

CEOS WGCV # 35

National Report Germany

German Space Centre – Space Administration

Albrecht von Bargaen

Hyderabad, September 25th, 2012



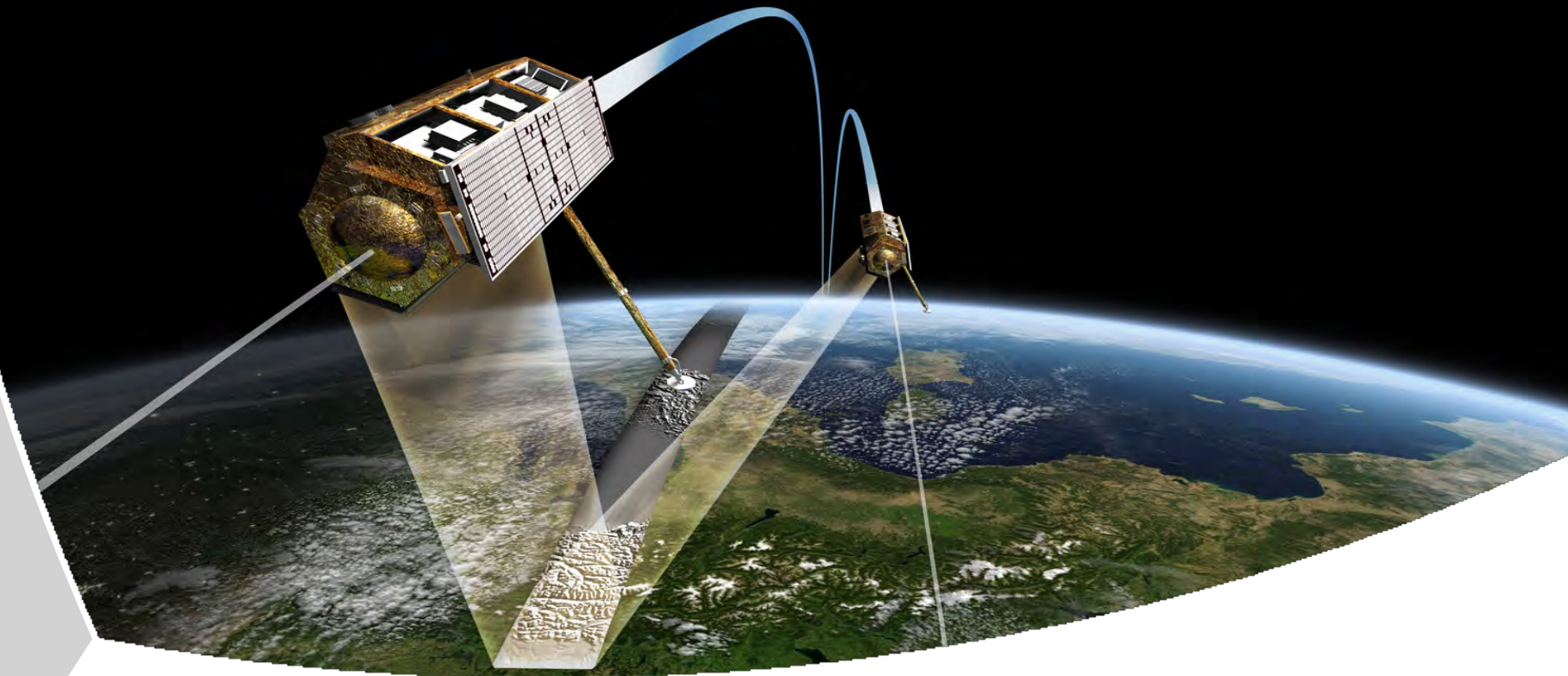
Knowledge for Tomorrow



Outline

- Status of TerraSAR-X / TanDEM-X
- SCIAMACHY Calibration issues
- DLR Validation Site @ DEMMIN
- Others





Status TerraSAR-X / TanDEM-X

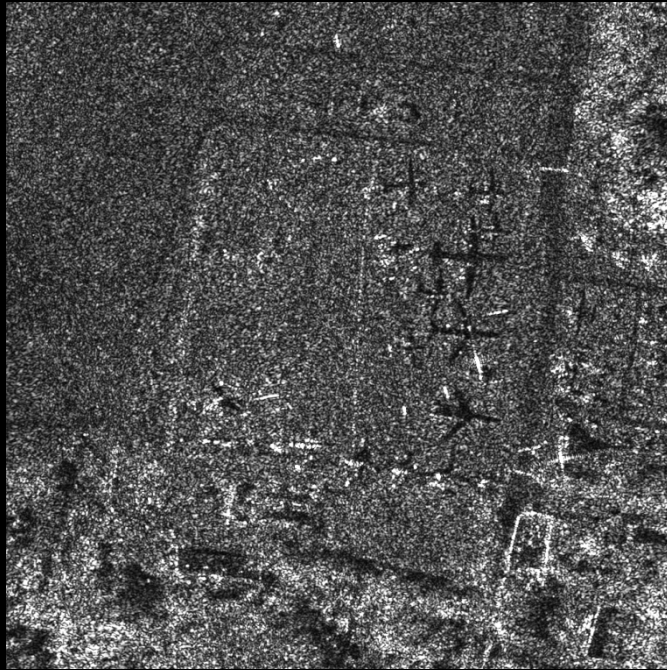


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Enhanced-Spotlight

Spotlight Basic Product



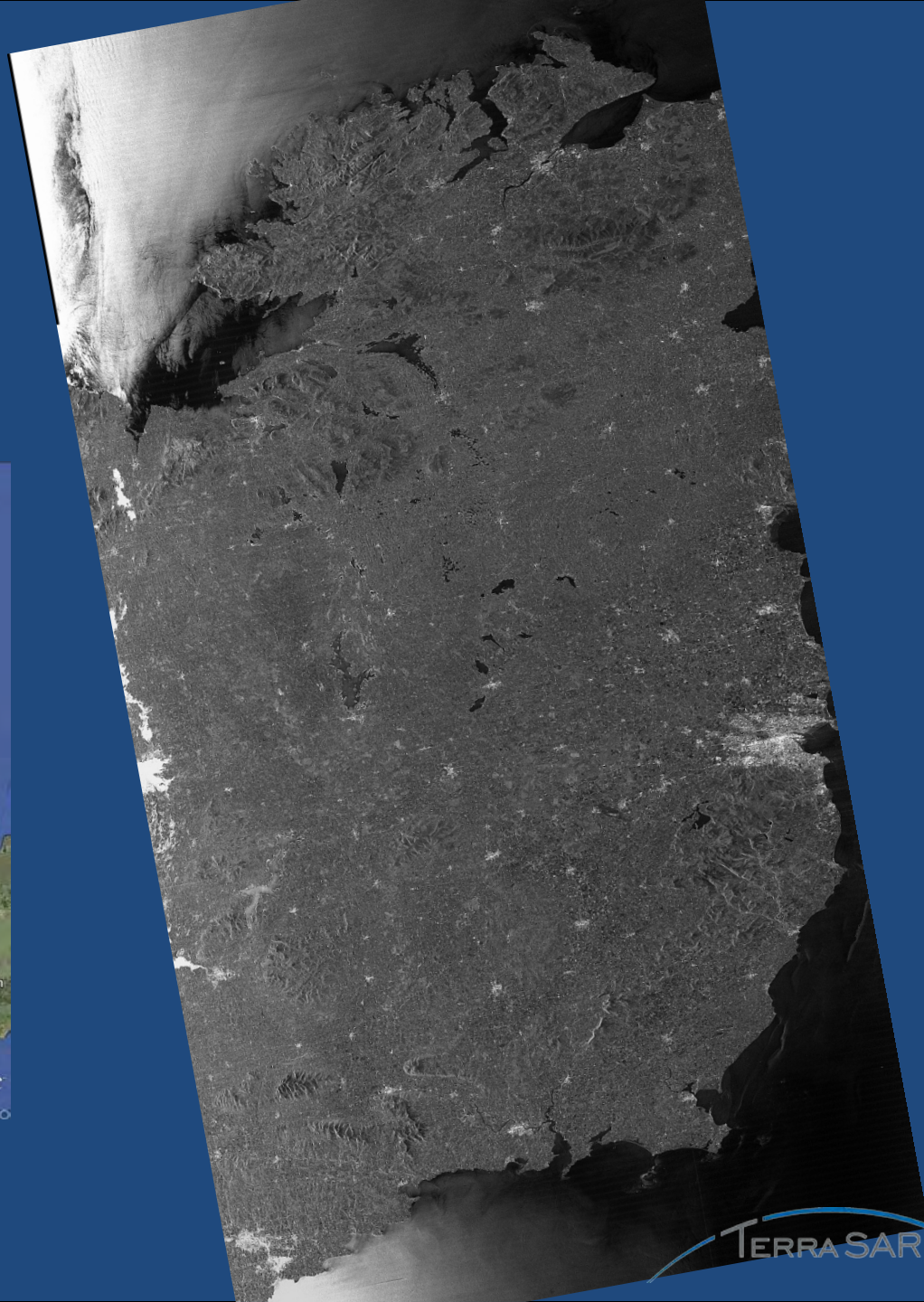
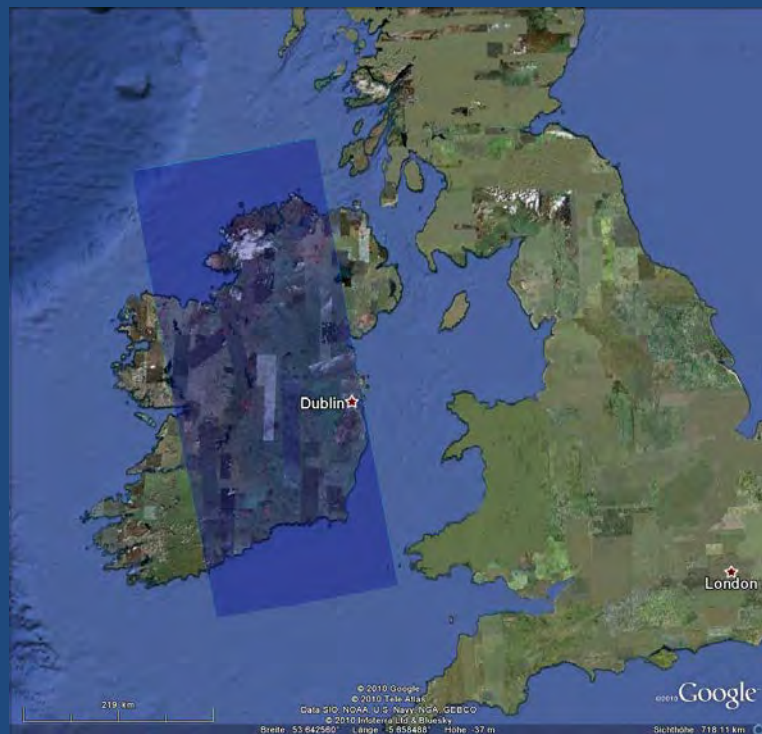
Enhanced Spotlight
improved radiometric resolution



