



A. Künzelmann

## Interdisciplinary research in the Schäfertal catchment: *Overview and first results*

Ute Wollschläger & the Schäfertal Team

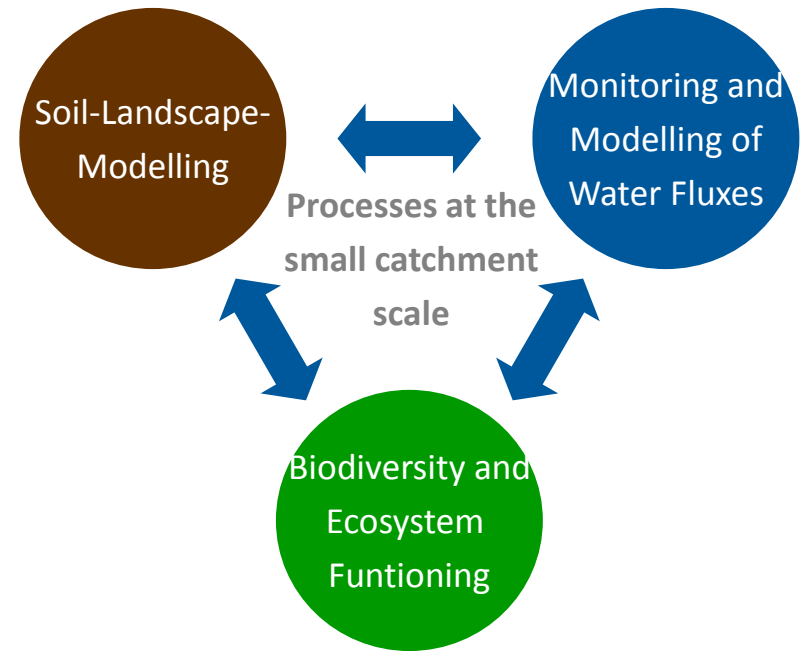
**WESS** Water Earth System Science  
Competence Cluster



**HELMHOLTZ**  
CENTRE FOR  
ENVIRONMENTAL  
RESEARCH – UFZ

# Understanding the Functioning of the Terrestrial System Using Novel Observation and Modelling Techniques – An Interdisciplinary Approach

- Monitoring & modelling of water fluxes at the small catchment scale
- Biodiversity monitoring
- Soil-landscape modelling





# The Schäfertal Catchment: New Infrastructure

## Multi-scale monitoring of soil moisture (& snow)

→ airborne and satellite borne remote sensing  
(e.g. F-SAR & hyperspectral measurements)



M. Pause, A. Lausch,  
I. Hajnsek, Th. Jagdhuber et al.

→ cosmic ray sensors



C. Rivera et al.

→ geophysical measurements



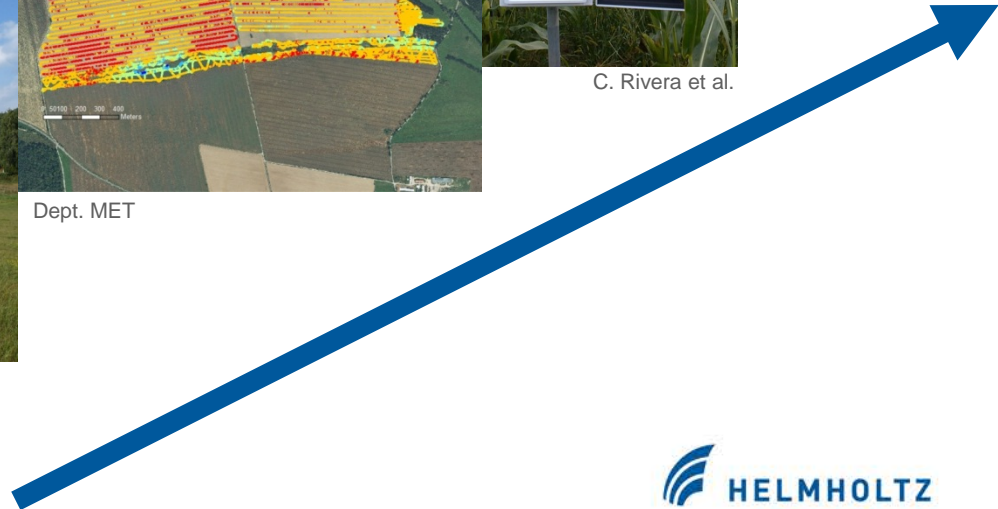
Dept. MET

→ wireless soil moisture monitoring network



Dept. MET

small catchment



→ lysimeters  
(SOILCan & VAMOS)



Dept. Soil Physics

point

**F. Reinstorf** (HS Magdeburg): The hydrological research basin Schäfertal in the Harz Mountains / Central Germany – current state of the observation program

**F. Lorenz** (HS Magdeburg): Derivation and test of a water balance model for the hydrological research catchment Schäfertal, Eastern Harz Mountains

**S. Kramer** (HS Magdeburg): Development of a concept for optimizing the distribution of snow measurement plots in the Schäfertal area using numerical regionalization methods

**Edoardo Martini** (UFZ): High-resolution investigation of hillslope hydrological processes using a wireless soil moisture monitoring network and EMI measurements

