



Hydrology of a forested groundwater-dominated lake system: structures and processes

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Ingo Heidbüchel, Christina Tecklenburg, Henriette Wilke, Janek Dreibrodt*

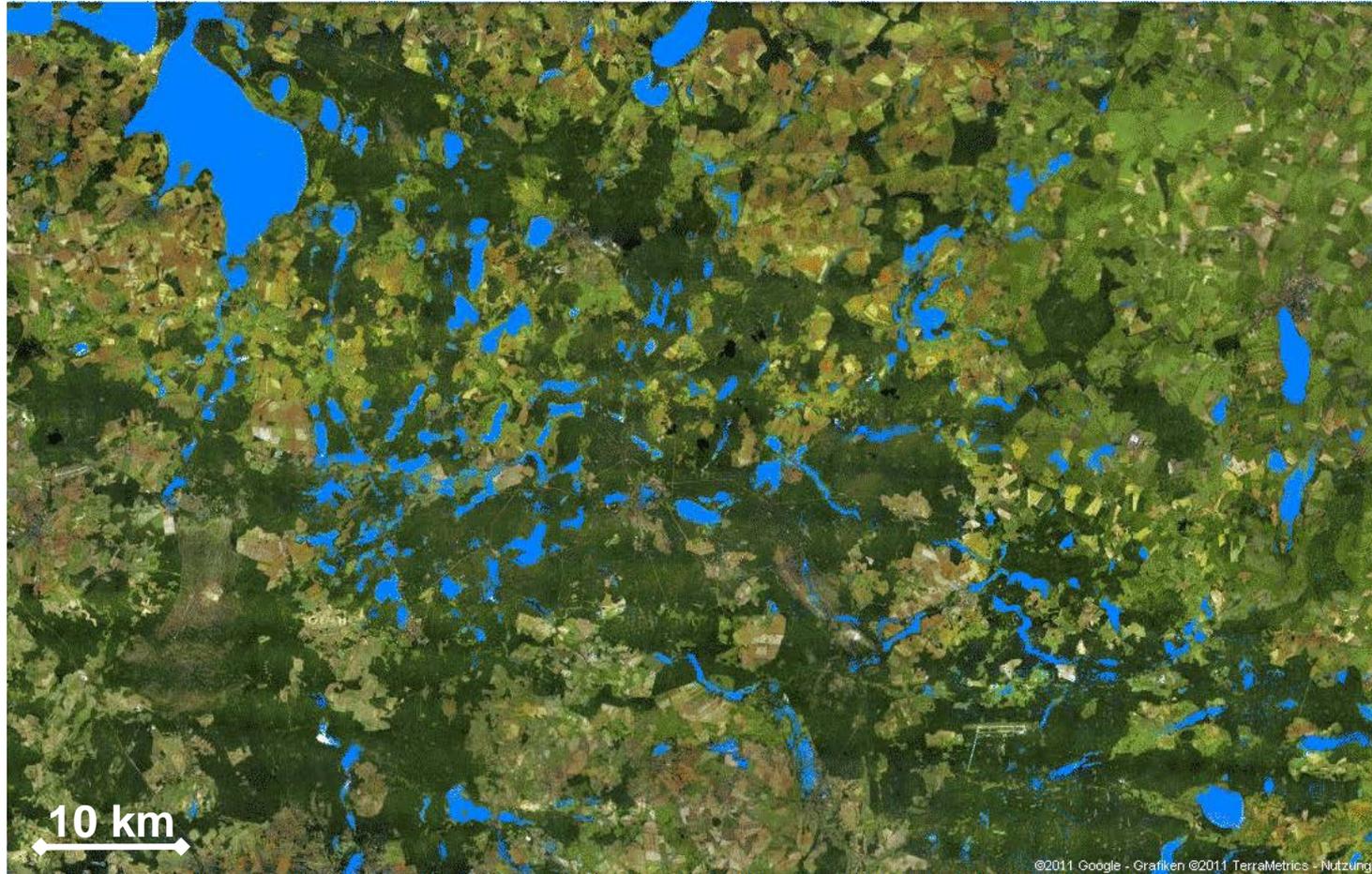


The North-Eastern Lowlands Observatory





The North-Eastern Lowlands Observatory



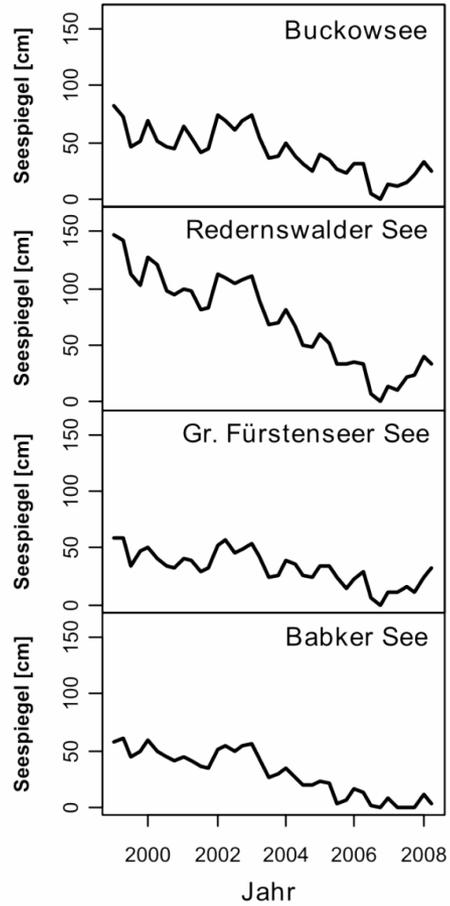
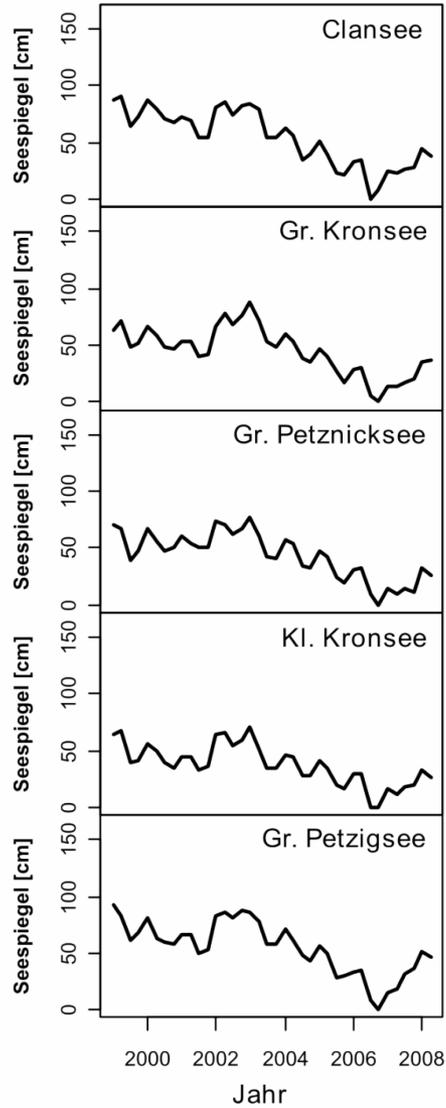


