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TERENO
TERRESTRIAL ENVIRONMENTAL OBSERVATORIES

TERENO General Overview – Status, Network Activities, Accessibility and International Integration

H. Vereecken and the TERENO team

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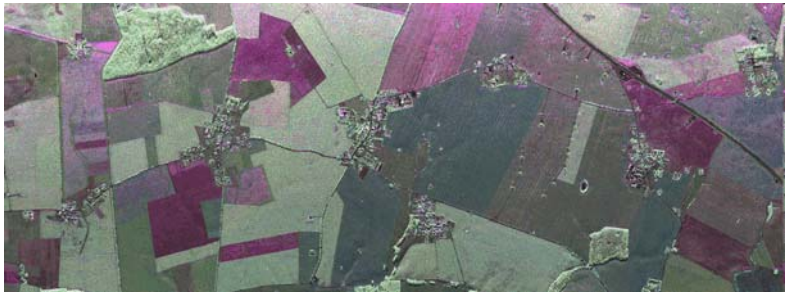
Success-full SOIMEX campaign 2013 with simultaneous use of passive and active microwave sensors

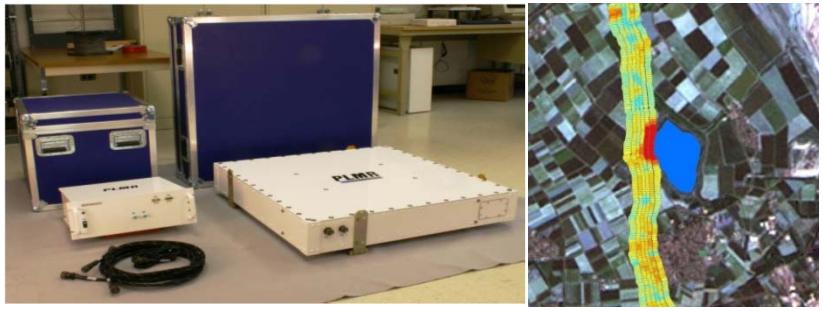
4 flights over Rur catchment and 1 flight over Bode catchment during April/May

Combination of PLMR2 and DLR F-SAR onboard a Dornier DO228 aircraft

+ IR-camera
+ Hyperspectral camera



F-SAR



PLMR2

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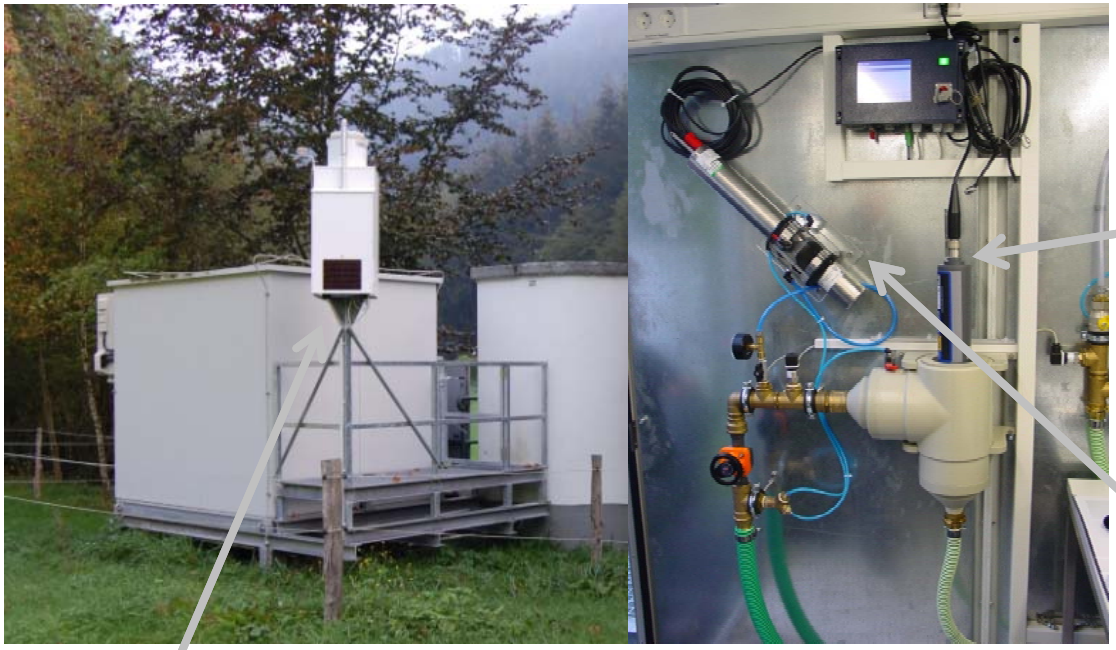
On-site isotope station in Rur catchment operational



