

# The German EO Application and Copernicus program: From research to service development

Copernicus – the road to economic development 26 - 27 February 2015  
Copernicus Science Centre , Warsaw, Poland

Michael Bock et. al  
DLR Space Administration



# Objectives of the German Earth Observation Programme

## **Routine Utilization of space borne Earth observation**

- to strengthen the industrial system- and instrument-manufacturing and science and service development in Germany
- for decisions in politics, business, government and society
- for global environmental, resource and disaster management and resulting applications

**Definition of Earth observation missions** based on the benefits and requirements of Science, business and government under the principle of sustainability.

## **Priority areas of application are:**

land cover, natural disasters, atmosphere, climate, water / oceans

**The EO Programme unded by the  
Federal Ministry for Economy Affairs and Energy**



# Elements of German Earth Observation



## National Programme

- Missions: TSX, TDX, Enmap,
- Scientific and technical Mission Preparation

- Mission Support & Development of Applications
- Market Development and GMES

## Internationale Kooperationen:

- CEOS
- GEO
- Disaster-CHARTER



# The German missions since 2007

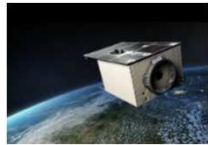


**TerraSAR-X:** Risk management & Security, cartography, Mining / Exploration, subsidence monitoring, maritime applications, etc.



**TanDEM-X:** HR Global DEM, 3D Monitoring of geosphere & cryosphere

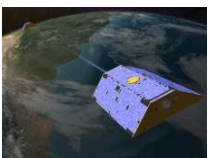
**RapidEye:** Agriculture, forestry, cartography, environmental monitoring



**EnMAP:** Quantitative environmental parameters: geology, monitoring of vegetation agriculture and water quality



**MERLIN:** Methan monitoring



**GRACE:** water budget, ice cover, ocean circulation





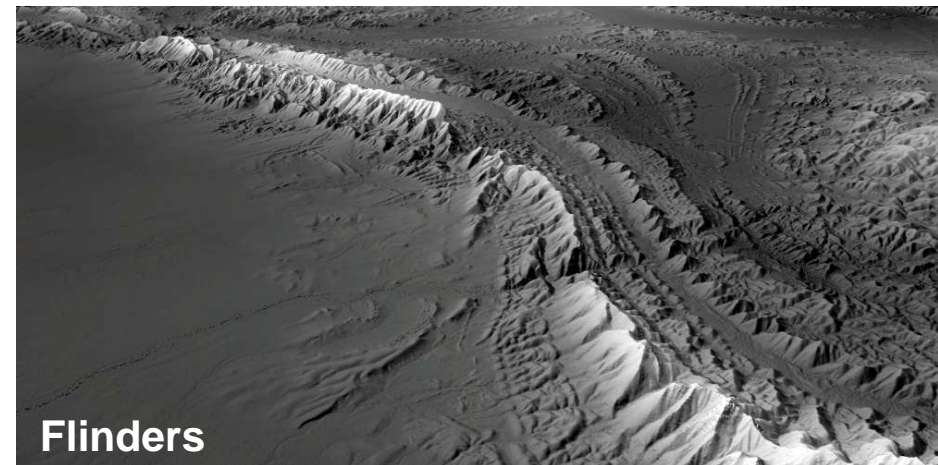
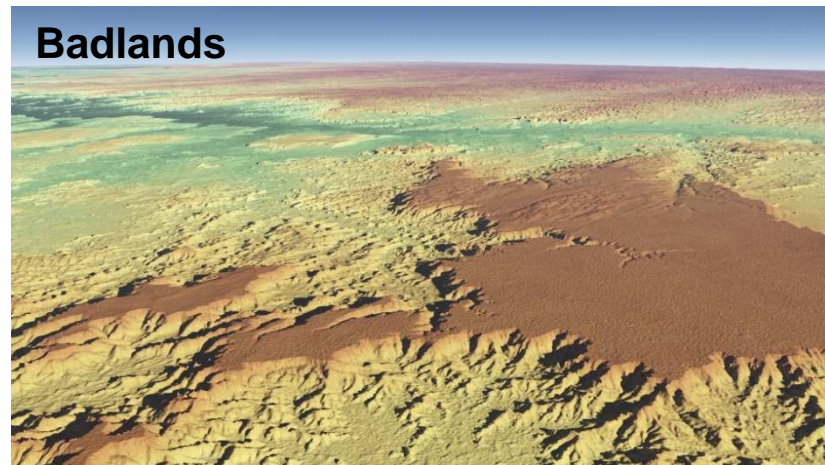
# TanDEM-X Upcoming Scientific Announcements of Opportunities

## ➤ TanDEM-X DEMs

- Dedicated to the TanDEM-X DEMs for 12m, 30m and 90m
- Spring 2015

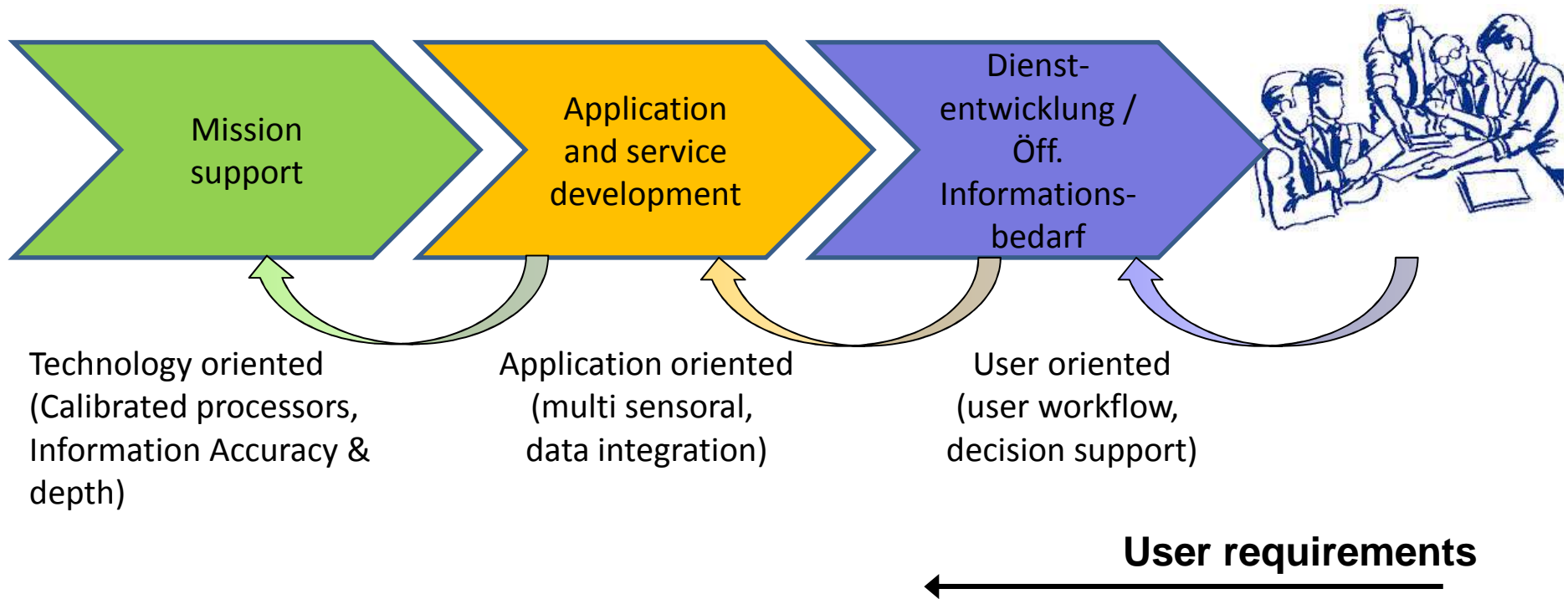
## ➤ Free DEMO TanDEM-X DEMs available for download