The North-Eastern Lowlands Observatory



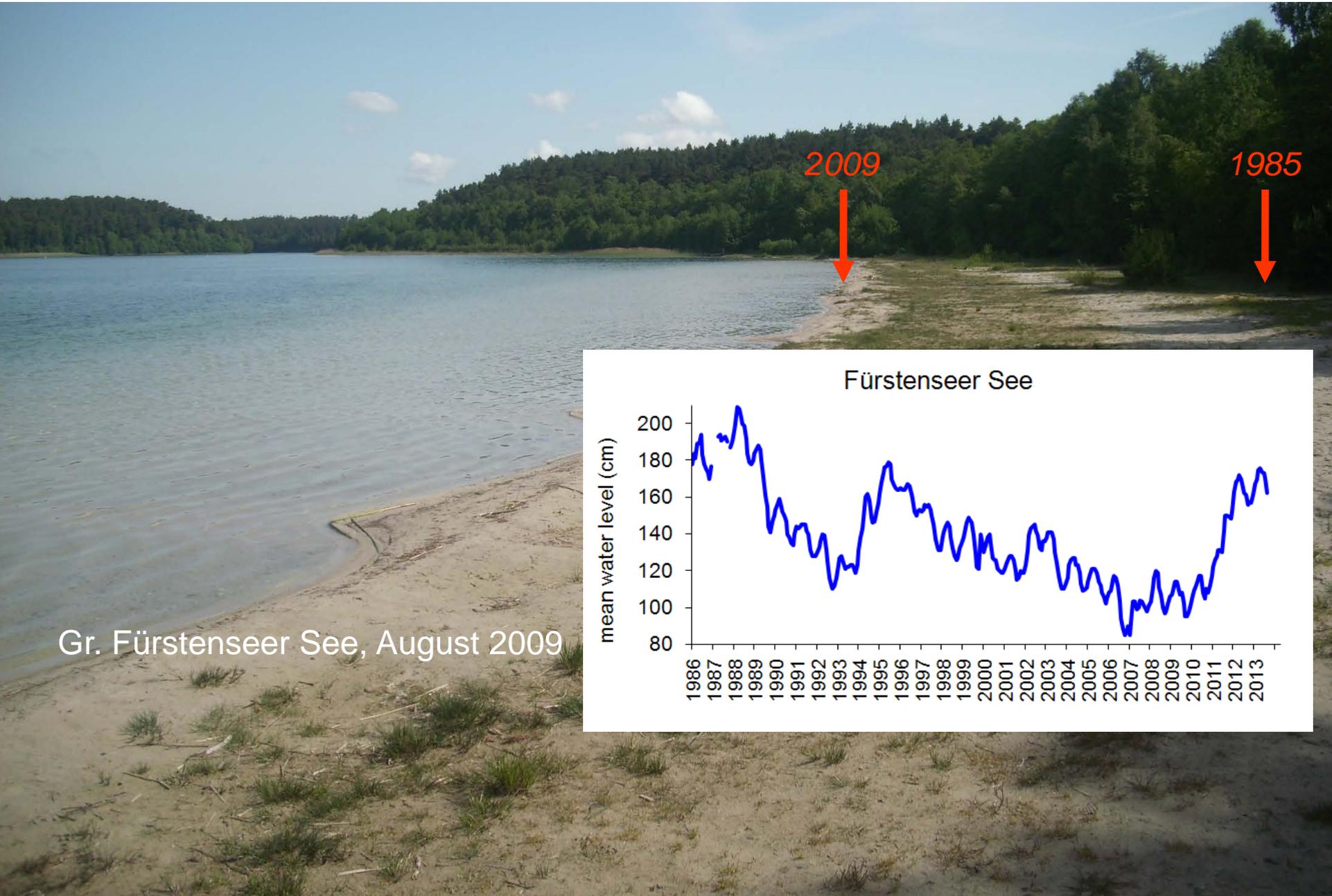


Gr. Fürstenseer See, August 2009

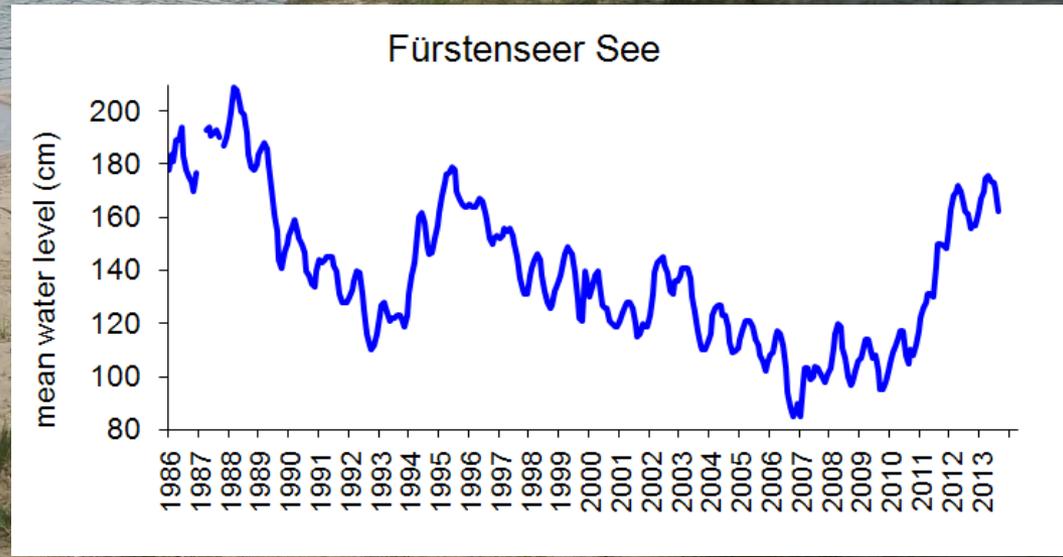


Germer et al. (2010)



