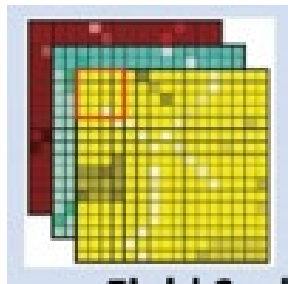
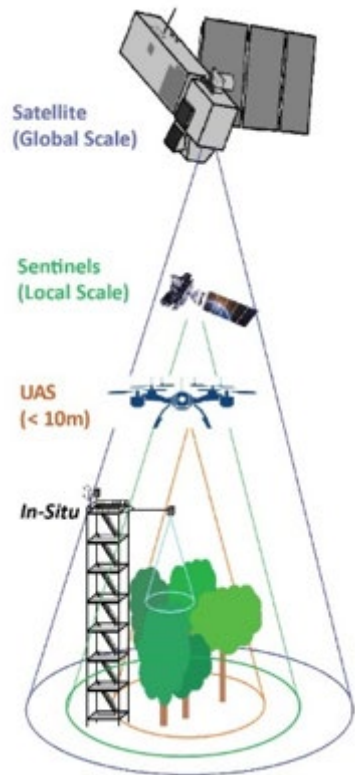


A photograph of four men standing in a shallow river with many rocks. The man on the far left is wearing a brown polo shirt and shorts, holding a plastic water bottle. The man next to him is wearing a light blue polo shirt and shorts, pointing towards the background. The man next to him is wearing a patterned short-sleeved shirt and blue pants, with his hand on his head. The man on the far right is wearing a white t-shirt and blue jeans. The background shows a riverbank with green grass and trees under a clear sky.

OBSERVING COMPONENTS OF THE WATER CYCLE WRS 2023

Diana Chavarro-Rincon, WRS



Mission
Create and share knowledge in satellite hydrology for solving society's problems in water resources and environment

Strategy
Interpret remote sensing and field observations with physically based models

1. Observation models

Developed models 'in house'

Open Sea: 2seacolor
Land surface: SEBS, Dattutdut,
Vegetation: SCOPE
Subsoil: STEMMUS (Zeng et al, 211)

<https://www.itc.nl/about-itc/organization/scientific-departments/water-resources/software-tools-models/>

2. Measurements

Sites for monitoring and validation of products obtained by remote sensing (SMAP, Smos, Flex)

<https://www.itc.nl/about-itc/organization/scientific-departments/water-resources/earth-observation-sites/>

3. Computation infrastructure

- **Geonetcast:** Quick access to satellite image information/lwis tools (Toolboxes)
- **Majisys** (time series)
- Data **repositories**, codes and github models, etc.
- **Linux server**
- **CRIB**

<https://www.itc.nl/about-itc/organization/scientific-departments/water-resources/earth-observation-sites/>

WHY OBSERVATION SITES?

It is needed to understand processes

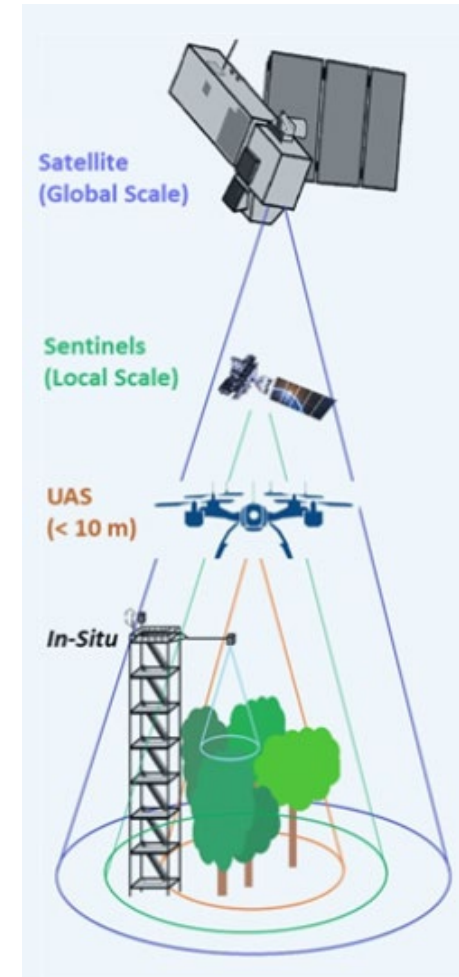


Net radiation

Soil heat flux

Sensible heat flux

Latent heat flux





You will get engaged with data: field data, measurement techniques, satellite data products



