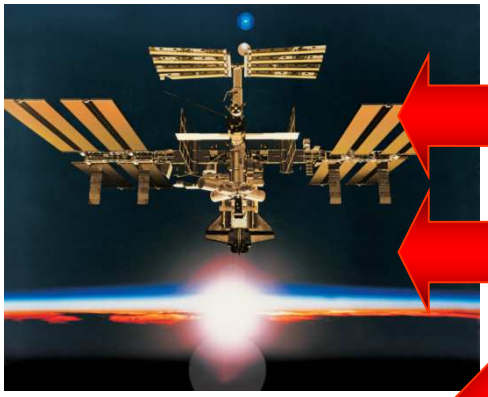
- Microwaves and Radar Institute
- Institute of Communications and Navigation
- Institute of Atmospheric Physics
- Remote Sensing Technology Institute
- Institute of Robotics and Mechatronics
- German Remote Sensing Data Center
- Space Operations and Astronaut Training
- Galileo Control Center
- Flight Experiments

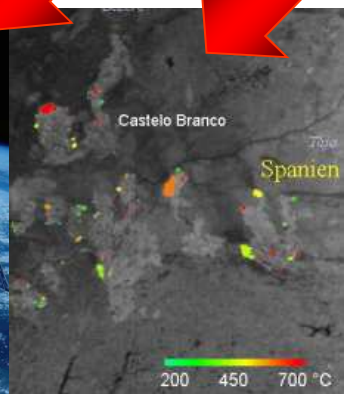


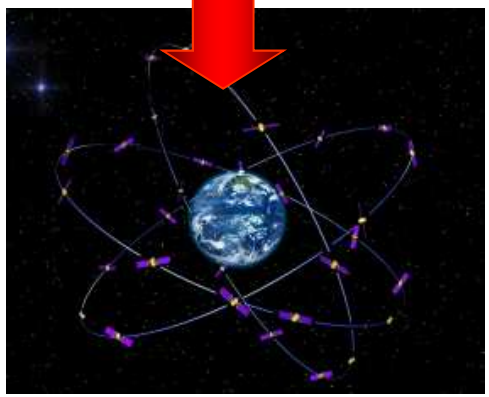


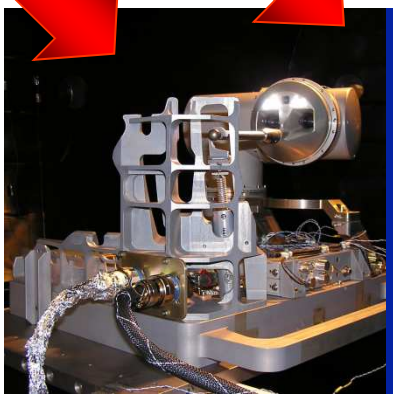
DLR_School_Lab

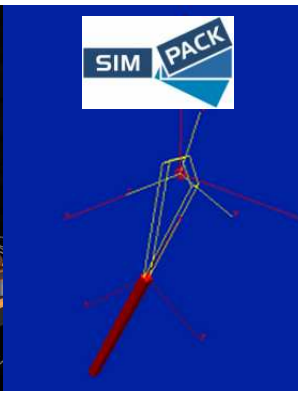
Oberpfaffenhofen











Experiments
DLR_School_Lab Oberpfaffenhofen

Experiment	Institute
1. Infrared Technology	Remote Sensing Technology
2. Laser Technology	Physics of the Atmosphere
3. Radar Technology	Microwave and Radar Technology
4. Envnmtl. Remote Sensing	Remote Sensing Data Center
5. Weather and Climate	Physics of the Atmosphere
6. Satellite Data Analysis	Remote Sensing Data Center
7. Satellite Navigation	Communication and Navigation
8. Robotics	Robotics and Mechatronics
9. Virtual Mechanics	Robotics and Mechatronics
10. Flight Team Simulator	Flighte Operations
11. Mobile Rocket Basis	Space Operations
12. ASUROnaut	Robotics and Mechatronics
13. Tunnel Boring Machine	Technical University Munich

DLR


Team 2011

Illustration: Daniel Matzenbacher für DIE ZEIT, www.matzenbacher.de

Ansturm der Ahnungslosen

Die meisten Abiturienten wissen nicht, was an der Universität auf sie zukommt. Engagierte Lehrer, Professoren und Studenten

Finnish Students - 05 December, 2011

09:00 – 10:00	**Introduction**
10:00 – 12:00	**Experiment #1**
12:00 – 13:00	**Lunch Break**
13:00 – 15:00	**Experiment #2**
15:00 – 15:30	**German Space Operations Center**
15:30 – 16:00	**Feedback**

DLR

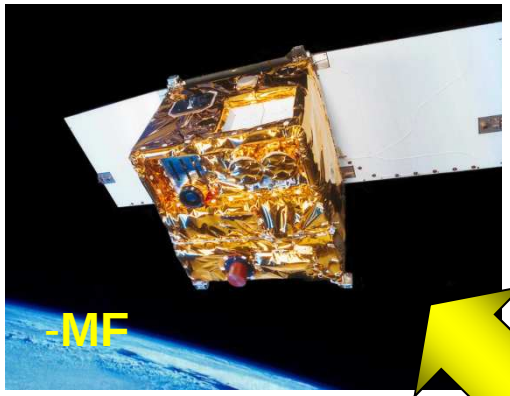
Today‘s Experimental Programme

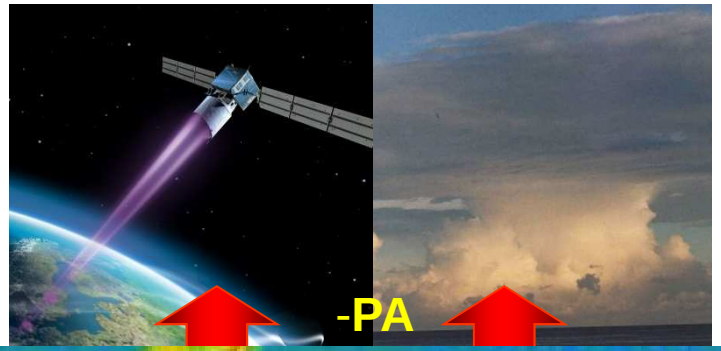
Experiment	Morning	Afternoon	Max. Number
Infrared Technology			6
Laser Technology	Julian	Nicola	6
Robotics			4!
Radar Technology			6
Satellite Navigation			6
Optical Environmental R.S.			6
Weather and Climate			9
Satellite Data			9
Virtual Mechanics	Ingo	Ingo	9
Flight Team Simulator			4!
Mobile Rocket Basis	Ulli		6
Tunnel Boring Machine		Thomas	4!