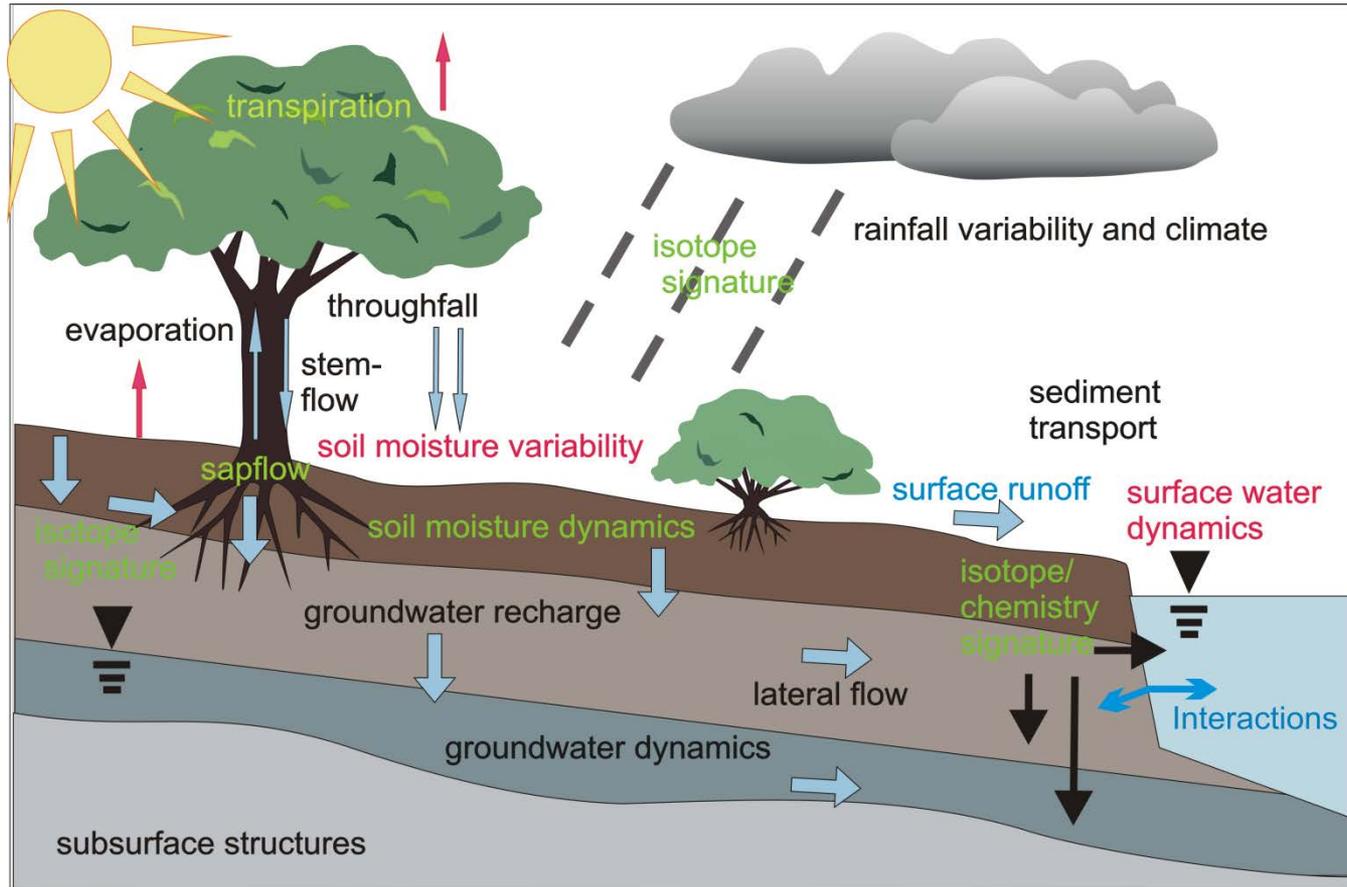


Gr. Fürstenseer See, August 2009



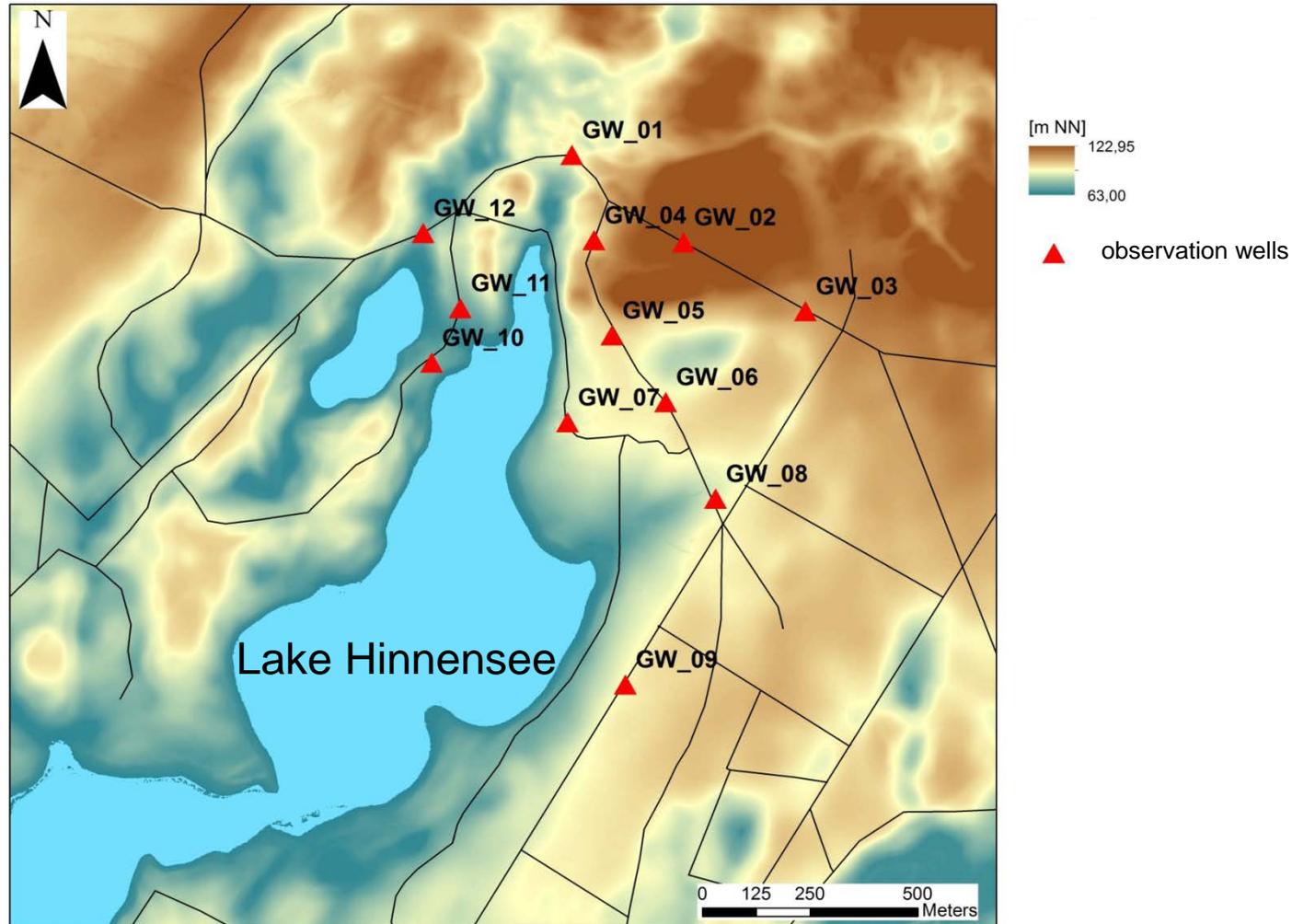


Monitoring design and research questions



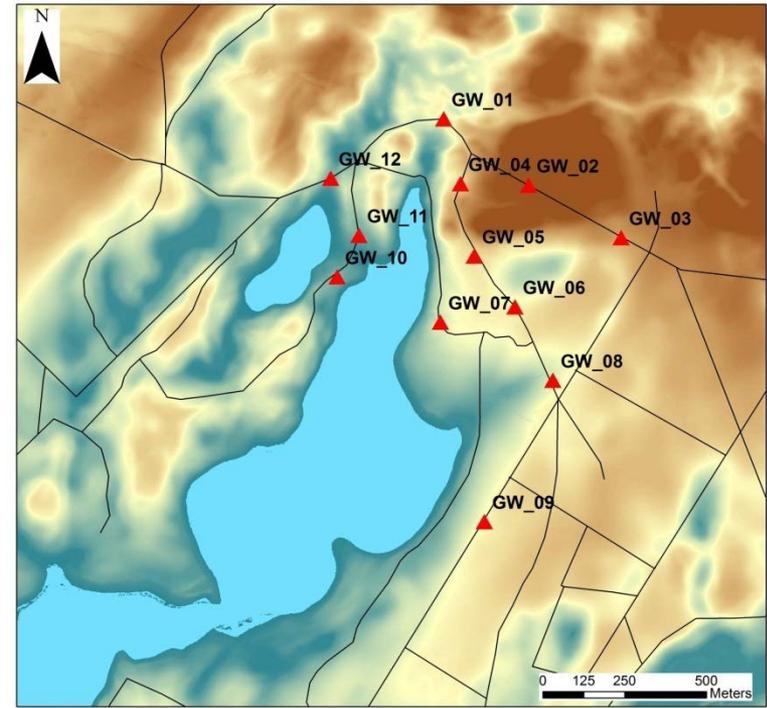
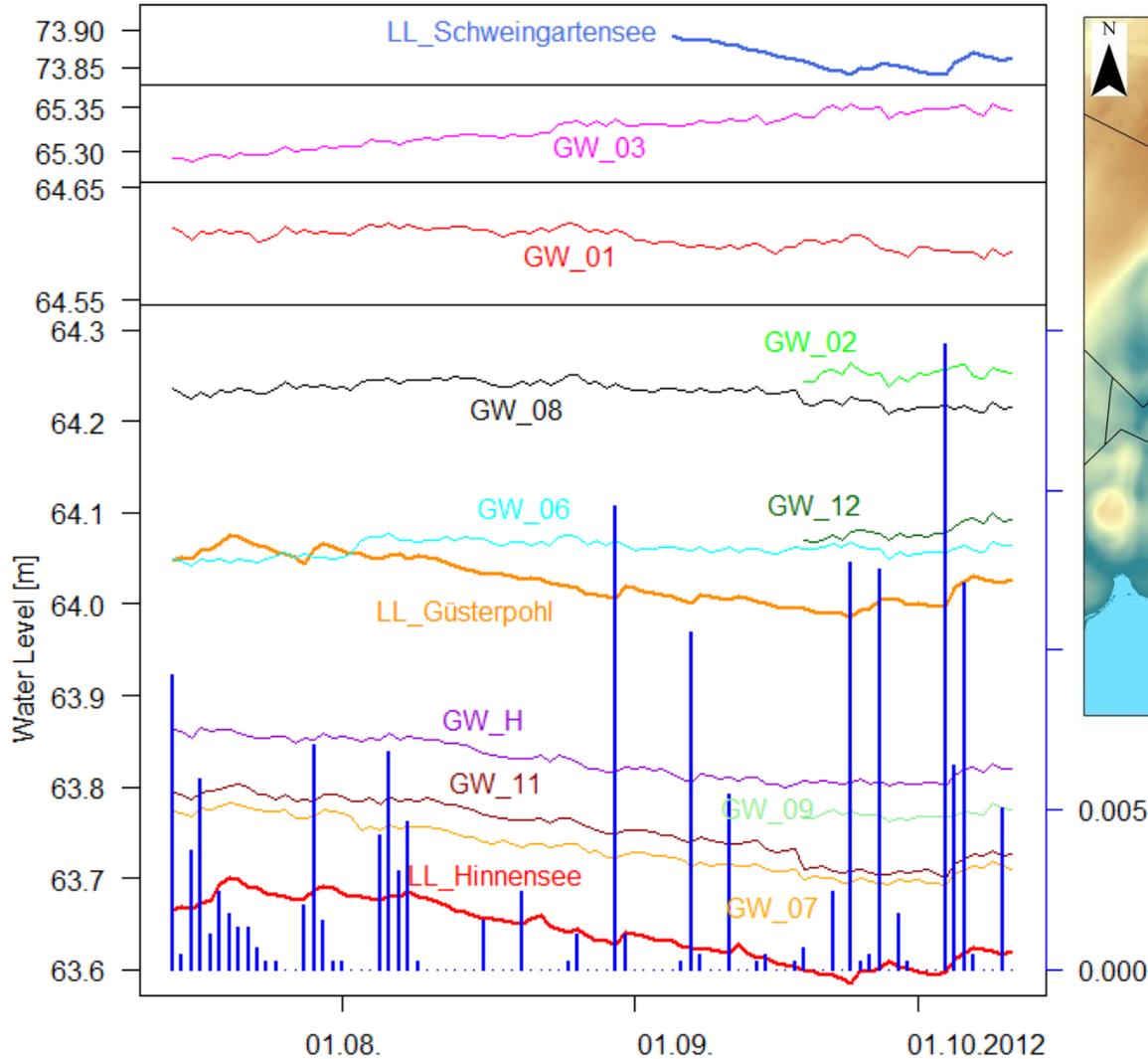


Subsurface structures and groundwater dynamics



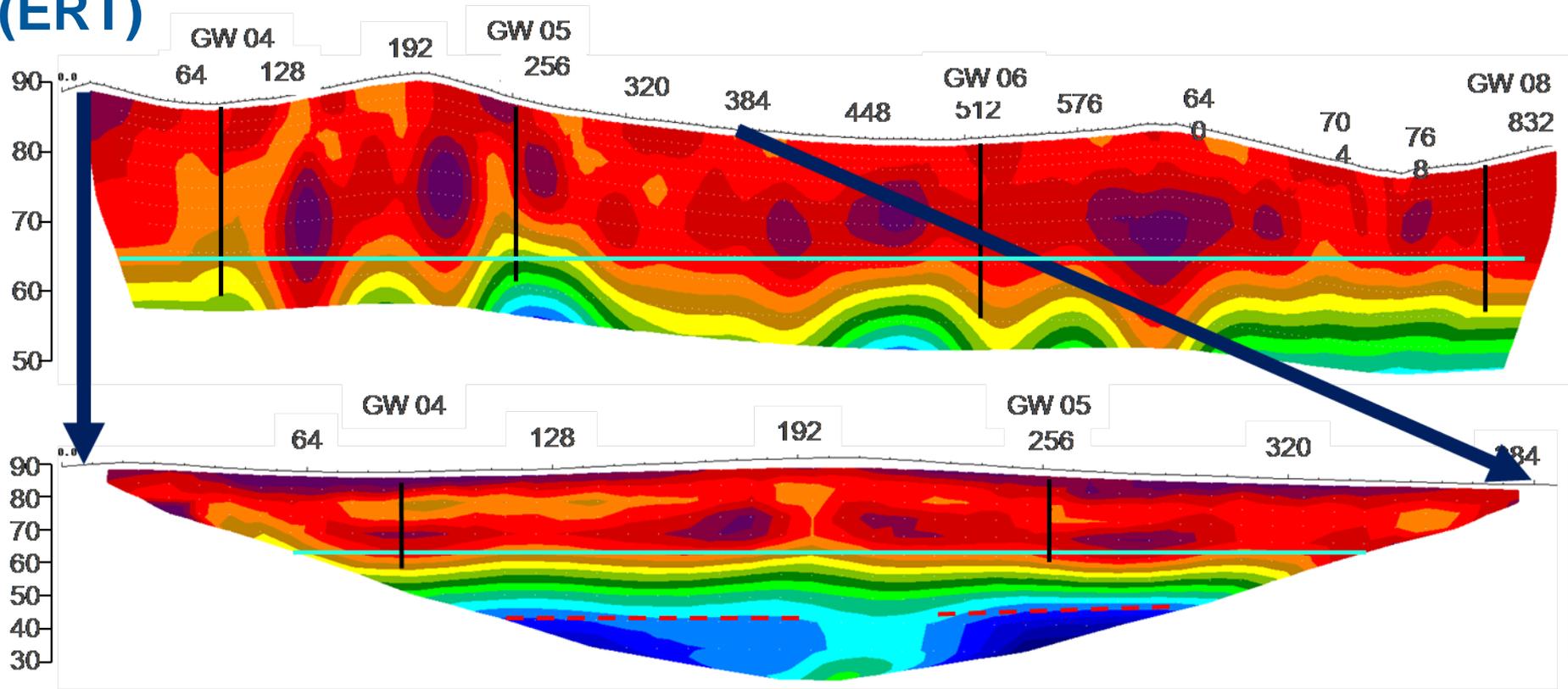


Groundwater dynamics: high resolution time series

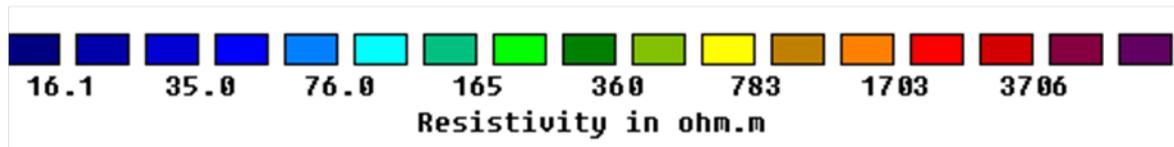




Subsurface Structures: Electrical resistivity tomography (ERT)