Resolution: $\sim 1 \text{ m} \times 1 \text{ m}$

8-Beam ScanSAR
Swath width: 200 km
(experimental)

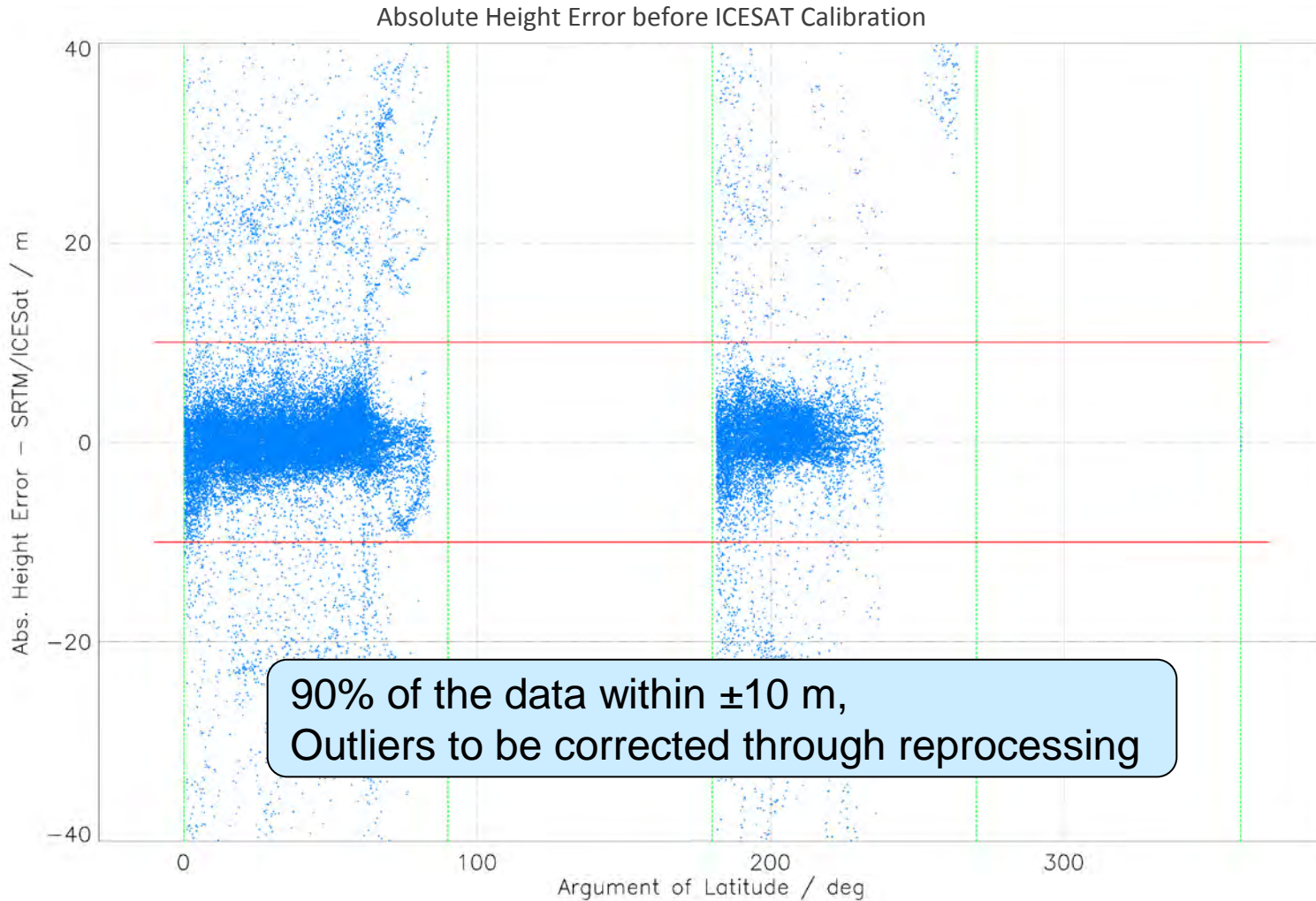
Ireland



Relative Height Error of 1st Global Acquisition

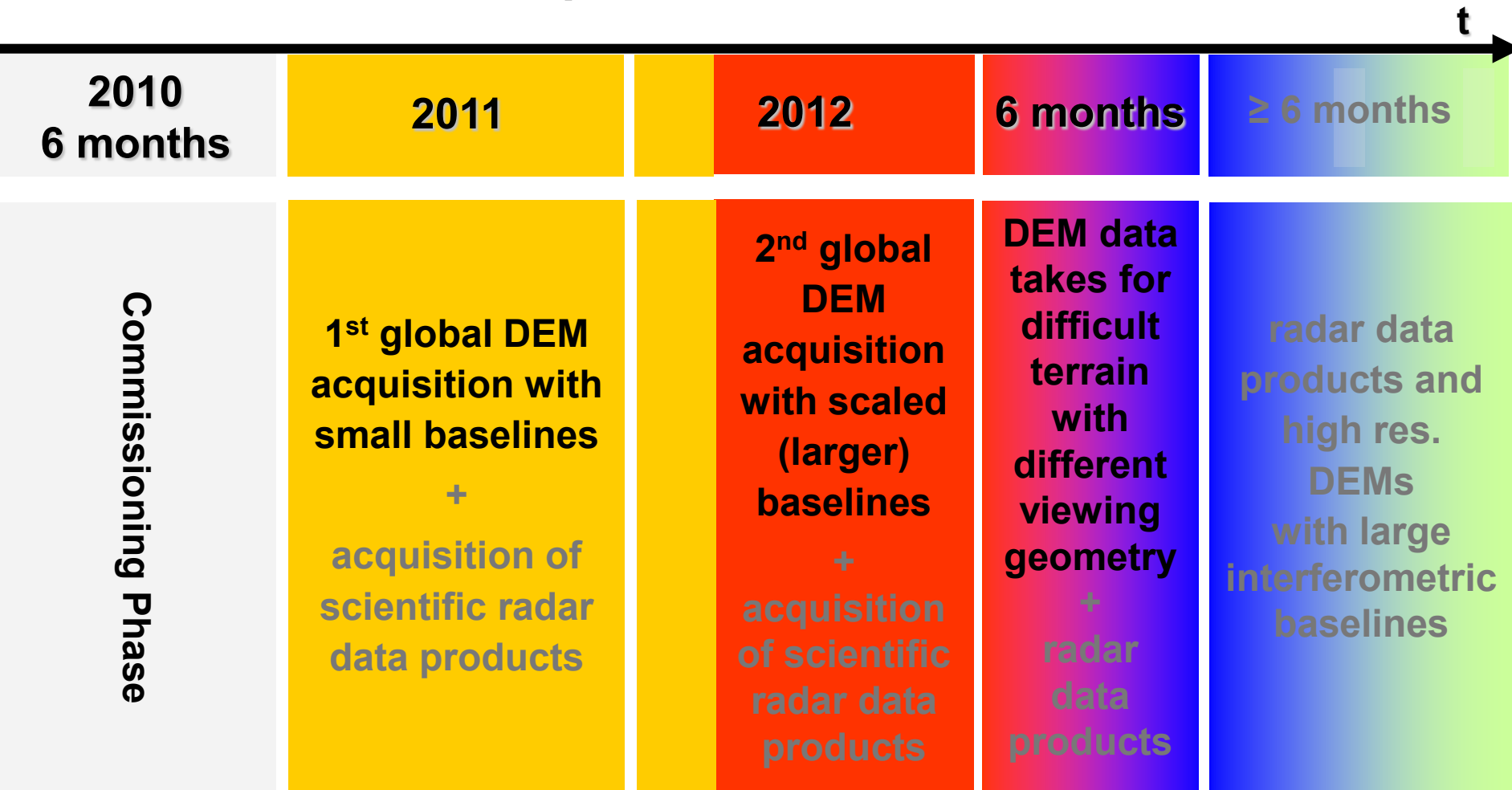


Absolute Calibration of Scene-Based DEMs Further Improved





Outline of the Data Acquisition Plan



Mid 2014: DEM processing finished (90%) - 1500 TByte to handle



SCIAMACHY on ENVISAT

Recent Results and Achievements

H. Bovensmann and the SCIAMACHY QWG

Contact:

Heinrich.Bovensmann@iup.physik.uni-bremen.de

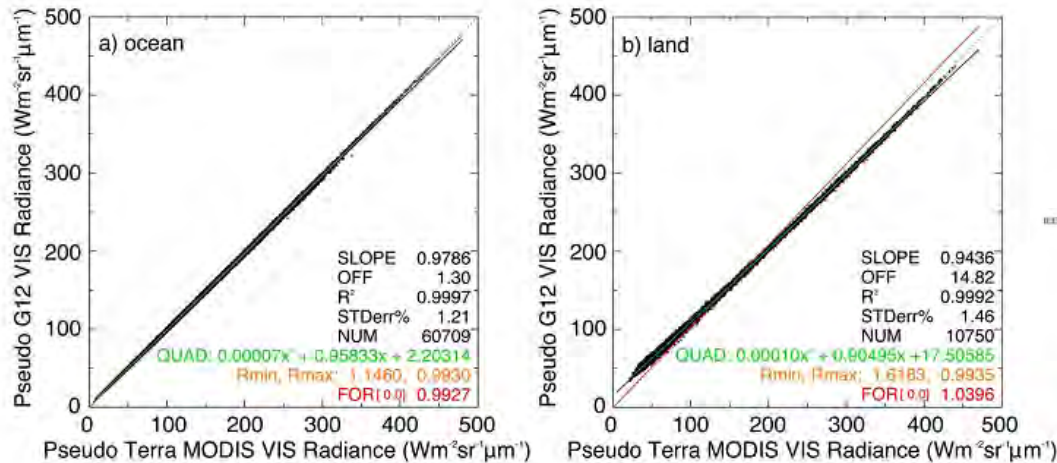


Usage of SCIAMACHY Level-1 data for „climate benchmarking“

- 10 years well calibrated high spectral resolution SCIAMACHY Radiance, Irradiance and Reflectance Data can serve as climate benchmark, as it covers nearly (240 nm – 2,4µm) the full solar spectral range!
- SCIAMACHY radiance/reflectance data is very well suited to inter-calibrate sensors with different spectral resolution (GSICS example SCIA-MODIS-METEOSAT, Doelling et al. 2012)
- SCIAMACHY Earth Radiance used to specify climate benchmark missions like CLARREO (US Decadal Survey)
 - Roberts, Y. L., P. Pilewskie, and B. C. Kindel, Evaluating the observed variability in hyperspectral Earth-reflected solar radiance, J. Geophys. Res., 116, D24119, 2011.
- SCIAMACHY Spectral Solar Irradiance data allows in depth characterisation of solar irradiance variations during solar cycle 21-13
- [Systematic research to make full usage of the radiance and irradiance data set in Europe is limited by lack of dedicated funding!]



SCIAMACHY used for inter-calibrating GOES, MODIS and Meteosat

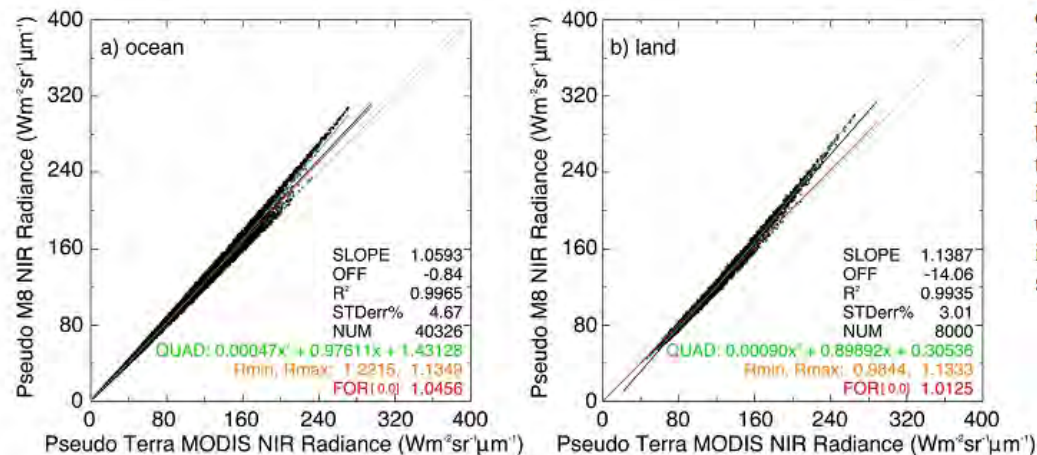


IEEE GEOSCIENCE AND REMOTE SENSING LETTERS, VOL. 9, NO. 1, JANUARY 2012

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Spectral Reflectance Corrections for Satellite Intercalibrations Using SCIAMACHY Data

David R. Doelling, Constantine Lukashin, Patrick Minnis, Benjamin Scarino, and Daniel Morstad

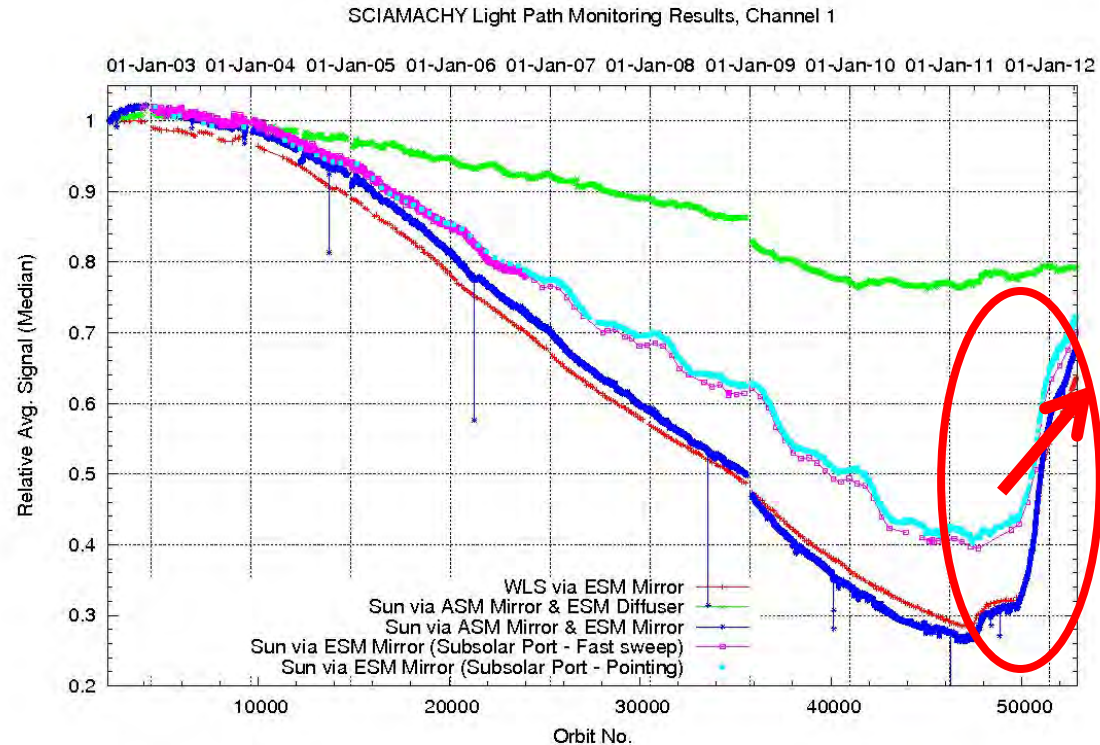


the radiances used for the imager intercalibrations. Using two different cases over both water and land, which differ the most spectrally, this letter has demonstrated that the SCIAMACHY spectra can be used to accurately account for the spectral response differences between similar channels, even those that barely overlap, on different imagers yielding calibration equations that differ by less than 0.5%. Based on these initial results, it is concluded that the SCIAMACHY data can be successfully used to develop spectral response corrections for many pairs of imager channels having wavelengths within the SCIAMACHY spectral range. Further study should address the dynamic range,



SCIAMACHY Throughput Recovery

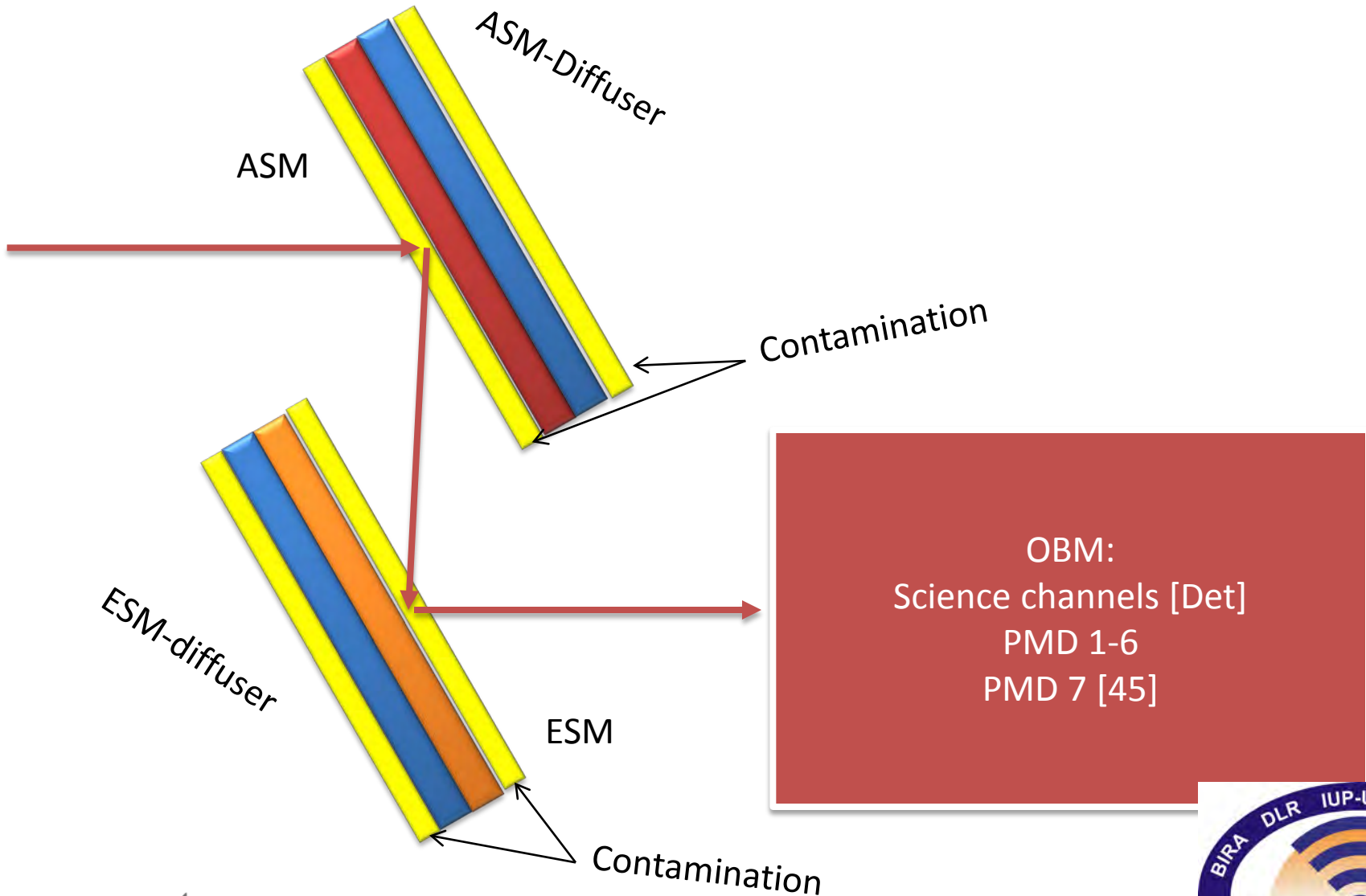
- SCIAMACHY/ENVISAT in excellent shape until the ENVISATs sudden death (April 2012)
- Recovery of throughput since February 2011:
 - Ch. 1 (UV) - Ch. 4 (NIR)
 - Ch. 1: <30% (1/2011) -> over 70% (4/2012) throughput
 - Operational degradation correction is covering the fast recovery



prod. 23-Apr-2012 by SOST-IFE (Stefan.Noel@iup.physik.uni-bremen.de)