**Thomas Grau** (UFZ): Physically-based modelling of hillslope-scale water dynamics

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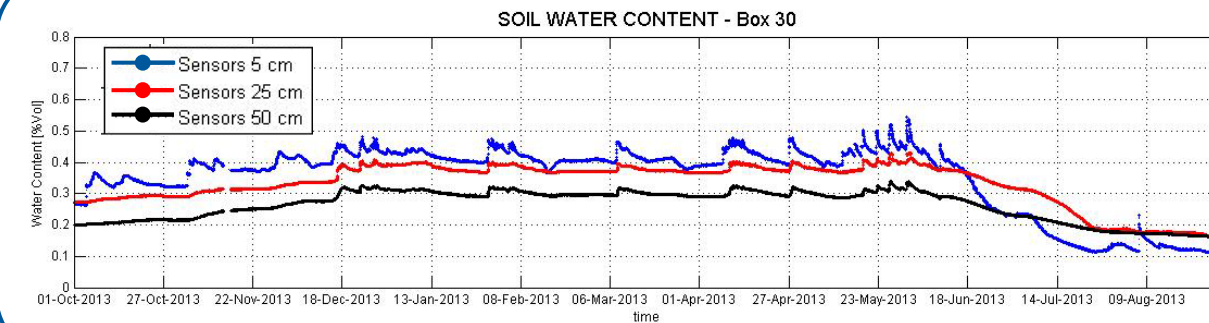
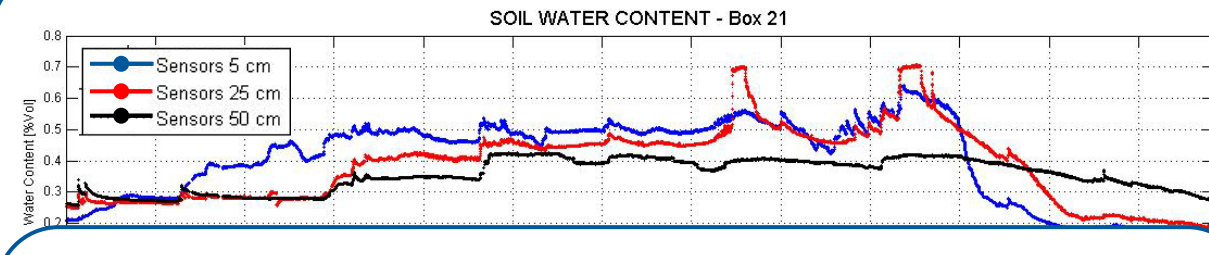
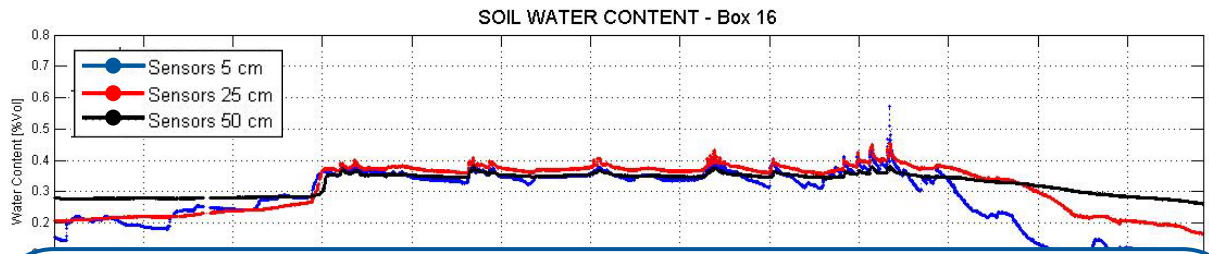
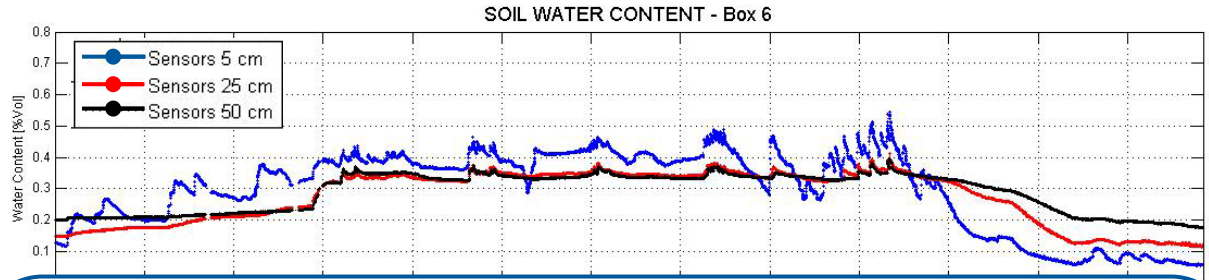


# High-resolution monitoring of hillslope-scale soil water dynamics using a wireless soil moisture monitoring network and Electromagnetic Induction (EMI) measurements

PhD thesis  
Edoardo Martini

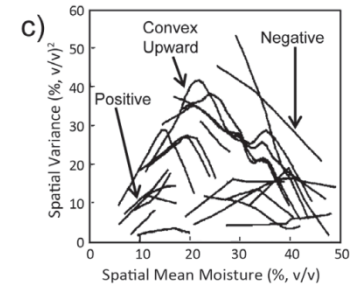
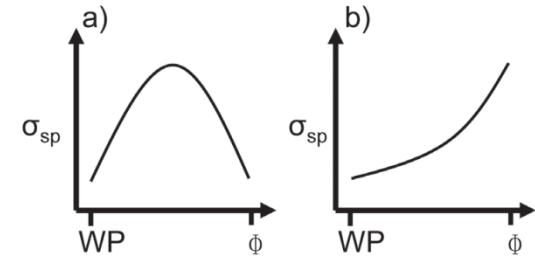
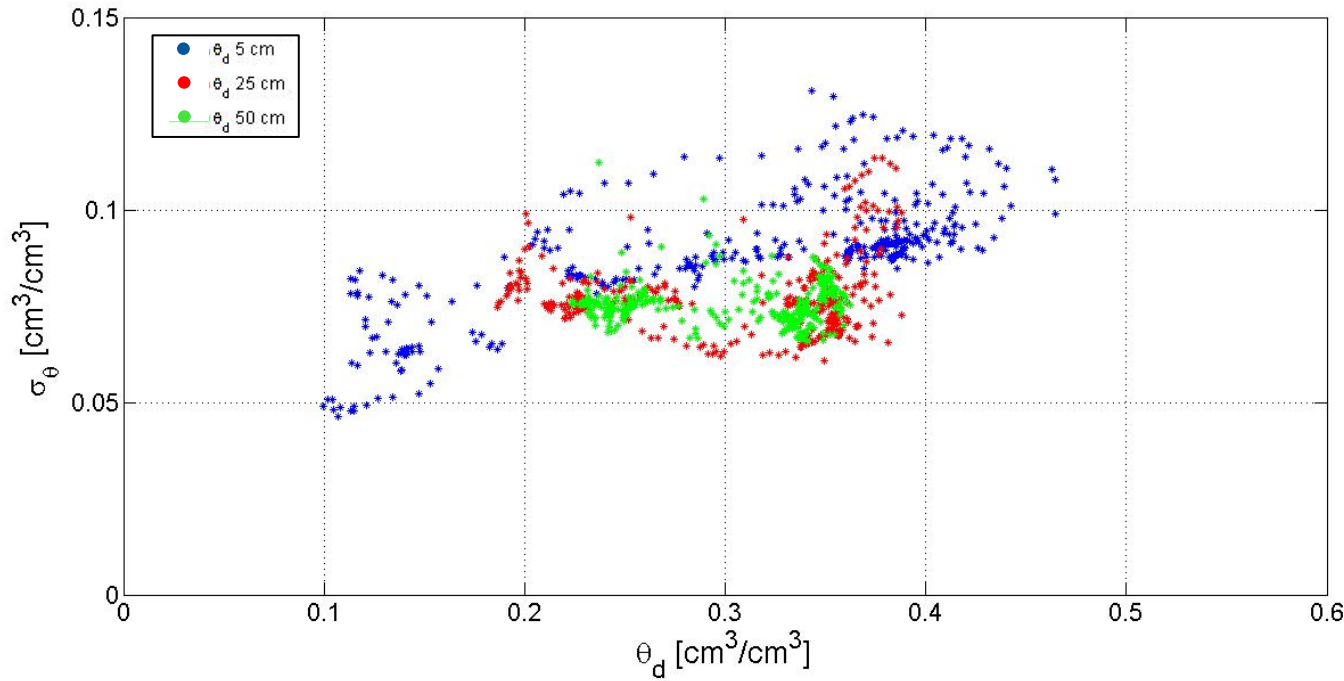