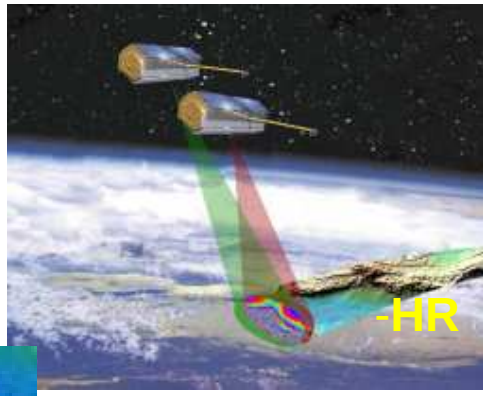
DLR_School_Lab

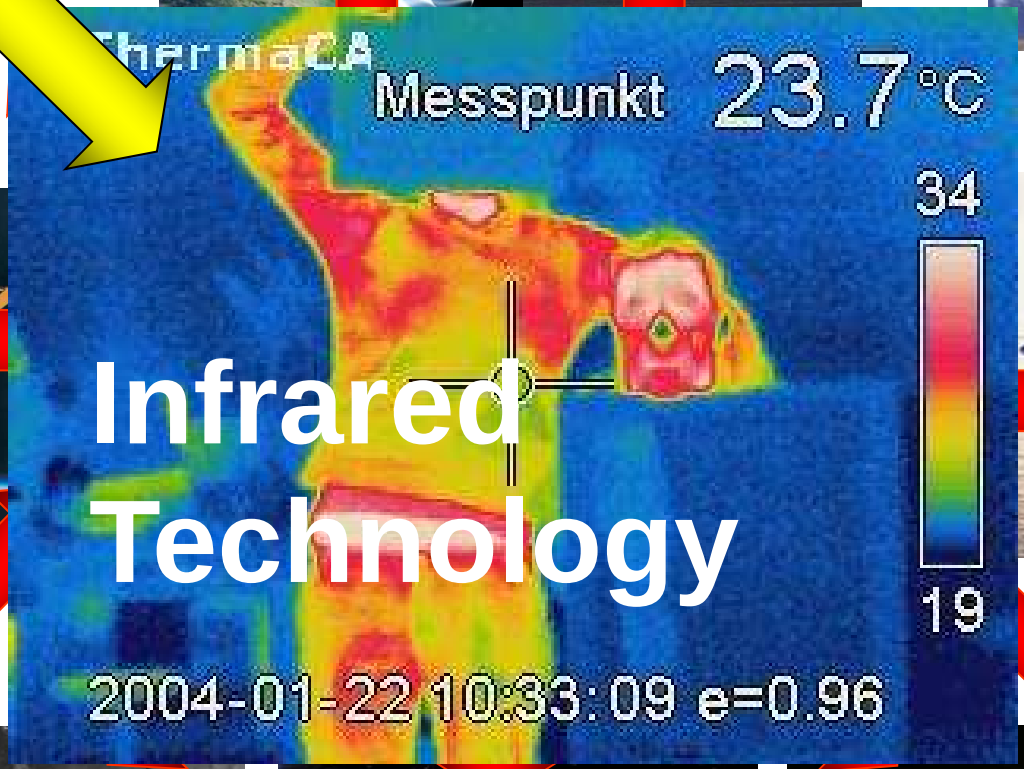
Oberpfaffenhofen

DLR


-MF


-PA

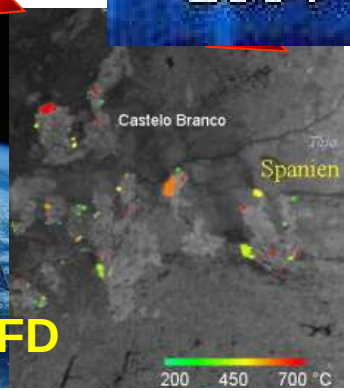

-HR

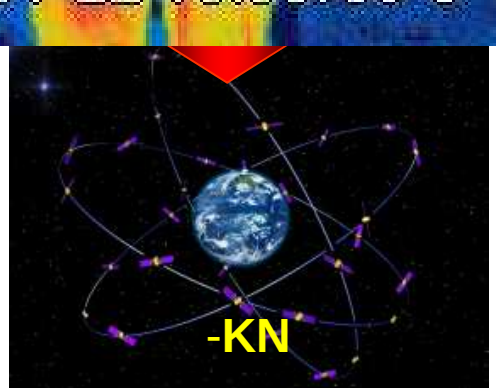

ThermaCA
Messpunkt 23.7°C
34
19
Infrared
Technology
2004-01-22 10:33:09 e=0.96

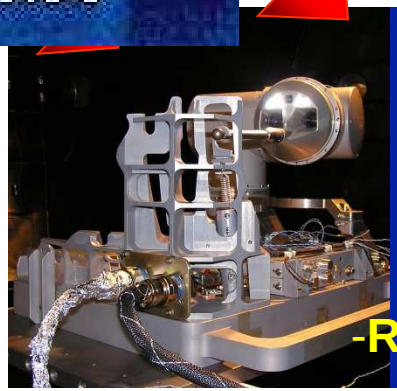

-RB

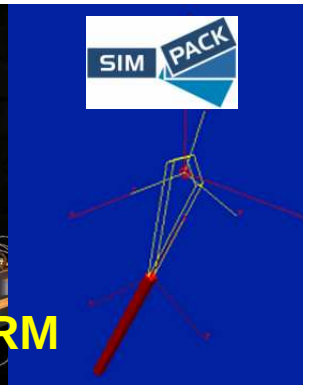

-FB


-DFD

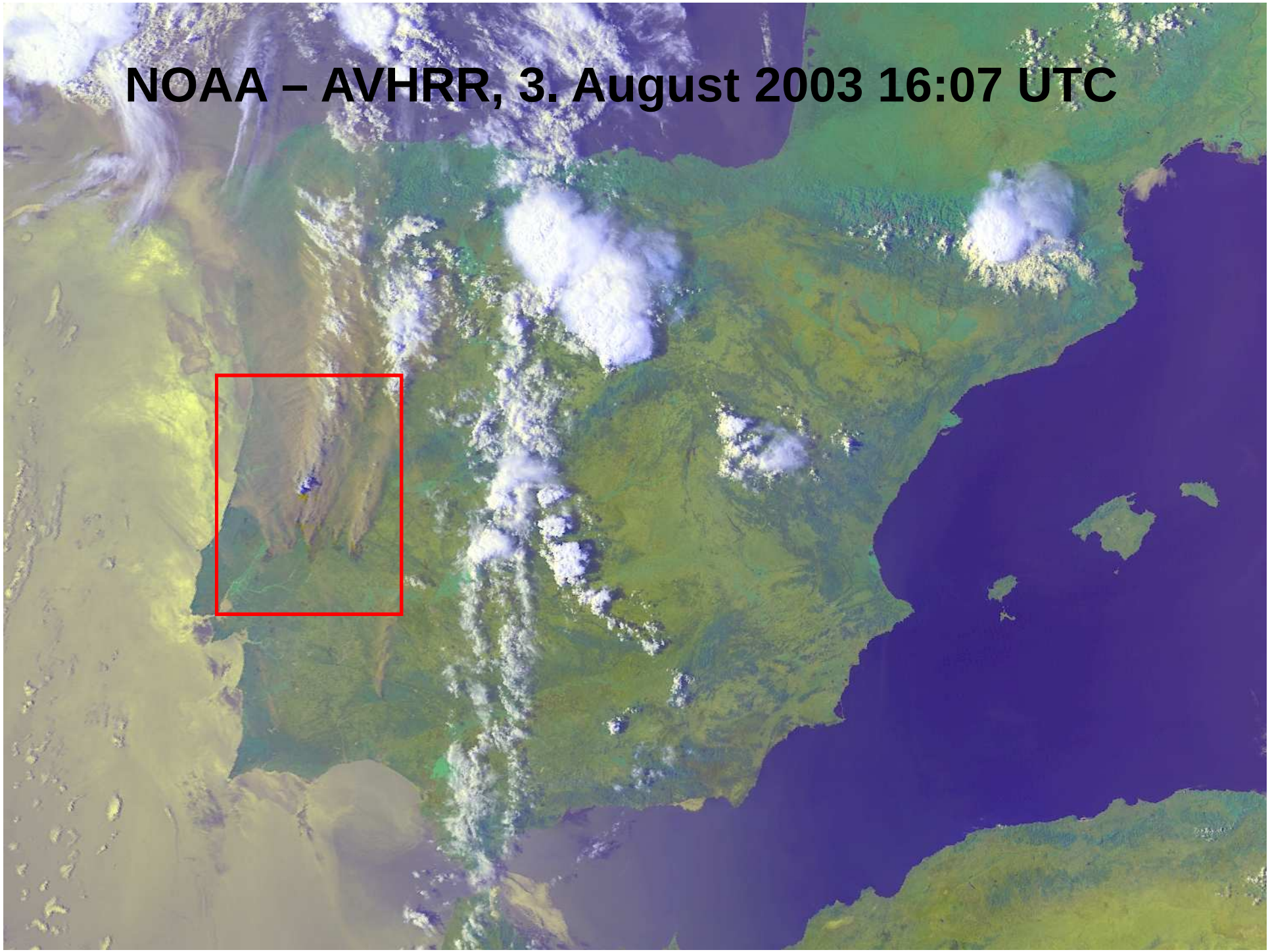

Castelo Branco
Spanien
200 450 700 °C

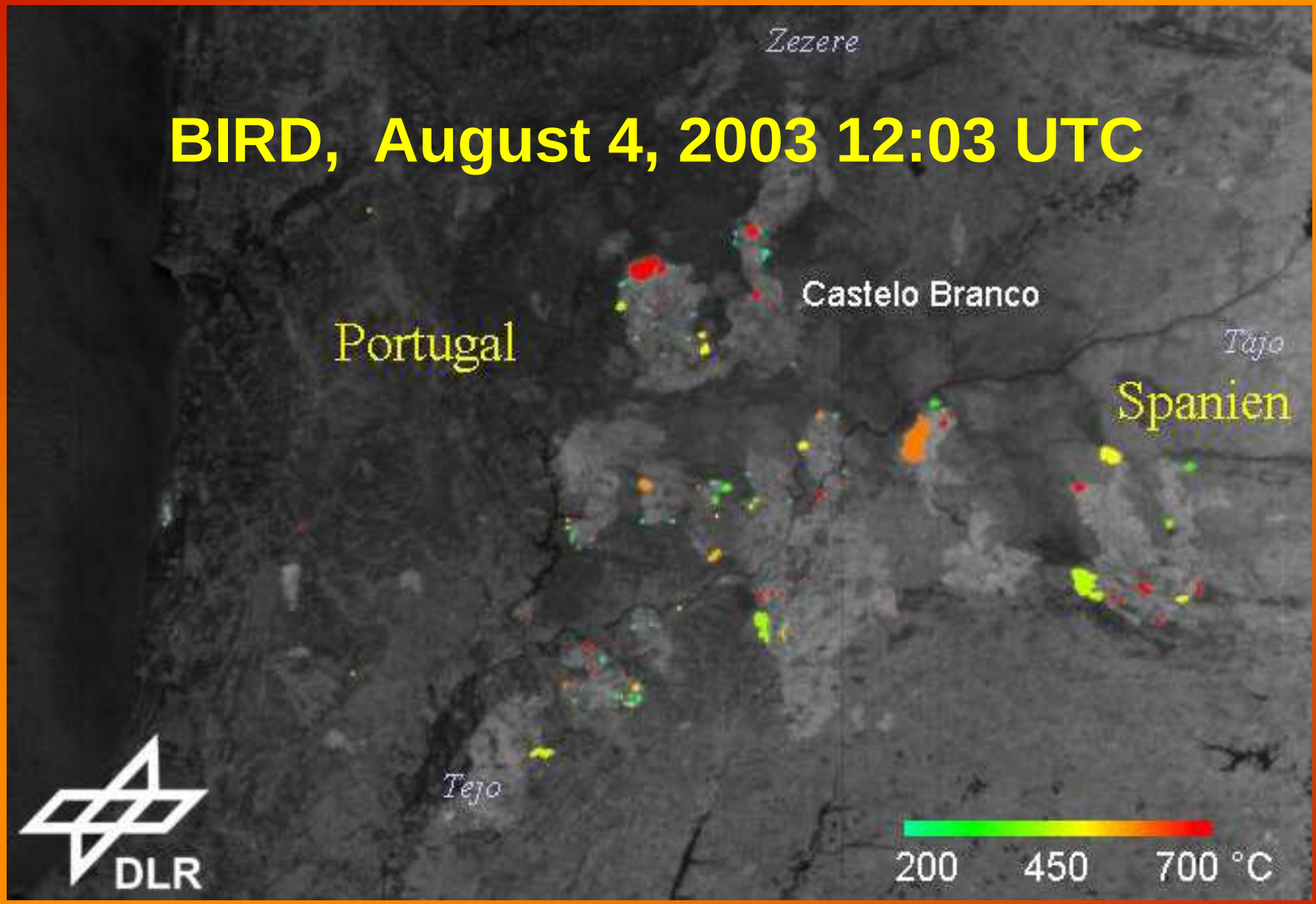

-KN


-RM


SIM
PACK

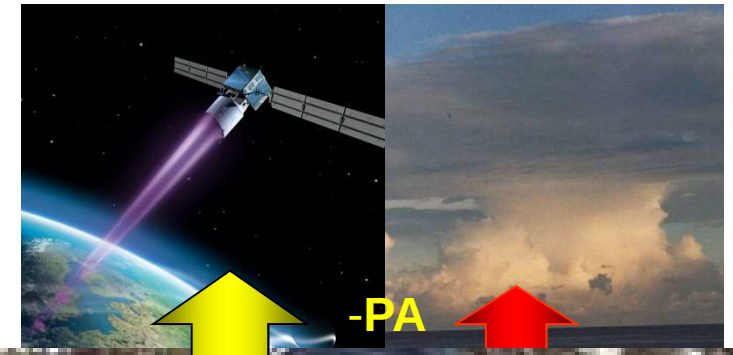

MODIS 26.08.07
Center for Satellite Based Crisis Information
– Emergency Mapping & Disaster Monitoring –
a service of DFD
DLR

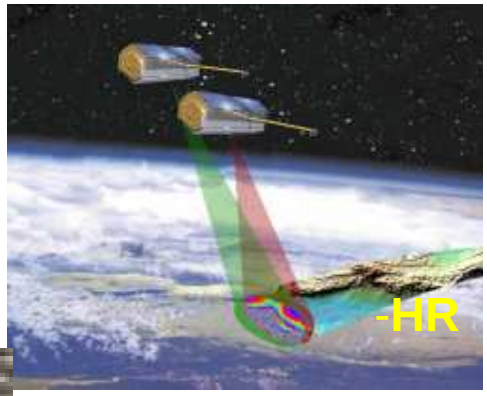

NOAA – AVHRR, 3. August 2003 16:07 UTC


Zezere
BIRD, August 4, 2003 12:03 UTC
Castelo Branco
Portugal
Tajo
Spanien
Tejo
DLR
200
450
700 °C