Precipitation sampler

Samples, Amount, Time

Daily & 15 minutes

Auto Sampler

River water samples

2/4 hours

Picarro Isotope Analyzer

12 minutes

$\delta^{18}O$ & $\delta^{2}H$

YSI Probe

15 minutes

T, pH, O_2, EC

TriOS Probe

15 minutes

DOC, NTU, SAC, $N\text{-}NO_3$

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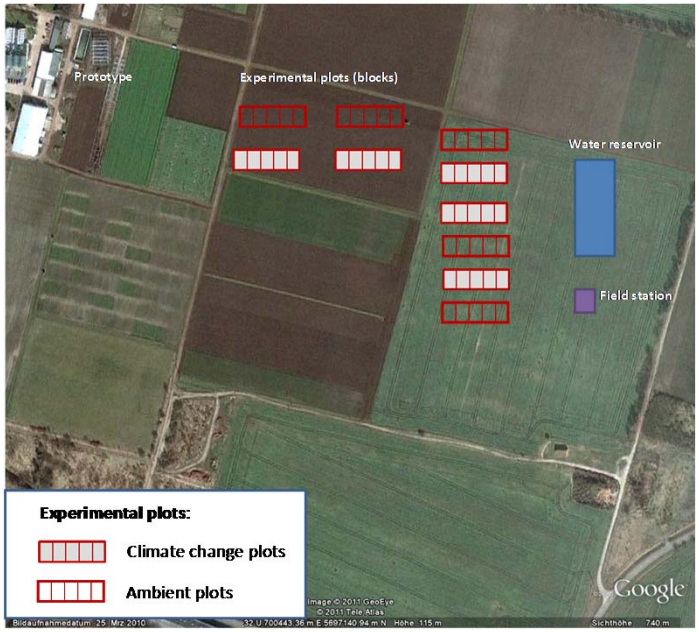
Global Change experimental facility opens

- Large-scale field-based experimental platform to assess the effects of climate change under different land use scenarios on the functioning of ecosystems and the provisioning of ecosystem services by ecological communities
- Parallel manipulation of land use and climate at plots of practice-related size
- **Opening in June 2013**



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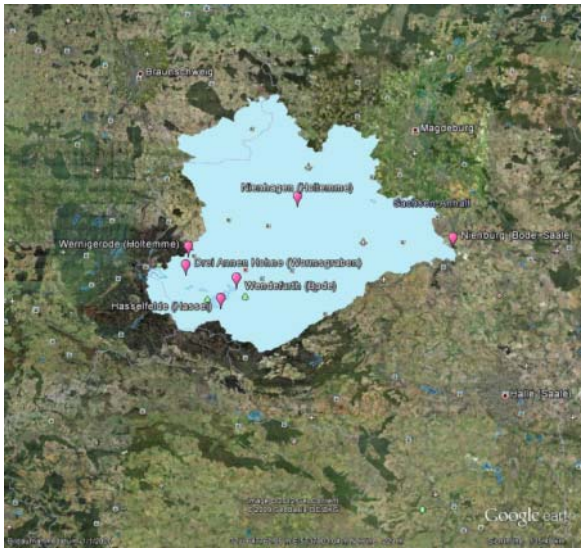
Mobile aquatic mesocosms (MOBICOS) in operation

- Mobile containers placed in or at water in which semi-natural investigations and experiments can be carried out
- Six MOBICOS-containers are implemented within the Bode-Observatory



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Automated GHG chambers for lysimeters are operational in two observatories

TERENO Rottenbuch site (KIT)

TERENO Selhausen site (Jülich)

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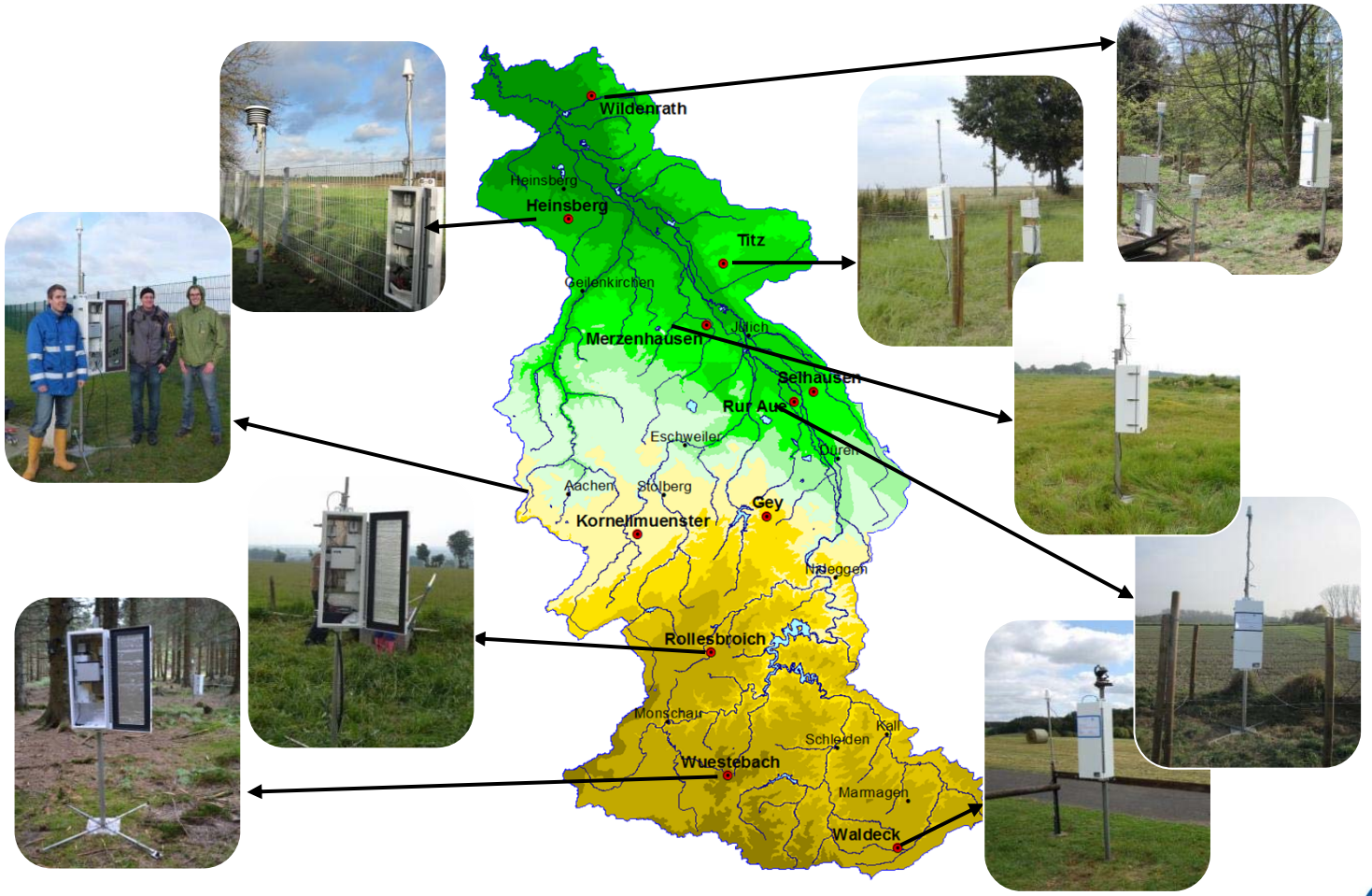
Network of 10 cosmic-ray probes in the Rur catchment is now operational and online