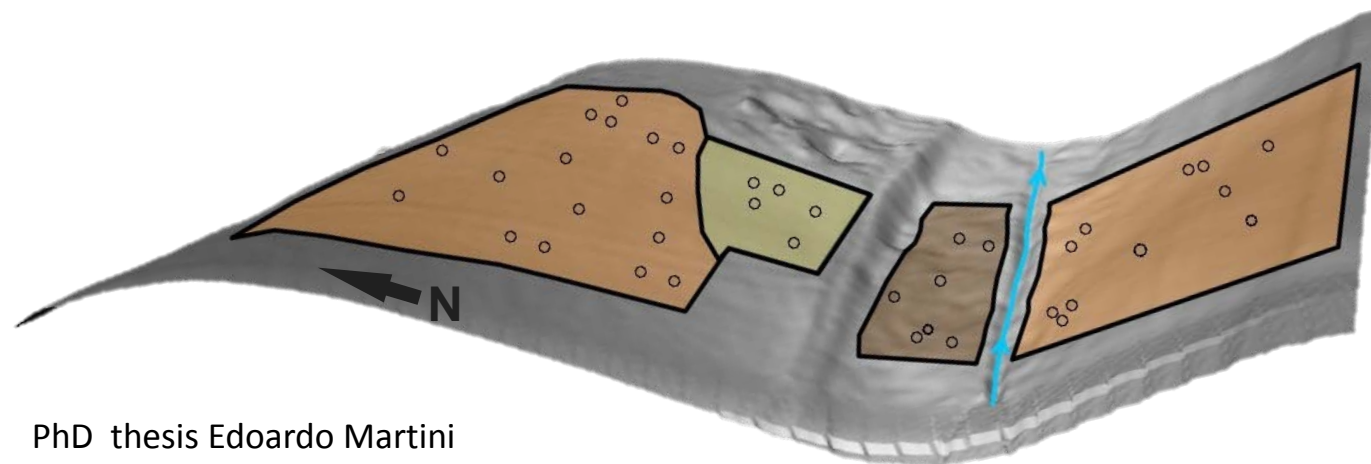




# Soil moisture variability at the hillslope scale

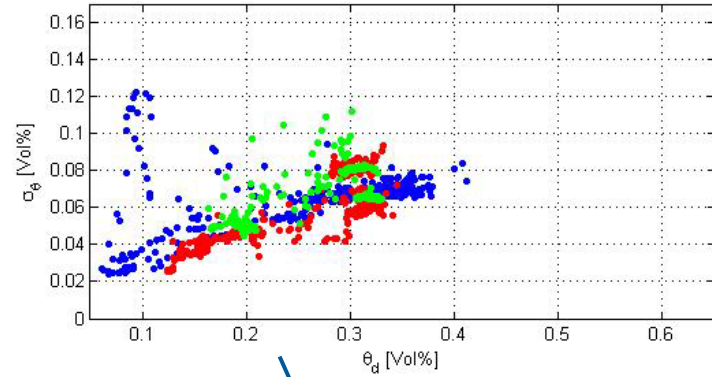


Takagi & Lin (2010)