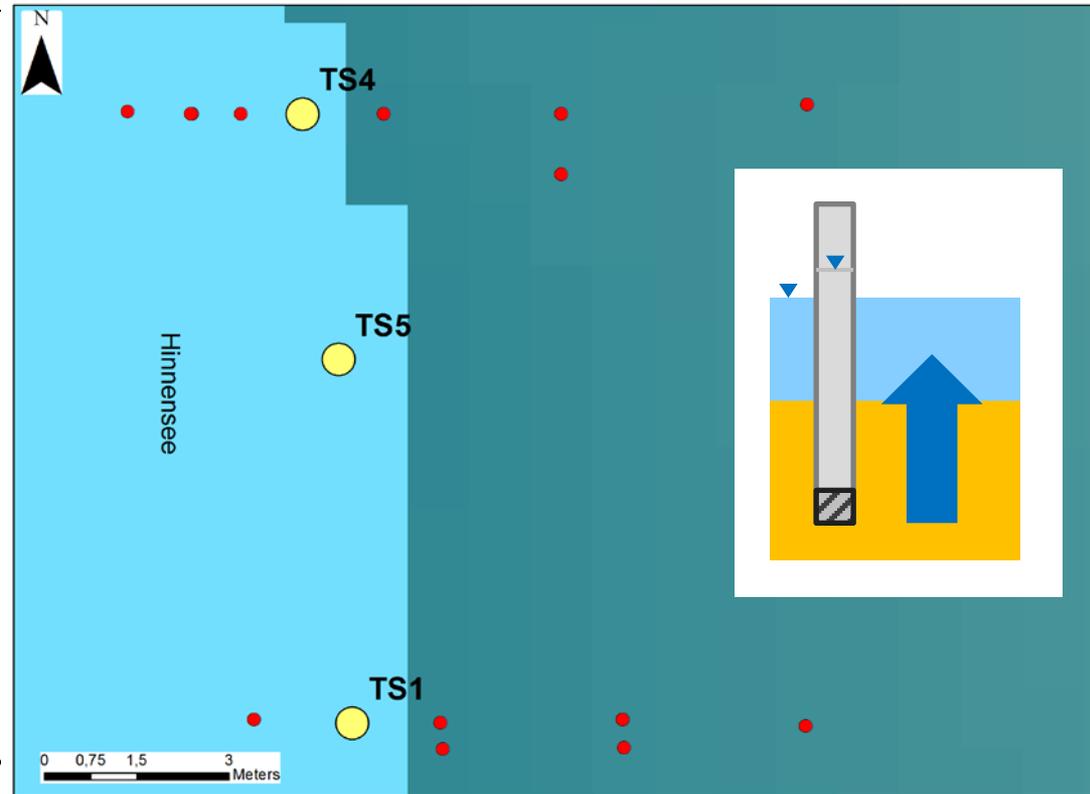
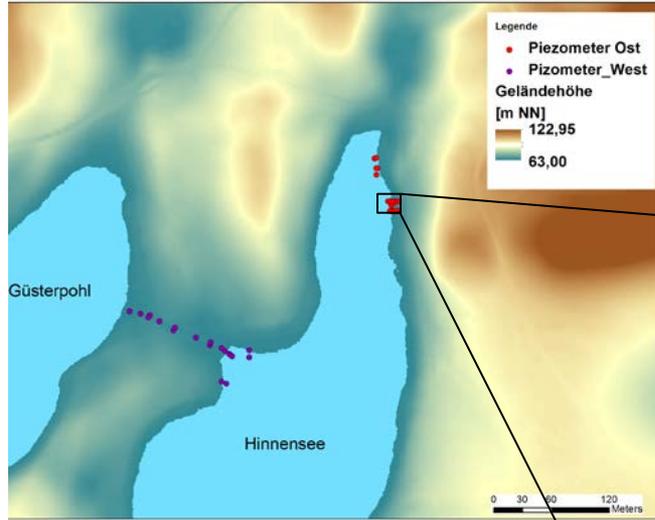


Henriette Wilke





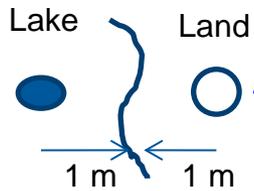
Groundwater-lake interactions: - piezometer data



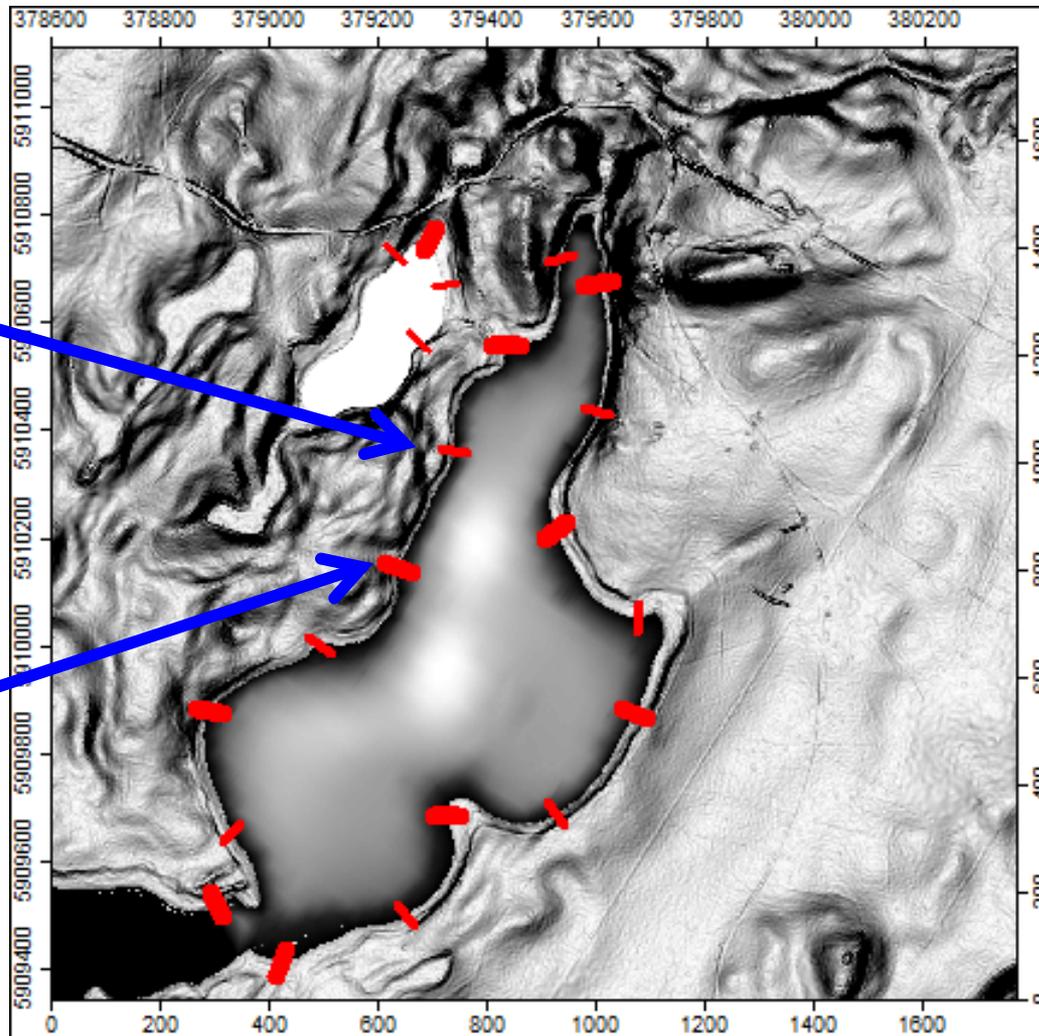
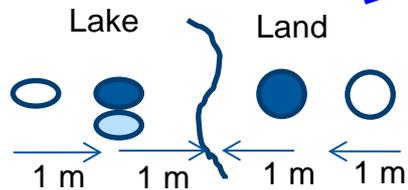