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TERENO data management

- TEODOOR Data Portal is online and functional
- Free data access of all standard monitoring sites
- The following monitoring stations are online:
  - Runoff gauging stations
  - Sensor networks
  - Climate stations
  - Cosmic ray stations
  - Weather radar
  - Remote sensing data

See also CT Datamanagement Presentation

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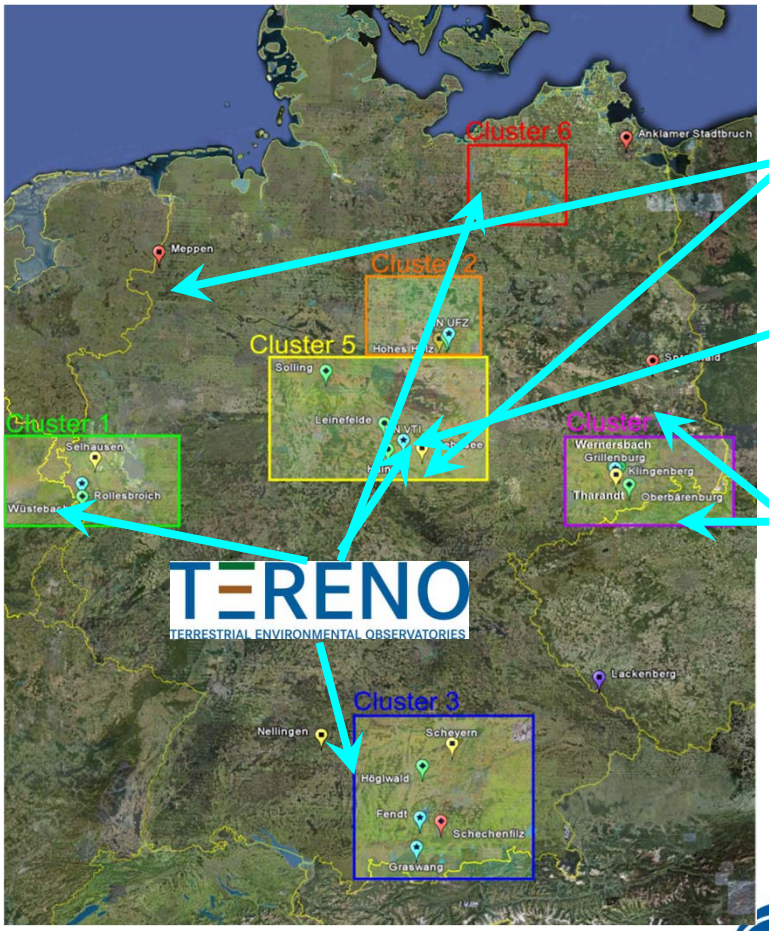
ICOS-D

- First implementation phase of ICOS-D has been approved
- Funding:

  ~13 Mio. € (2013-2016)
- VTi, DWD and HGF are key partners
- 3 TERENO observatories are included
- 4th observatory will possibly follow

ICOS integrated carbon observation system

A European infrastructure dedicated to high precision monitoring of greenhouse gas fluxes



vTI Johann Heinrich von Thünen-Institut

TECHNISCHE UNIVERSITÄT DRESDEN

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List of topics with high potential and with merit for future Horizon 2020 actions for integrating and opening existing national research infrastructures

Topics relevant for TERENO:

ENV01: Infrastructures for Long-Term Ecosystem and Socio-ecological Research (terrestrial and aquatic environments in Europe).

ENV02: Infrastructures for hydrological/hydrobiological research (hydrological,hydrometeorological and hydrochemical aspects as well biological/ecological indicators).

ENV17: European Critical Zone Observatories: threats to soil and water.