Monitoring and Managing Water Resources

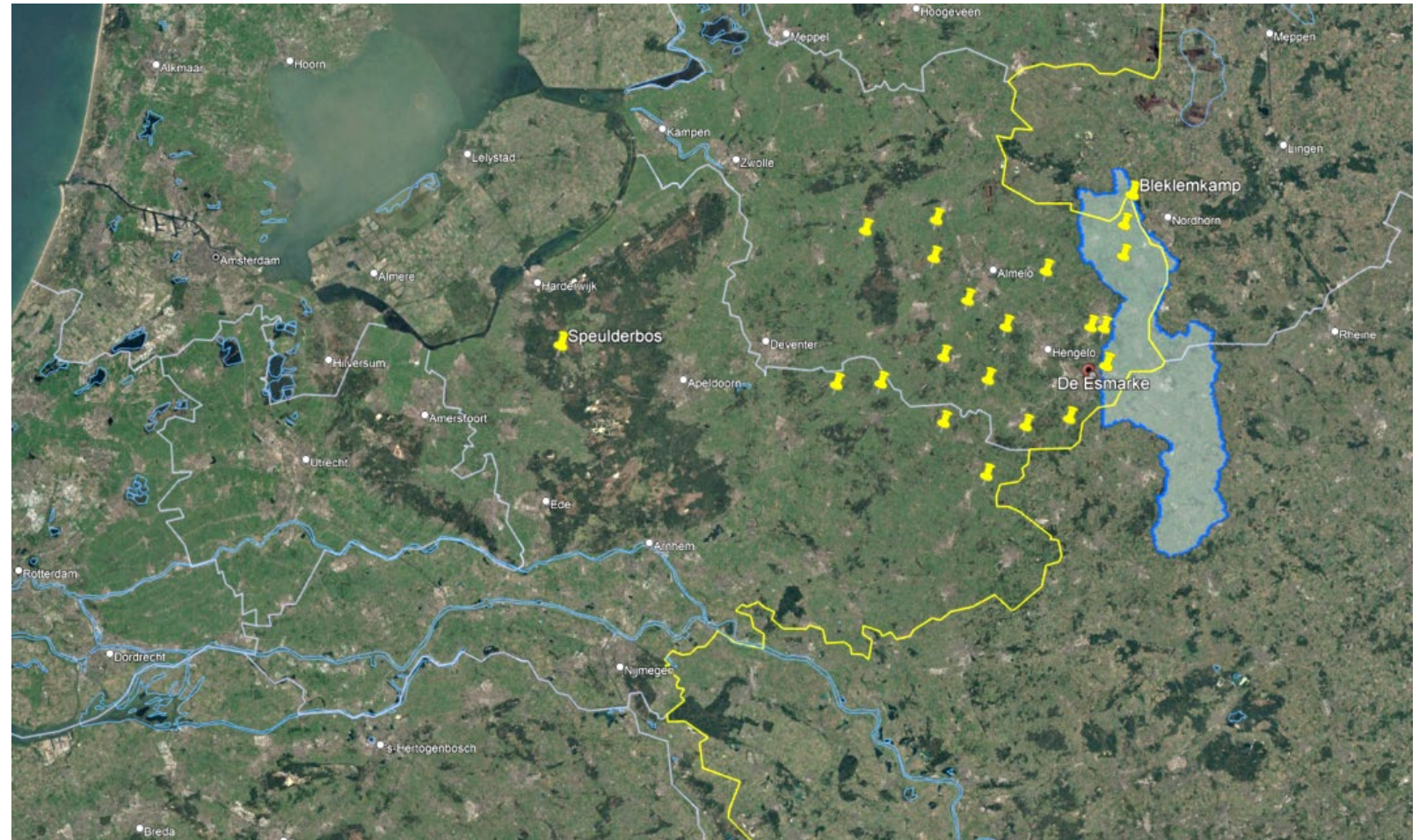
With remote sensing and field data & equipment



Satellites data infrastructure Data archiving
time series groundwater resources cloud
computing open science spectrometers
living laboratories



OBSERVATION SITES IN THE NETHERLANDS



ENSCHEDÉ URBAN CLIMATE MONITORING

Enschede: Monitoring Urban Climate



what: Radiation fluxes
Turbulent fluxes

how: Scintillometer,
eddy covariance
system

who Timmermans *et al*

goal(s) investigate urban
heat islands effect
and urban
microclimates

TWENTE SOIL MOISTURE NETWORK

what:

Soil Moisture

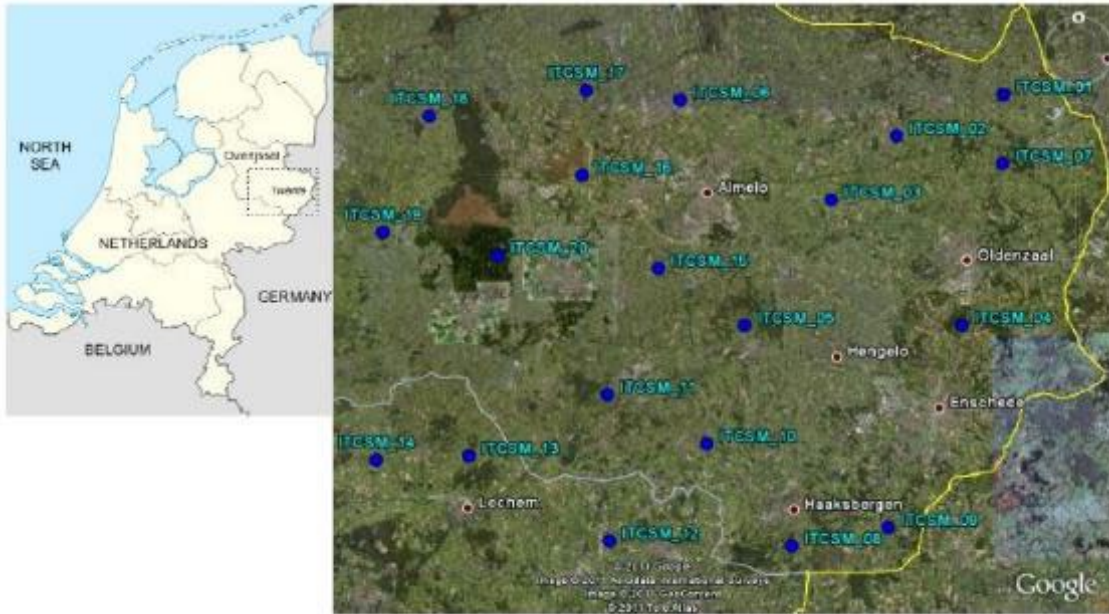
how:

who

Paul (prev. Rogier)

goal(s)