New Degradation Approach



Main SCIAMACHY Calibration Equation

Following SRON's *SCIAMACHY degradation model ATBD*:

$$S_{det} = \underbrace{M_1}_{\text{radiance re-}} \cdot \underbrace{M_1^{OBM}}_{\text{response}} \cdot \underbrace{\begin{pmatrix} 1 & \mu_2^{OBM} & \mu_3^{OBM} & \mu_4^{OBM} \end{pmatrix}}_{\text{OBM m-factor } m_1} \cdot \underbrace{\begin{pmatrix} M_{11}^{SC} & M_{12}^{SC} & M_{13}^{SC} & M_{14}^{SC} \\ M_{21}^{SC} & M_{22}^{SC} & M_{23}^{SC} & M_{24}^{SC} \\ M_{31}^{SC} & M_{32}^{SC} & M_{33}^{SC} & M_{34}^{SC} \\ M_{41}^{SC} & M_{42}^{SC} & M_{43}^{SC} & M_{44}^{SC} \end{pmatrix}}_{\text{OBM polarisation sensitivity } \vec{\mu}} \cdot \underbrace{\begin{pmatrix} 1 \\ q \\ u \\ v \end{pmatrix}}_{\text{Scanner model } \vec{K}(d)} \cdot \underbrace{I}_{\text{Incoming signal}}$$

- q, u, v are the fractional polarisation of the incoming light.
- WLS and solar light are unpolarized: $q = u = v = 0$!
- d thickness of the contamination layer(s).

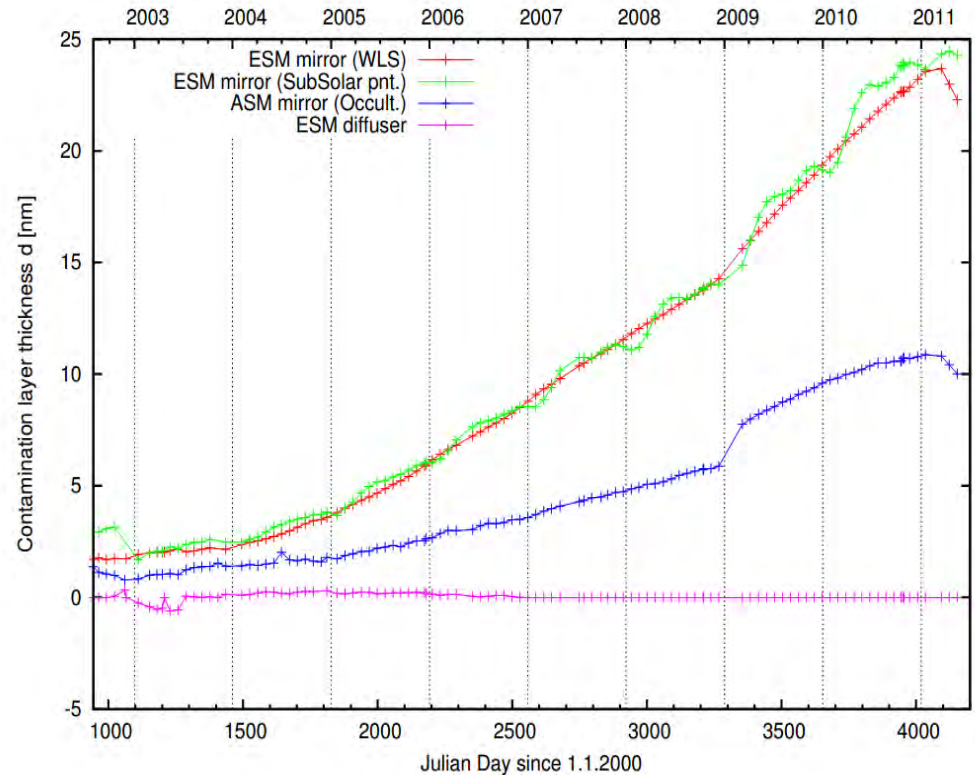
Simplified notation:

$$S_{det} = m_1 \cdot M_1 \cdot \vec{\mu} \cdot \vec{K}(d) \cdot I$$

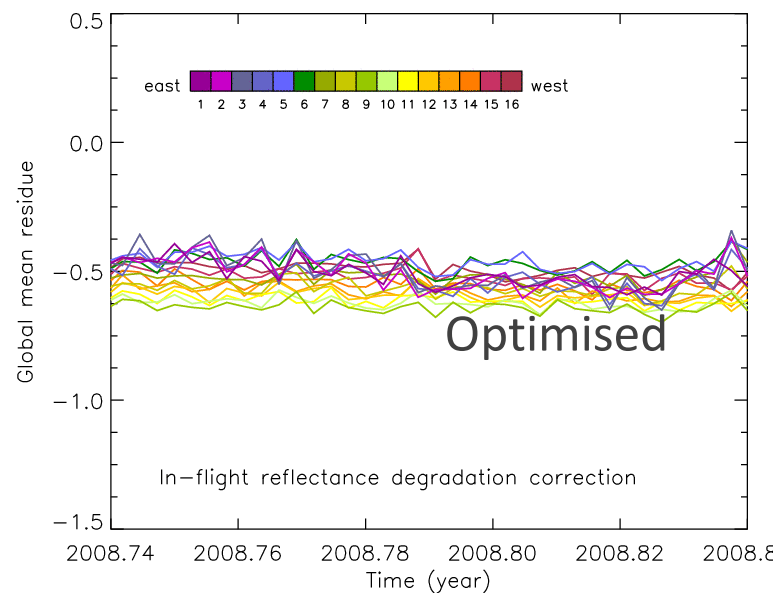
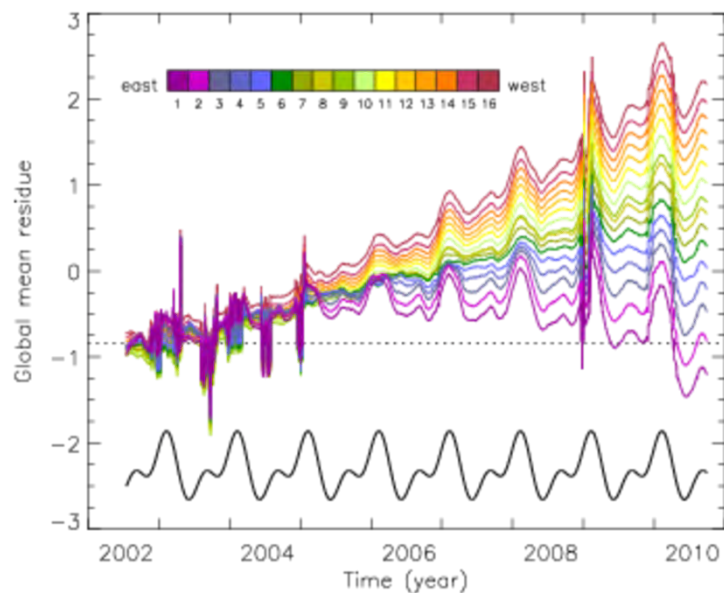


SCIAMACHY New End-to-End Calibration Model

- New end-to-end calibration model including contaminant layer modelling under test
- Uses **on-ground and in-flight calibration** data to constrain full Muller Matrix of the instrument over mission lifetime.
- Minimises impact of scan angle dependent degradation
- Contaminant layer thickness on mirrors to be monitored including their impact on instrument degradation
- Implementation planned ongoing



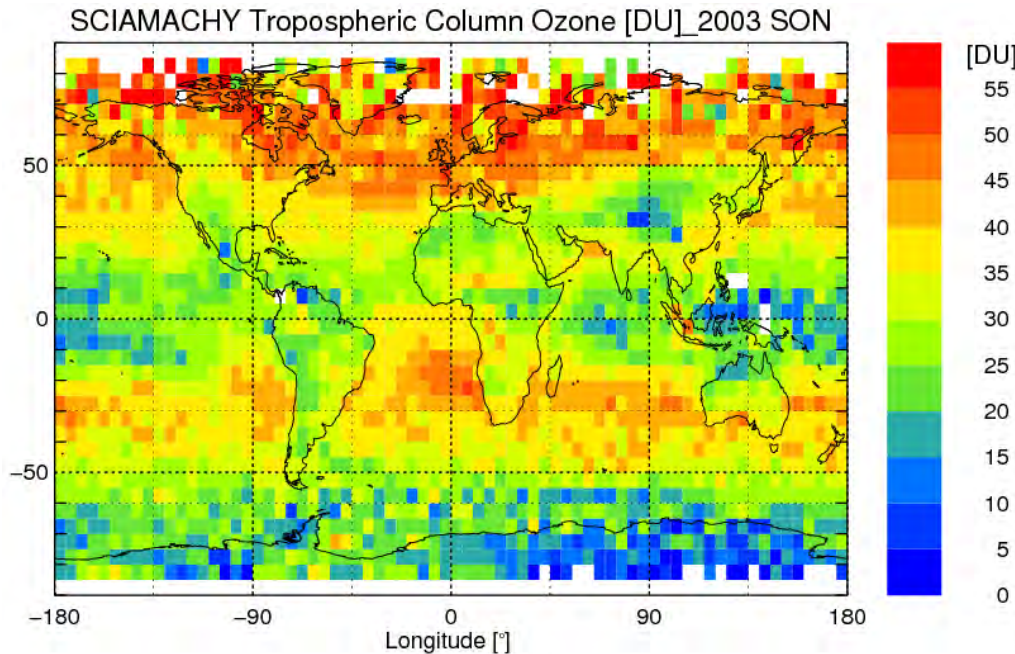
And does new approach work?