ENV19: Aquatic ecology mesocosms infrastructure (across Europe and in different ecosystems from sub-Arctic to Coastal Mediterranean).

ENV23/ENV28: European Network of Atmospheric Observation Infrastructures (integrating activities of ACTRIS, IAGOS, ICOS, InGOS and incl. Sun-Photometric network).

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TERENO-MED - Global Change Observatory Network for the Mediterranean Region

Objectives: To study the long term effect of climate change and anthropogenic changes on Mediterrean terrestrial systems

Countries to be involved: Spain, Marocco, Italy, Turkey, Greece, Cyprus, Israel, Egypt

Partners with approved application:

Spain: Technical University of Valencia
Cyprus: The Cyprus Institute: Energy, Environment and Water Research Center

Further possible partners:

Italy: ENEA, University of Cagliari (Sardinia), University of Naples
Greece: University of Patras
Morocco: Université Cadi Ayyad, Marrakesch
France: INRA (SupAgro Laboratoire sur les Interactions Sol-Agrosystème-Hydrosystème)
Jordan: Jordan University

Coordinator: UFZ
TERENO-partners involved: FZJ, KIT and UFZ
Funding: 50% UFZ, 50% FZJ
Total volume: 6.8 Million euro

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Deutsche Forschungsgemeinschaft

Langzeitperspektiven und Infrastruktur der terrestrischen Forschung Deutschlands – ein systemischer Ansatz

Strategiepapier

Arbeitsgruppe „Infrastruktur für die terrestrische Forschung"
Senatskommission für Stoffe und Ressourcen in der Landwirtschaft
Senatskommission für Wasserforschung
Senatskommission für Zukunftsaufgaben der Geowissenschaften
Nationales Komitee für Global Change Forschung

DFG

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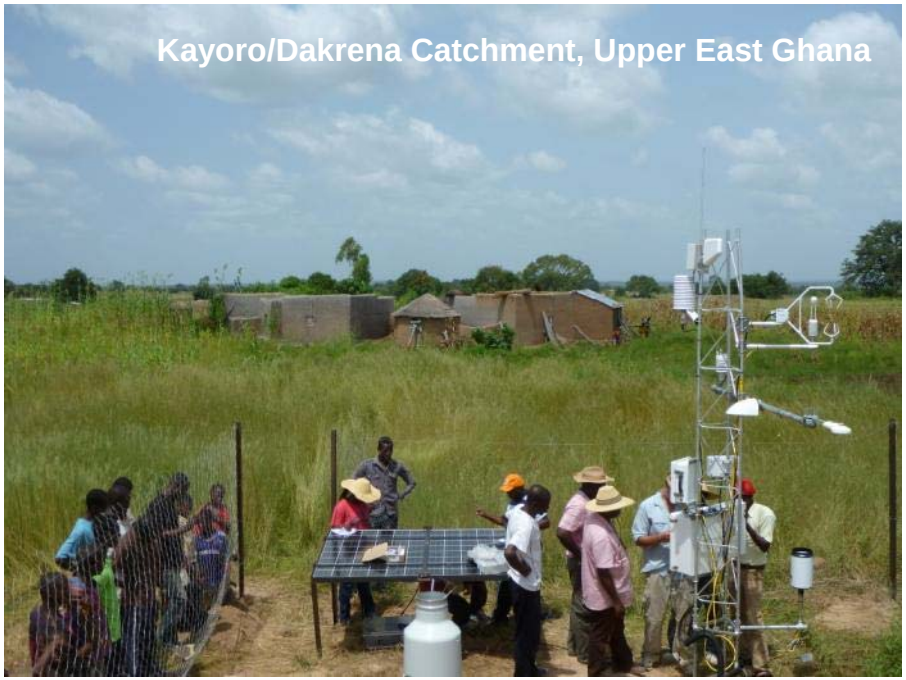
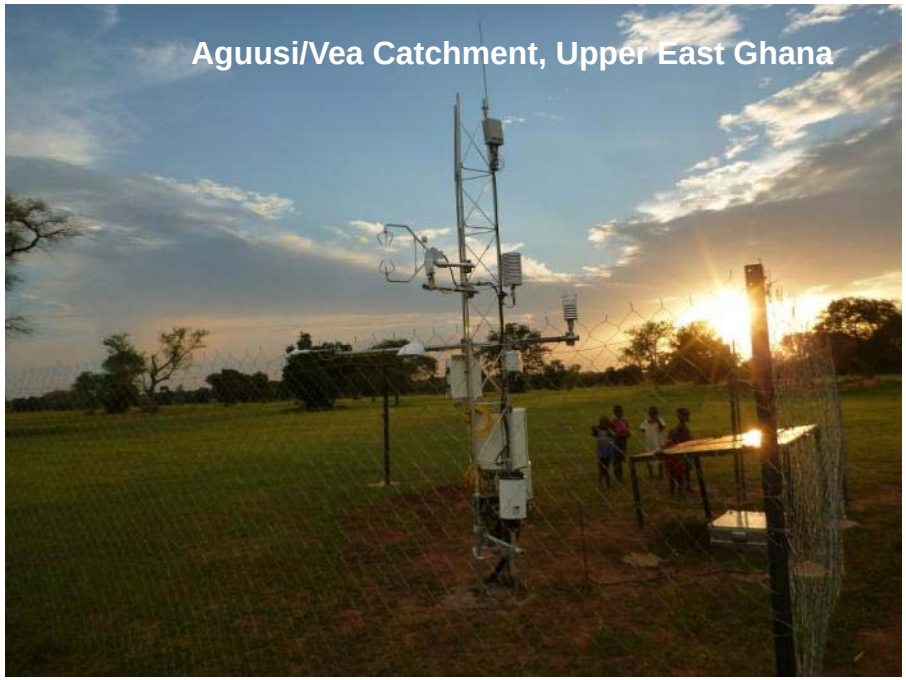
TERENO Outreach: WASCAL