- <https://tandemx-science.dlr.de>



# Preparing EO data utilization From research to user oriented services

**Method development** →



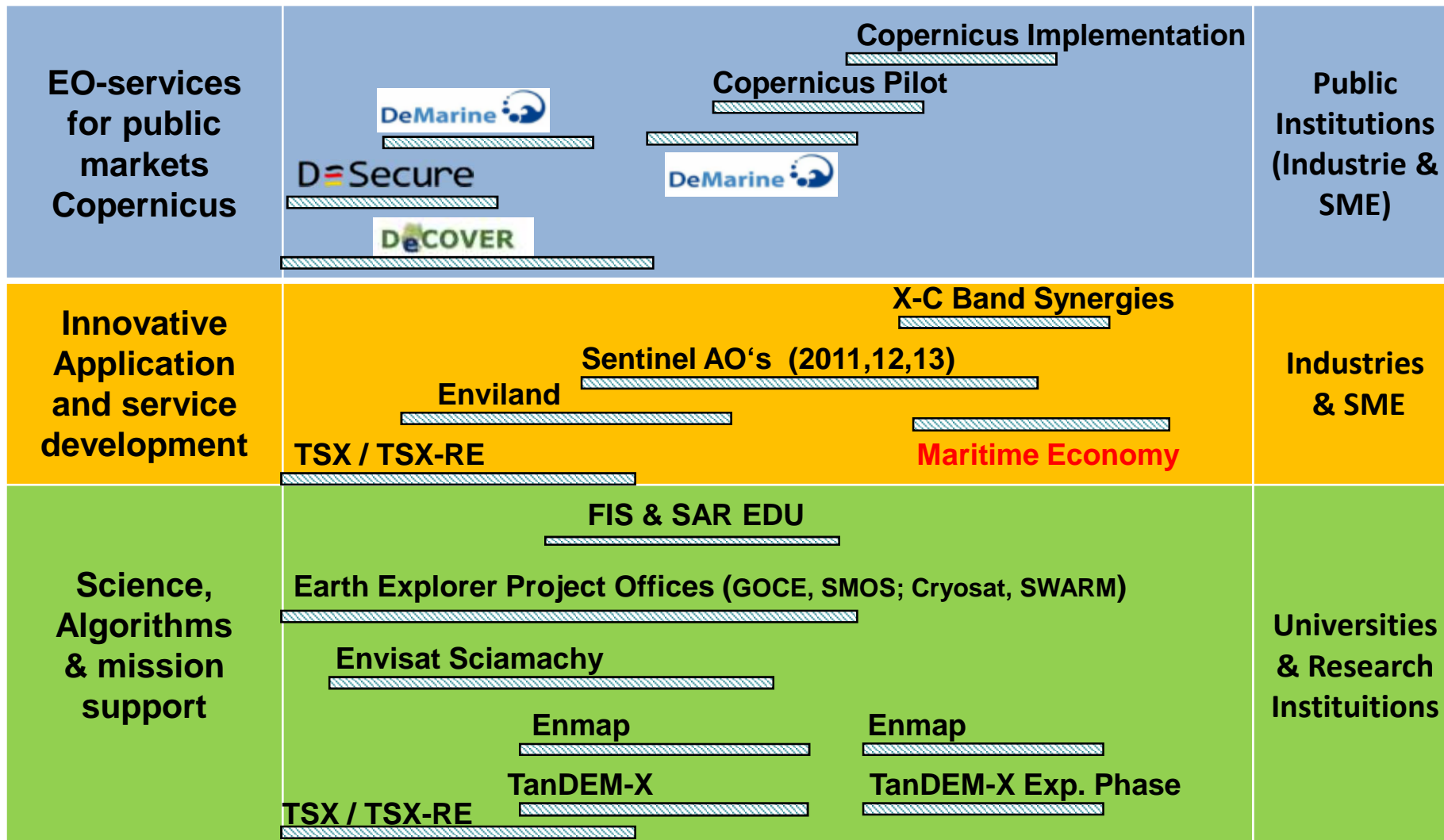
# The German Earth Observation Application programme

Focus	Objectives	Addresses
<b>EO-services for public markets Copernicus</b>	<ul style="list-style-type: none"> <li>• Implementation of EO-products in routine operations of national authorities</li> <li>• Service definition and contracting by public authorities</li> </ul>	<b>Public Institutions (Industrie &amp; SME)</b>
<b>Innovative Application and service development</b>	<ul style="list-style-type: none"> <li>• Development of innovative EO applications</li> <li>• Optimisation and automization of methods &amp; products</li> </ul>	<b>Industries &amp; SME (Research)</b>
<b>Science Algorithms &amp; mission support</b>	<ul style="list-style-type: none"> <li>• Promotion of fundamental research,</li> <li>• Development of data processors for ground segments,</li> <li>• Build-up of a broad science community</li> </ul>	<b>Universities &amp; Research Institutions (SME)</b>



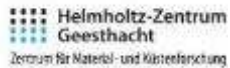
# The German Earth Observation Application programme

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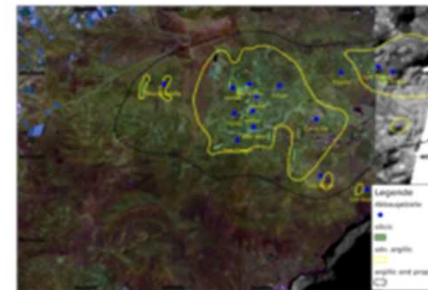
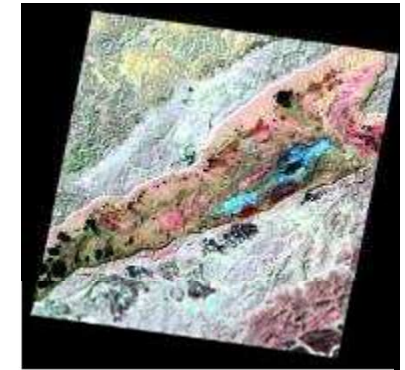