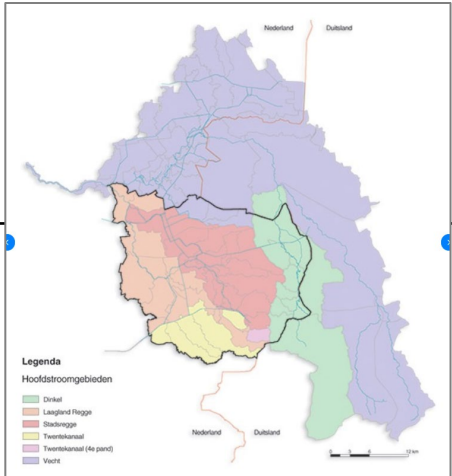
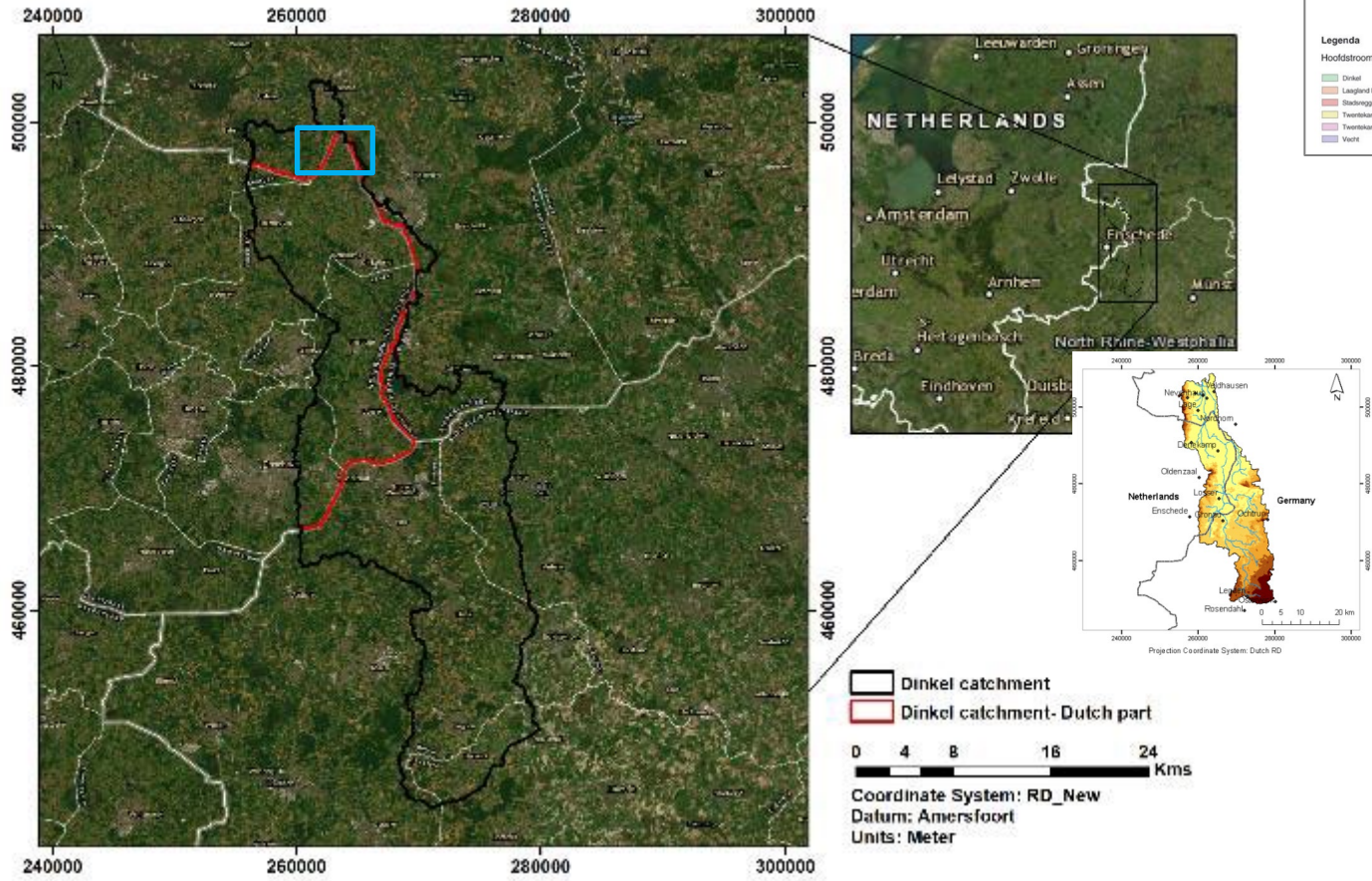
SM historic data for satellite products validation



TWENTE SOIL MOISTURE NETWORK



DINKEL CATCHMENT - B



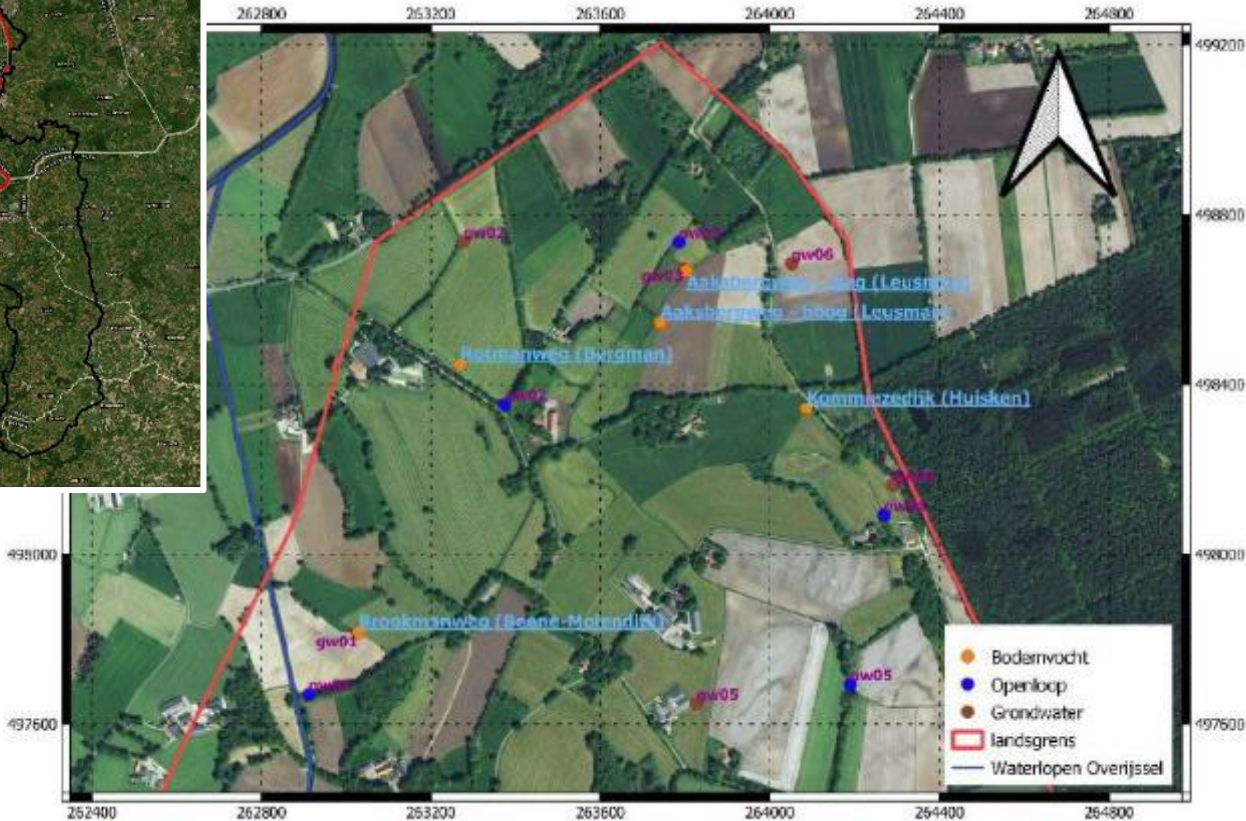
(Source: WRD)