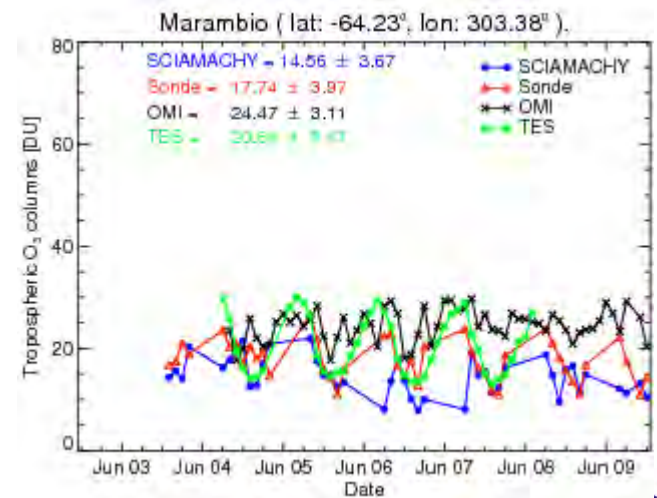
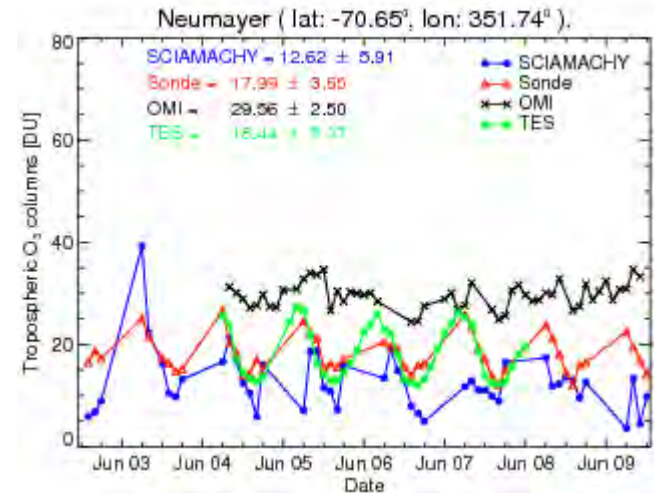
- Substantial reduction of the impact of the scan angle dependent degradation on Absorbing Aerosol Index (AAI) global residuals.



SCIAMACHY trop. O₃ from Limb-Nadir



- improved scientific data product tropospheric column O₃ from combined limb-nadir data analysis under development and validation
- Monthly mean difference to O₃ sondes typically 10%-20%



Eboje et al. 2012, in preparation





DEMMIN

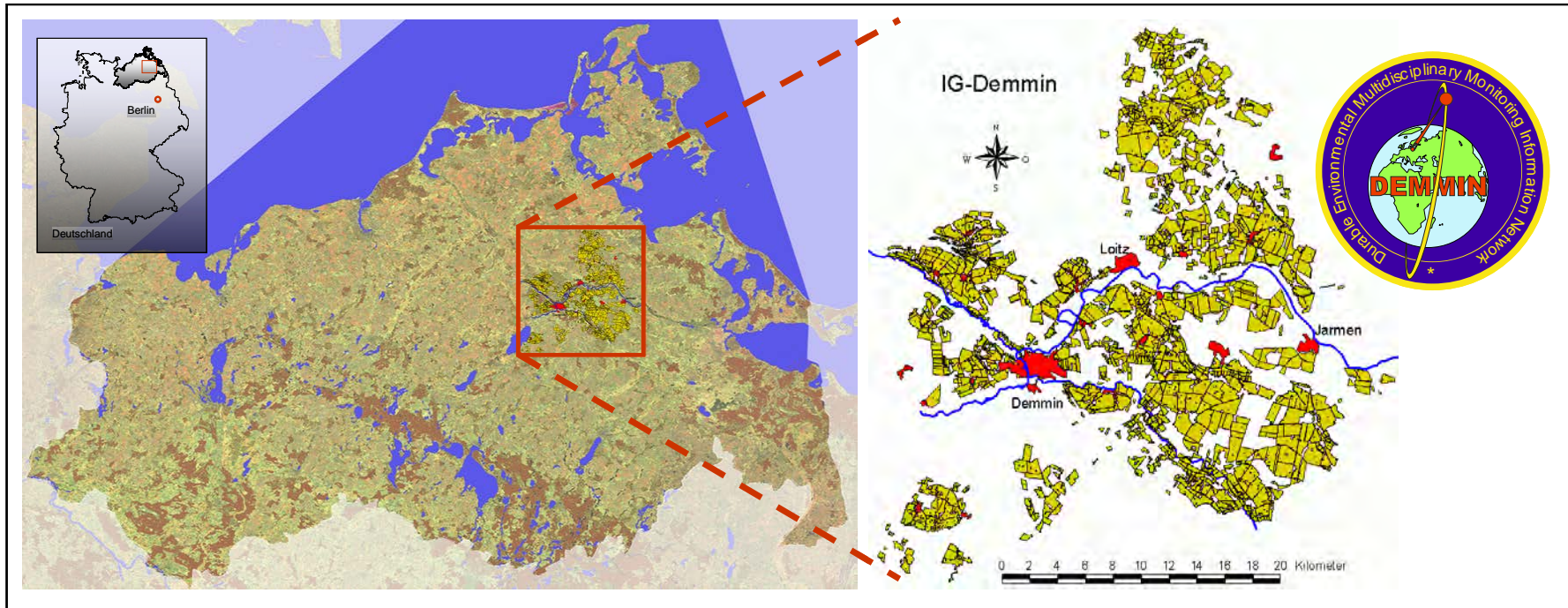
Test site for calibration and validation of remote sensing missions, sensors, data and value added products

Neustrelitz, 24.07.2012

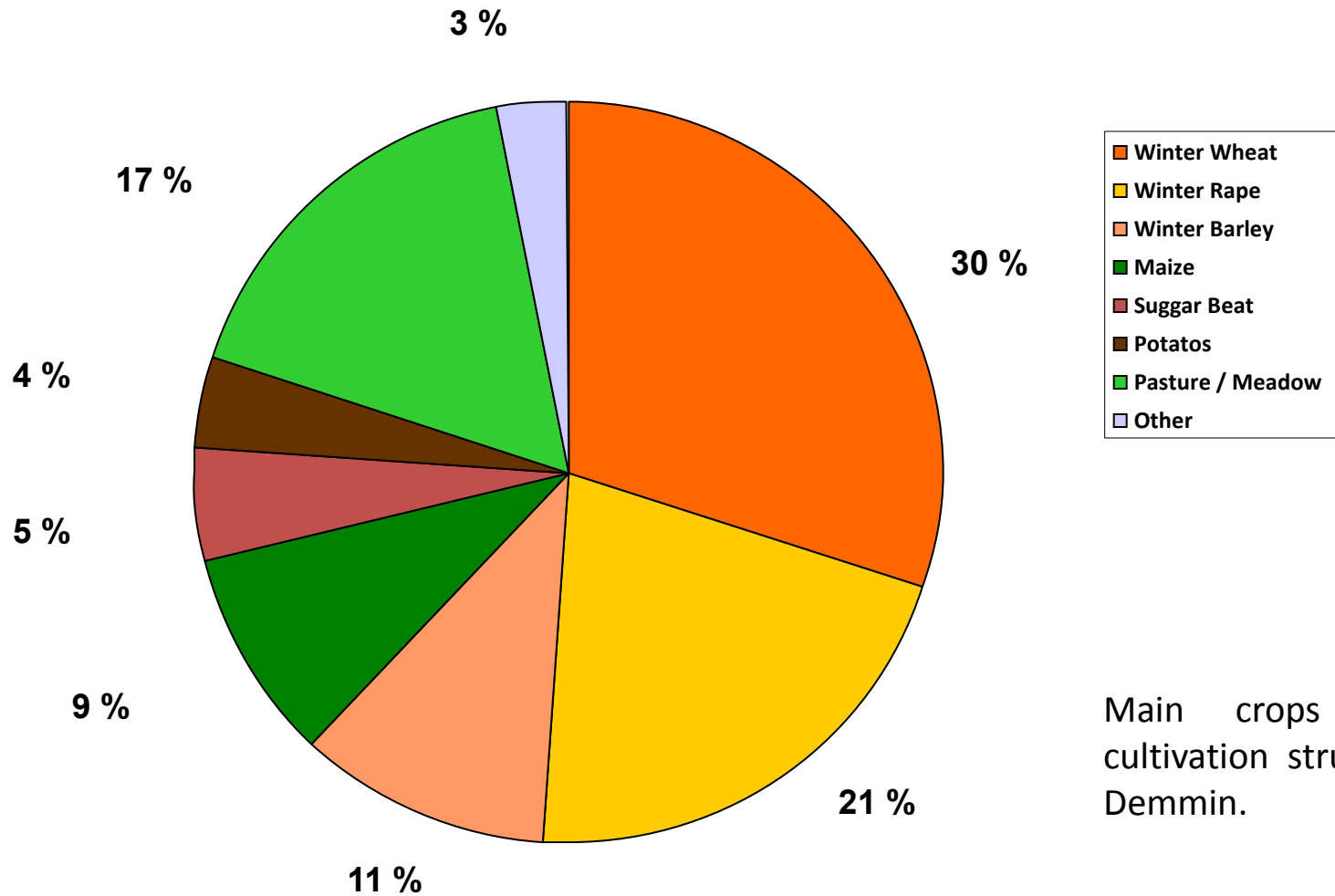


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Durable Environmental Multidisciplinary Monitoring Information Network (DEMMIN)



Cultivation Structure of IG Demmin



Main crops and average cultivation structure of the IG Demmin.