# EnMAP data utilisation preparation



## Core activities covered by EnSAG include:

- Data simulation and Toolbox
- Algorithm development in the fields of
  - Geology
  - Soils
  - Agriculture
  - Forests
  - Natural vegetation / transition areas
  - Coastal waters
- Systematic analysis of scaling, BRDF-effects and synergies with Sentinels



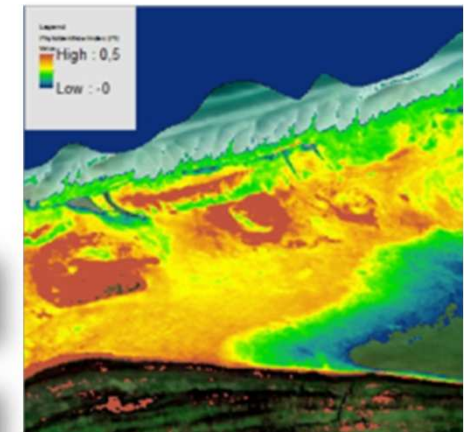
Gold mining sites Rodalquilar Caldera; Spain; HyMAP, Hyperion; Geology after Arribas (1989)



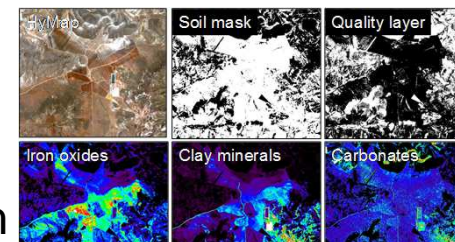
Hyperspectral image



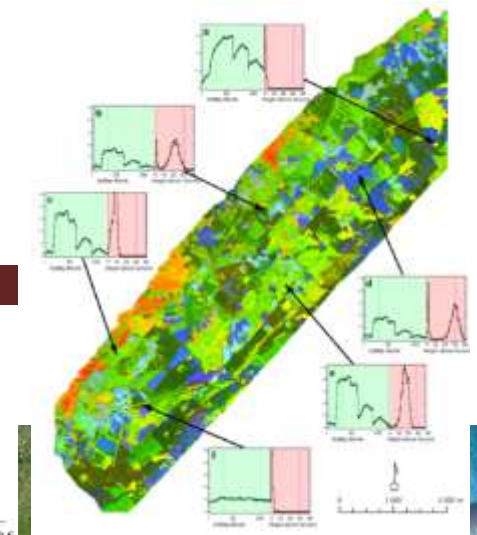
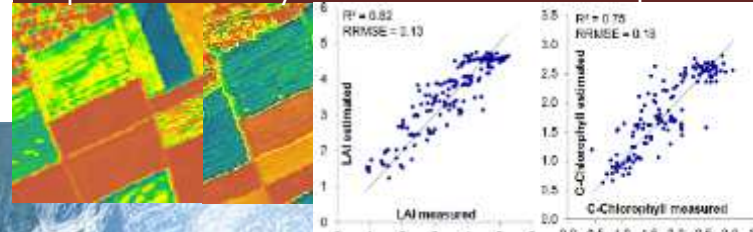
L3-Product: abundant minerals (red-carbonates, blue-epidotes, green-clays)



Windtatt - Map of Phytobenthos Distribution



April 28<sup>th</sup>    May 25<sup>th</sup>    June 16<sup>th</sup>    September

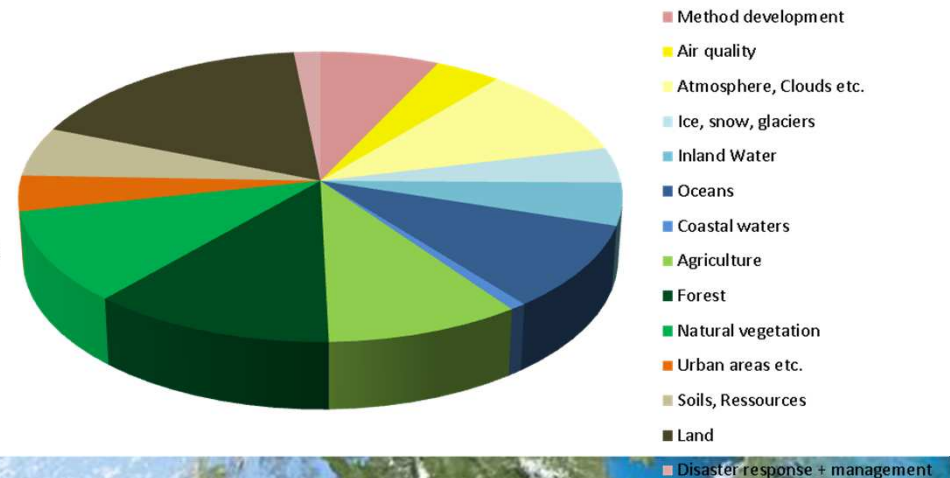




- **Three Calls** April 2011,2012,2013 with 135 Proposals submitted
- **26 projects**, ca. 70% from research institutes; ca. 30% from industry, mostly SME
- **Grants:** 200-350 T€ / max. 3 years duration

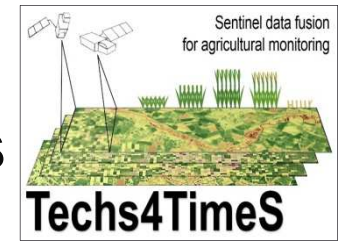
- **Thematic foci:**  
ca. 24 % forest  
ca. 10 % agriculture  
ca. 38 % vegetation, land applications  
ca. 15 % ocean, inland water, glacier, ice  
ca. 10 % atmosphere  
ca. 5 % general methods

Proposals per topic

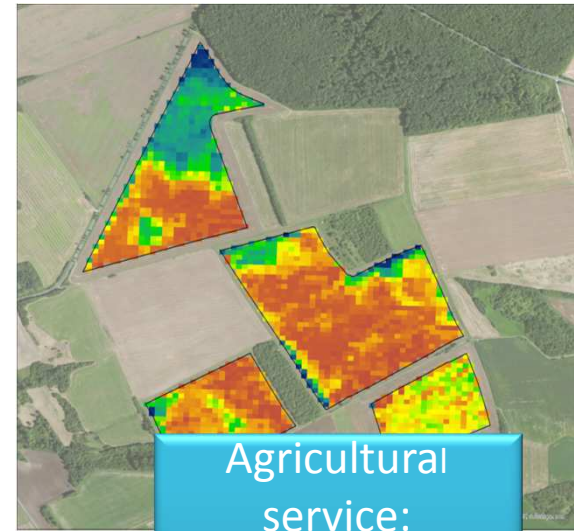




# Techs4TimeS – innovative techniques for the generation and evaluation of Sentinel time series



- 1) Generation of high-resolution time series by data fusion
- 2) Derivation of FAPAR and LAI



Agricultural service:  
Yield modeling  
(wheat and maize)



Techs4TimeS is funded by:  
 Bundesministerium für Wirtschaft und Energie  
FKZ No. 50 EE1353



## Witamy w świecie teledetekcji radarowej

- Czy kiedykolwiek zastanawiałeś się, jak można oszacować skutki trzęsienia ziemi albo przewidzieć erupcję wulkanów?
- Czy chciałbyś wiedzieć jak mierzyć ruch lodowców z centymetrową dokładnością?
- Lub czy ciekawiło Cię jak duża powierzchnia lasów pozostała na naszej planecie?