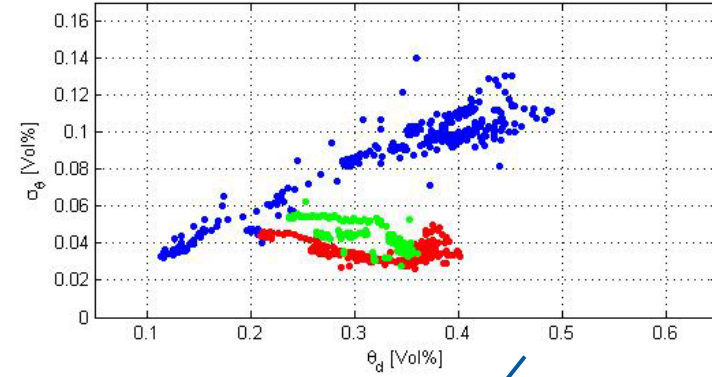


# Soil moisture variability at the STU-scale

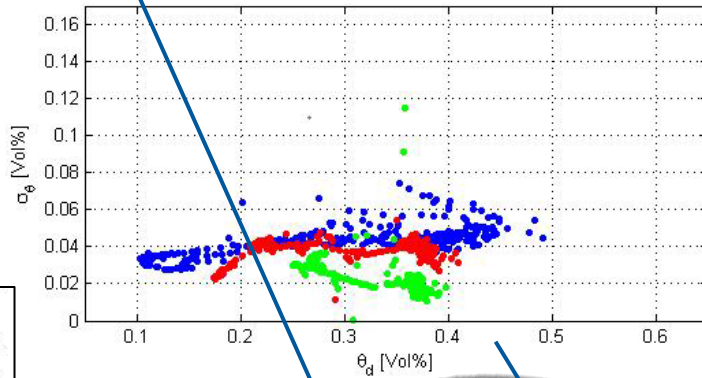
STU 1



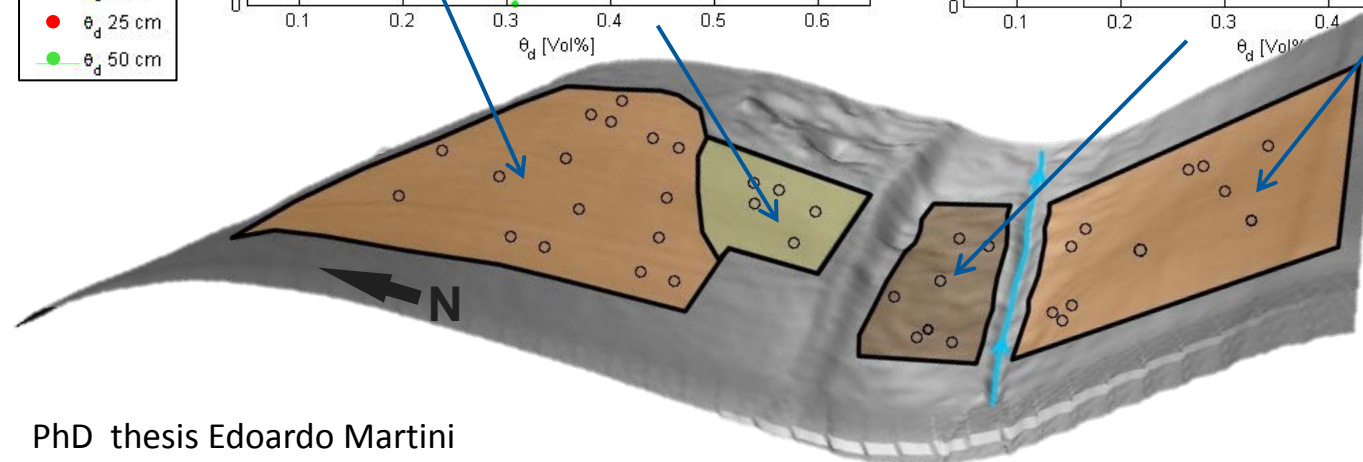
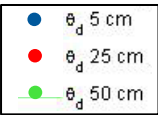
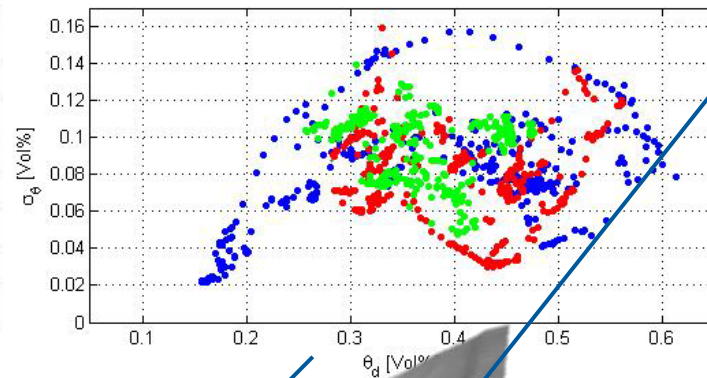
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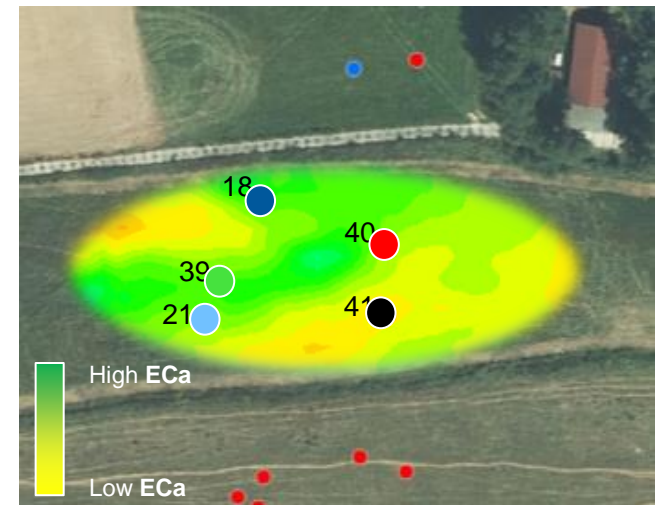
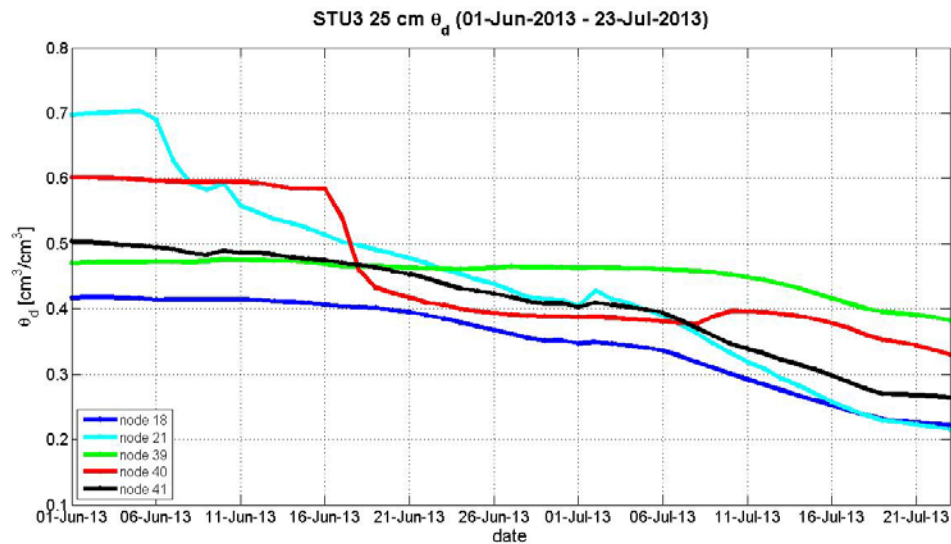
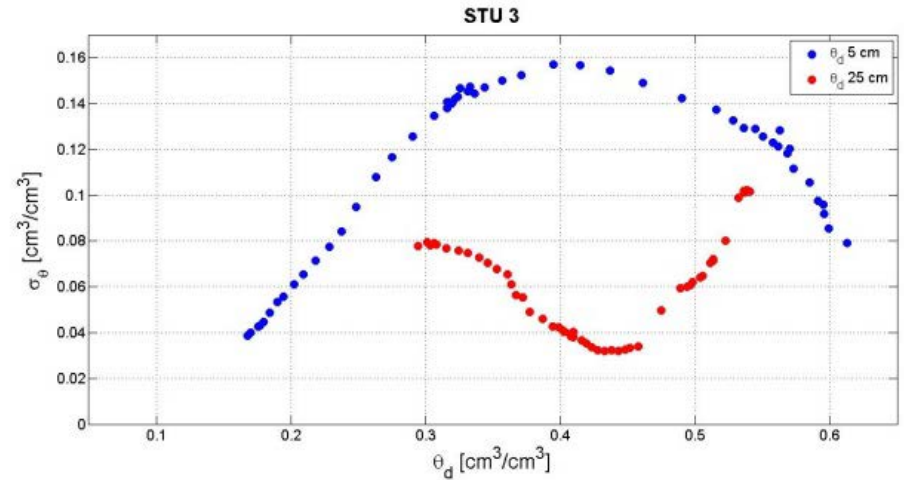
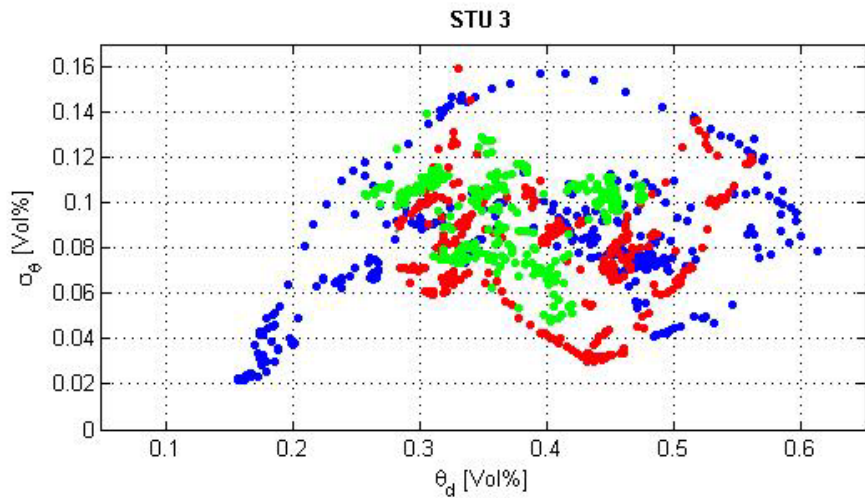
STU 2