- what:** Groundwater, SM, ET, biomass
- how:** SM sensors
- who:** Mostafa et al together with WUNDER researchers
Gabriel to measure in the streams
- goal(s):** Investigate role of groundwater in the distribution and severity of drought events in the Dinkel (coupling STEMMUS-SCOPE with MODFLOW)



DINKEL CATCHMENT - BRECKLENKAMP

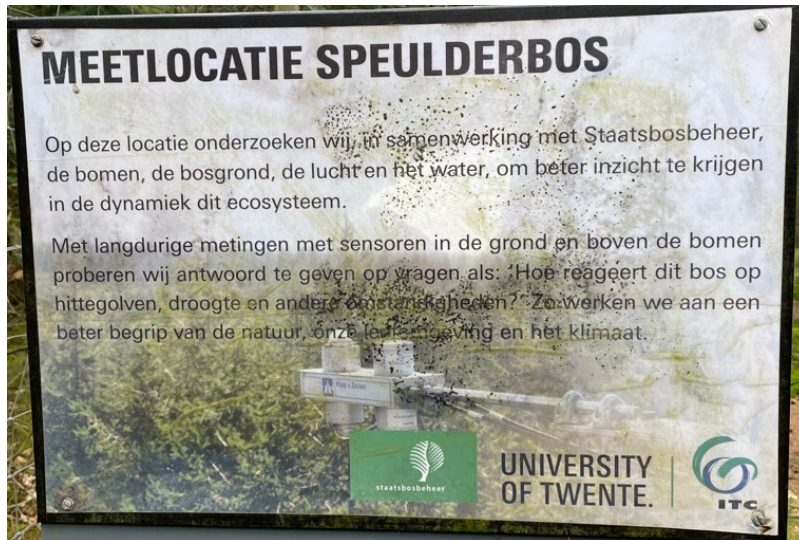


what: soil moisture
how: TEROS 11 SM sensor
who Paul (prev. Rogier)
goal(s) monitor SM content changes to evaluate measures taken by the water authority for improving water retention in the context of droughts