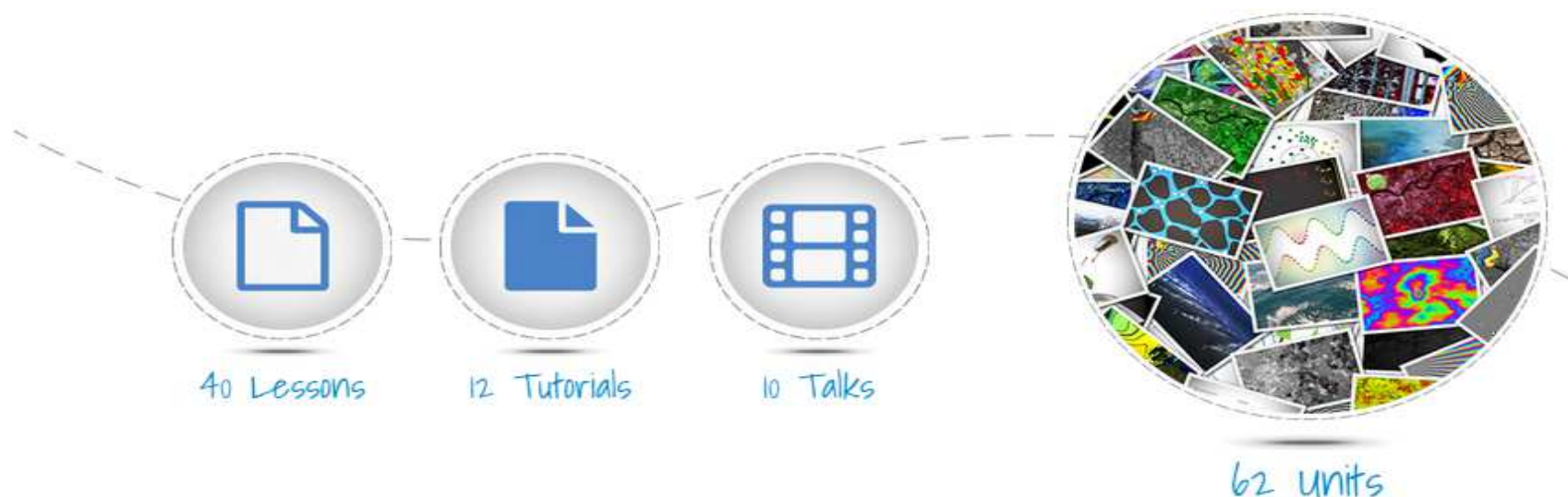
*Teledetekcja radarowa* (SAR) stanowi potężne narzędzie, za pomocą którego można znaleźć odpowiedź zarówno na powyższe jak i inne pytania naukowe. Zapraszamy do przyłączenia się do ekscytującego świata mikrofal oraz radarowej technologii teledetekcji satelitarnej, w celu monitorowania naszej dynamicznie zmieniającej się planety. Proponujemy Ci materiały, na poziomie wstępnym i zaawansowanym, zarówno dla wykładowców jak i studentów, których intryguje radarowa teledetekcja satelitarna oraz chcą poszerzyć swoją wiedzę na temat pozyskiwania, przetwarzania i zastosowania zobrażeń radarowych.

[Read More](#)

[Browse Material](#)

[Join the Community](#)

## SAR-EDU in figures





no comments

no comments

no comments

no comments



**SUBSIDENCE MONITORING (NEST)**  
tutorial #3102

15 Dec, 2014  
TUC  
no ratings  
no comments



**DIANA WALTER: ANTHROPOSPHÄRE**  
talk #3103

24 Nov, 2014  
TUC  
no ratings  
no comments



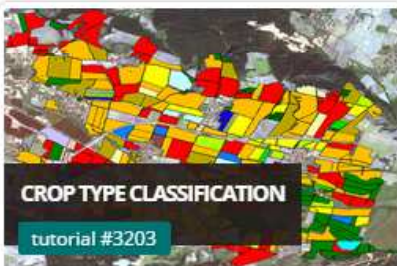
**BIOMASS**  
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no ratings  
no comments




**AGRICULTURE**  
lesson #3202

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**CRYOSPHERE - BASICS**  
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tutorial #3306

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**HYDROSPHERE**  
lesson #3401

15 Dec, 2014  
FSU



# Unlocking Copernicus for users in Germany

*How can German users profit from Copernicus and how can the Federal government support?*



- Inform
- Coordinate and engage
- Enable and support
- Access



## The Copernicus Action Plan (2011)

The Copernicus Programme funded by the Federal Ministry for Transport and Digital Infrastructure



# Inform

Home | Dienste | Daten | Maßnahmen | Veranstaltungen | Aktuelle Meldungen | Kontakt

## Copernicus in Deutschland

Erdbeobachtung und Dienstleistungen der Geoinformation

Das europäische Erdbbeobachtungsprogramm Copernicus schafft eine moderne und leistungsstarke Infrastruktur für Erdbbeobachtung und Dienstleistungen der Geoinformation. Auch für Deutschland schafft Copernicus neue Chancen, Nutzen in Deutschland sollen von den europäischen Investitionen in Copernicus profitieren.

Dieses Portal bietet Informationen zu Copernicus auf europäischer und nationaler Ebene in Deutschland.

## Copernicus Dienste

Die Copernicus Dienste sind das Herz von Copernicus. Die sechs europäischen Kerndienste stellen Grunddateninformationen bereit, die für vielfältige Anwendungen weiter verarbeitet werden können.

- Landbeobachtung
- Überwachung der Meeresumwelt
- Katastrophen- und Krisenmanagement
- Überwachung der Atmosphäre
- Überwachung der Kontinente
- Sicherheit

## Copernicus Beobachtungen

Erdbbeobachtungen = Messungen von Satelliten, Flugzeugen, boden- oder seegestützten Beobachtungs-Infrastrukturen = sind der Treibstoff der Copernicus Dienste. Die Copernicus Beobachtungsinfrastruktur steht für leistungsfähige Planung, nachhaltigen Betrieb und verlässliche Bereitstellung. Sie wird oft konzeptionell aufgeteilt in die Satelliten-Komponente und andere Systeme. Die letzteren werden unter dem Begriff der „in situ“ Komponente zusammengefasst.