ThermaCA
Messpunkt 30.4°C
36
21
2 16:15:52 e=0.95


-MF


-PA

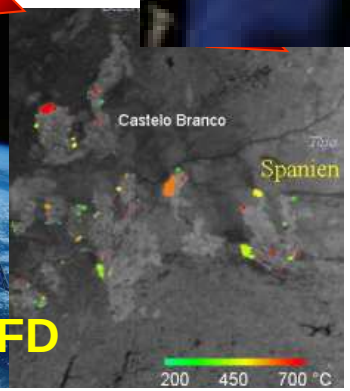

-HR


Laser
Technology

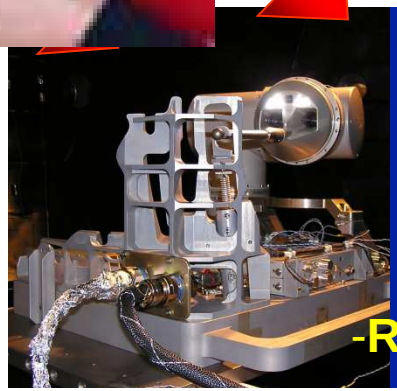

-RB

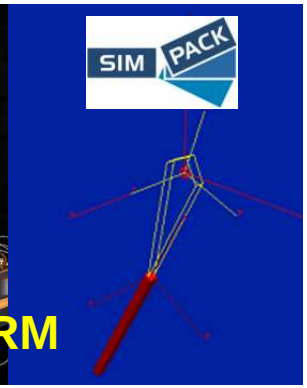

-FB


-DFD


Castelo Branco
Spanien
200
450
700 °C

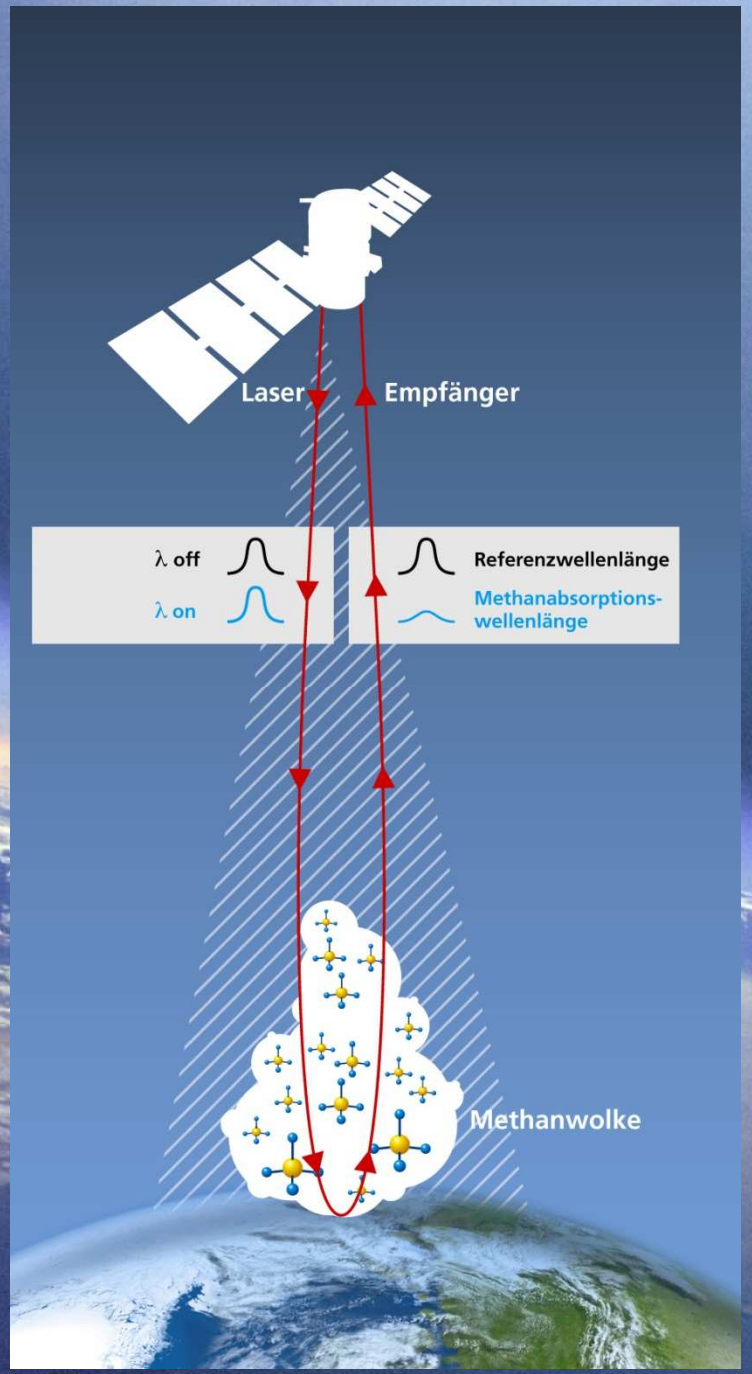

-KN

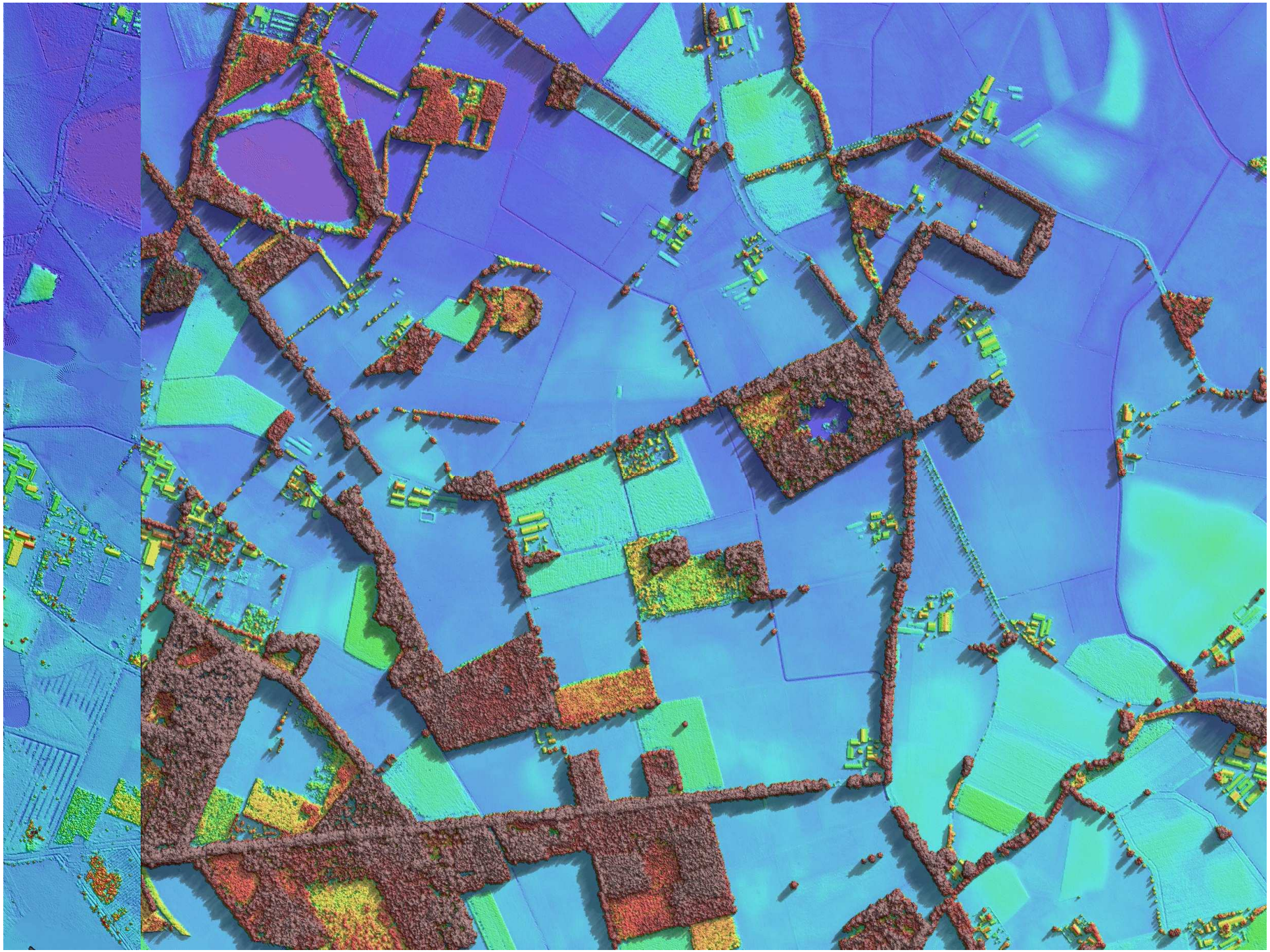

-RM


SIM
PACK

MERLIN

Methane Remote Sensing Lidar Mission

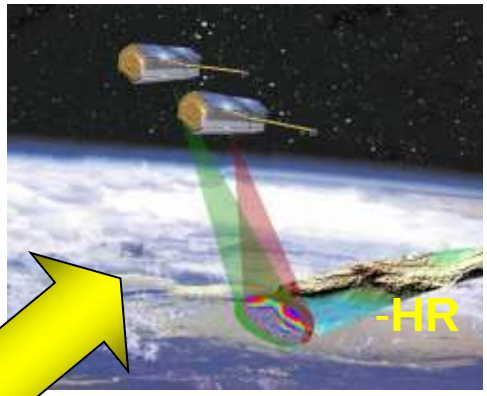




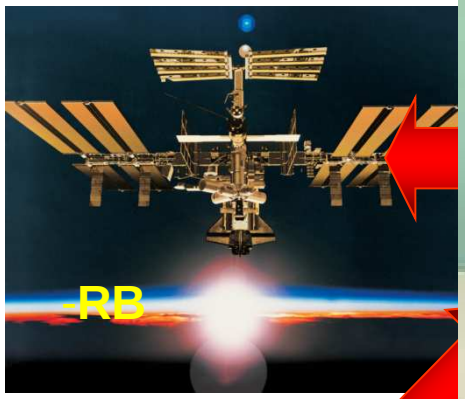

TITAN


-MF


-PA

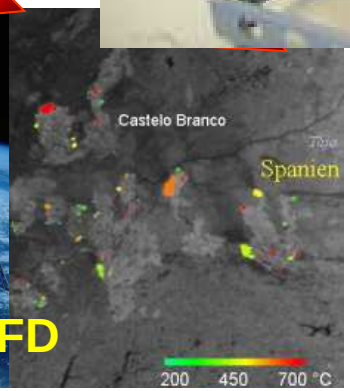

-HR


Radar
Technology

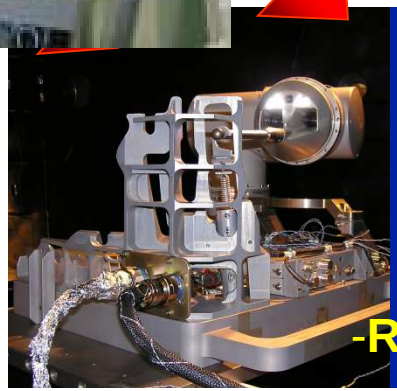

-RB

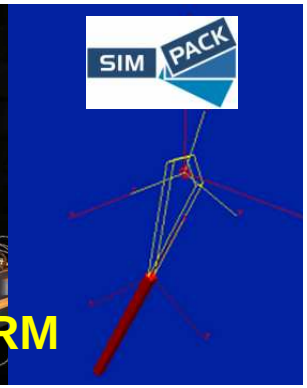

-FB


-DFD

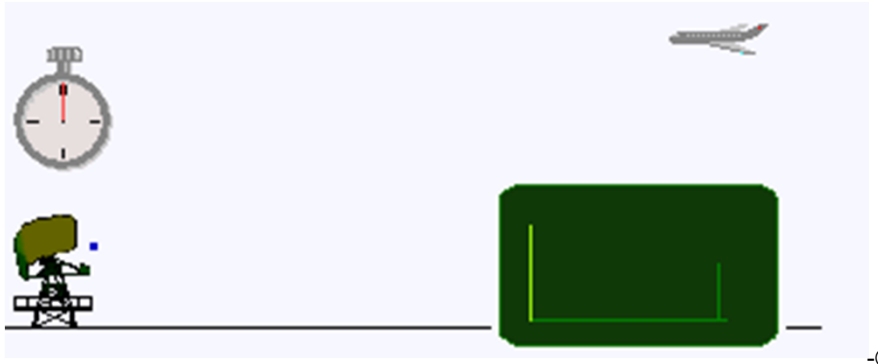

Castelo Branco
Spanien
200
450
700 °C


-KN


-RM


SIM
PACK

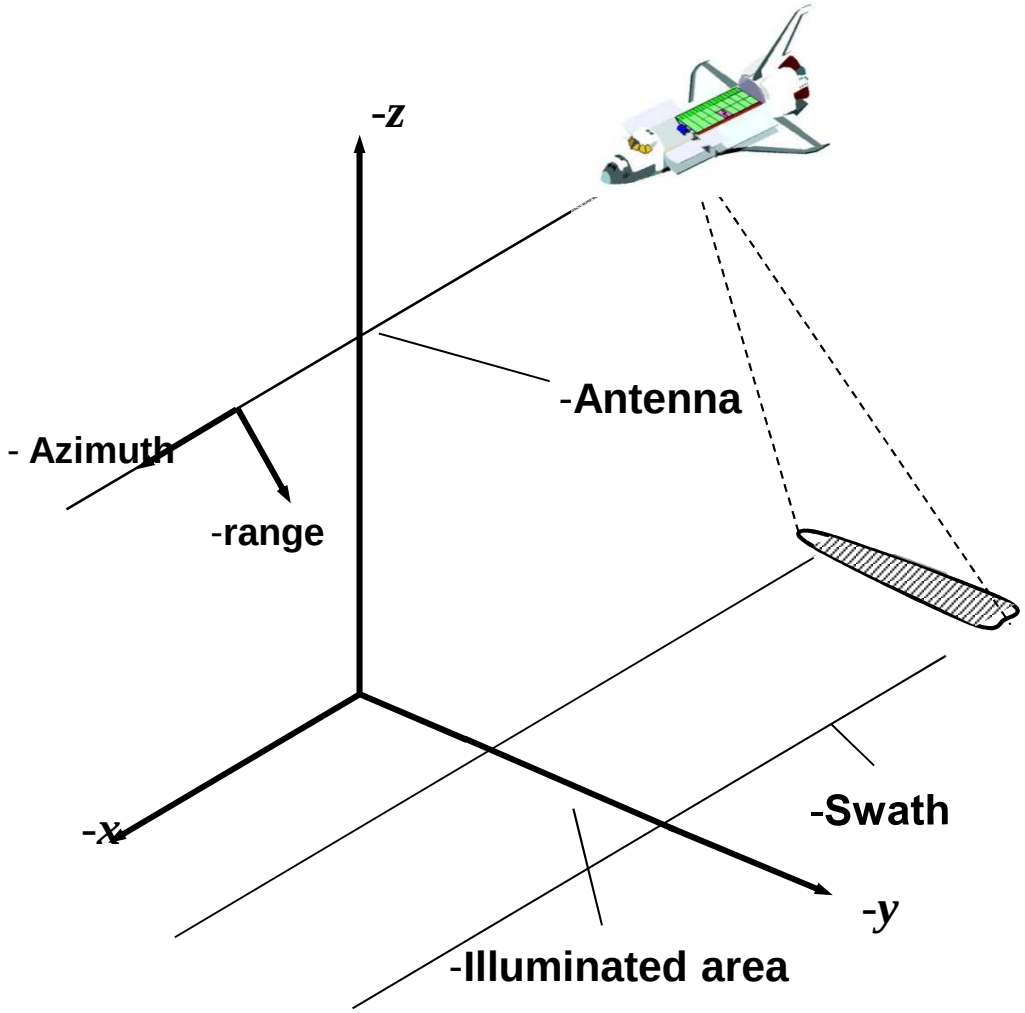
RADAR: „*Ra*dio *D*etection *a*nd *R*anging“



-© Wikipedia

- **Emission of electromagnetic pulses**
- **Reception of the reflected echo**
- **Radiation penetrates clouds**
- **Independend from daylight**