SPEULDERBOS

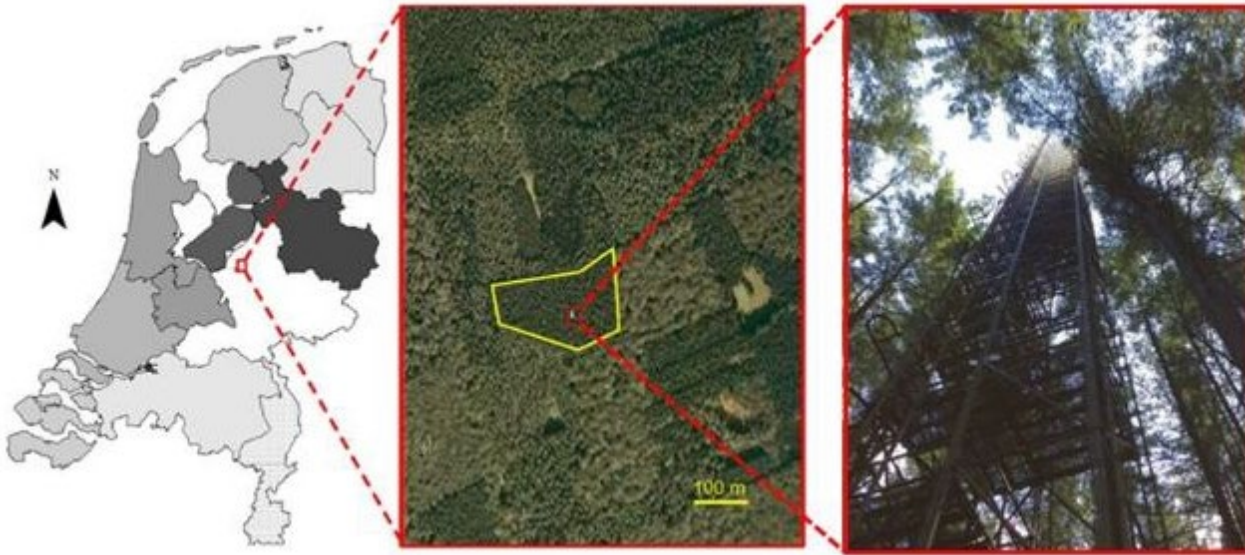
to provide a long-term monitoring of key variables of forest physiology, soil physics and chemistry, hydrology and atmosphere. These data are used at ITC to develop remote sensing measurement techniques.



Since the mid 1980's, measurements in a Douglas fir plantation

- Acid rain and forest health
- Air quality
- Nitrogen deposition
- Hydrology and meteorology

SPEULDERBOS



what:

solar-induced chlorophyll fluorescence (SIF).

how:

spectrometers, Piccolo system

who

Xuhui, Christiaan, Egor

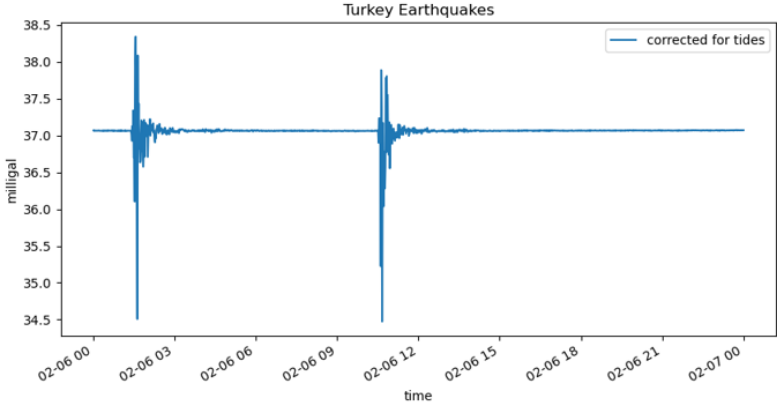
goal(s)

understand the link between SIF and stomatal conductance for transpiration estimation.
Assessing the impacts of environmental stress on plants physiological activities