- Weltraumkomponente
- In situ Komponente

## Erdbbeobachtung für Mensch und Umwelt

### Nationales Forum für Fernerkundung und Copernicus 2014

Vom 08.-10. April 2014 im Bundesministerium für Verkehr und digitale Infrastruktur

08. - 10. April 2014

## 03. bis 05. November 2015 Berlin

### Use Copernicus successfully

- National Copernicus Forum
- Thematic workshops
- Information of relevant bodies

[www.d-copernicus.de](http://www.d-copernicus.de)




# Coordinate & engage: Thematic coordinators

 Bundesamt für Kartographie und Geodäsie  
Dr. Andreas Busch  
Bundesamt für Kartographie und Geodäsie  
069 / 6333 – 312  
andreas.busch@bkg.bund.de

**Land**

 Umwelt Bundesamt  
Vertreter:  
Dr. Thomas Schultz-Krutisch  
Umweltbundesamt  
0340 / 2103 – 2631  
thomas.schultz-krutisch@uba.de


**Land Environment**

 Bundesamt für Bevölkerungsschutz und Katastrophenhilfe  
**Fachkoordinator Katastrophen- und Krisenmanagement**  
Dr. Michael Judex  
Bundesamt für Bevölkerungsschutz / Katastrophenhilfe  
0228 / 99-550-2502  
michael.judex@bbk.bund.de

**Emergency & crisis management**

 DWD  
**Fachkoordinator Atmosphäre und Klimawandels**  
Überwachung der Atmosphäre und Überwachung des Klimawandels  
Dipl.-Met Tobias Fuchs  
Deutscher Wetterdienst  
069 / 8062-2872  
tobias.fuchs@dwd.de

**Atmosphere & climate change**

 Bundesamt für Seeschifffahrt und Hydrographie  
**Fachkoordinator Überwachung der Meeresumwelt**  
Dr. Bernd Brügge  
Bundesamt für Seeschifffahrt und Hydrographie  
040 / 3190-3000  
bernd.bruegge@bslh.de

DeMarine Nutzerbüro

**Marine Environment**

 Bundesministerium des Innern  
**Fachkoordinator Sicherheit**  
Heinz-Dieter Meier  
Bundesministerium des Innern  
0151 / 120 452 48  
heinzdieter.meier@bmi.bund.de

**Security**

- Support services and advice to the Federal Government
- Inform user and coordinate requirements
- Represent Germany in the user forum



# Enable and support



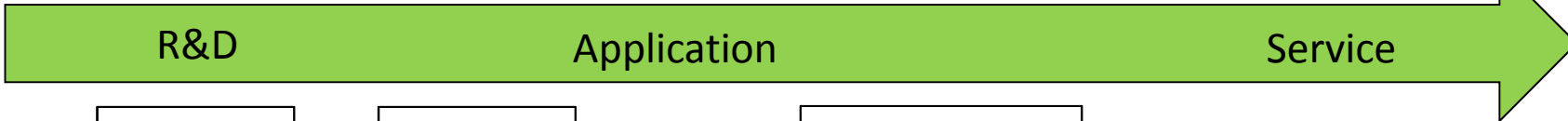
Sentinel preparation, Pilot-applications,  
integration in user workflows

- EU Horizon 2020
- Ressort-Research
- BMBF-Research Programme
- EO Application programm (BMW<sub>i</sub>)
- Copernicus Action Plan (BMV<sub>I</sub>)





# Enable and support



Research  
Institutions

SMEs

Authorities  
SMEs



Pilot Projects

Implementation Projects

Thematic coordinators

Sentinel AO  
(2011, 2012, 2013)







**Call May 2012**  
**„GMES-Services for the public demand in Germany“**

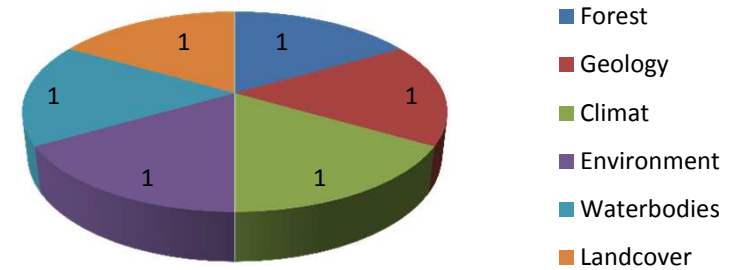
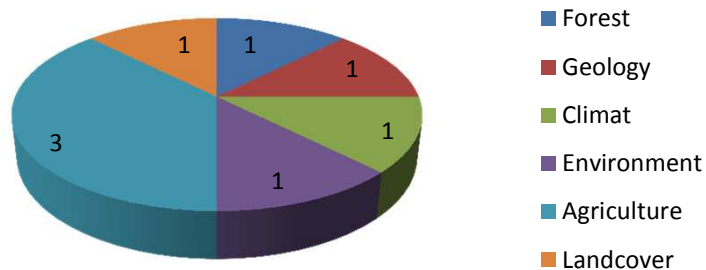
**Call October 2013**  
**„Development and implementation of Copernicus Services for the public demand in Germany“**

31 Proposal submitted **➔** 8 Proposals selected

32 Proposal submitted **➔** 6 Proposals selected

**Thematic distribution of the selected proposals (Call 2012)**

**Thematic distribution of the selected proposals (Call 2013)**

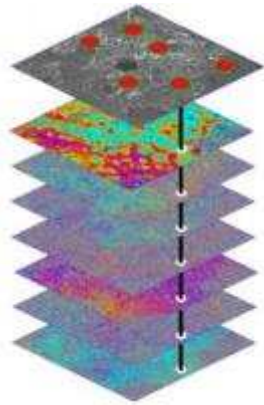


# Development of an Copernicus Service to support hazard analysis



Implementation of air borne and space borne image data into existing and new workflows of geoscience authorities.

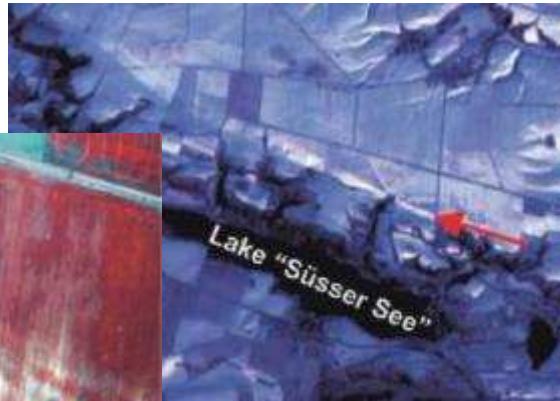
- The concept will be realised together with the State office of Geology and Mining Rheinland-Pfalz



Time series of Radar data  
[Adam et al., 2011]



Vegetation anomaly (Infrared-aerial photo)  
[Kühn, Hörig & Budziak, 2009]