Establishment of EC-Stations in Ghana and Burkina Faso

October 2012 (still ongoing)



10° 55‘ 5.84“ N
1° 19‘ 14.75“ W



10° 50‘ 43.80“ N
0° 55‘ 8.72“ W

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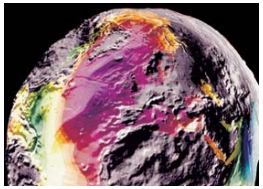
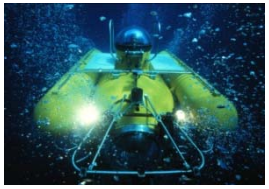
TERENO and Research Field Earth and Environment



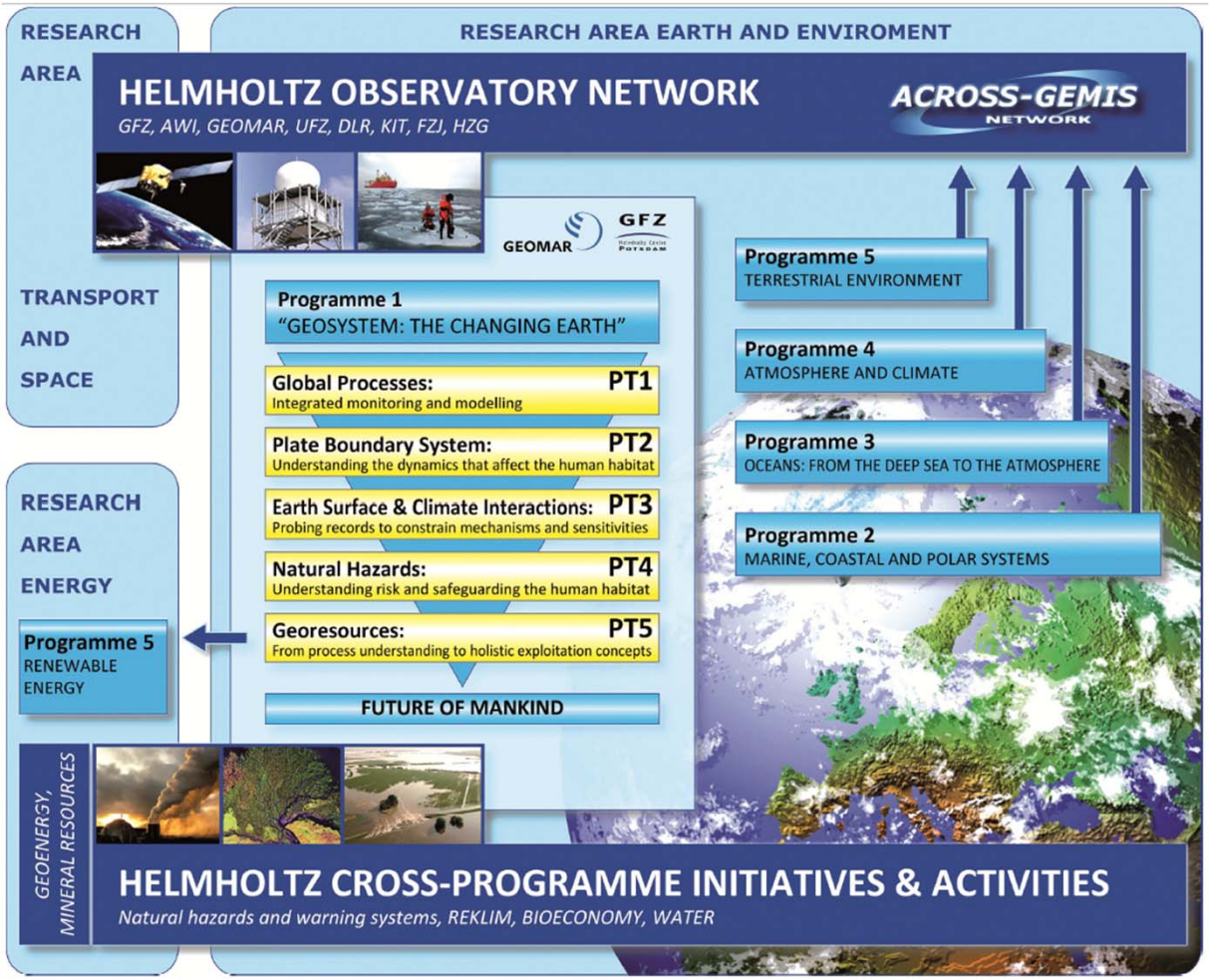


Research Programmes

- Geosystem: The Changing Earth (GFZ)
- Marine, Coastal and Polar Systems
- Oceans: From the Deep Sea to the Atmosphere
- Atmosphere and Climate (KIT)
- Terrestrial Environmental (FZJ, UFZ, HMGU)