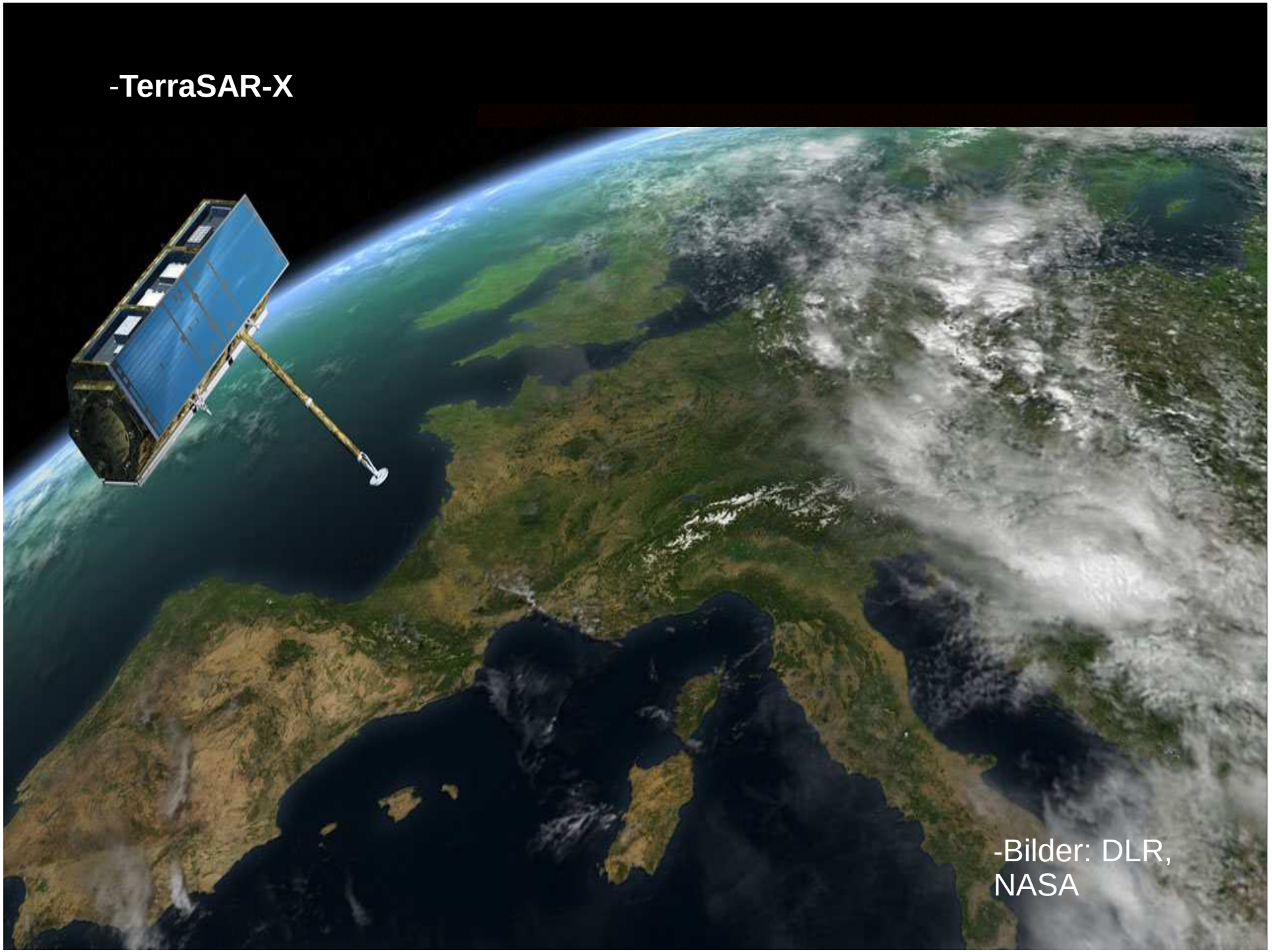
-Side-Looking Imaging Geometry



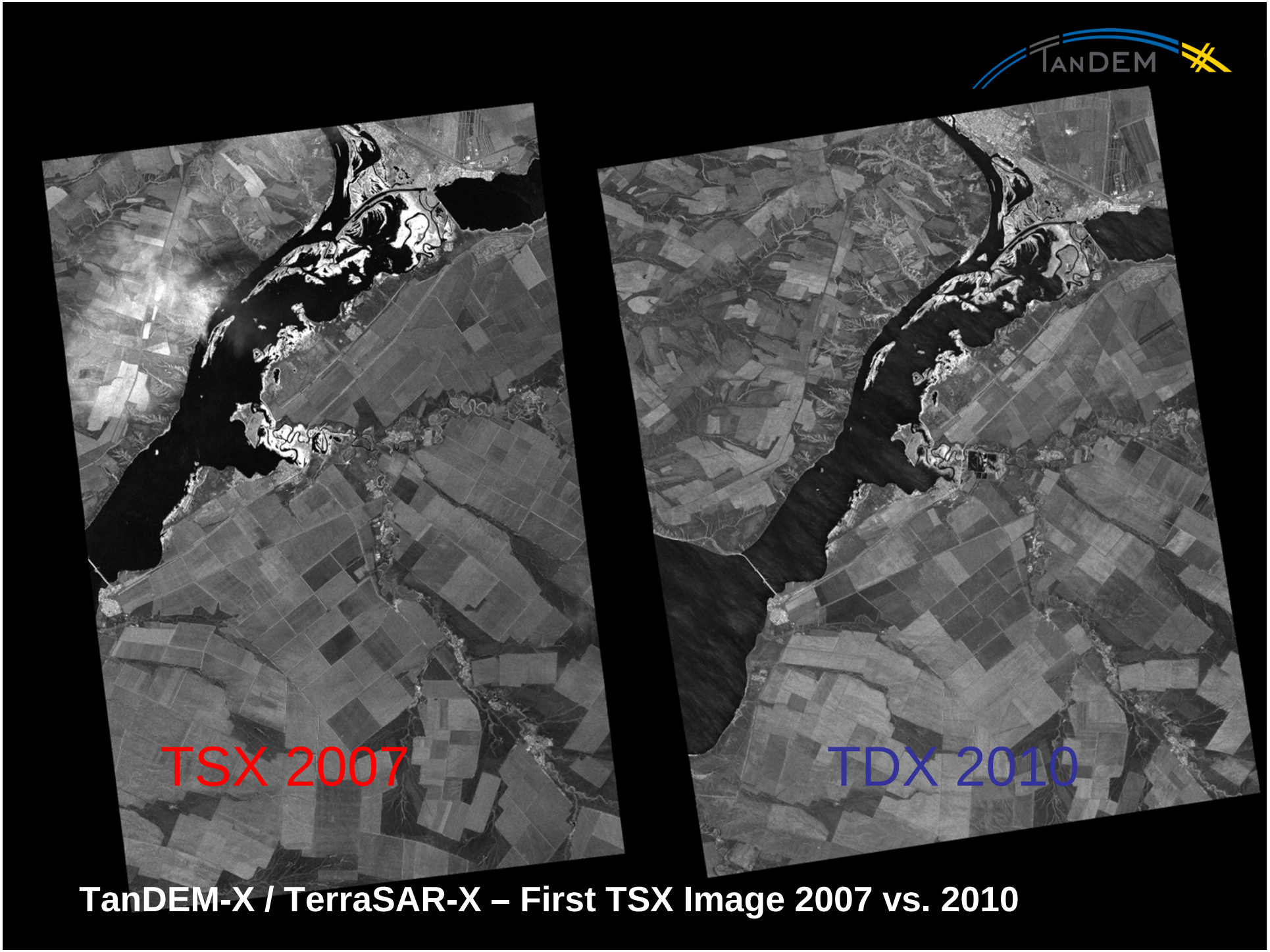
- Pulsed radar system
- Two-dimensional imaging (azimuth x slant range)

DLR

-**TerraSAR-X**



-Bilder: DLR, NASA

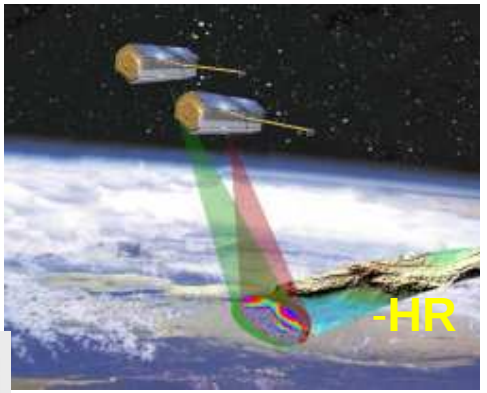


TanDEM-X / TerraSAR-X – First TSX Image 2007 vs. 2010


BIG BLUE


-MF


-PA

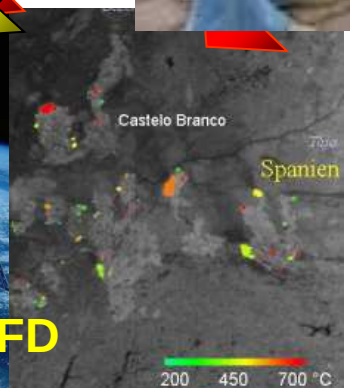

-HR

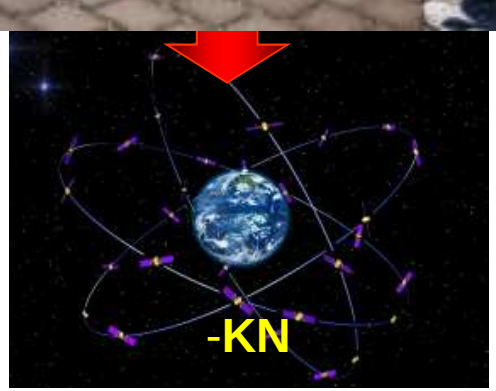

-RB

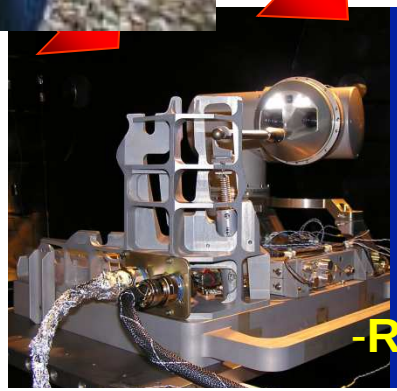

Environmental
Remote Sensing

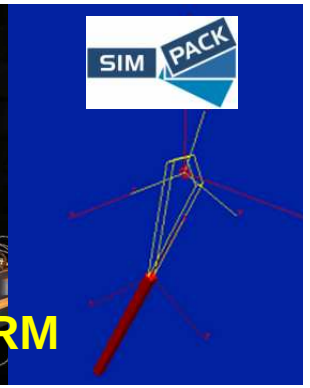

-FB


-DFD


Castelo Branco
Spanien
200
450
700 °C

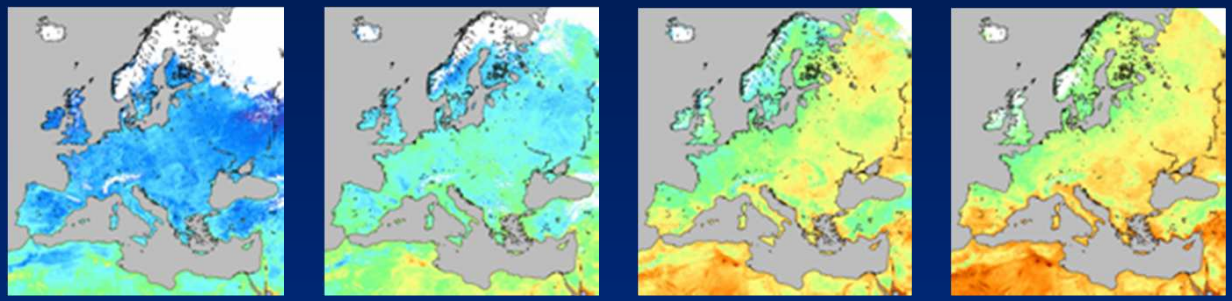

-KN


-RM

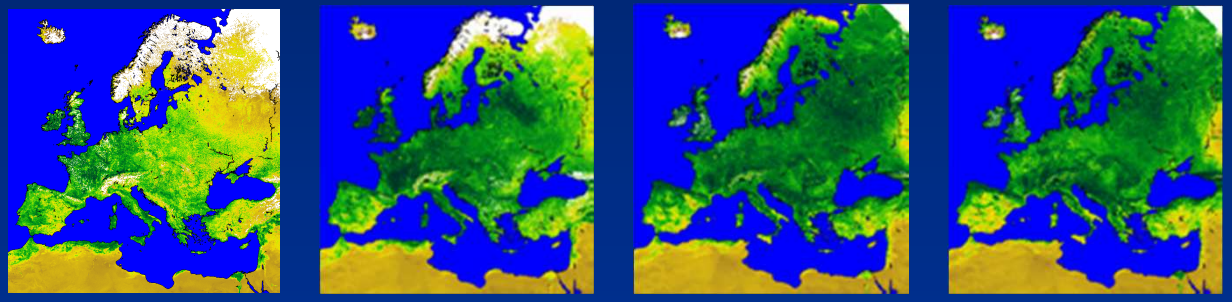

SIM
PACK

Time Series of Satellite Observations

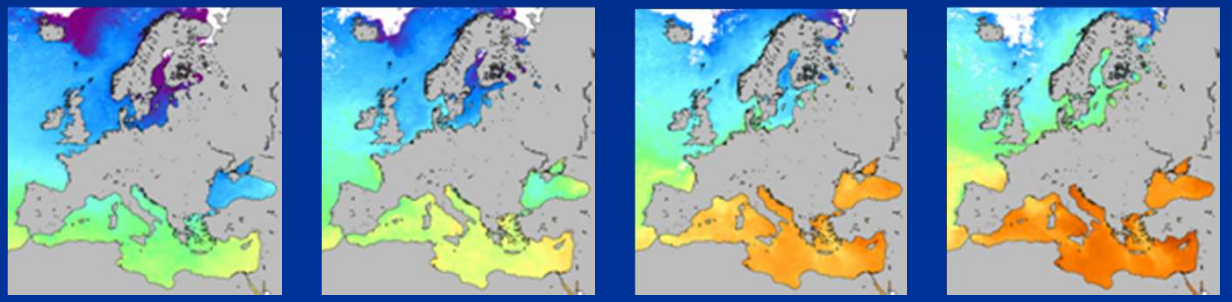
April May June July



Land surface temperatures (LST)