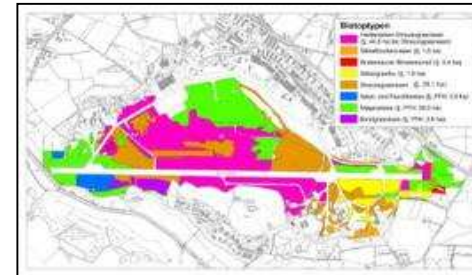
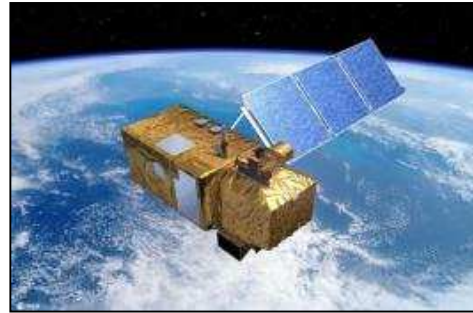
visible depression  
SPOT Satellite  
[Kühn, Hörig & Budziak, 2009]



sinkholes in the landscape  
[Kühn, Hörig & Budziak, 2009]



# NATURA 2000 Monitoring Service



**Optimise the existing workflow of the Natura 2000-Monitoring within the LANUV (North Rhine-Westphalia State Office for nature environment and consumer protection)**

- Reduce the effort of the site inspection by using remote sensing data
- The Natura 2000 Monitoring should be reproducible and cost saving
- Adaption of the developments of parent projects (DeCover, MS.MONINA) to Sentinels



Landesamt für Natur,  
Umwelt und Verbraucherschutz  
Nordrhein-Westfalen





# Collaborative Copernicus data access and exploitation infrastructure in Germany

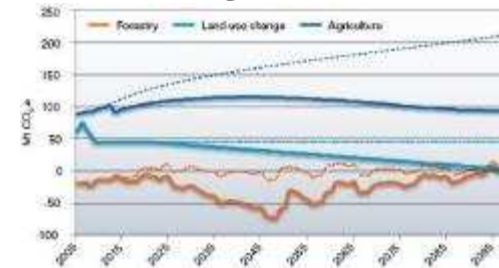


**Policy**

## Enable

- government agencies,
- companies, and
- research institutions

in Germany to benefit optimally from Copernicus through



**Research**



**Commercial sector**

**Public institutions**



- 1. Access** to Copernicus data and information products according to needs identified in Germany
- 2. Provision of tools** – computing resources and software – to enable operational exploitation of large data volumes from a variety of sources



**General Public**



# Planned Functions for the Collaborative GS



## Access

Search / View /  
Download of...

- all Sentinel data
- CCM data licensed for use
- Services products

Use of additional receiving stations as required



## Hosted processing

- Integrated data access
- cloud processing
- Upload own „apps“
- Use third-party apps
- Buy additional resources



## Extended Portfolio

- „convenience products“, dependend on demand
- Offered by third-parties on platform

**1. Phase: Development Prototyp and test of operations (2015/15)**

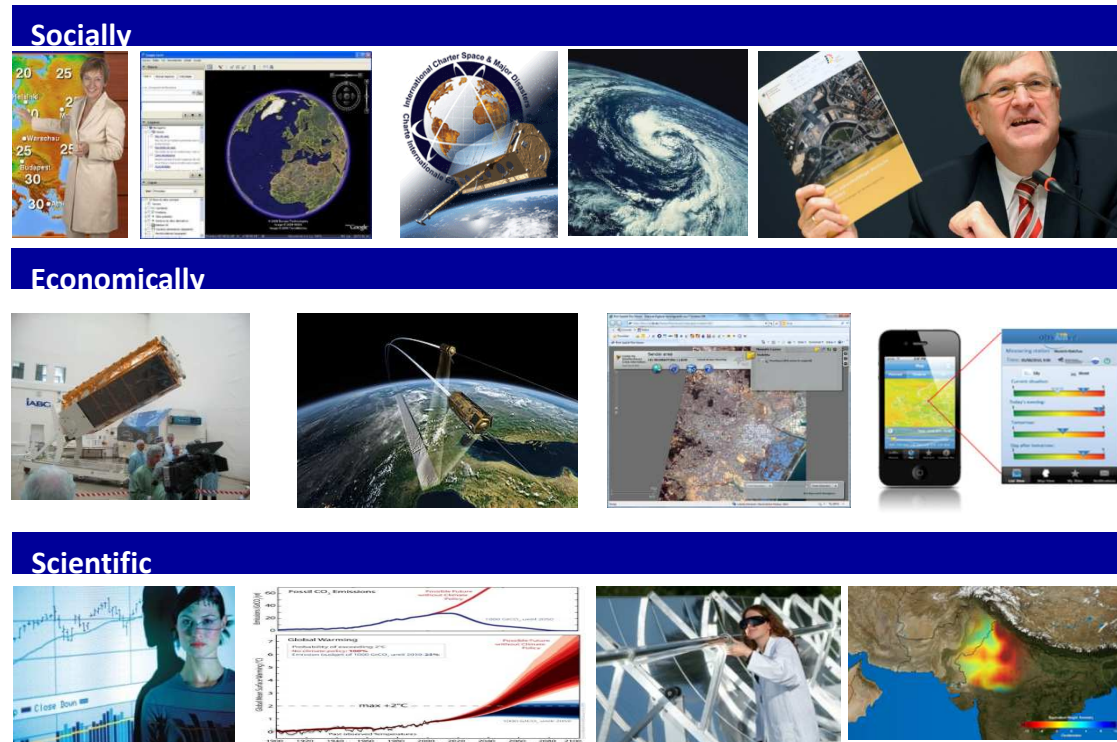
**2. Phase: Pilot Operation (2016 – 2017/18)**