TERENO

Programme Geosystem: The Changing Earth



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Programme Atmosphere and Climate

T1: CLOUD AND WEATHER RESEARCH (KIT, GFZ)

T2: LAND SURFACE PROCESSES IN THE CLIMATE SYSTEM (KIT)

- **ST: Effects of land use and climate change on regional matter fluxes**
- **ST: Vegetation in the climate- and land use system**
- **ST: Regional Climate- and Water Cycle Variability**
- **ST: Urban-Rural Interactions**
- **ST: Atmospheric Exchange Processes in Complex Terrain**

T3: TROPOSPHERIC TRACE SUBSTANCES AND THEIR TRANSFORMATION (FZJ, KIT)

T4: COMPOSITION AND DYNAMICS OF THE UPPER TROPOSPHERE AND MIDDLE ATMOSPHERE (KIT, FZJ, GFZ)

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Programme Terrestrial Environment

T1: LAND USE, BIODIVERSITY, AND ECOSYSTEM SERVICES: SUSTAINING HUMAN LIVELIHOODS

IP: Emerging ecosystems: functional dynamics under global change
IP: Mitigating land use conflicts – between land sparing and land sharing
IP: Urban transformations – sustainable urban development towards resource efficiency, quality of life and resilience
IP: Land use aspects of transforming the energy system: sustainable options for a renewable energy era

UFZ

T2: SUSTAINABLE PLANT PRODUCTION IN A CHANGING ENVIRONMENT

IP: Abiotic stress resistance and resource use efficiency
IP: Biotic interactions – signalling mechanisms in plant defence
IP: Bioproduction and sustainable use of resources

HMGU
UFZ

T3: SUSTAINABLE WATER RESOURCES MANAGEMENT

IP: Water and matter flux dynamics in catchments
IP: Healthy aquatic ecosystems
IP: Dynamics of groundwater ecosystem services
IP: Water scarcity

UFZ
HMGU

T4: CHEMICALS IN THE ENVIRONMENT: TOWARDS ECO-COMPATIBILITY AND ENVIRONMENTAL HEALTH

IP: Controlling chemicals' fate
IP: Exposome – impact of environmental perturbation on health

UFZ

T5: TERRESTRIAL SYSTEMS: FROM OBSERVATION TO PREDICTION

IP: Linking novel measurement methodologies to models across scales
IP: Critical Zone controls on hydrological and biogeochemical processes and fluxes
IP: From local scale processes to regional prediction

FZJ
UFZ
HMGU

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Statements der Gutachter zu TERENO aus den POF3 Gutachterberichten

“access to unique infrastructure ”

„exceptional infrastructure“

“The unique TERENO concept of terrestrial observatories is being realized within Germany, and will be extended to high-stress Mediterranean regions; this work can be seen as a blueprint of similar observatories on a global scale”

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Publications and PhD students

TERENO-related publications:

	2010	2011	2012	2013	in press	in review
GFZ	1	4	5	4	1	3
KIT	0	2	8	4	6	
FZJ	1	5	6	4	1	3
HMGU	0	1	1	0		
UFZ	0	3	5	7		1
DLR	0	0	4	1		
total	1	15	30	20	8	7

PhD students:

	2010	2011	2012	2013	ongoing
GFZ	0	0	0	1	11
KIT	0	0	2	0	18
FZJ	0	1	2	0	20
HMGU	0	0	2	0	6
UFZ	0	0	1	0	25
DLR	0	0	0	0	0
total	0	1	7	1	80

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TERENO International Conference 2014

Title “From observation to prediction in terrestrial systems“

Planned number of participates 300-350

Proposed time frame: 29.09. - 02.10.2014

Venue: University of Bonn

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TERENO International Conference 2014

- Quantifying water scarcity under data scarcity
- Transfering local understanding of vadose zone processes to the landscape scale
- Monitoring and modeling of water quality
- Modelling the Hydrosystem – Balancing of complexity and uncertainty
- Environmental Monitoring to quantify Ecosystem Services
- Novel Approaches in Biodiversity and Ecosystem Monitoring
- Remote Sensing of Land surface
- Coupled processes in soil-plant-atmosphere systems across scales
- Monitoring and data assimilation: Predicting states and fluxes
- Crossing time scales – from paleo records to forecast

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Further developments

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Larger Research Projects in Germany related to TERENO

- DFG-Forschergruppe: “Data assimilation in virtual catchment systems”
- HGF Allianz: „Remote Sensing and Earth System Dynamics“
- HGF Infrastructure: Advanced Remote Sensing - Ground Truth Demo and Test Facilities Virtual Institute for Integrated Climate and Landscape Evolution Analyses (ACROSS)
- Helmholtz Young Investigators Group TEAM
- Helmholtz Young Investigator Group "Capturing all relevant scales of biosphere-atmosphere exchange – the enigmatic energy balance closure problem (ENCLOSE)“
- Helmholtz Research School on Mechanisms and Interactions of Climate Change in Mountain Regions (MICMoR)
- BMBF project „Integrated Carbon Observation System Germany (ICOS-D)“
- DFG Forschergruppe: Agricultural landscapes under global change - Processes and feedbacks on a regional scale (HMGU: E. Priesack, UHOH: T.Streck)
- Helmholtz Young Investigators Group MicroCene (Microbial communities of the methane cycle as proxies for peatland condition and genesis)
- Water Science Alliance