Planned piezometer transects – the larger scale

short transect

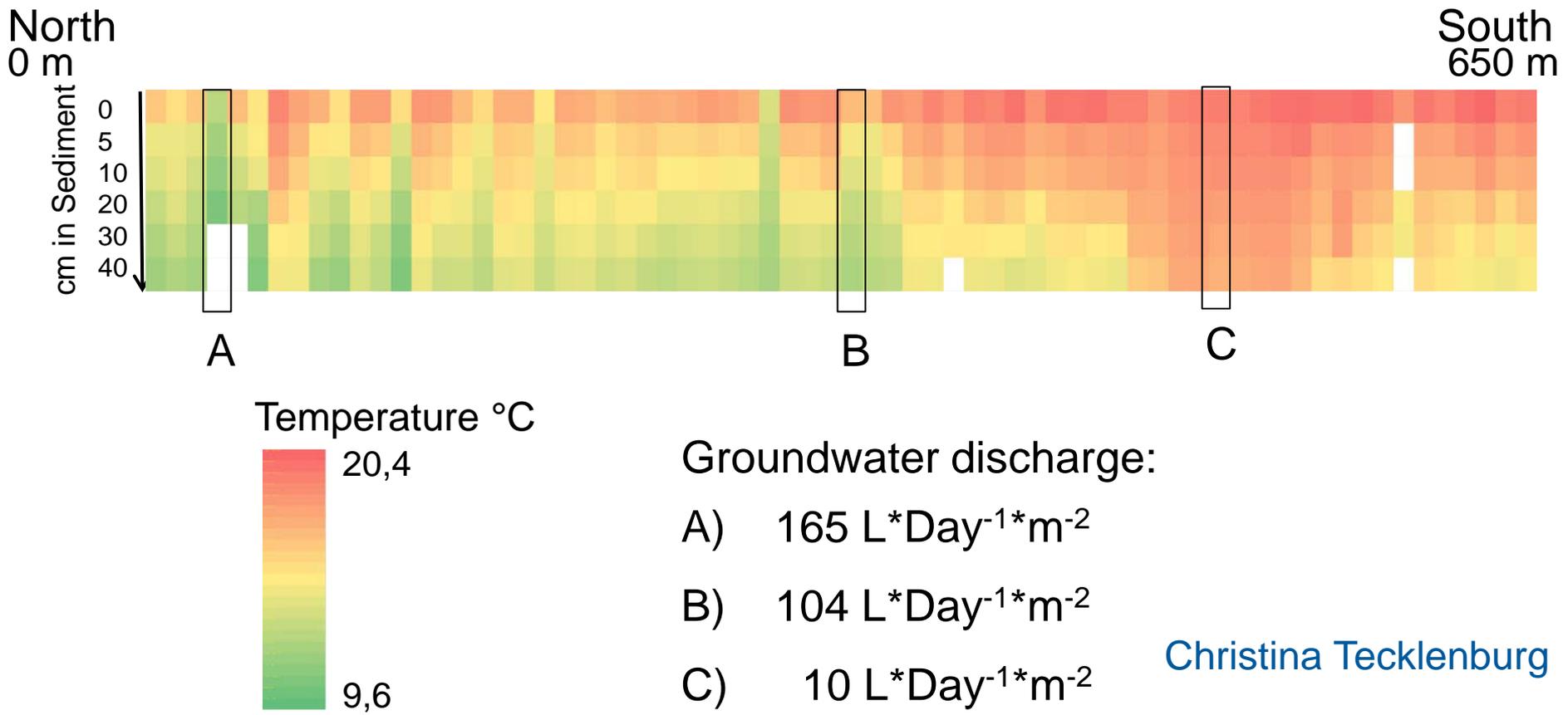


long transect





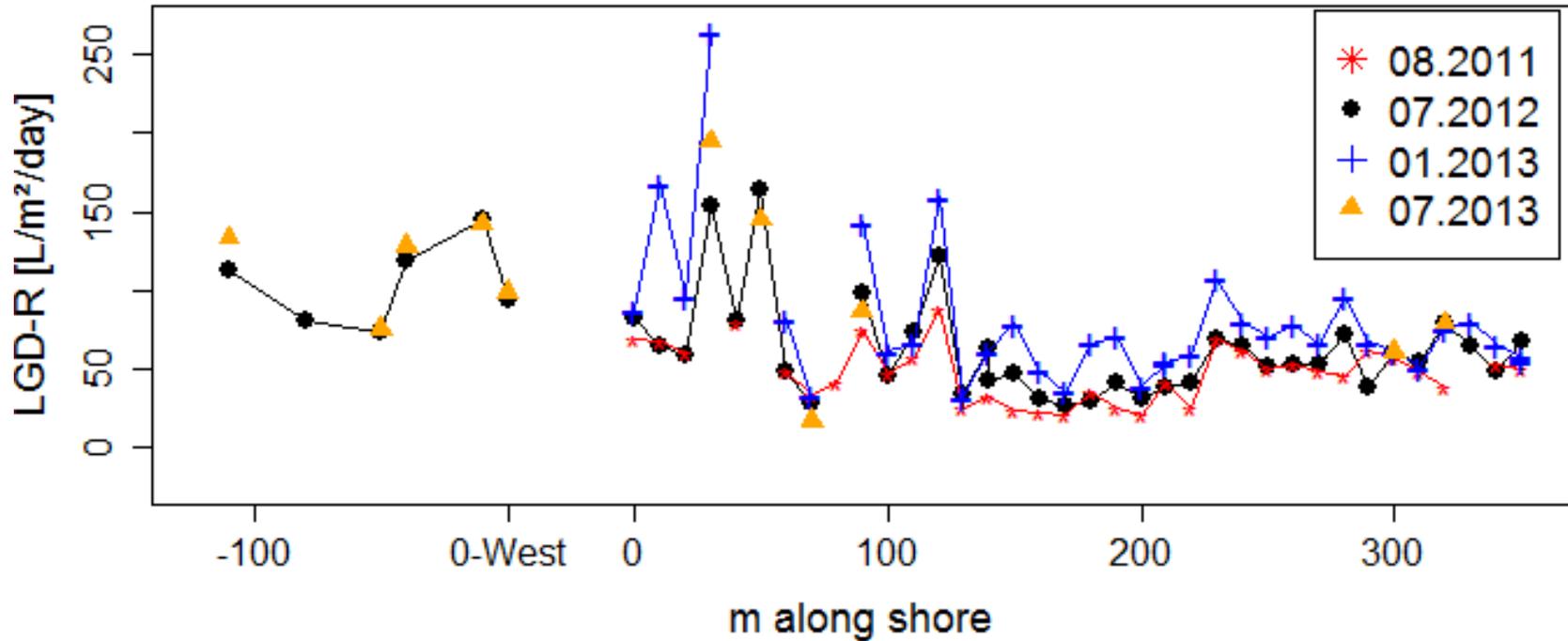
Groundwater-lake interactions: - temperature profiles



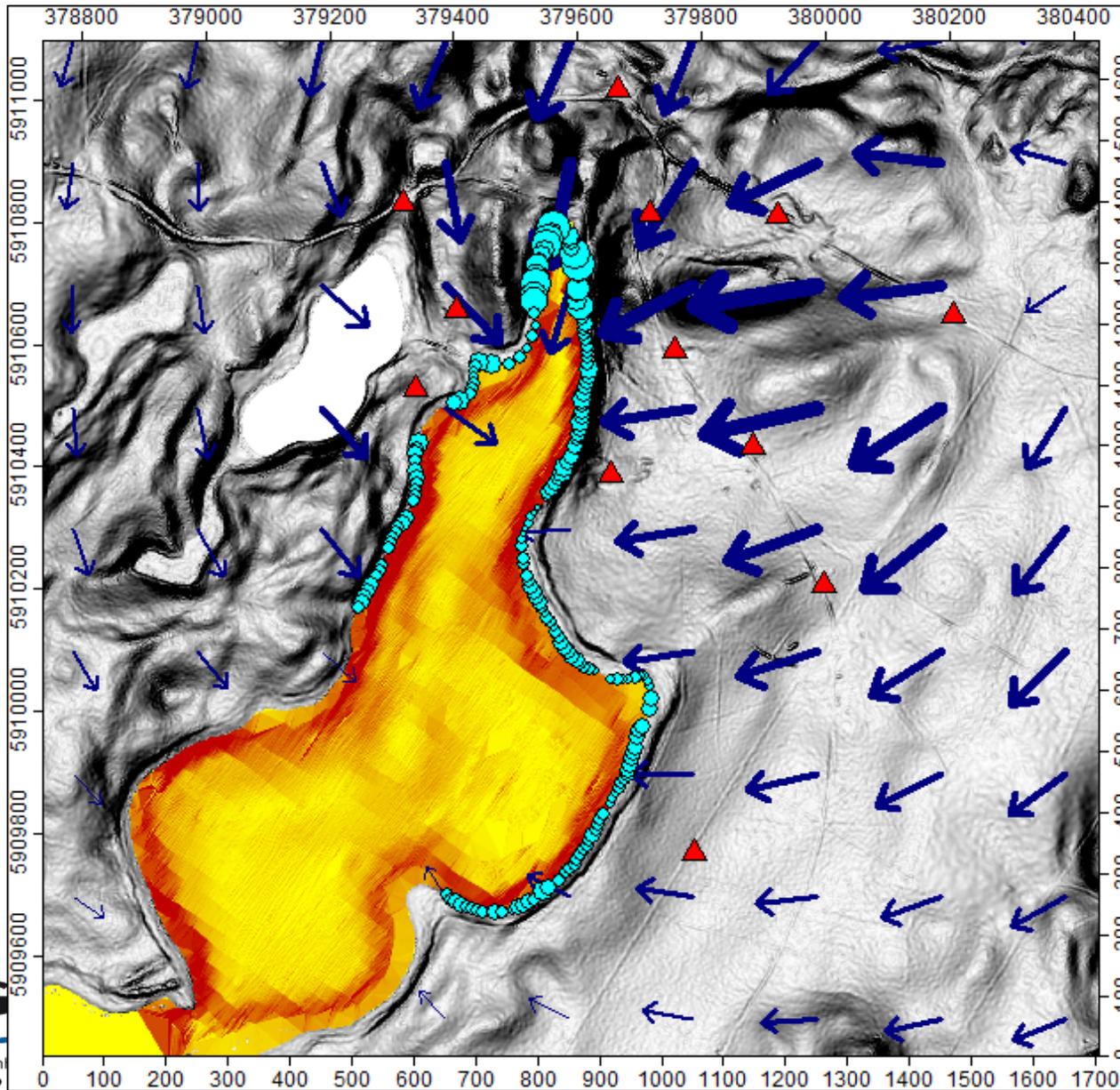
Christina Tecklenburg



Groundwater-lake interactions: - temperature profiles



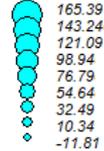
Christina Tecklenburg



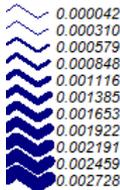
Borewells



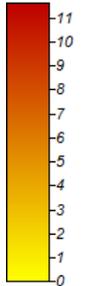
LGD [L/m²/day]



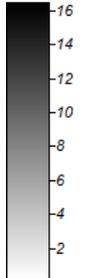
GW_Flow



Lakeslope [°]



Surfaceslope [°]