SPEULDERBOS



SPEULDERBOS - GEODESY FLAVOURED RESEARCH

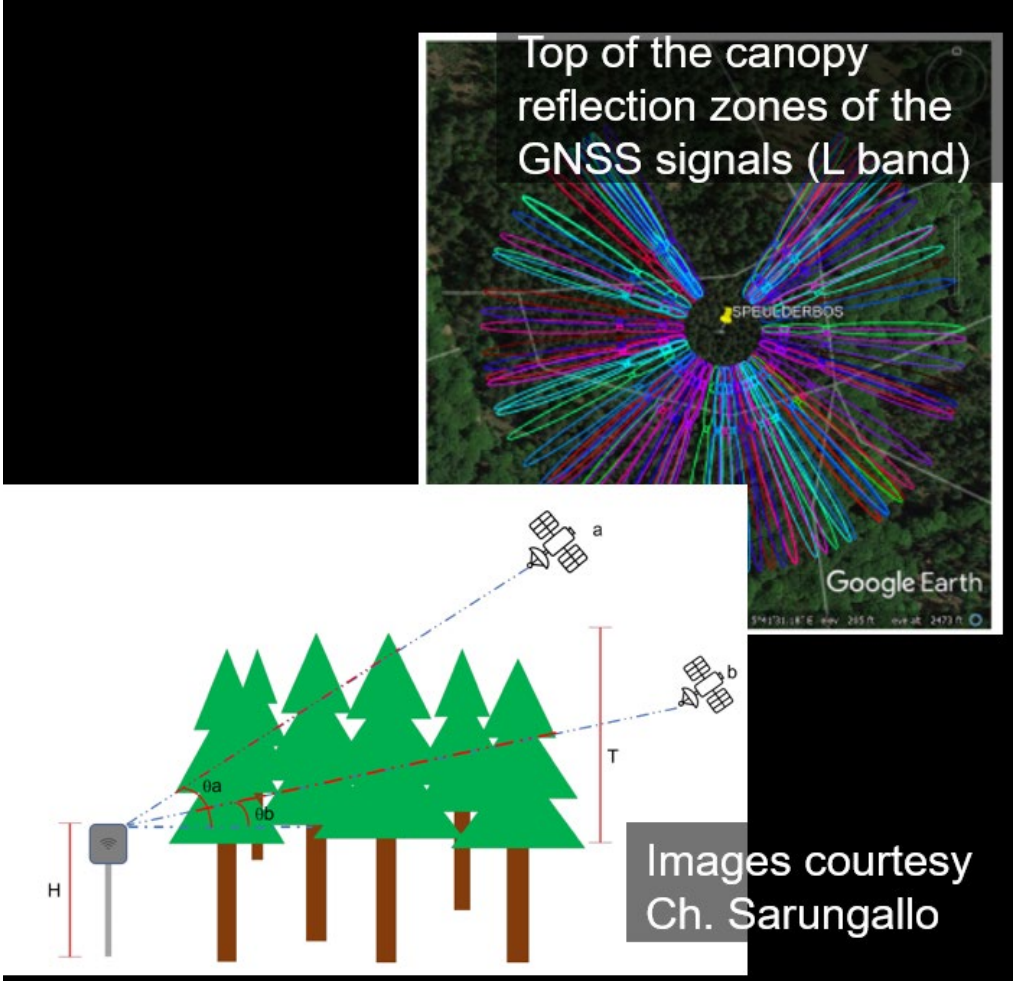


Earthquakes are clearly visible in the data but hydrological signals are ~10x smaller (!!)

- what:** Time series of gravimetry using University of Bonn CG-5 spring operated gravimeter
- how:** gravimeter
- who:** Roelof & colleagues from U Bonn
- goal(s):** Time series may possibly contain aggregate hydrological signals (groundwater, soil moisture,...).



SPEULDERBOS - GNSS INTERFEROMETRIC REFLECTOMETRY



what: Measurements of the signal attenuation and canopy/forest floor reflections

how: Low-cost GNSS-interferometry

who Roelof, Paul et al., (Blue Sky project) – Also to be used in the Nile river basin for validation of altimetry observations in rivers (EO AFRICA research project)

goal(s) Investigate canopy reflections, interception. Get insights on low-cost GNSS-reflectometry

TIBETAN PLATEAU OBSERVATORY OF PLATEAU SCALE SM & ST (TIBET-OBS)



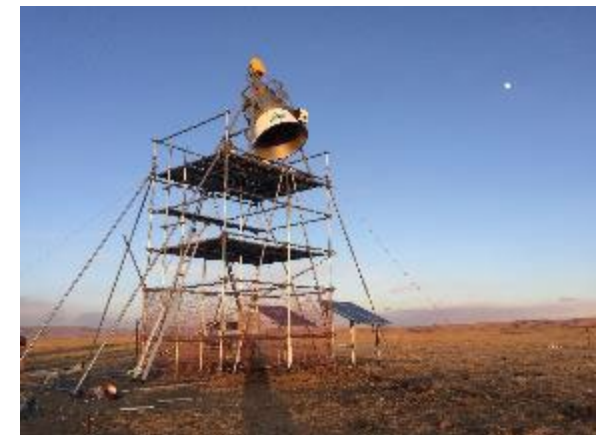
<http://en.tpdatabase.cn/>
ISMN

(Established since 2004; Su et al. 2011, HESS; Zeng et al. 2016, RS; Zhang et al. 2020, ESSD)