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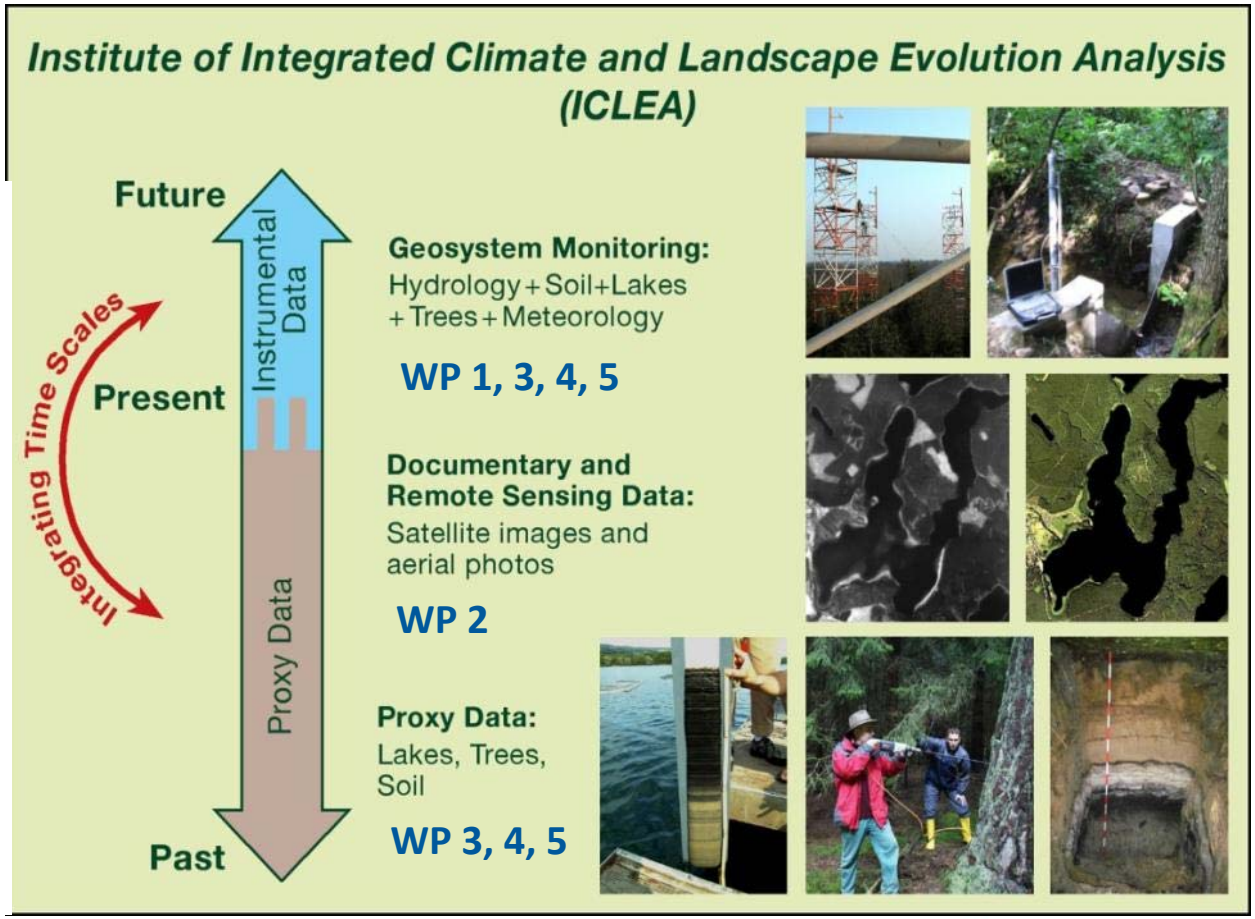
ICLEA
Virtual Institute of Integrated Climate and Landscape Evolution Analyses

Deutsches GeoForschungsZentrum GFZ
Ernst Moritz Arndt Universität Greifswald
Polnische Akademie der Wissenschaften (PAN)
Brandenburgische Technische Universität Cottbus (BTU)

Virtual Institute for Integrated Climate and Landscape Evolution Analyses

- **Helmholtz-Funding:** Start 01/2012 (3+2 yrs.)
- **Leader:** GFZ
- **New unique concept:** Integration of hydrologic and climatic **instrumental monitoring data** (TERENO) with **proxy data** from natural environmental and climatic archives at all relevant time scales, as well as with **historical remote sensing data** sets.
- **Region:** Northern-Central European Lowlands as natural lab for landscape evolution.