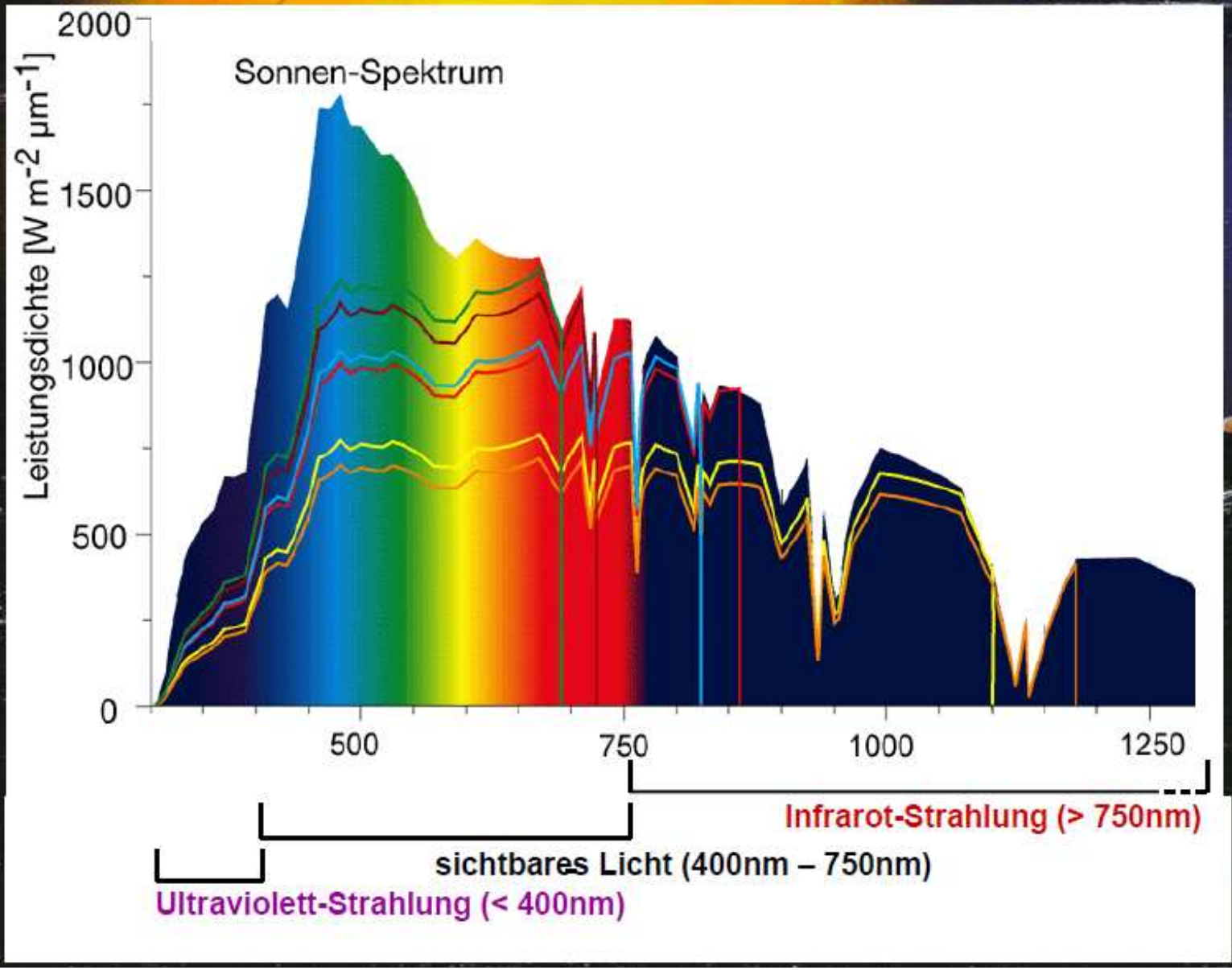


Vegetation index (NDVI)

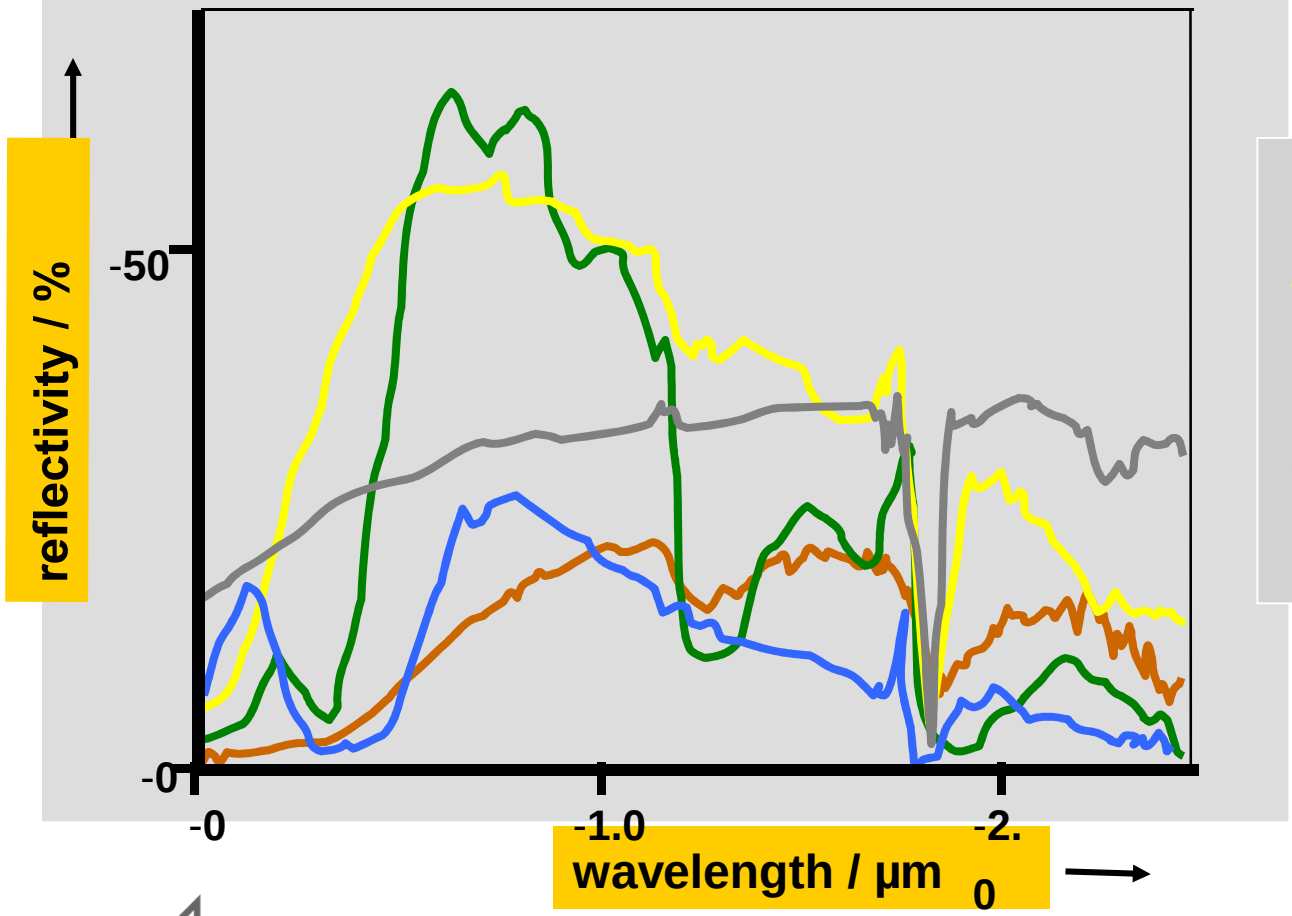


Sea surface temperatures (SST)