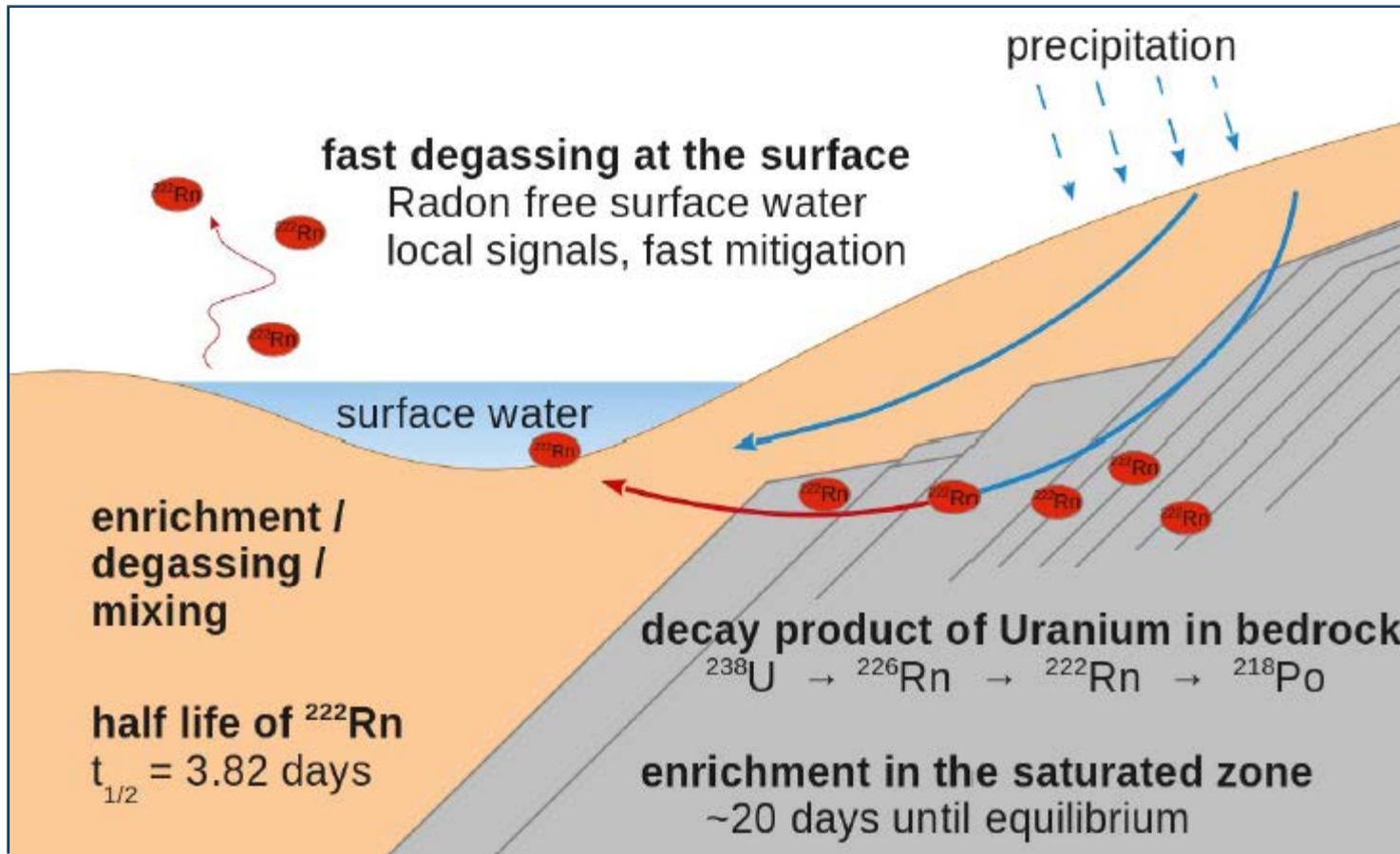
Christina
Tecklenburg

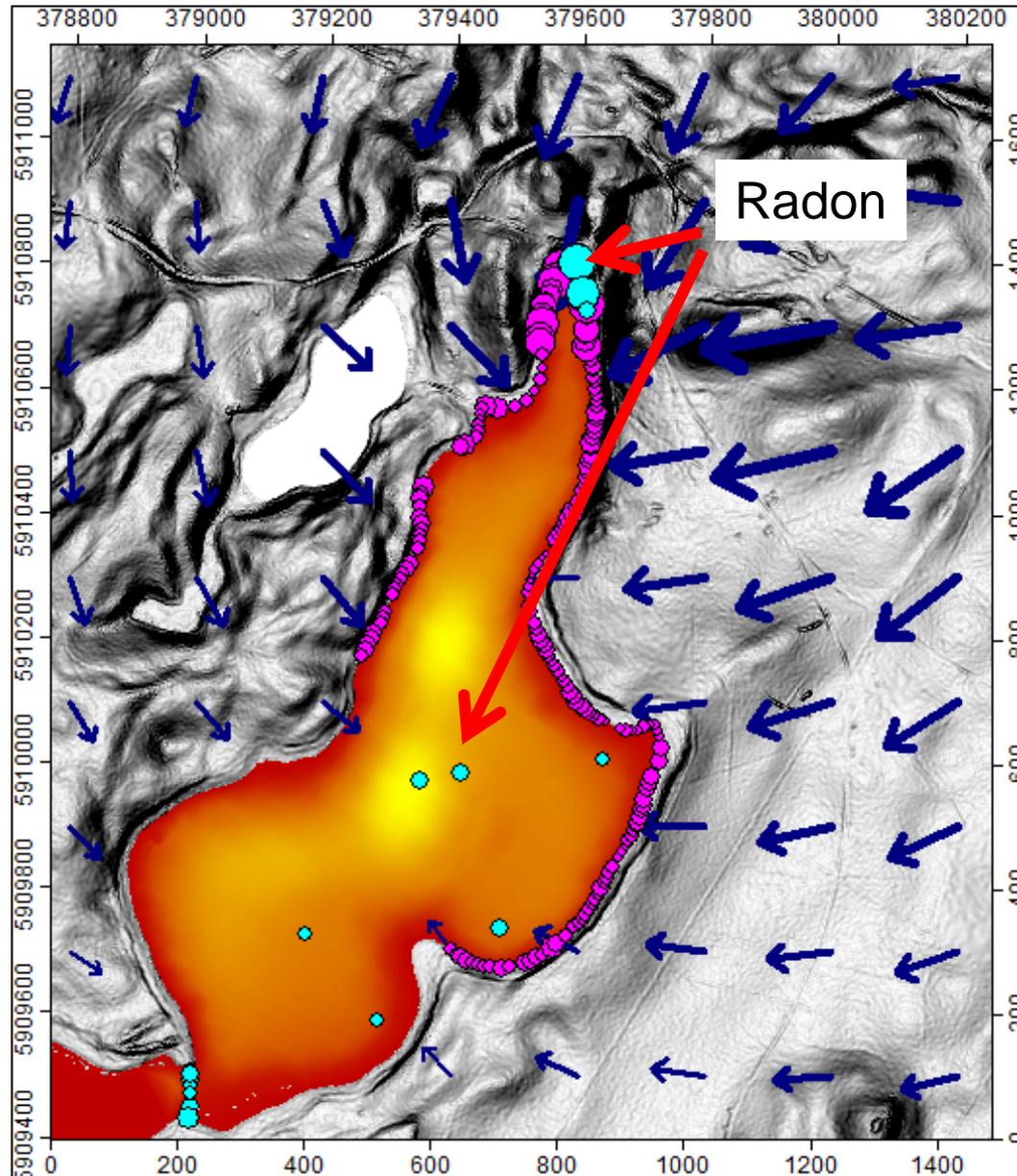
Müritz-
ationalpark





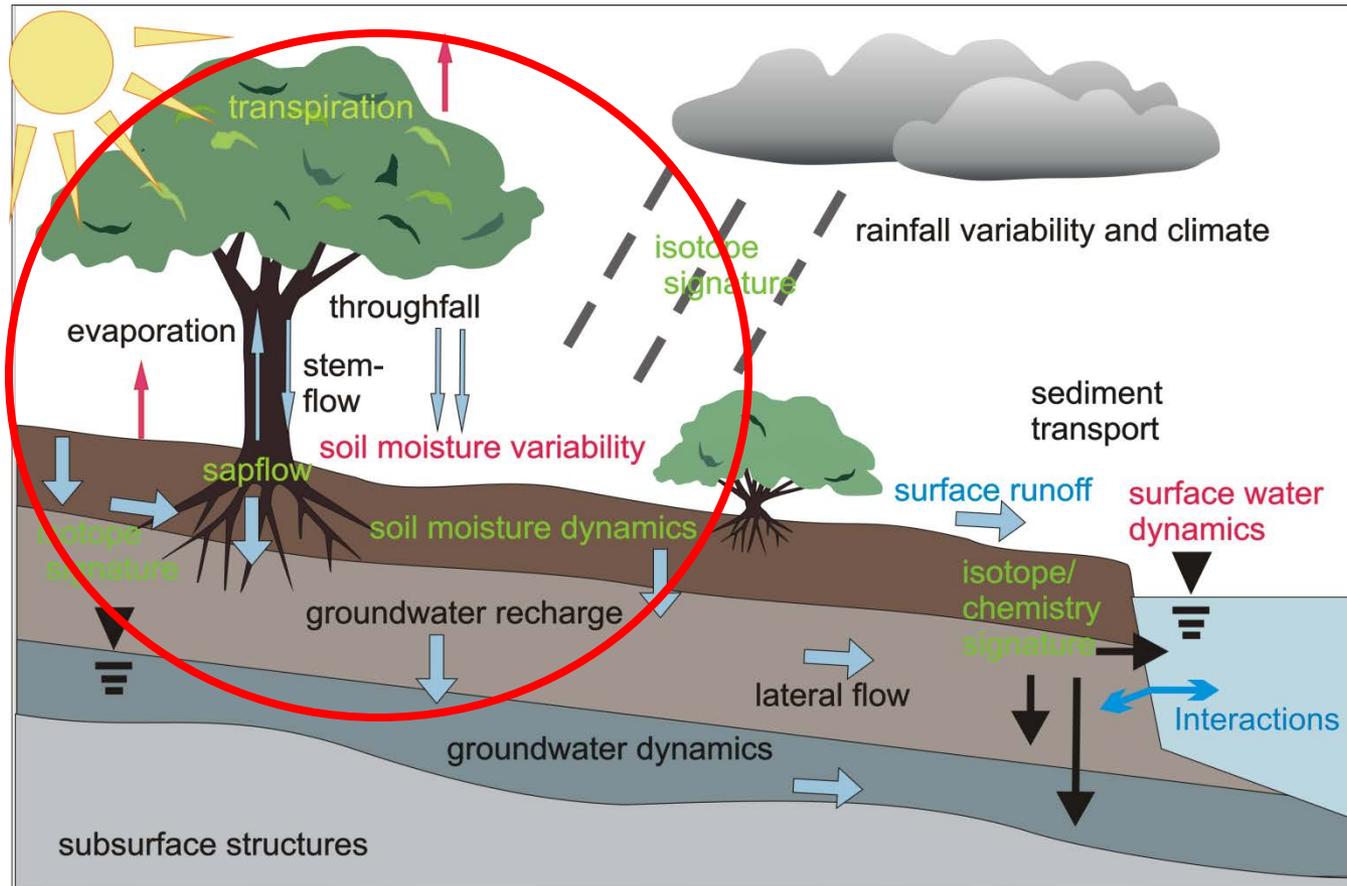
Water flow paths in the subsurface: Groundwater-lake interaction







Groundwater recharge and vegetation





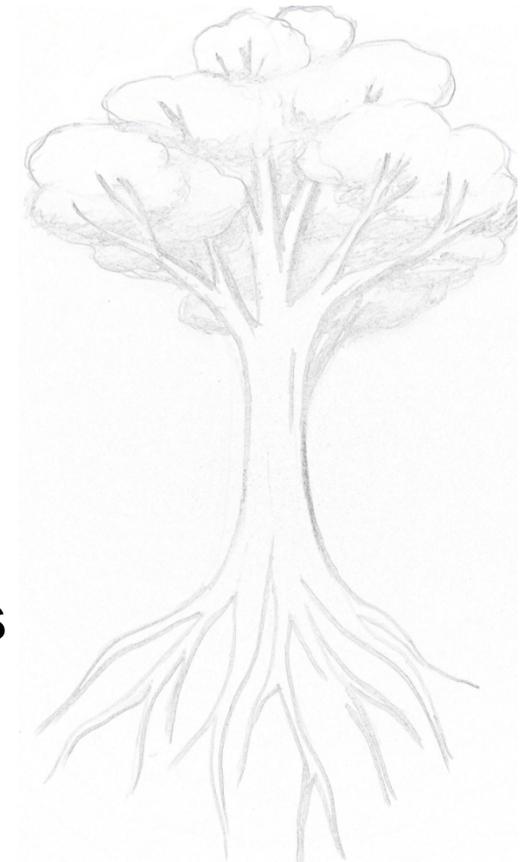
Linking trees and hydrology

Measuring today's processes:

- Precipitation/throughfall/stemflow
- Soil moisture/matrix potential dynamics
- Groundwater dynamics
- Sapflow dynamics
- Tree radial growth dynamics