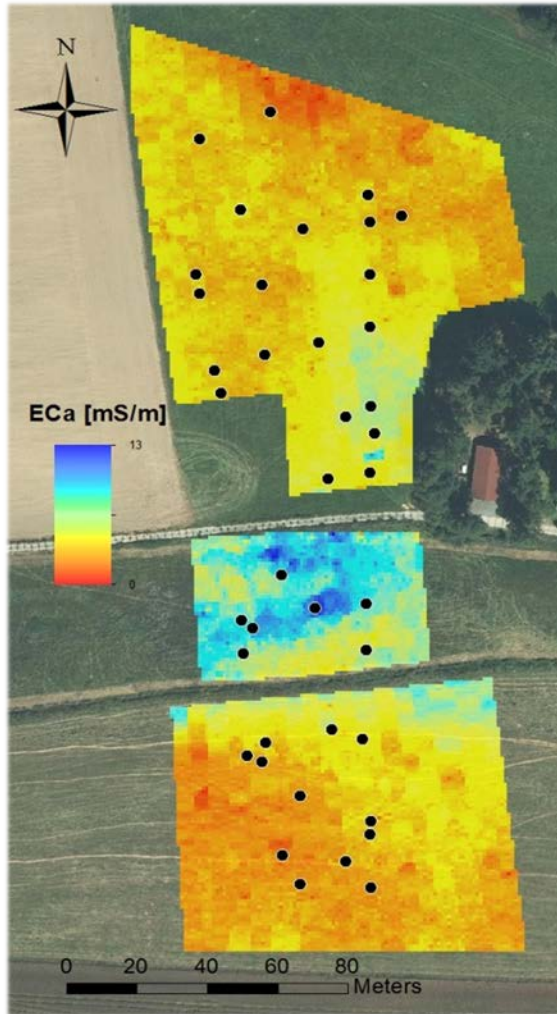


STU 3

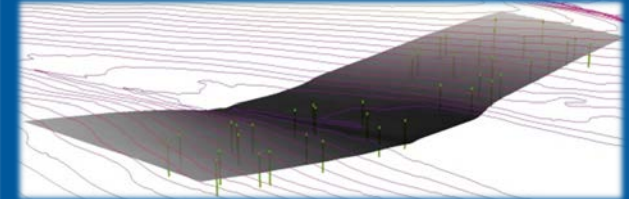








PhD Thesis Edoardo Martini



## Criteria 3D (Bittelli et al., 2010)

- Subsurface flow: 3D Richards eq.
- Surface flow: 2D St. Venant eq.
- Radiation budget
- Snow accumulation and melt
- Evaporation and Transpiration: FAO Penman Monteith eq.