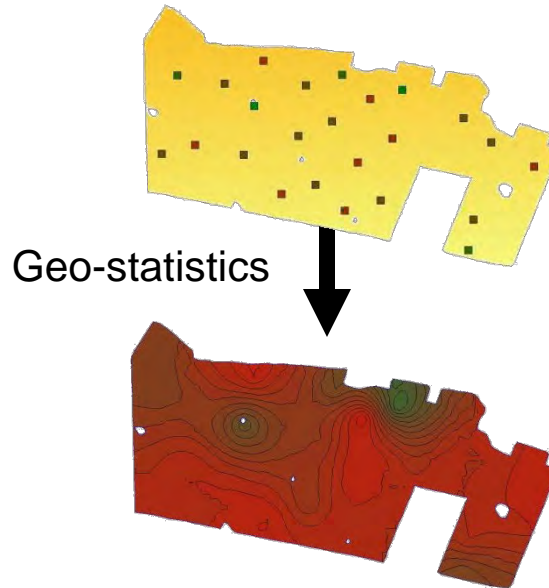


Partial Data Availability by Precision Farming Techniques

Yield-Measures



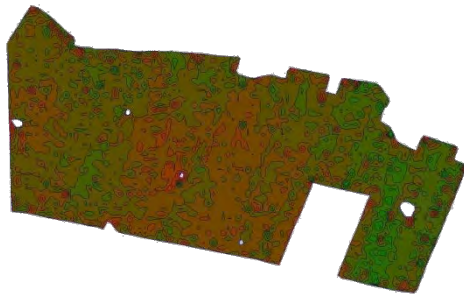
Geo-statistics



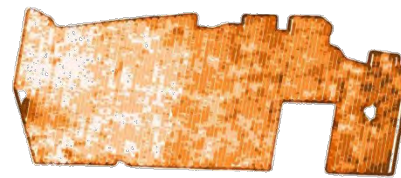
N-sensor for measuring
Nitrogen content of crops



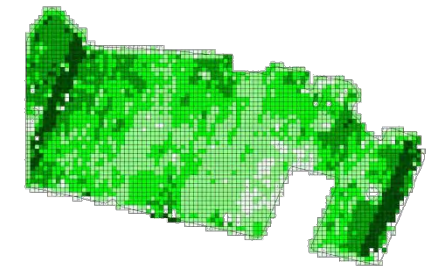
Regular soil investigation
(cycle 4 years)



Yield mapping



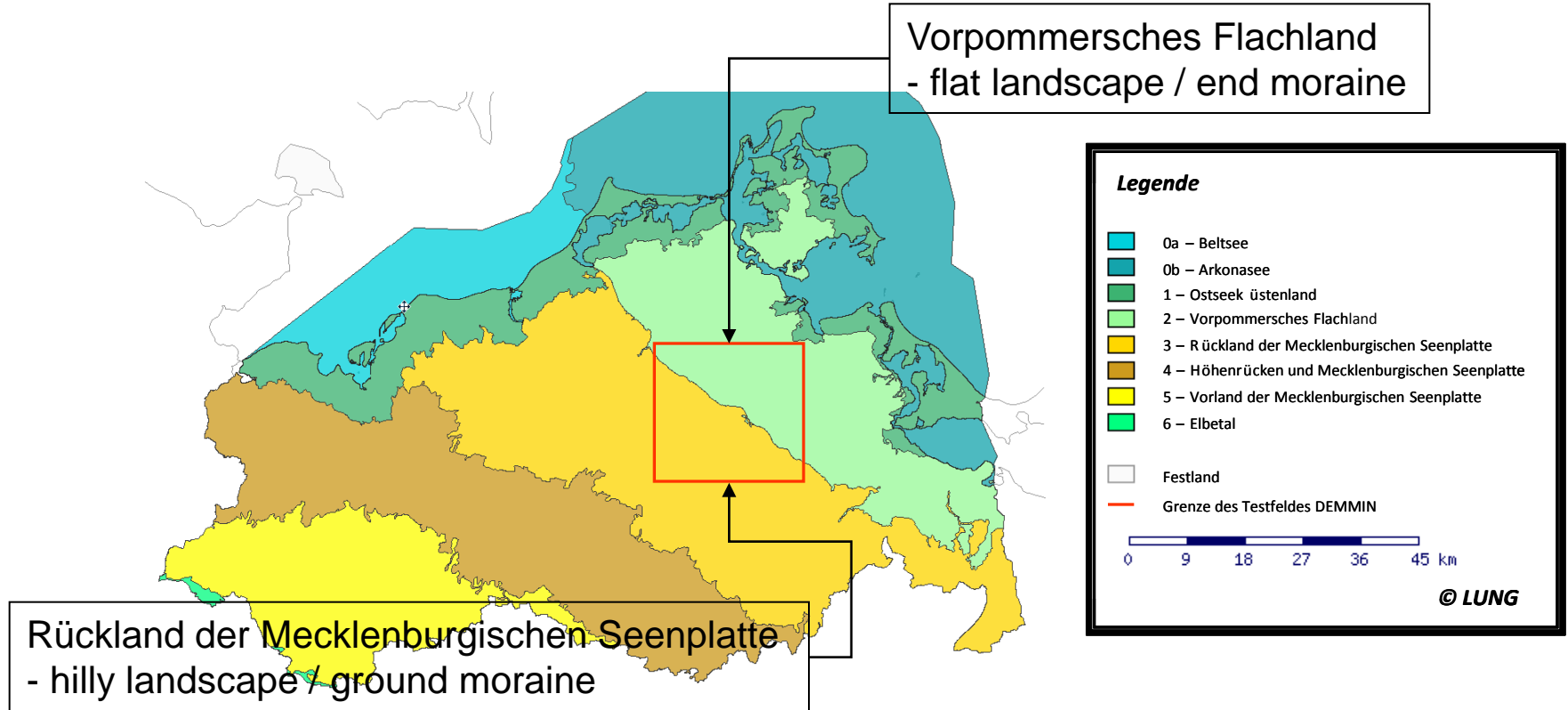
Em38 – Soil conductivity



N-Sensor / Biomass



Landscape Zones



Formation of observatory DEMMIN with respect to landscape zones

(<http://www.umweltkarten.mv-regierung.de/script/>)



Hydrology



characterized by

- diffuse, undeveloped water network,
- internal drainage areas,
- innumerable lakes,
- many bifurcation,
- numerous hollow forms (germ: sölle)

Rivers: Trebel, Tollense, Peene

Lakes: Kummerower lake - 0.2 m over NN

Malchiner lake - 0.6 m over NN

Peene: approx. river depth 2 - 3 m;

approx. river slope (Malchin to Peene
mouth 0.03%)

Peene in the region of old peat-ditches. Especially notable are the natural meander.

Natural peat bogs formed by through flow along Peene

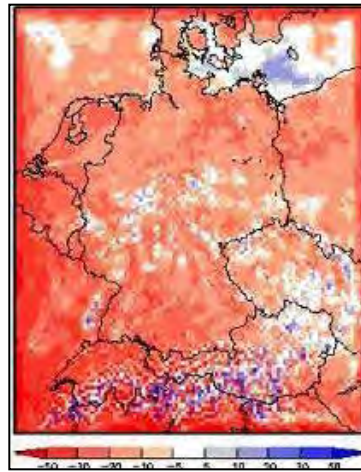


TERrestrial ENvironmental Observatories (TERENO)

Climatological Forecast

Climatological models forecast a significant climate change (Period: 100 years)

- increase of annual mean temperature von 2.5 –3.5°C,
- decrease of annual mean precipitation of up to 30 %



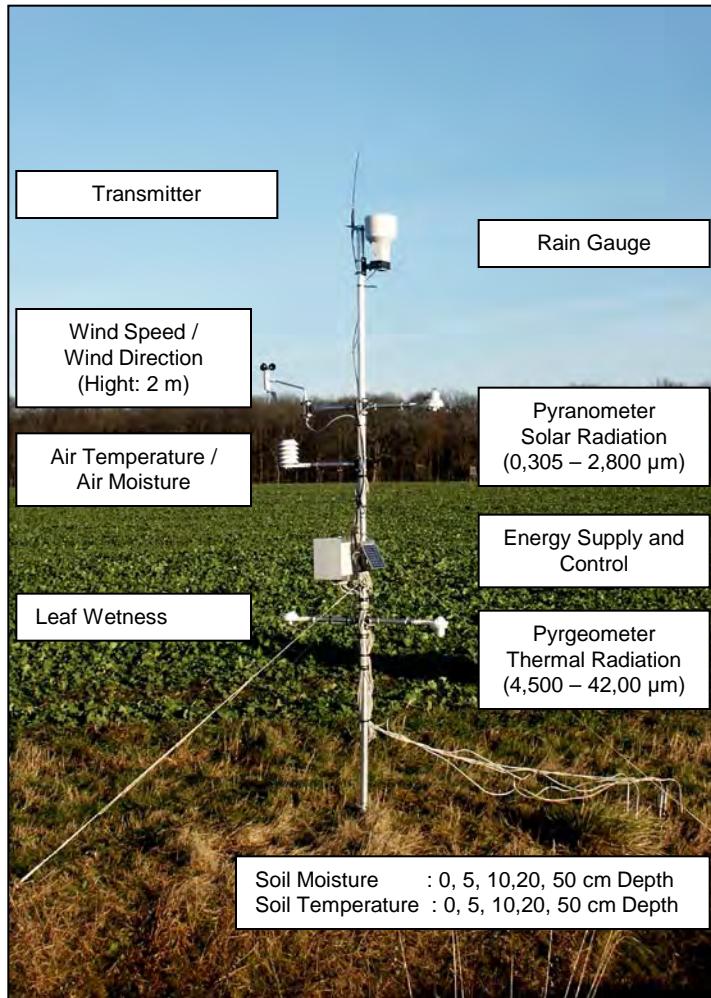
Regions of high stress

Spatial distribution of climate change on regional scale

Klimageschichte Mitteleuropas - 1200 Jahre Wetter, Klima, Katastrophen (Glaser, 2008)