**2. Phase: Regular Operation**





# Importance of Space and Earth Observation

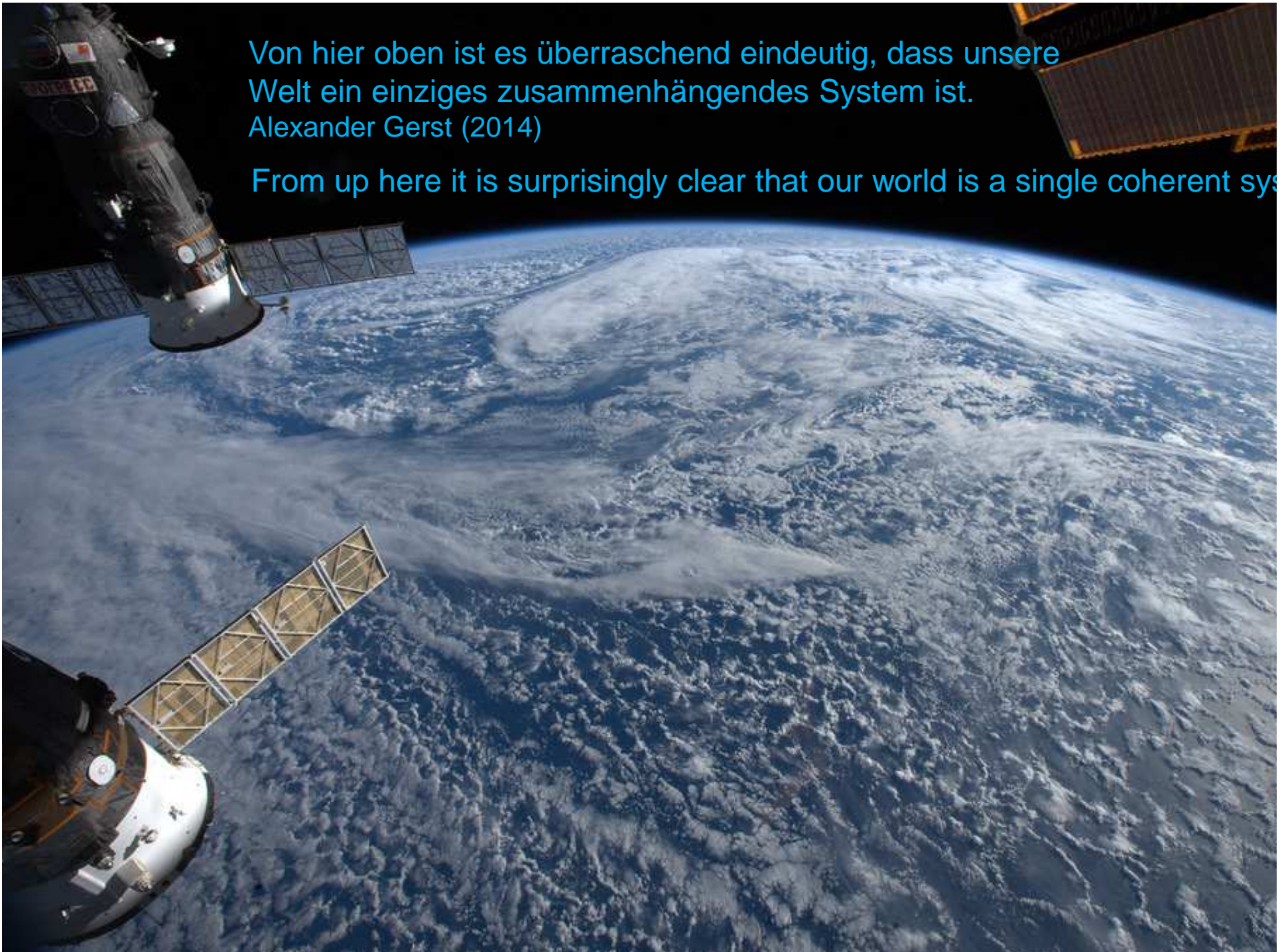


- Space is a means to an end and must be based on the benefits and requirements
- Earth observation makes an outstanding contribution to the solution of terrestrial problems.



Von hier oben ist es überraschend eindeutig, dass unsere Welt ein einziges zusammenhängendes System ist.  
Alexander Gerst (2014)

From up here it is surprisingly clear that our world is a single coherent system.





Questions ?

## Further Infos:

[www.de-copernicus.de](http://www.de-copernicus.de)  
[www.dlr.de](http://www.dlr.de)

[Michael.Bock@dlr.de](mailto:Michael.Bock@dlr.de)



# RESERVE





# Copernicus implementation in Germany: “ Precursor GMES Interface projects”

## Three Copernicus interface projects:

- Address user requirements, conduct feasibility tests
- Focus on operational services
- Stimulate discussion amongst users
- First successes: uptake of EO products/services by national authorities