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Helmholtz Young Investigators Group TEAM

Trace Gas Exchange in the Earth-Atmosphere System on Multiple Scales

- **Multi-scale** direct **measurements** of GHG flux
- Quantification and understanding of interactions **across temporal and spatial scales**
- **Modeling and scaling** from local to regional

Group Leader: Torsten Sachs/GFZ

Funding period: 2012-2016

Study sites: Several peatlands and lakes in NE Germany (TERENO NE)

Method		TERENO Site
	Airborne eddy covariance regional (1000–100.000 km²)	
	Airborne eddy covariance subregional (10 – 10.000 km²)	
	Ground-based eddy covariance Ecosystem scale (0,01 – 10 km²)	

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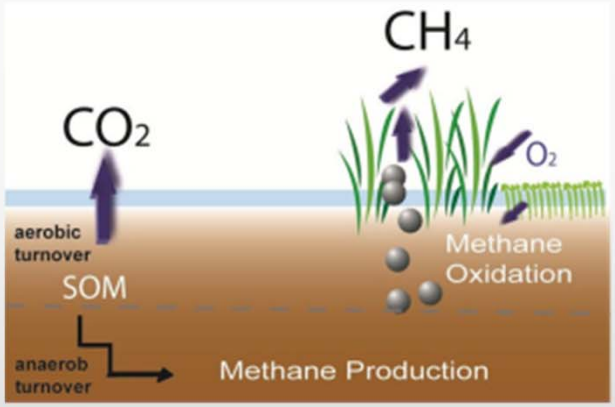
Microbial communities of the methane cycle as proxies for peatland condition and genesis

Section 4.5 Geomicrobiology & Helmholtz Young Investigators Group *MicroCene*

Goal



Peatland degradation, eutrophication and pH

LINK

Composition and activity of microbial communities of the methane cycle

Sites

- Peatlands Müritz National Park & Ucker Catchment (to be specified)
- Test Site DEMMIN

Methods

Molecular community screening, Enzyme assays, Plot-scale methane emissions, Pore water analysis

Staff: Dirk Wagner, Susanne Liebner, PhD (N.N.)

Duration: Jan 2013- Dec 2015 plus...?

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Helmholtz Young Investigator Group approved:

"Capturing all relevant scales of biosphere-atmosphere exchange – the enigmatic energy balance closure problem (ENCLOSE)"

Partners: University Hannover, KIT Institute of Geography and Geoecology (IfGG)

Funding period: 5 years

Funding volume: 1.5 Mio €

Start: February 2012

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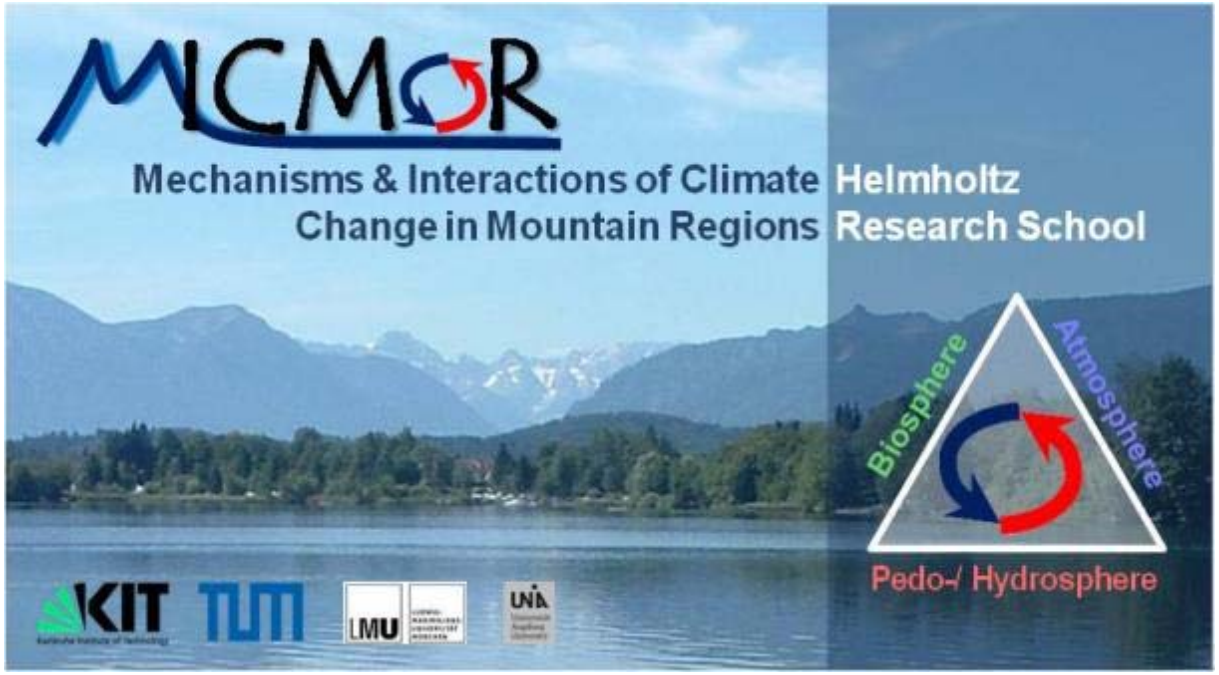
Helmholtz Research School on

Mechanisms and Interactions of Climate Change in Mountain Regions (MICMoR)

Research at Atmosphere– Biosphere–Pedo-/Hydrosphere Interfaces

Approved and started this year



Principal Applicant:
Karlsruhe Institute of Technology (KIT) – Alpine Campus (IMK-IFU), Garmisch-Partenkirchen
Chair: Prof. Dr. Hans Peter Schmid

Core Partners:
Technische Universität München (TUM)
Ludwig-Maximilian-University Munich (LMU)
University of Augsburg (UA)

Associated Partners:
University Bayreuth
University Würzburg
DLR
HMGU

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