Automatic Meteorological Network

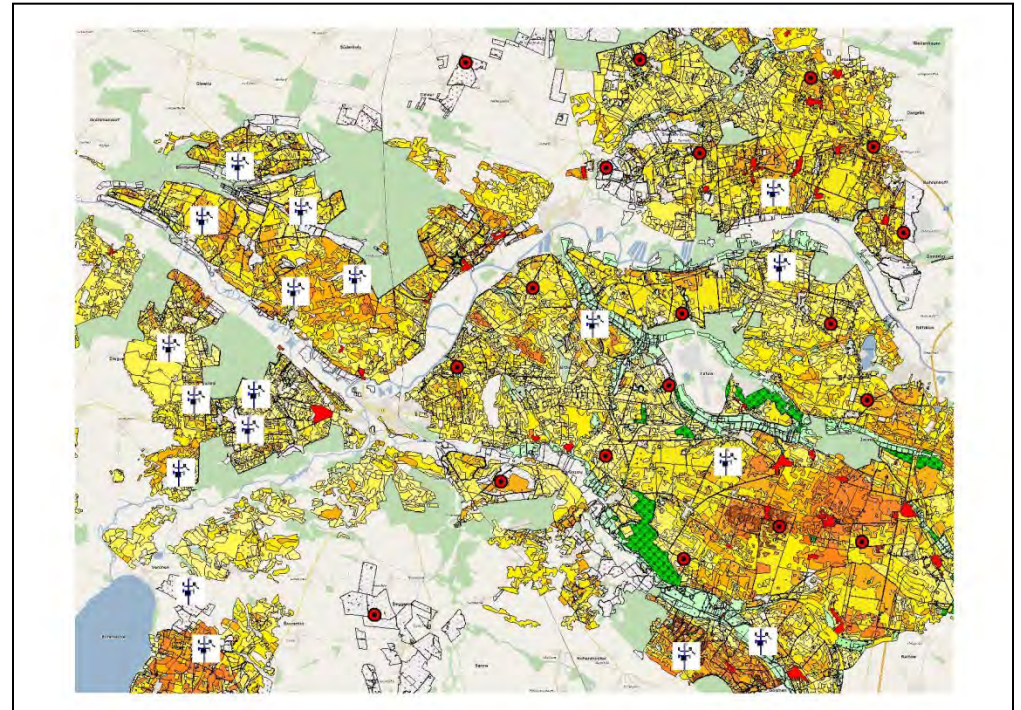
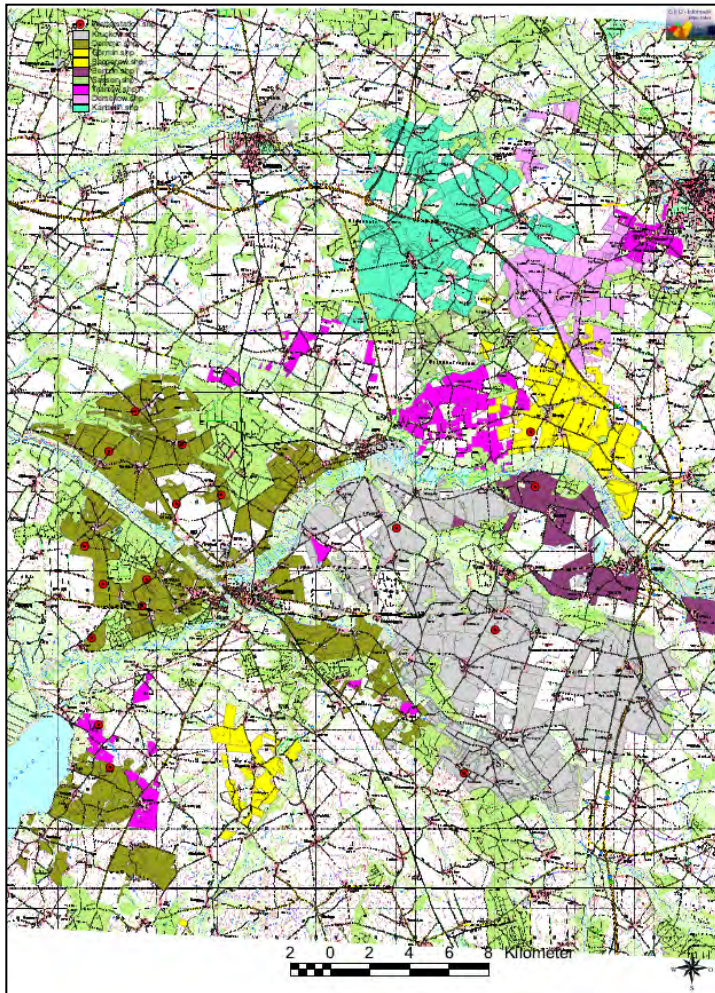


- 30 meteorological stations
- measurement interval 15 minutes (programmable)
- data transfer between meteorological station and data server is realized by telemetry transfer
- web-based data access on data server

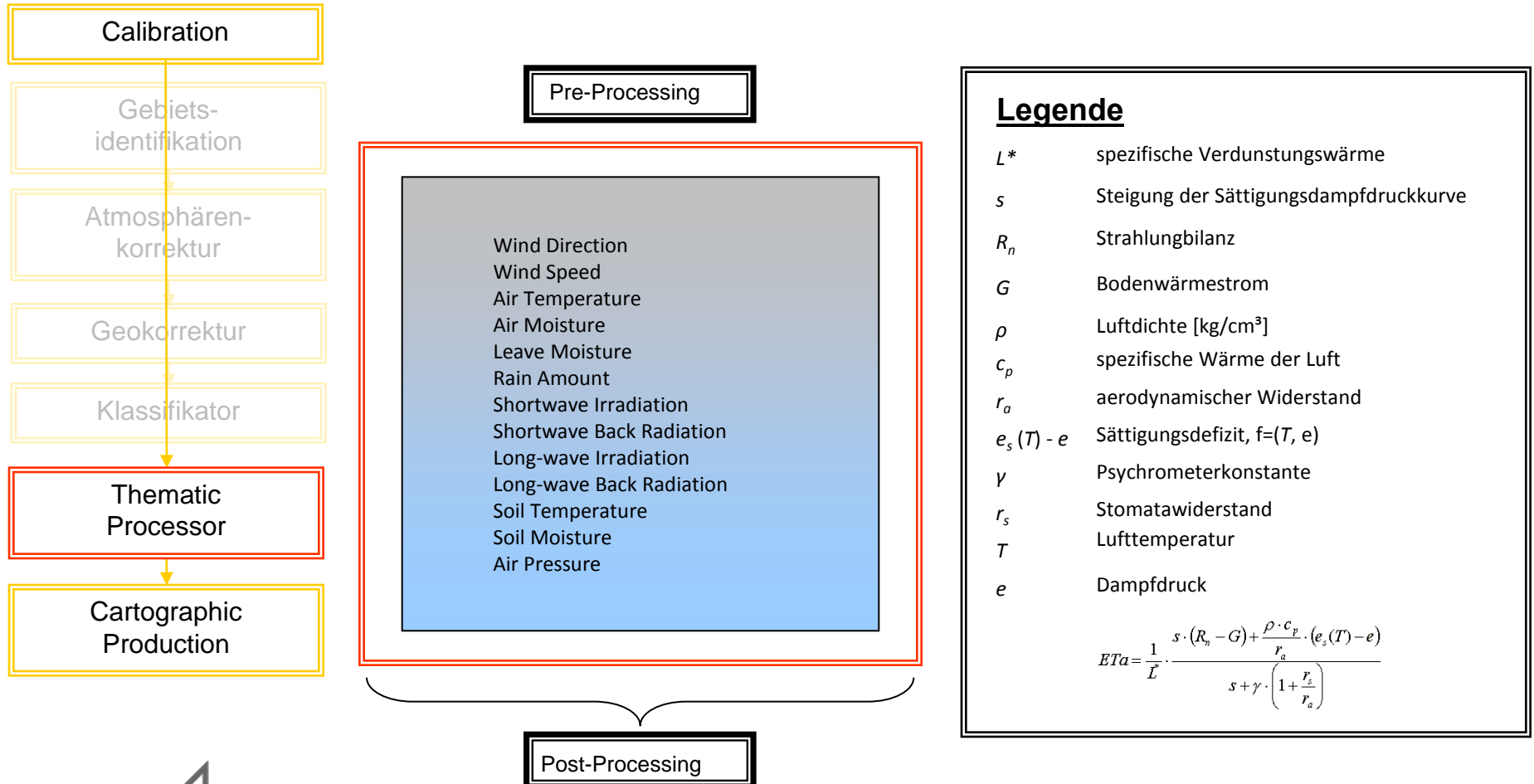
- Corner-Reflektoren für Radarmissionen (Buchholtz)