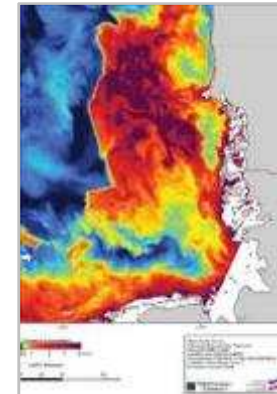
DeCOVER



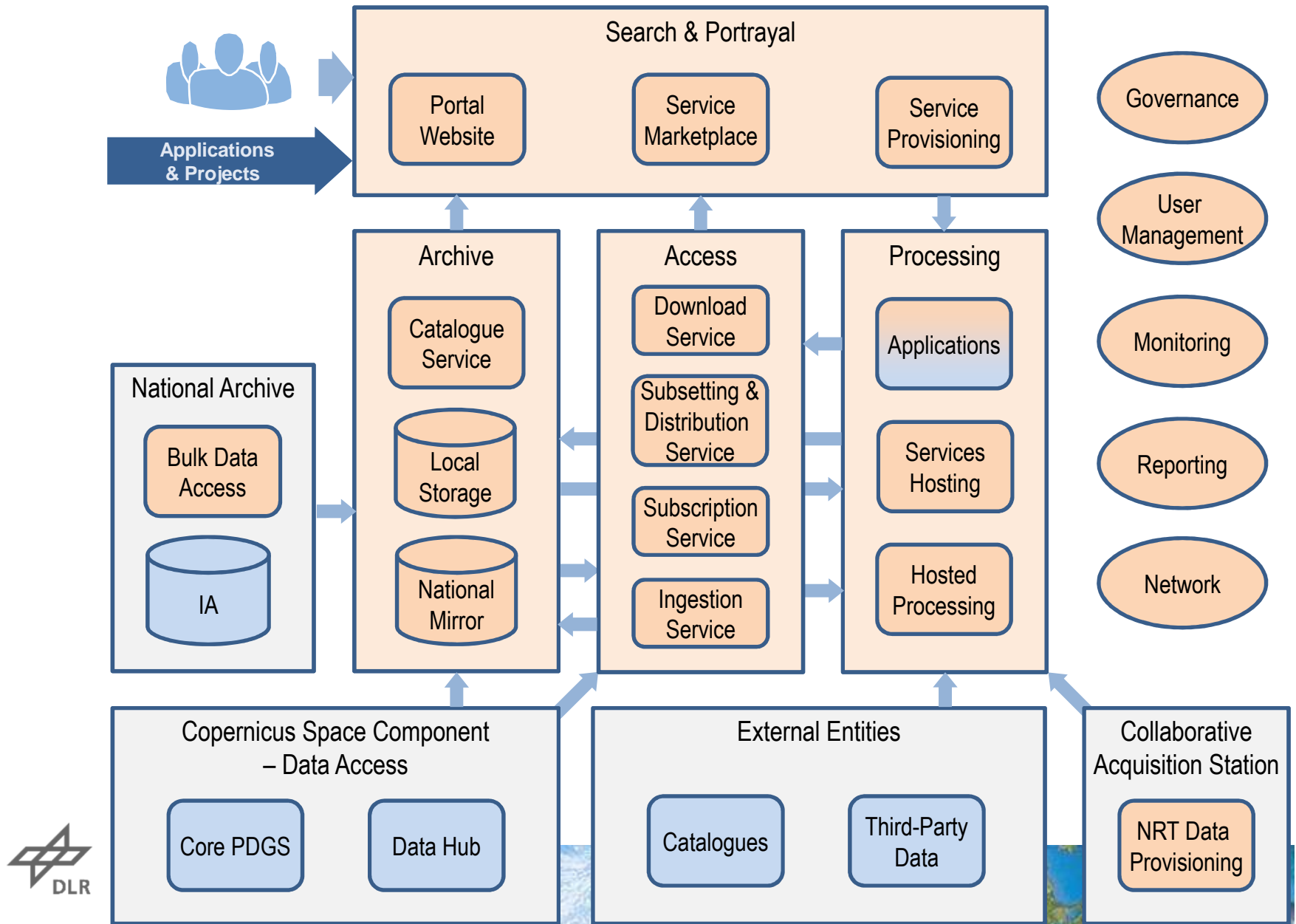
D=Secure



DeMarine

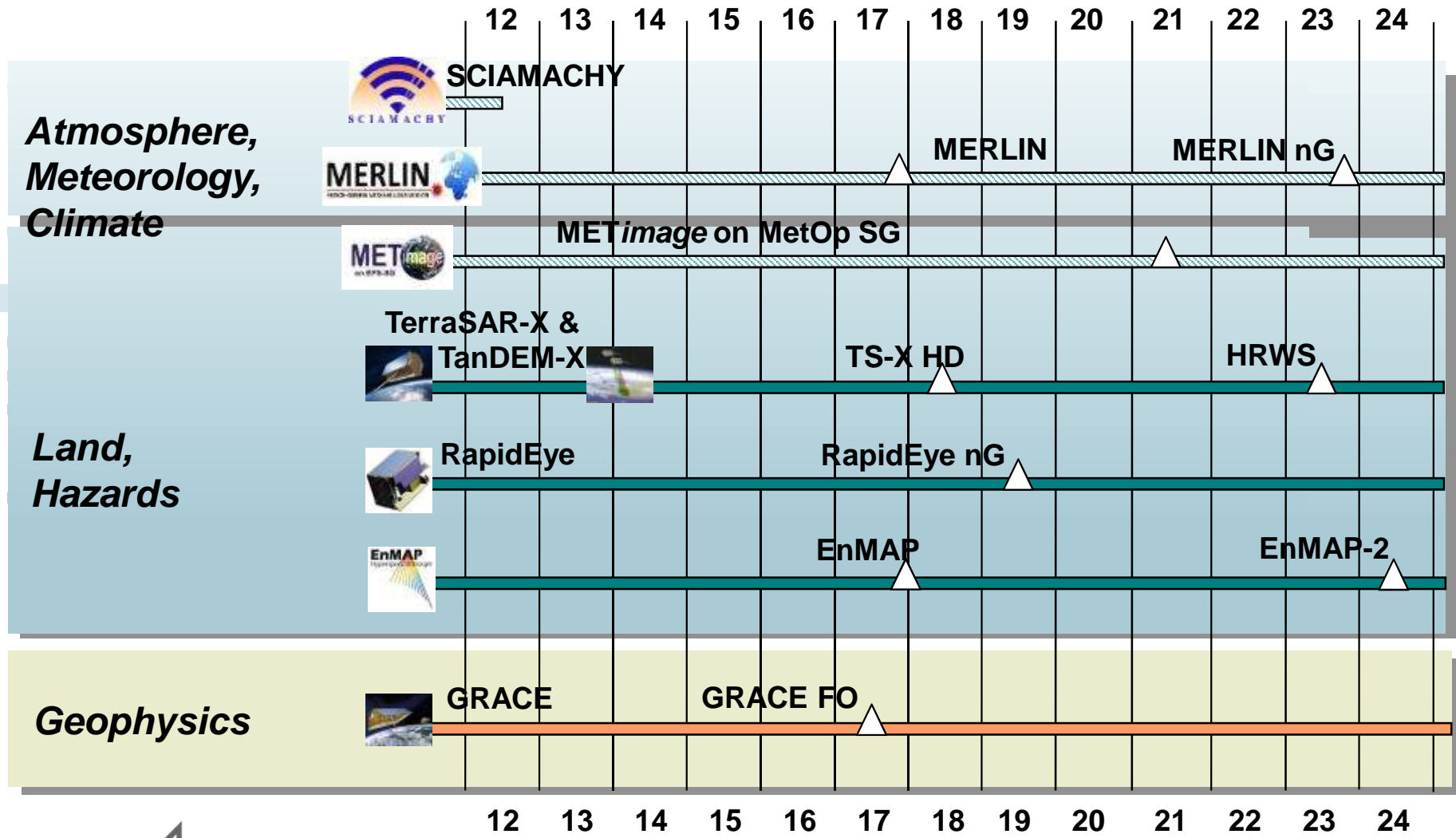


# Systemkonzept



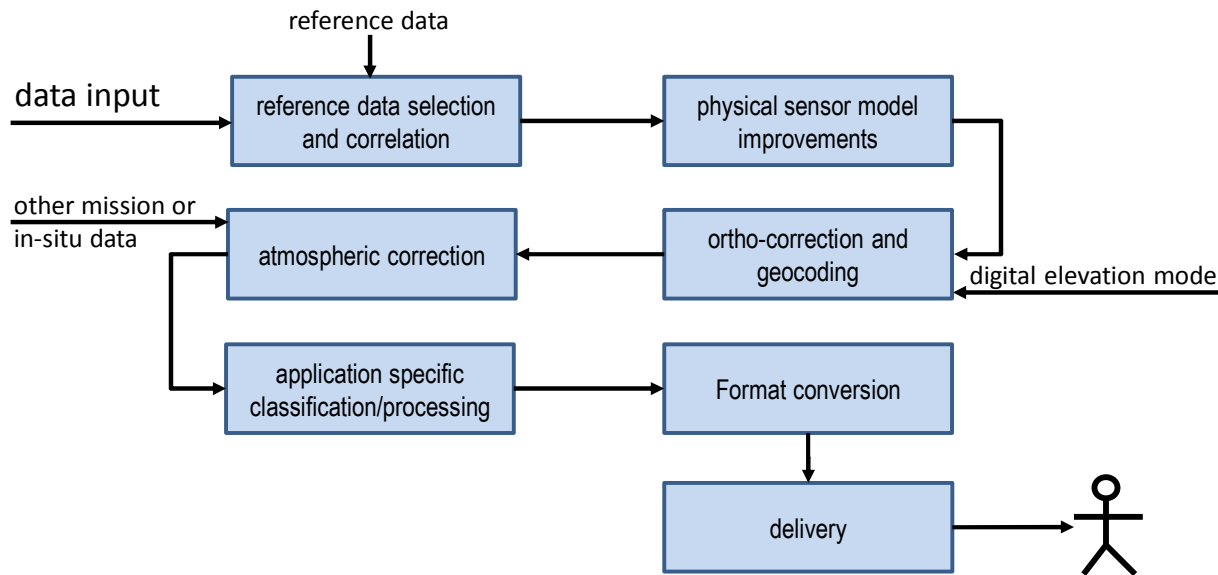
**ERSETZEN**

# National Missions





# Scenario „land applications“



- Regional data sets (~10 TB).
- Requires external data sets
- Planned, often data-driven
- Pre-processing common (geocoding, atmospheric correction, cloud mask)
- Processing local or remote
- Mass production needs to be automated and cost efficient