what: soil moisture, soil temperature network

who Bob, Yijian, Hong, Jan, Ting, Andy Nelson, Michael Schlund

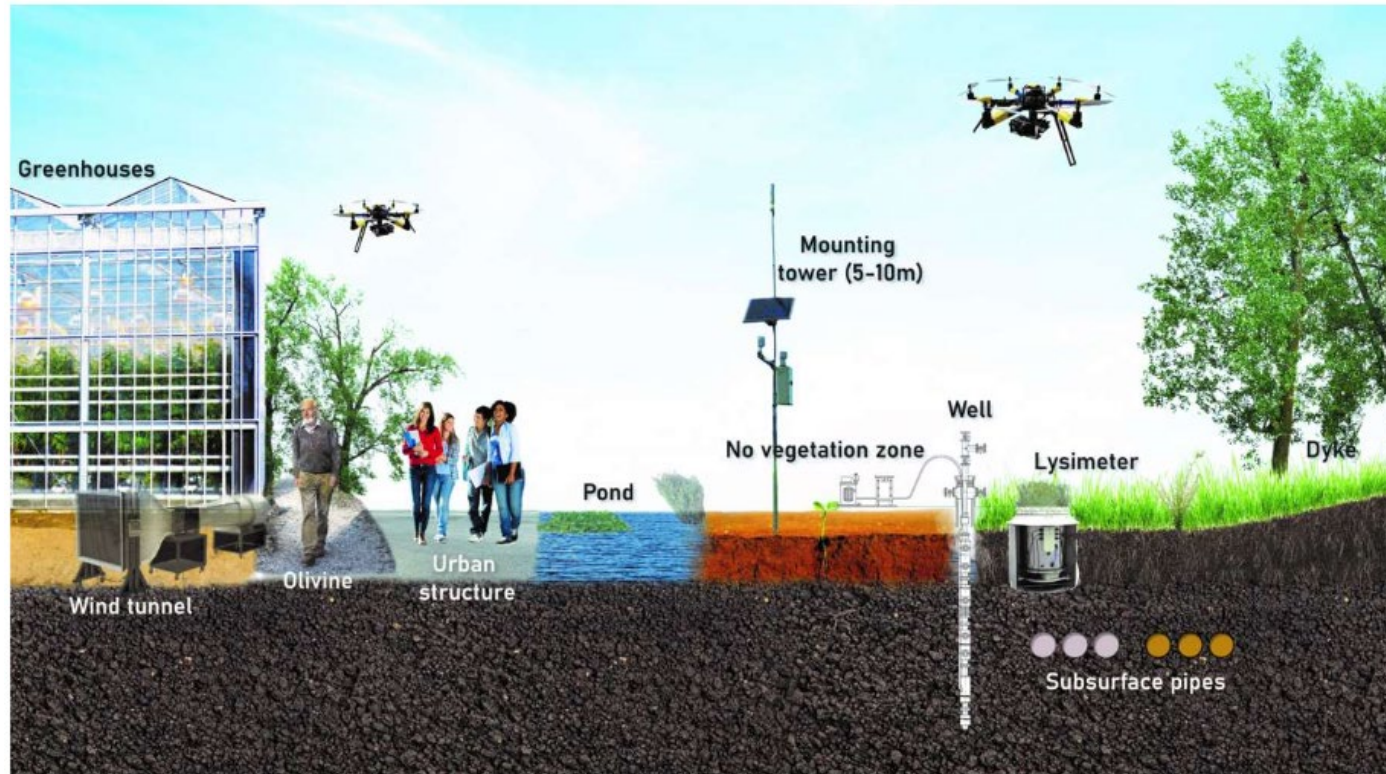
goal(s) Digital Twin Earth – Observation Operator & Dynamic Model components/ validating remote sensing products



OBJECTIVES & ROLES

- Stimulate staff participation/contributions
- Include measurements in education
- Provide visibility
- Facilitate project funding
- Working towards converting our sites in Water Oriented Living Labs (WoLL) in Europe and beyond.
- Operational Manager - Diana
 - Logistics/purchase (Murat, +staff)
 - Visibility/Promotion (internal/external)
 - Projects
- Scientific Manager – Roelof
 - Instruments (Murat, Christiaan)
 - Computation/Data (Bas, +staff)

UTWENTE - LIVING INNOVATION LAB LILA (COMING SOON...)



A unique facility where we can take years of collaborative research between faculties to the next level

LILA will offer researchers the opportunity to work on developing new methods and techniques in a transdisciplinary setting

LILA WILL OFFER A BROAD SPECTRUM OF TRANSDISCIPLINARY SUBJECTS: AT, UNDER AND ABOVE THE GROUND.

<https://www.itc.nl/news/2021/6/1094358/ut-campus-will-have-a-living-innovation-lab#a-transdisciplinary-lab>

Thanks