Solares Spektrum



Spectral signatures of surfaces



gray: asphalt

yellow: yelllow paint

brown: field

geen: meadow

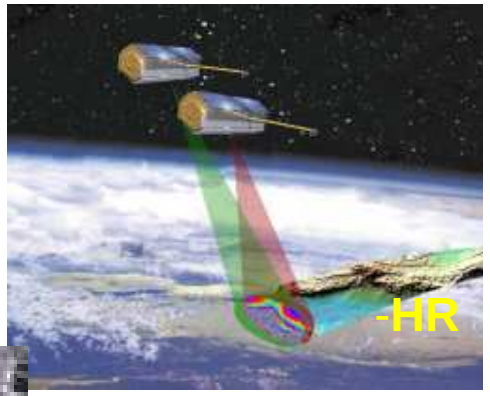
blue: blue paint

DLR


V6
Umwelt


-MF


-PA

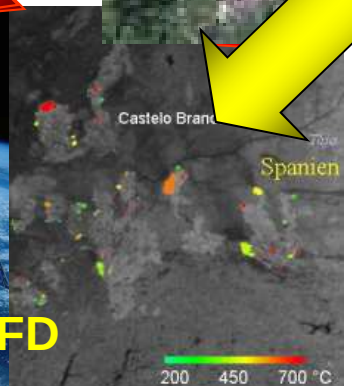

-HR


-RB

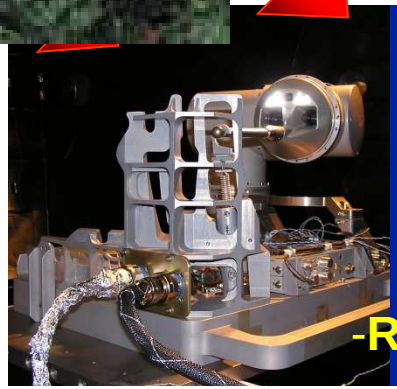

EO
Data
Analysis

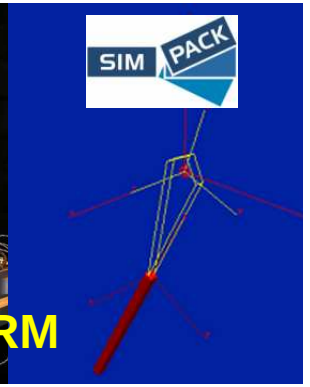

-FB

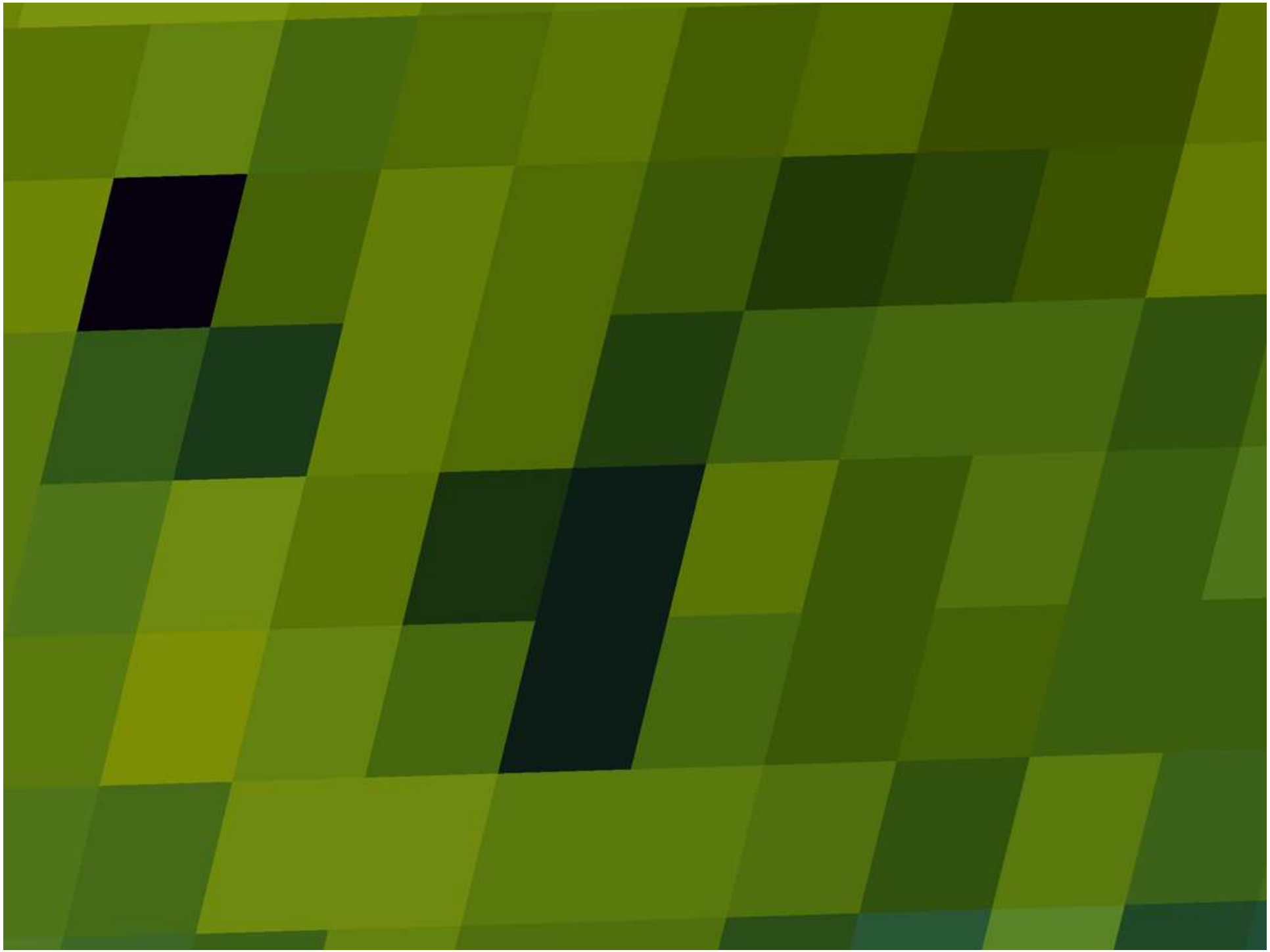

-DFD

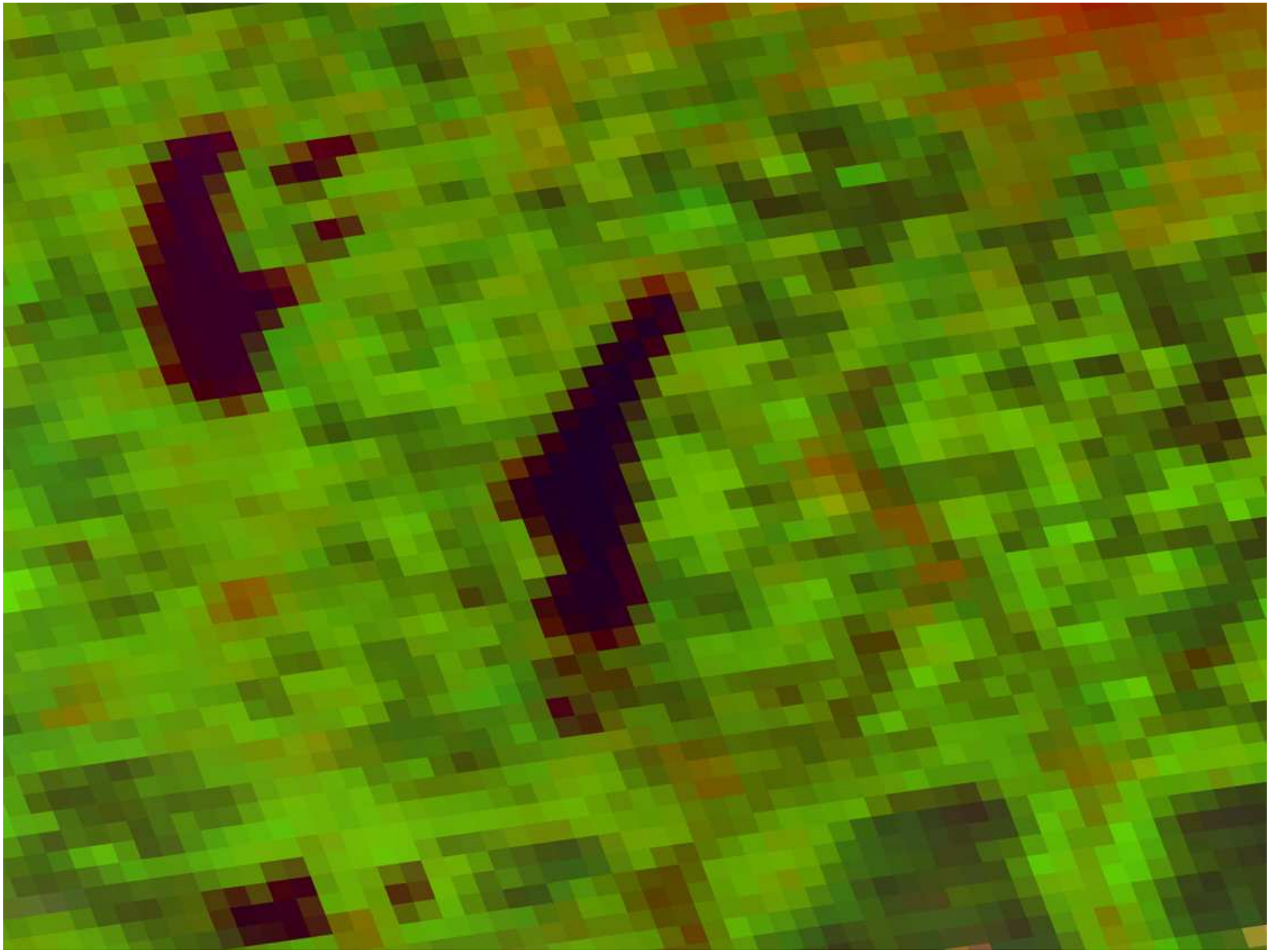

Spanien
200
450
700 °C

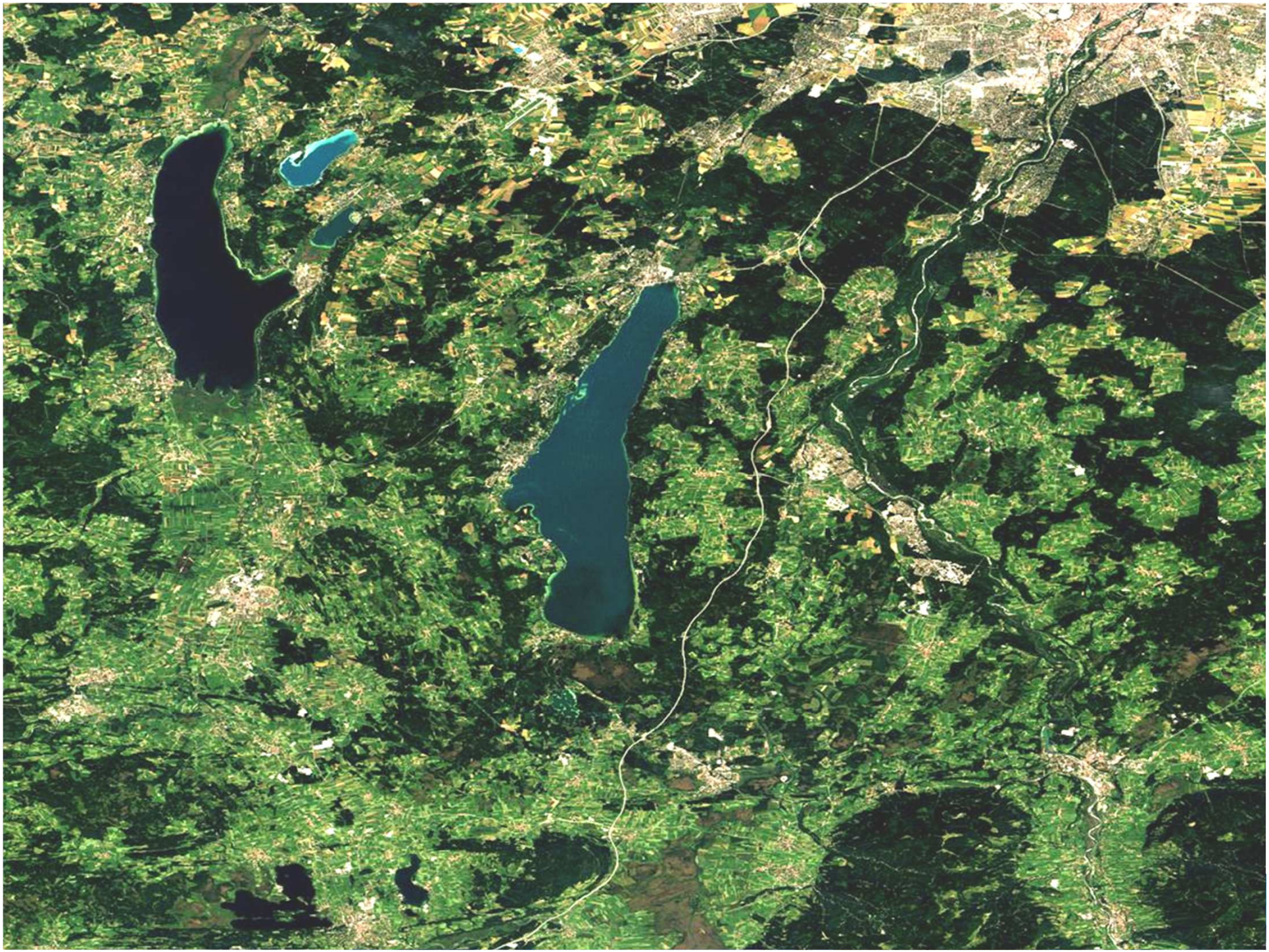

-KN


-RM


SIM
PACK







Example: Glacier-Deterioration in the Alps

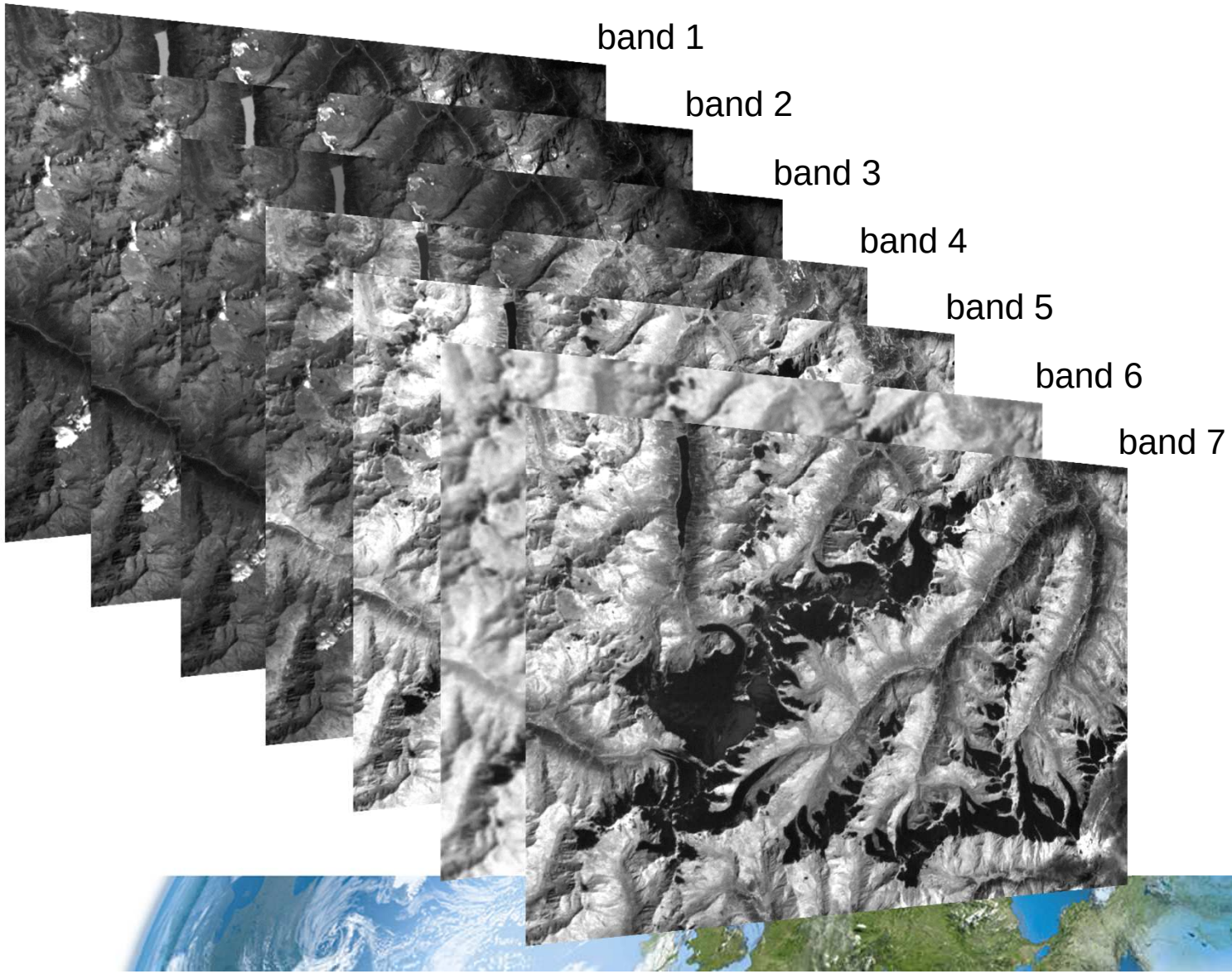
Location: Pasterzenzunge/Großglockner (3798 m)