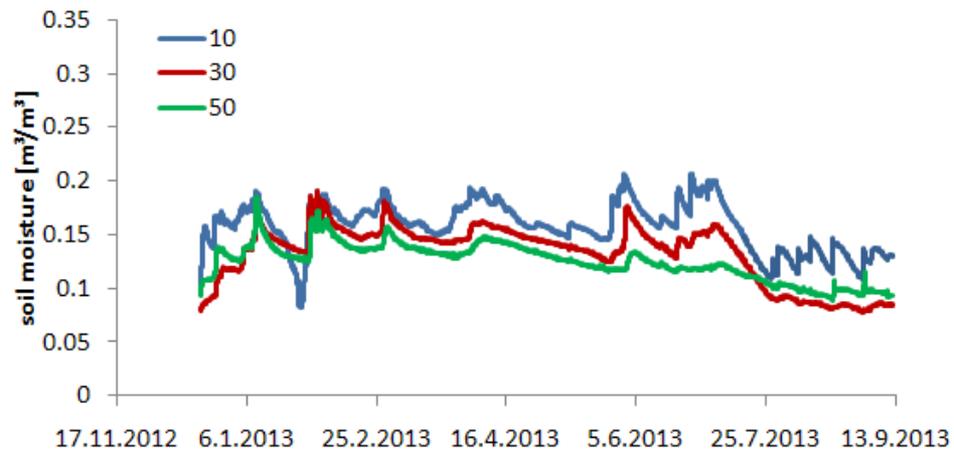
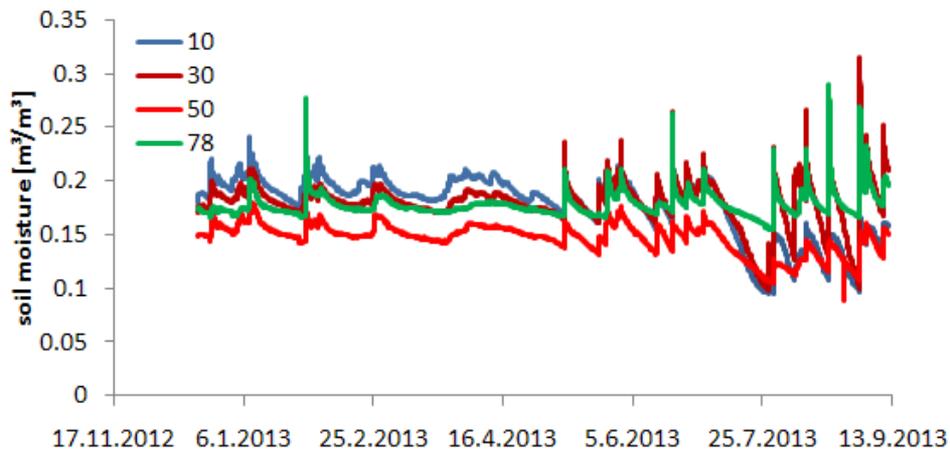
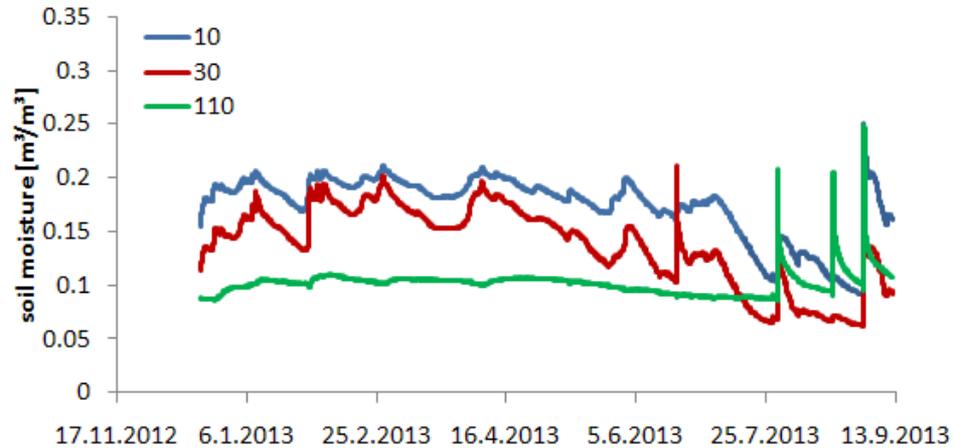
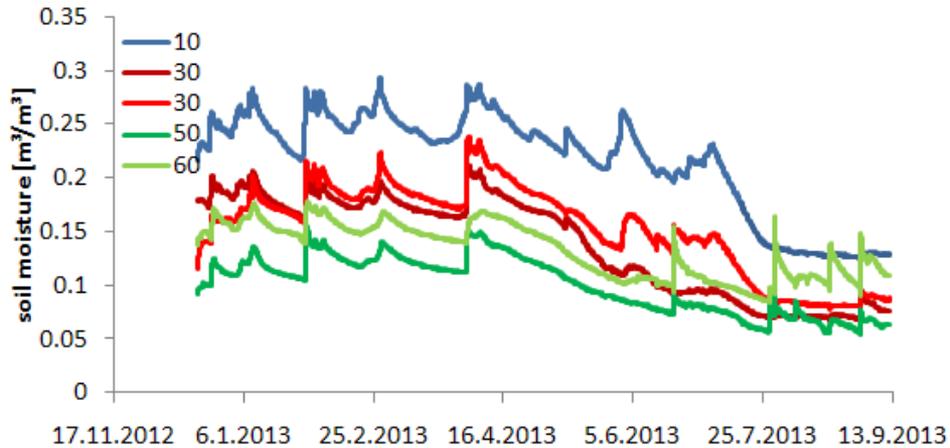
Measuring stable isotope concentrations

- indicators of origin of water supply
- Rainfall, groundwater, soil moisture
- Xylem water, tree rings, leaves