PhD Thesis Thomas Grau



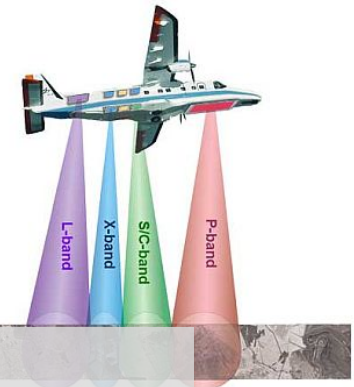
# Demand-driven observation of soil moisture: A multi-sensor approach



Hyperspectral RS – campaigns → **PhD thesis Andreas Schmidt**

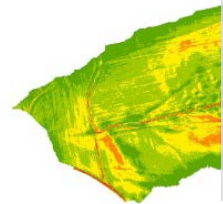


TerraSAR-X – 11 days



F-SAR, PLMR – campaigns → **HGF Alliance EDA (Th. Jagdhuber (DLR), C. Montzka (FZJ))**

→ identify optimal combination of sensors for catchment-scale, process-based estimation and monitoring of soil moisture dynamics



DGM 1



SoilNet – continuous → **PhD thesis Edoardo Martini**



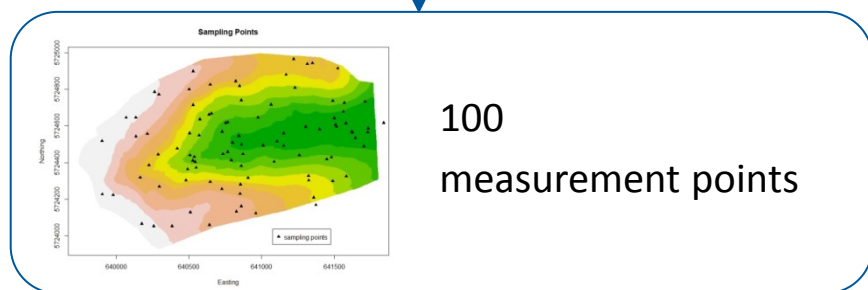
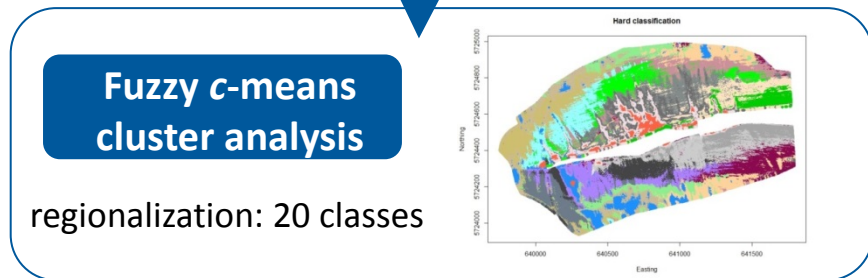
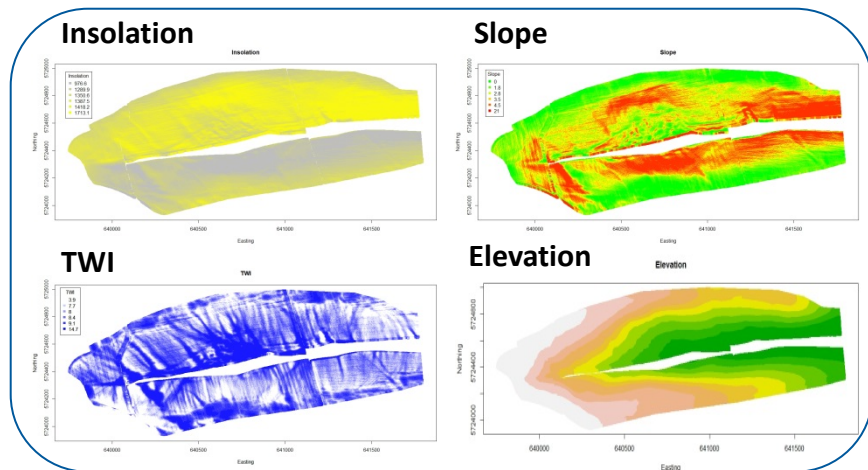
TDR – campaigns



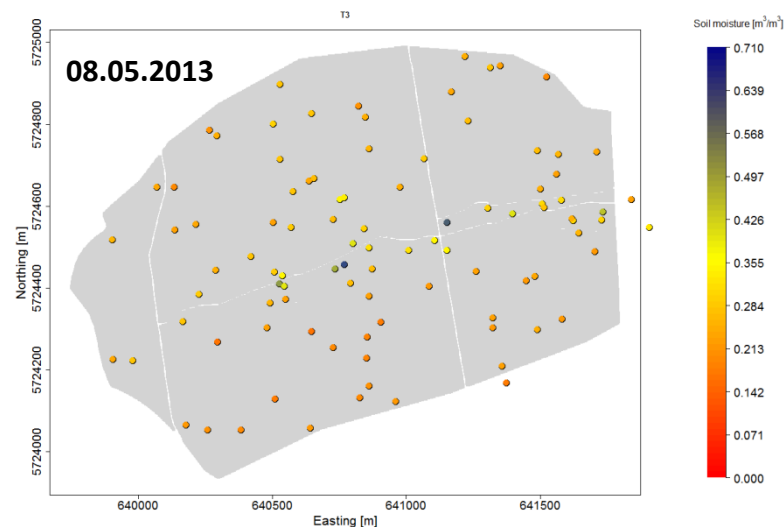
Geophysical measurements (EMI, gamma spectroscopy) – campaigns > after harvest