around 1900	2000

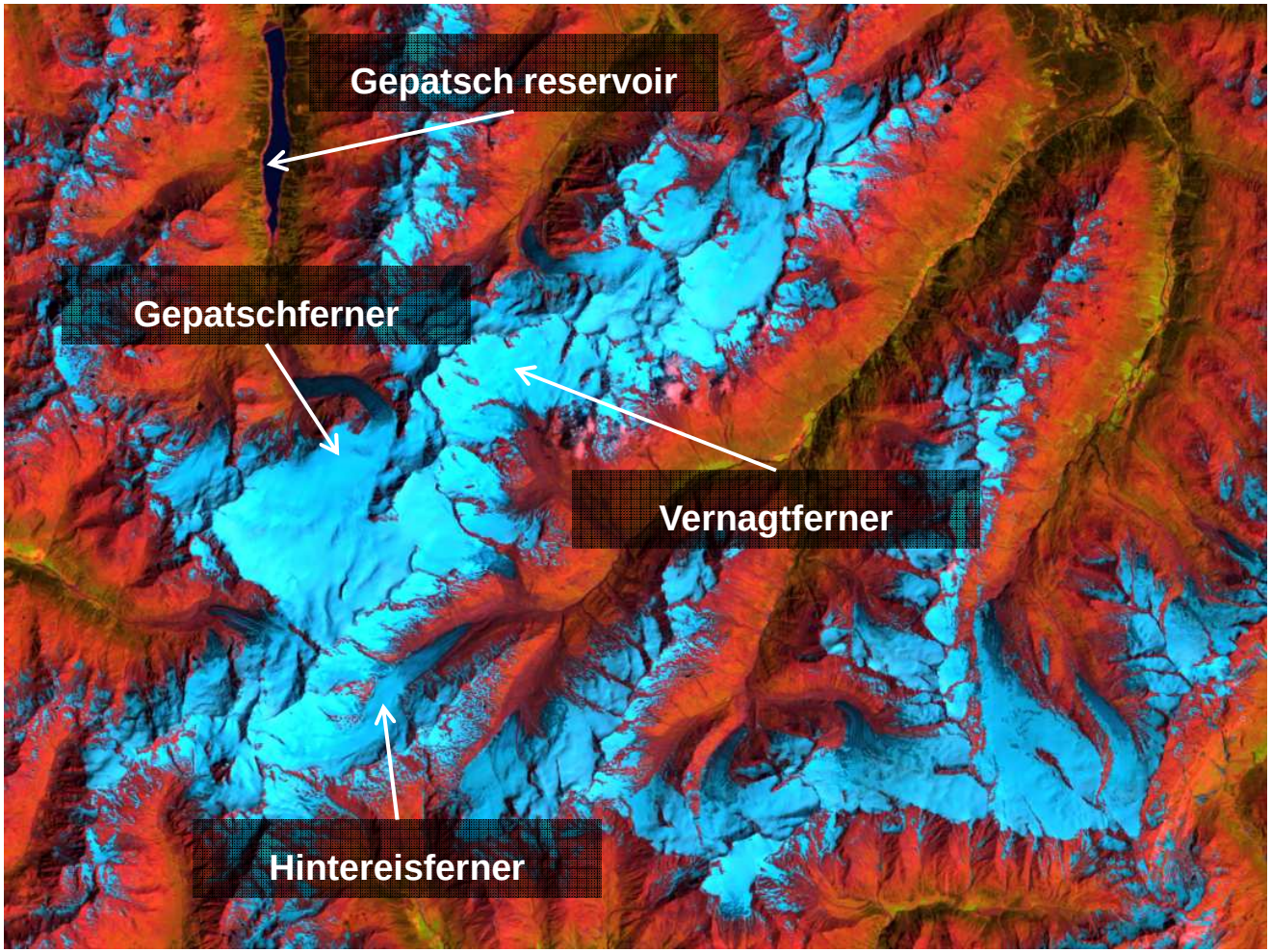
Gesellschaft für ökologische Forschung, Wolfgang Zängl, http://www.gletscherarchiv.de

DLR

Satellite Data: Landsat TM
Available at Glovis / USGS

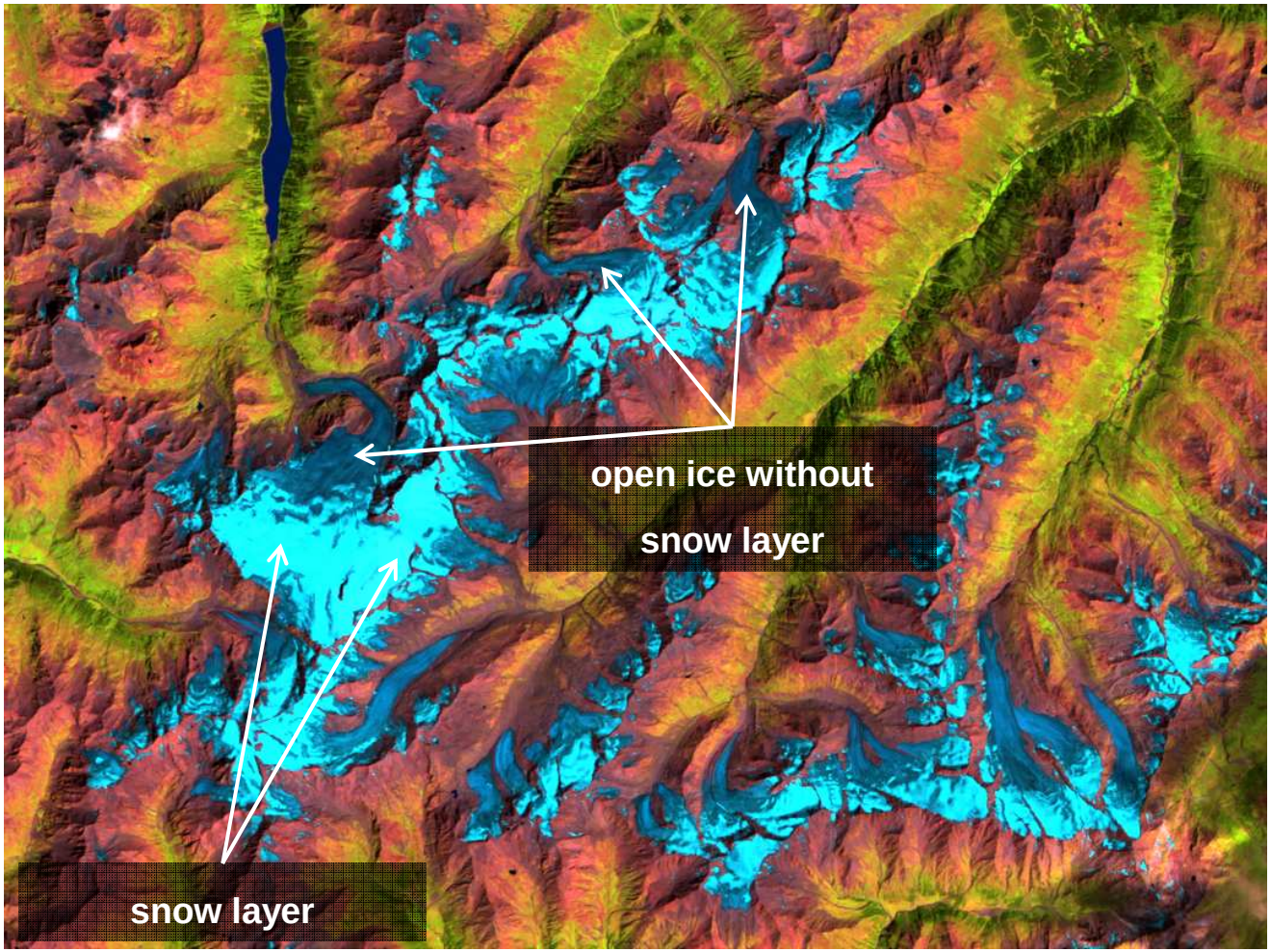


Ötztaler Alpes, Austria
September 1986



-Landsat TM, RGB 5/4/3

Ötztaler Alpes, Austria
September 2003



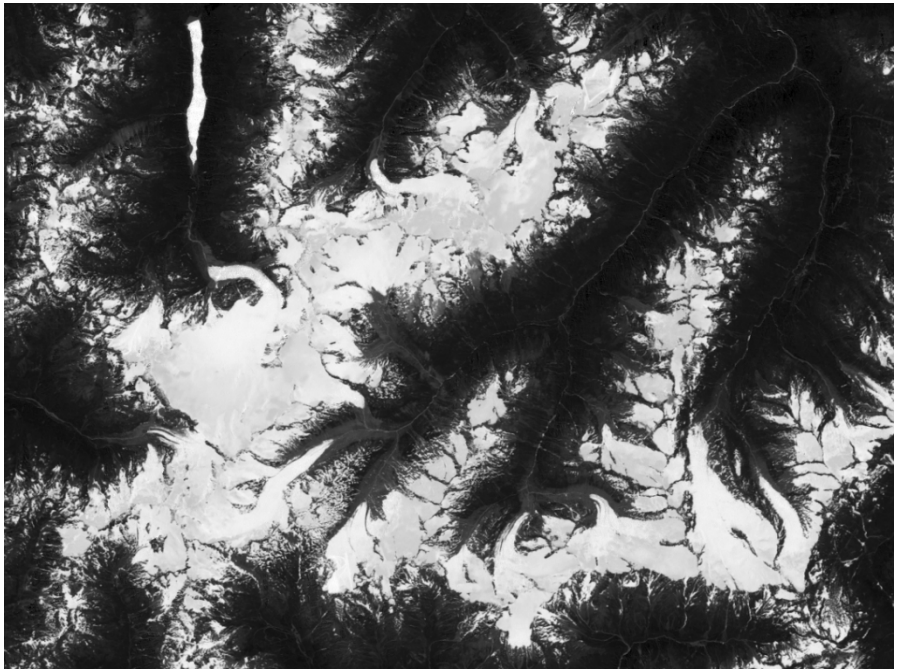
-Landsat TM, RGB 5/4/3

Change Detection

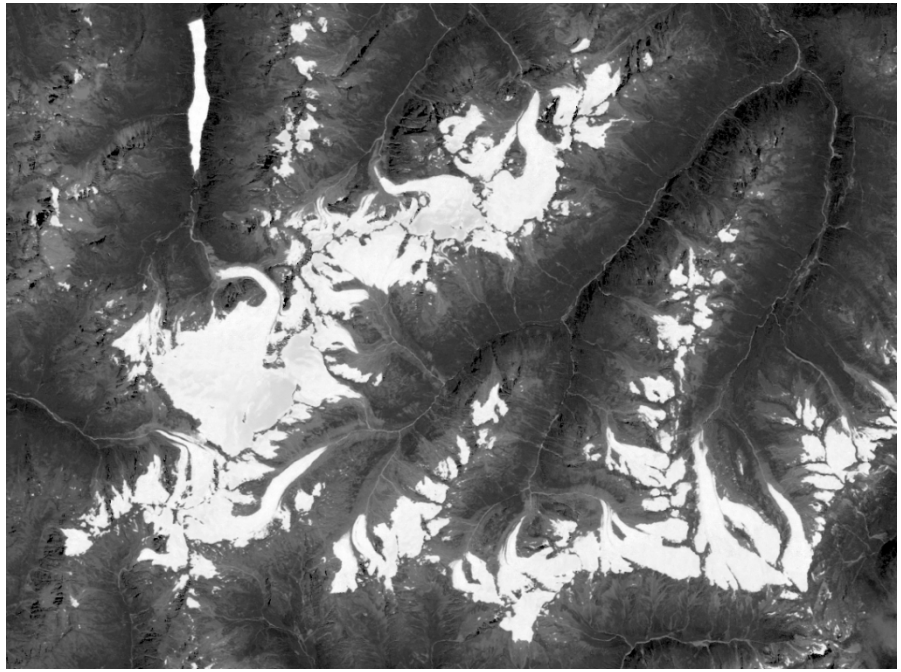
Step 1 – Calculating NDSI (Normalized Difference Snow Index)