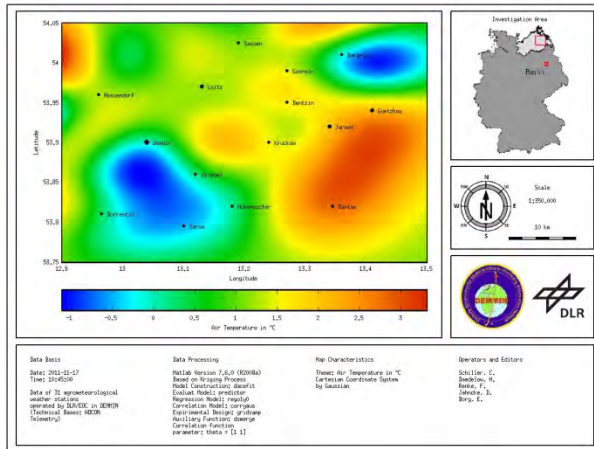
Measurement Network – 2013: 40 Stations



In-situ-Data Thematic Processor – RealET



Browse data / Weather Measuring Network

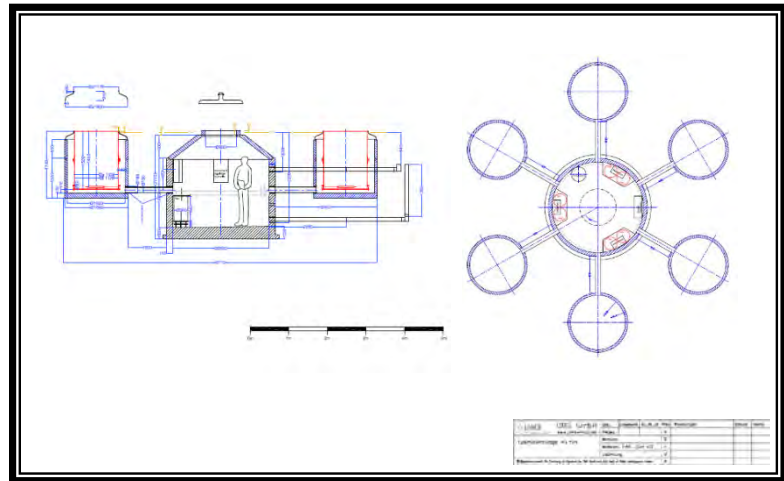
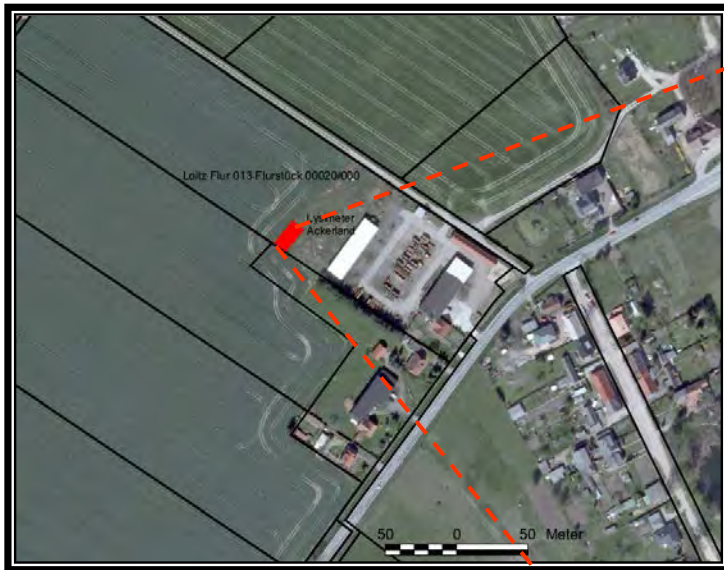


Weather measuring network

- Automated derivation of In-situ-data
- 19 Basic products
- xx Additional products

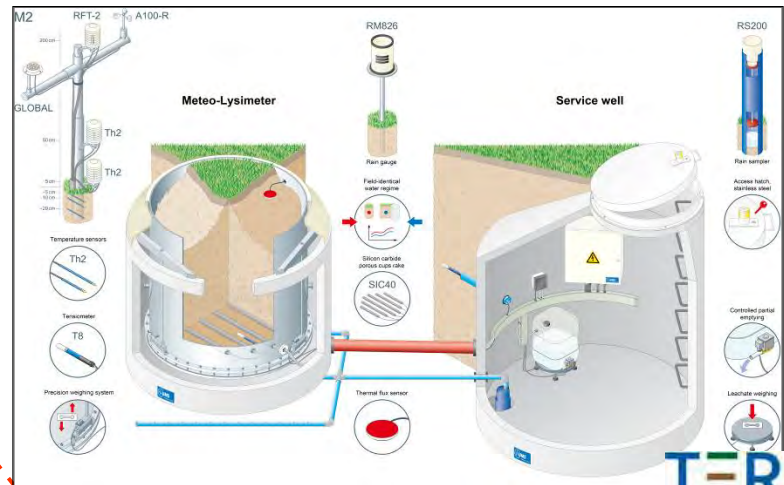


Lysimeter Station - Project SoilCAN



- Lysimeter station Rustow – 6 monoliths

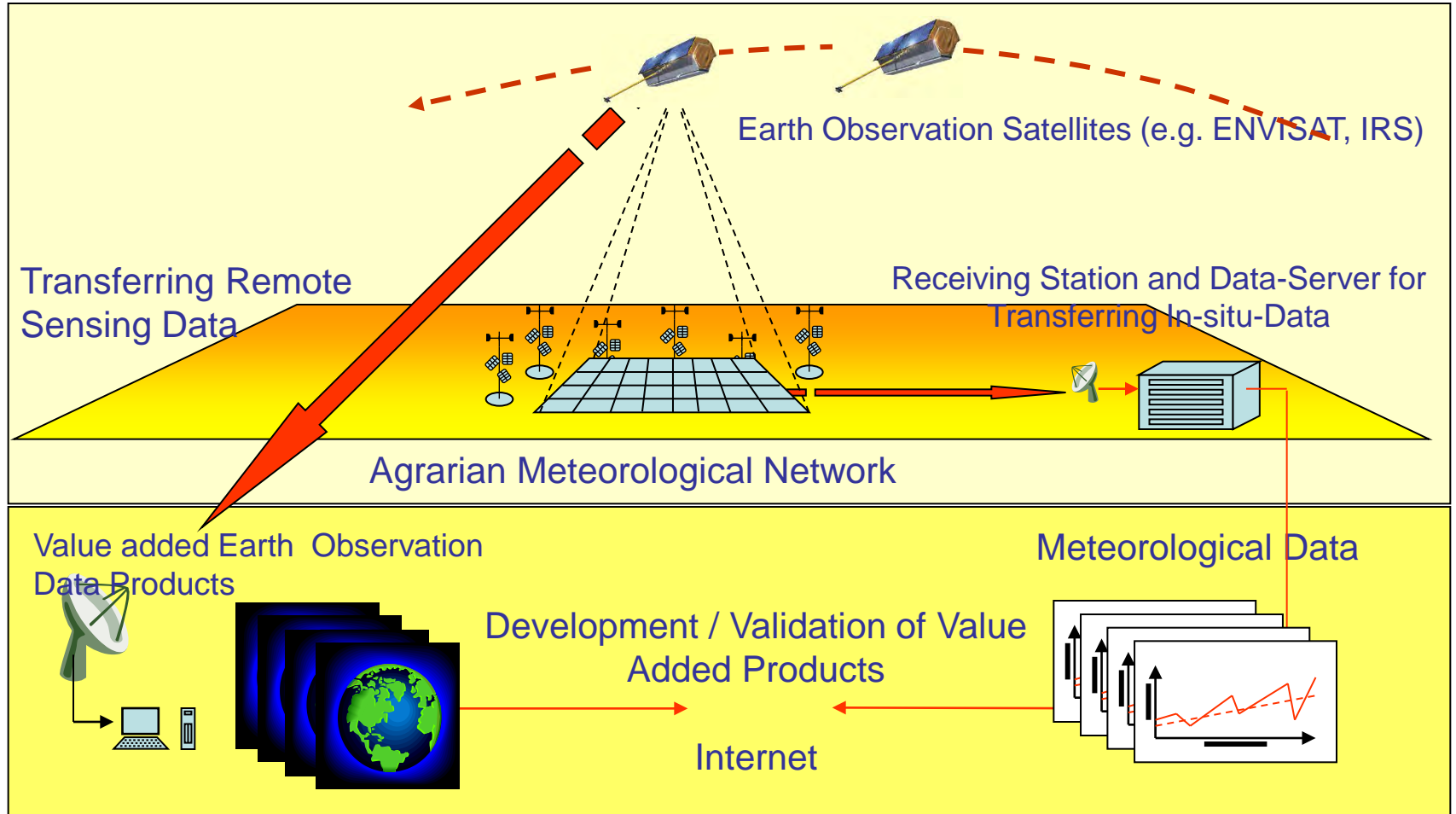
Von Unold (2011): http://www.uns-muc.de/lysimeter_systeme/lysimeter/meteo_lysimeter.html (last access: 18.02.2011)



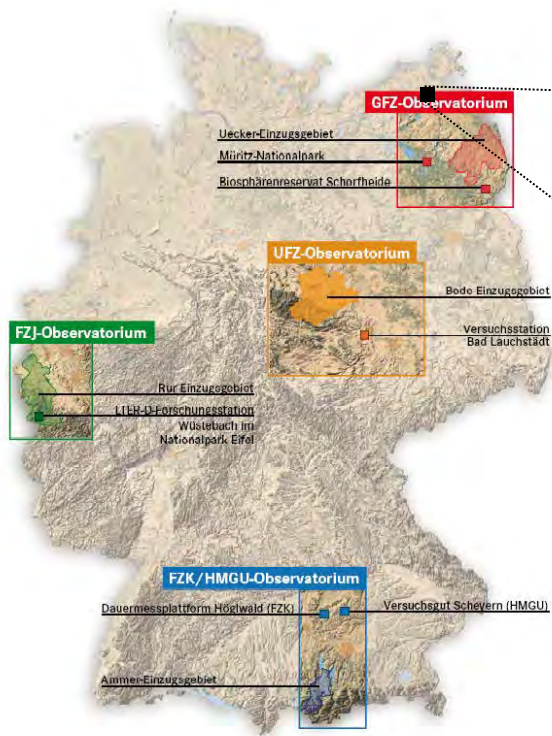
TERENO
TERRESTRIAL ENVIRONMENTAL OBSERVATORY



Automatic Meteorological Measurement Network



Development of DEMMIN



Deutschlandkarte mit den Untersuchungsgebieten von TERENO:

- **Großraum Leipzig-Halle**
 Koordination: Helmholtz-Zentrum für Umweltforschung
- **Alpen- und Alpenvorlandregion**
 Koordination: Forschungszentrum Karlsruhe und Helmholtz Zentrum München
- **Region Eifel-Niederrheinische Bucht**
 Koordination: Forschungszentrum Jülich
- **Nordostdeutsches Tiefland**
 Koordination: Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum.



The Test site DEMMIN is listed in the following catalogues:

USGS
TERENO
ESA

http://calval.cr.usgs.gov/sites_catalog_template.php?site=demm
<http://www.tereno.net>
<ftp://pcf:Ciqcsp01@uranus.esrin.esa.int/PH/Deliverables/>



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Telefax:	03981/480-299
E-mail:	erik.borg@dlr.de
Internet:	http://www.caf.dlr.de/



Others / Additional Information

- French / German Lidar Mission MERLIN (CH₄)
 - PRR passed successfully during summer
 - Phase B in preparation, will begin soon
- EnMAP
 - System CDR in preparation
 - CDR announced for finalization end of November 2012



Thank you for your attention