# Basic Data: TDR measurement campaigns

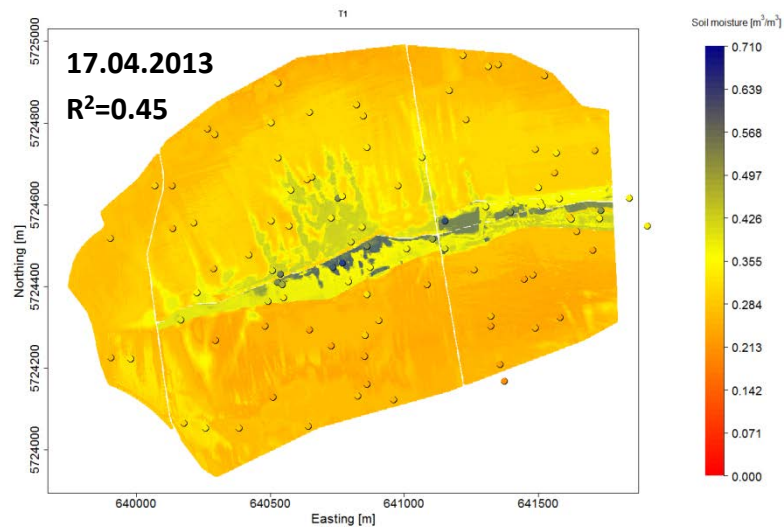
Initial sampling design based on topography



## Measurement



## Prediction

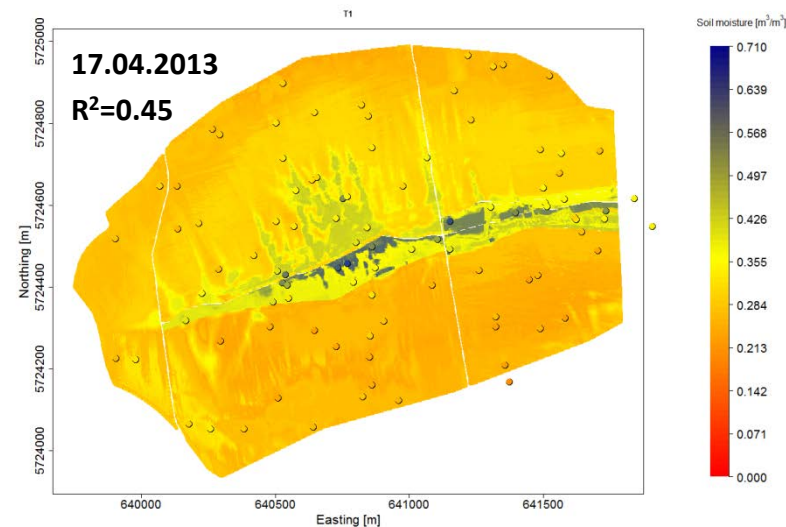
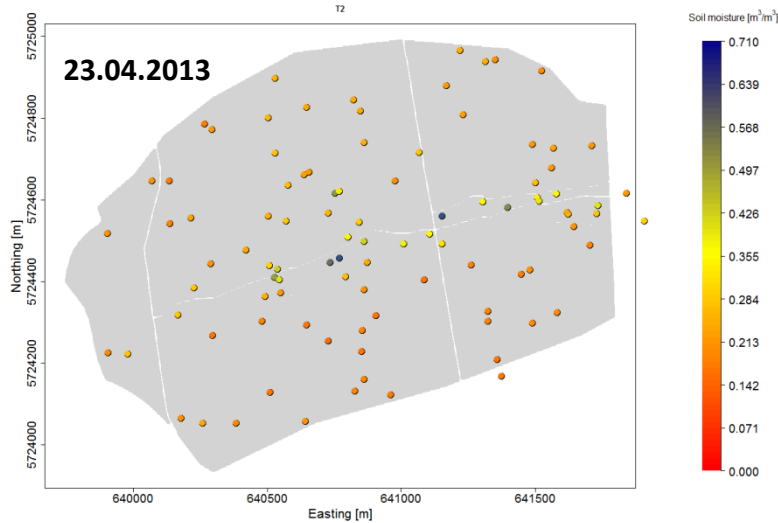




# Catchment-scale soil moisture dynamics

Links to other studies: Hydrology

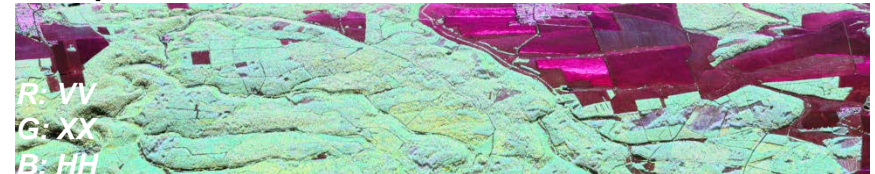
## Measurement



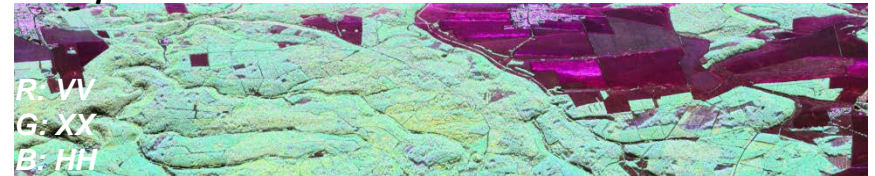
TERENO 2013 Multi-Sensor Campaign – Bode @ Schäfertal