$$NDSI = (VIS_{green} - MIR) / (VIS_{green} + MIR)$$

$$NDSI_{TM} = (band\ 2 - band\ 5) / (band\ 2 + band\ 5)$$



NDSI 1986

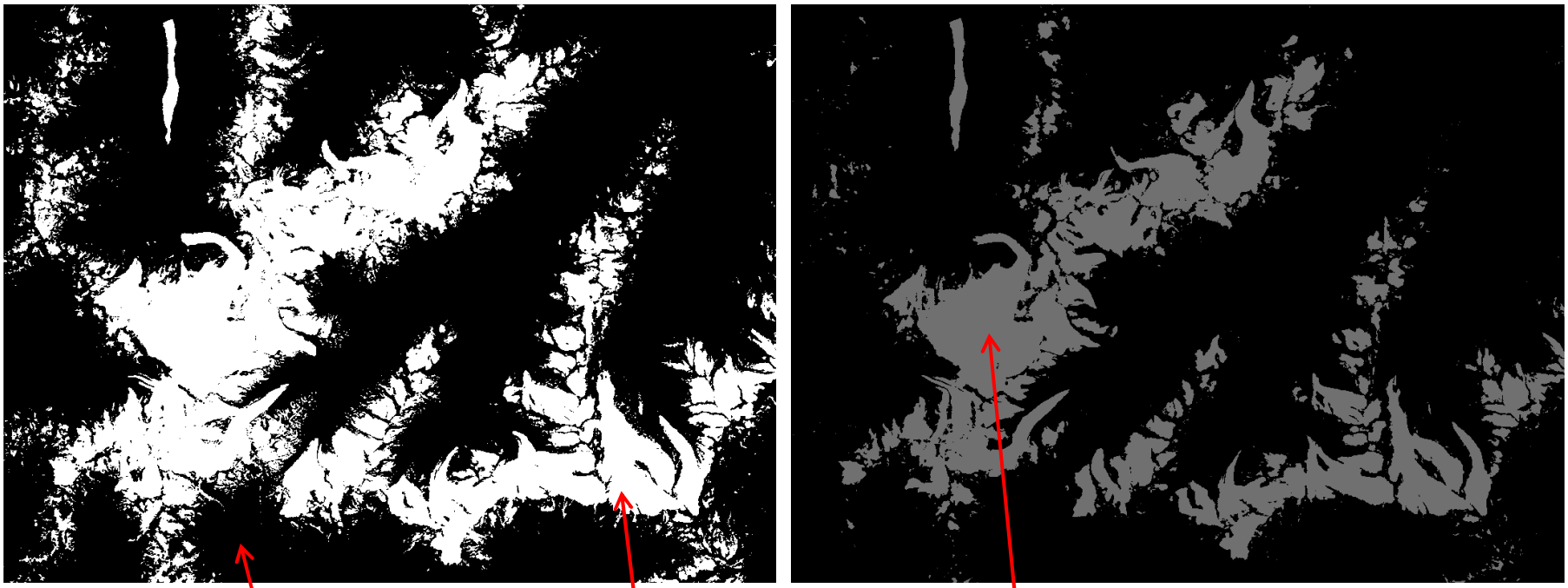


NDSI 2003

Change Detection

Step 2 – Building a snow & ice mask from NDSI image

1. *maximize contrast*
2. *tone mask*

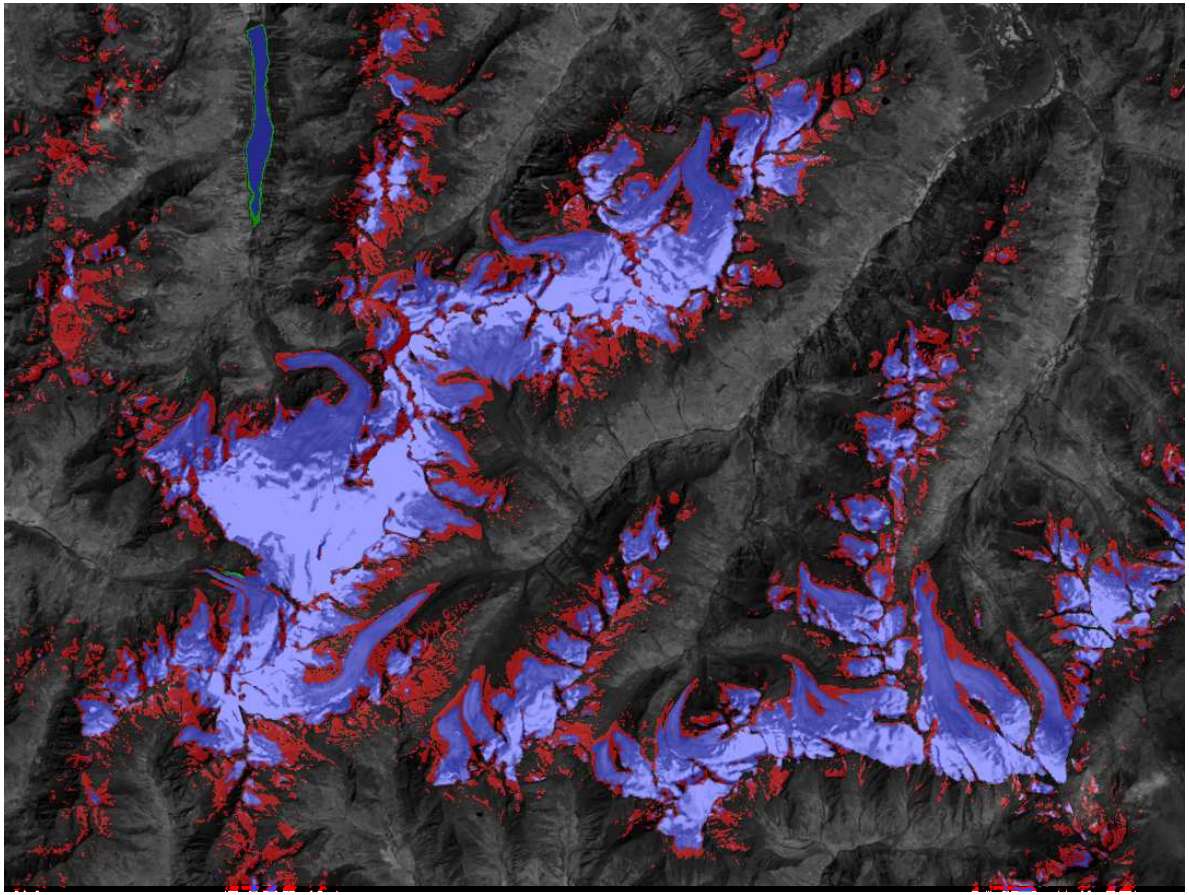


Value 0 | Value 255 | Value 128

Change Detection

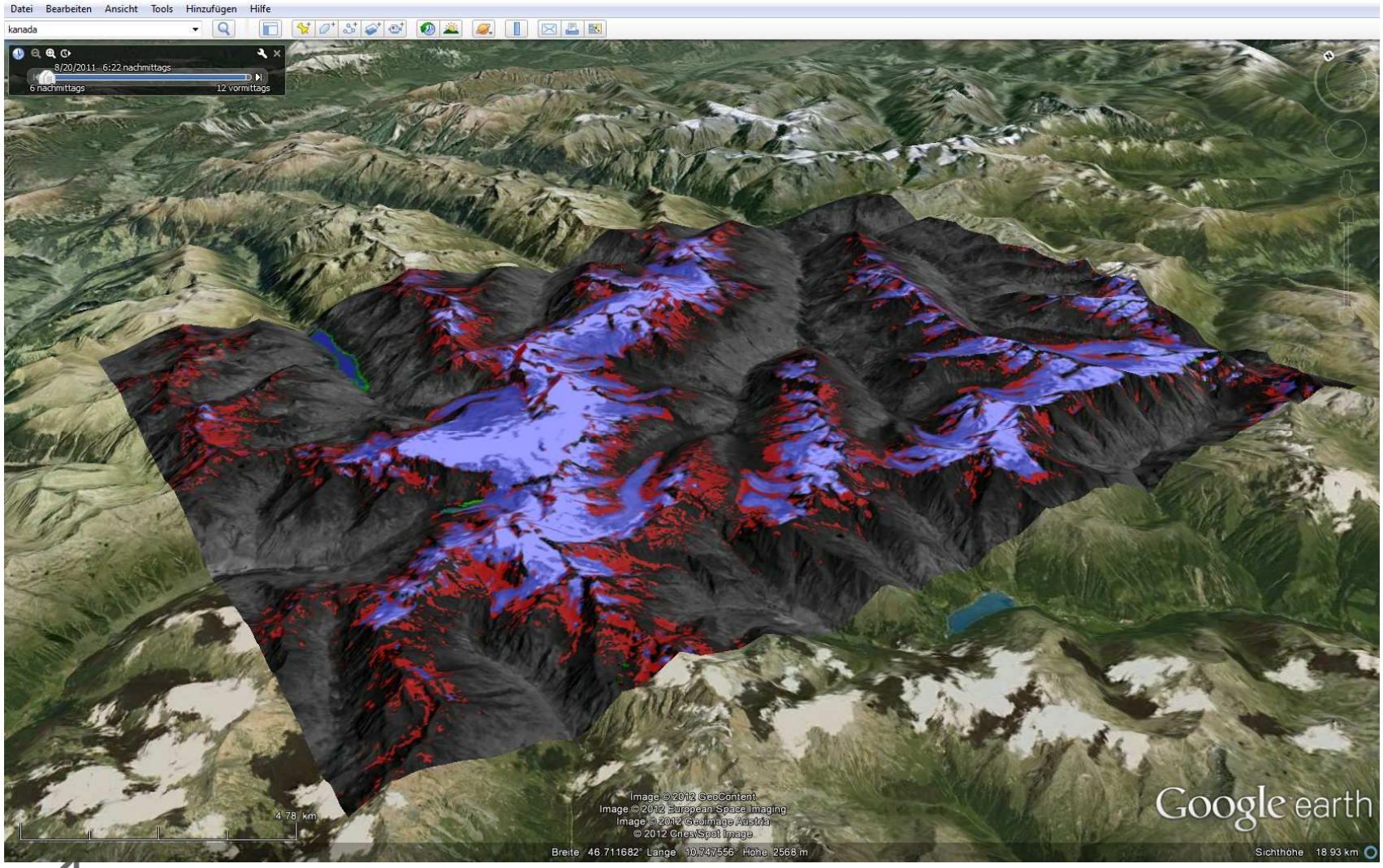
Step 3 – combining the masks & transparent overlay

1. *subtract masks*
2. *color combined mask*
3. *transparent overlay*



Change Detection

Step 5 – export image to Google Earth



Schülerlabore als interessefördernde außerschulische Lernumgebungen für Schülerinnen und Schüler aus der Mittel- und Oberstufe

Learning laboratories as interest-supporting out-of-school learning environments for secondary school students

Dissertation zur Erlangung des Doktorgrades
an der Mathematisch-Naturwissenschaftlichen Fakultät
der Christian-Albrechts-Universität zu Kiel

vorgelegt von
Christoph Pawek

Creating Awareness from the Beginning…

1. **Secondary School Students**
2. **Teachers**

3. **Teacher Educators**
4. **School Adminstration**
5. **Curriculum Makers**
6. **Ministeries**
7. **International Political Entities (GOs and NGOs)**

Covering the Whole Chain

1. **Starting Problem – Motivation**
2. **Strategy**
3. **Sensor**
4. **Data**
5. **Tools & Software**
6. **Expertise**
7. **Didactics**