FIRST POLARIMETRIC SAR RGB QUICKLOOKS

1. Acquisition - 16.4.2013



2. Acquisition - 24.4.2013



T. Jagdhuber, I. Hajnsek, M. Jaeger, R. Horn, A. Reigber

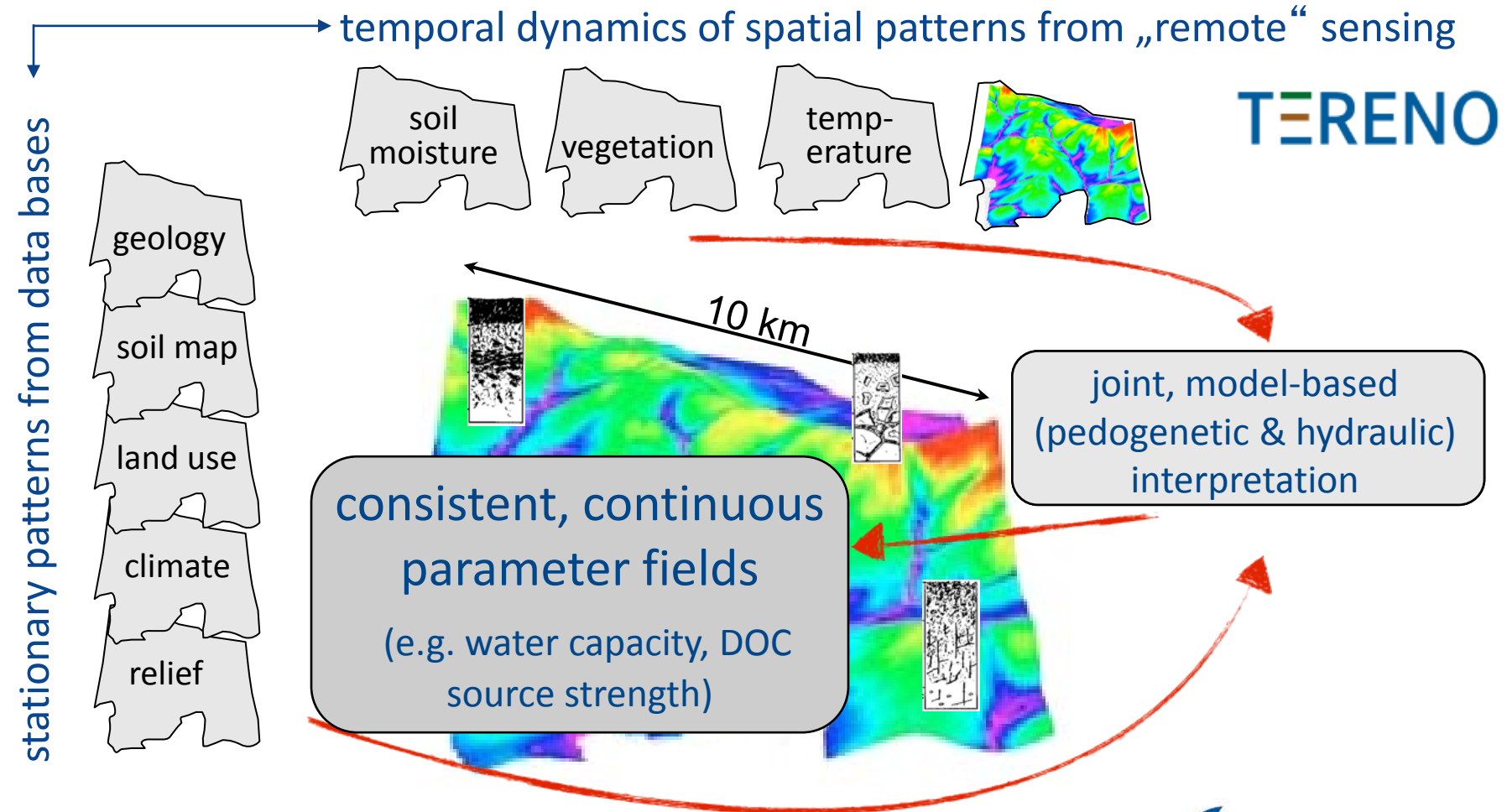
## PhD projects:

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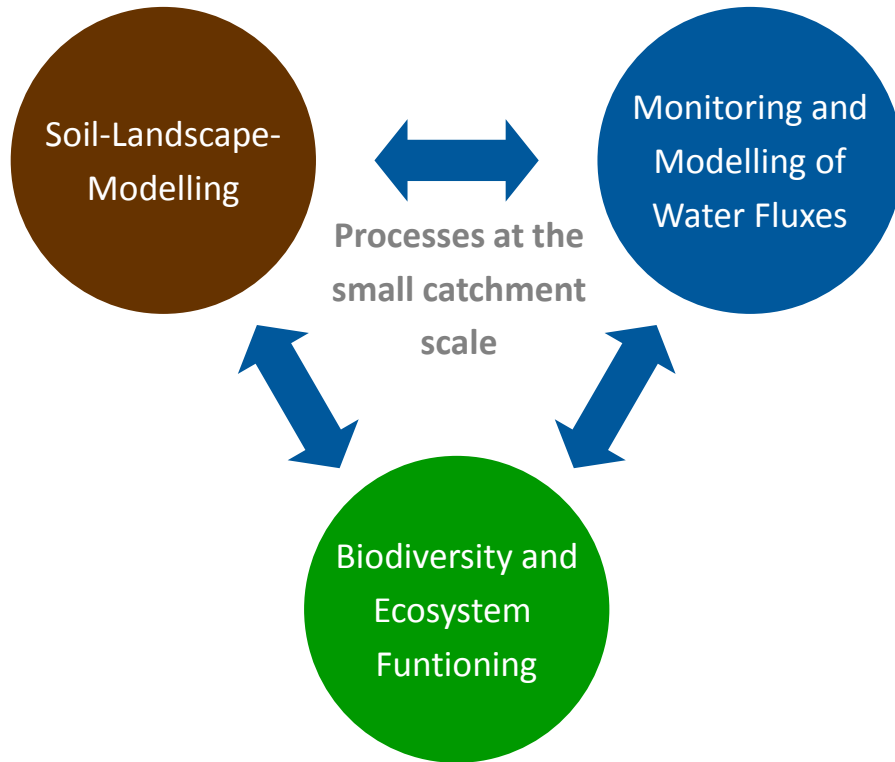
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ExpeER BIODIVERSITY AND ECOSYSTEM PROCESS SCALING STUDY (Les Firbank, Leeds University)



PI: Hans-Jörg Vogel, Dept. Soil Physics





- infrastructure up and running
- good collaboration of PhD students from different disciplines and with external partners
- interdisciplinary research at same site opens new research directions
- site becomes more attractive as soon as data and first results are available