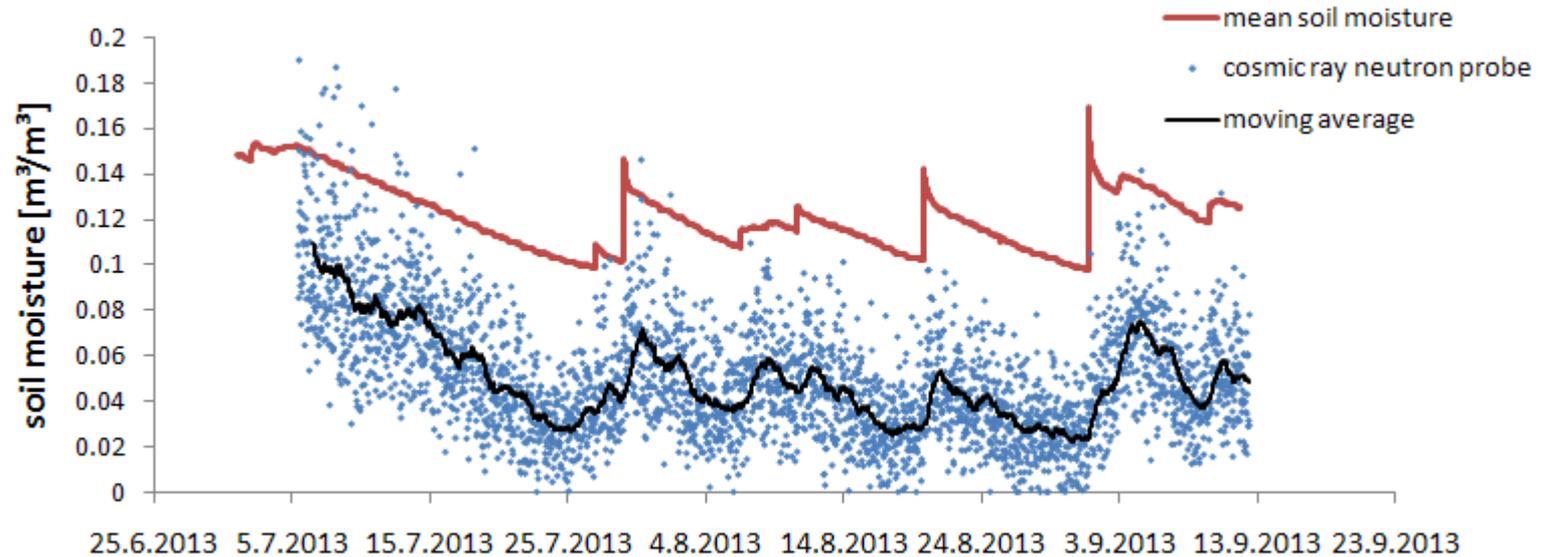


Soil moisture: profiles of point measurements

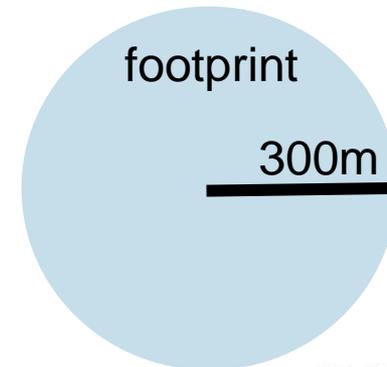




Soil moisture: Cosmic Ray Neutron Probe

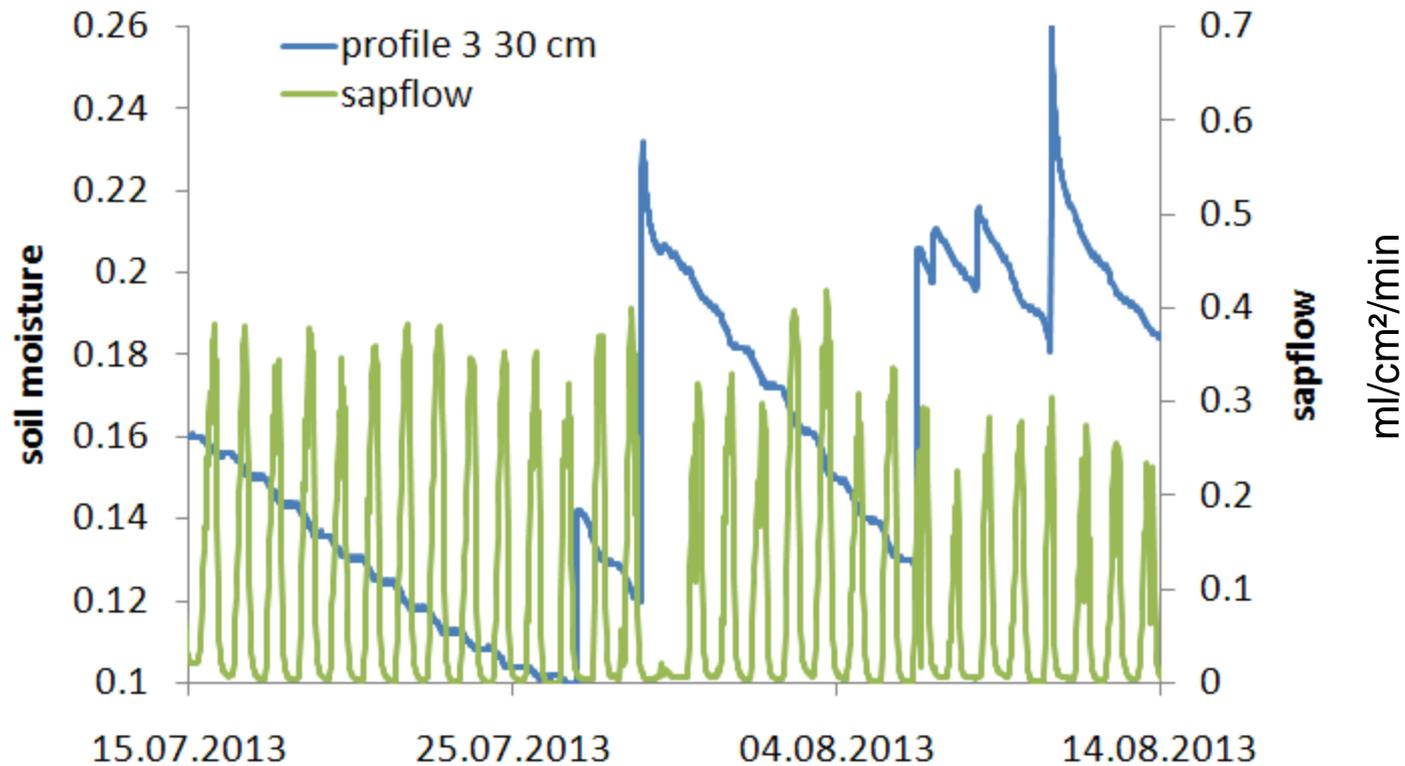


correlation between both data sets: $R^2 = 0.78$



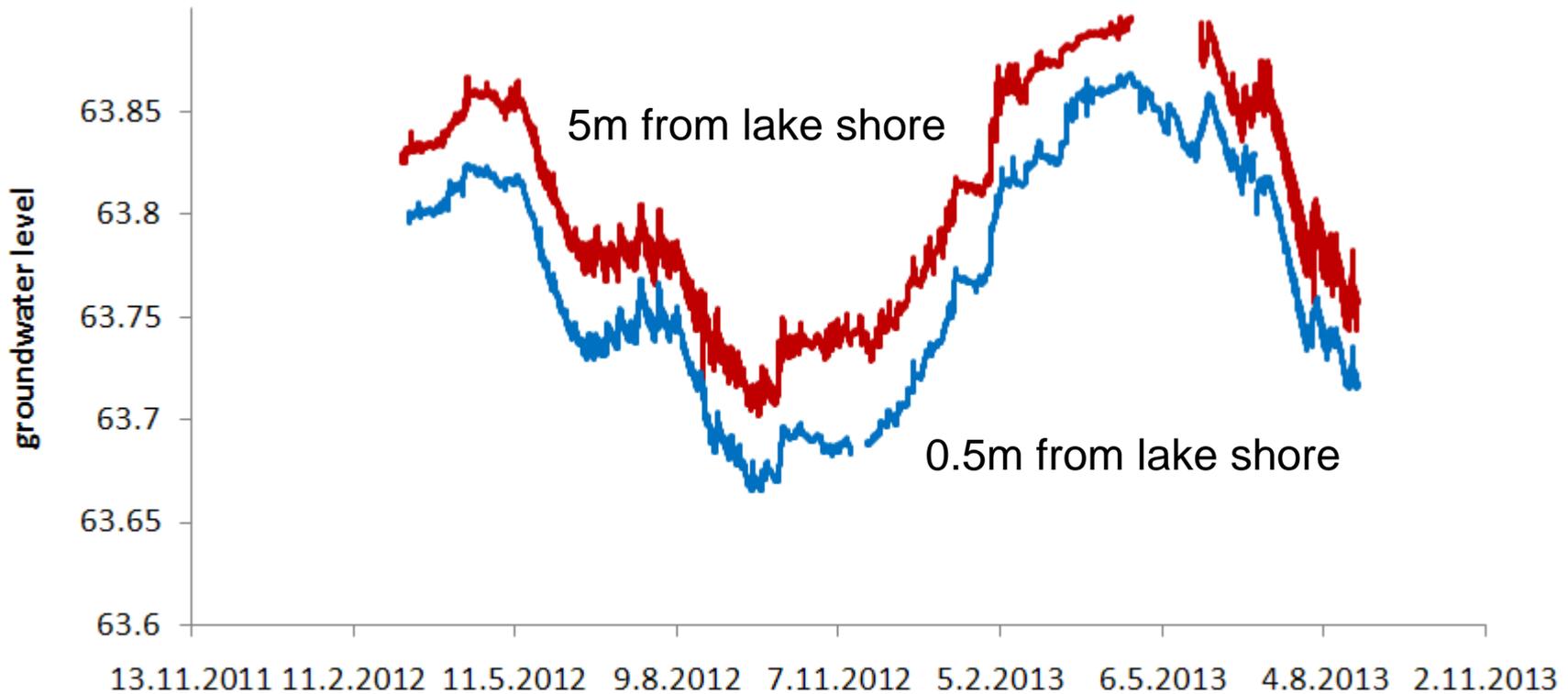


Soil moisture and sapflow



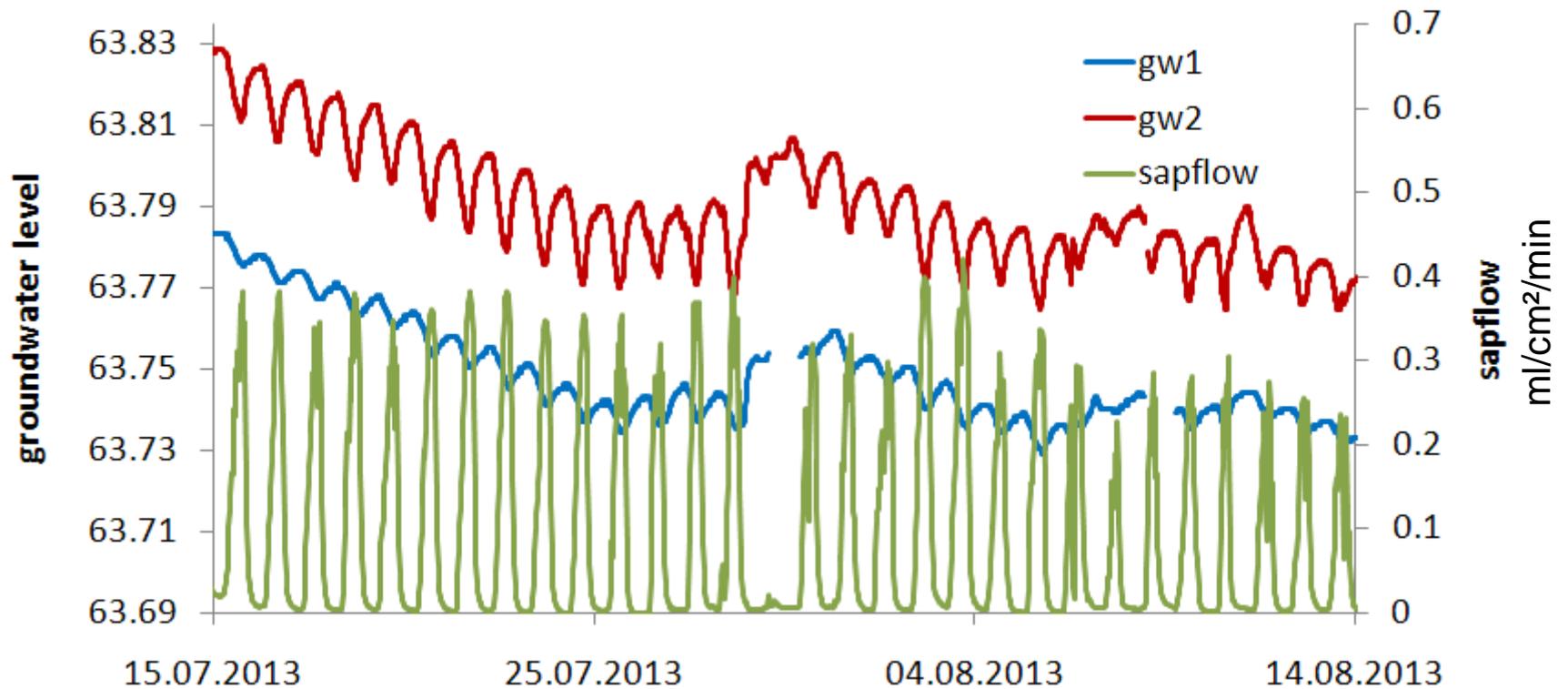


Piezometers: water level dynamics



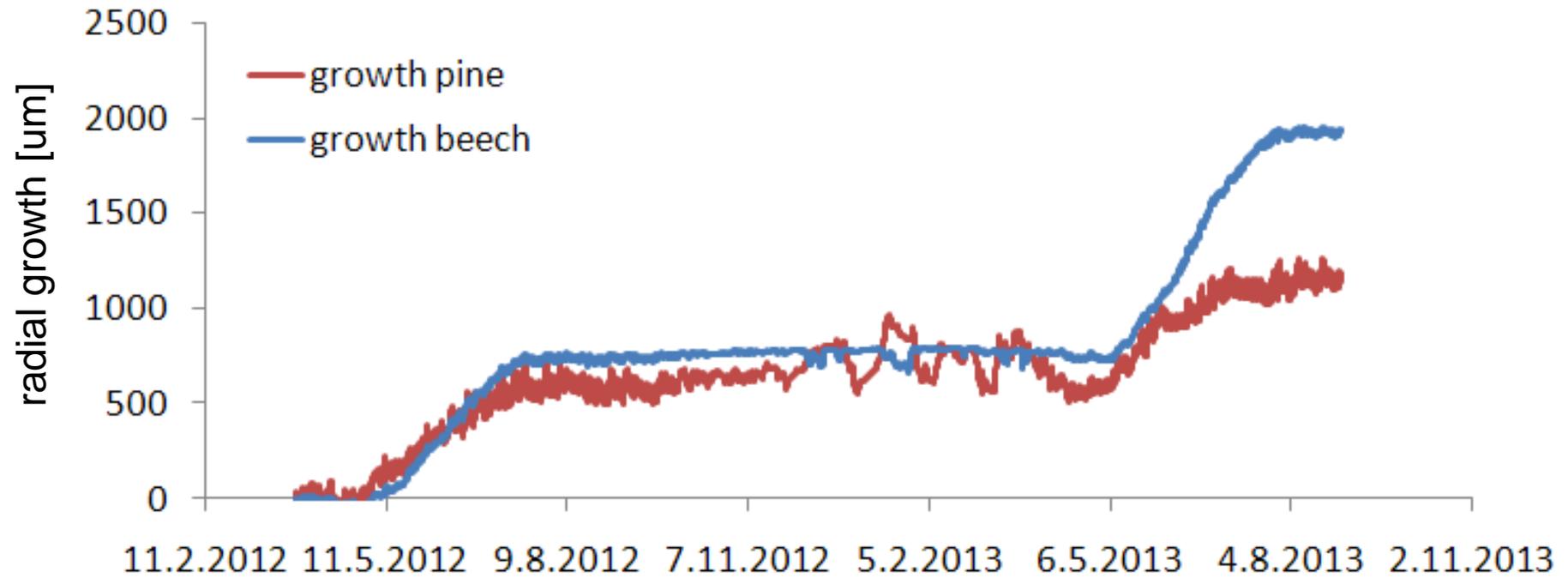


Piezometers and Sapflow



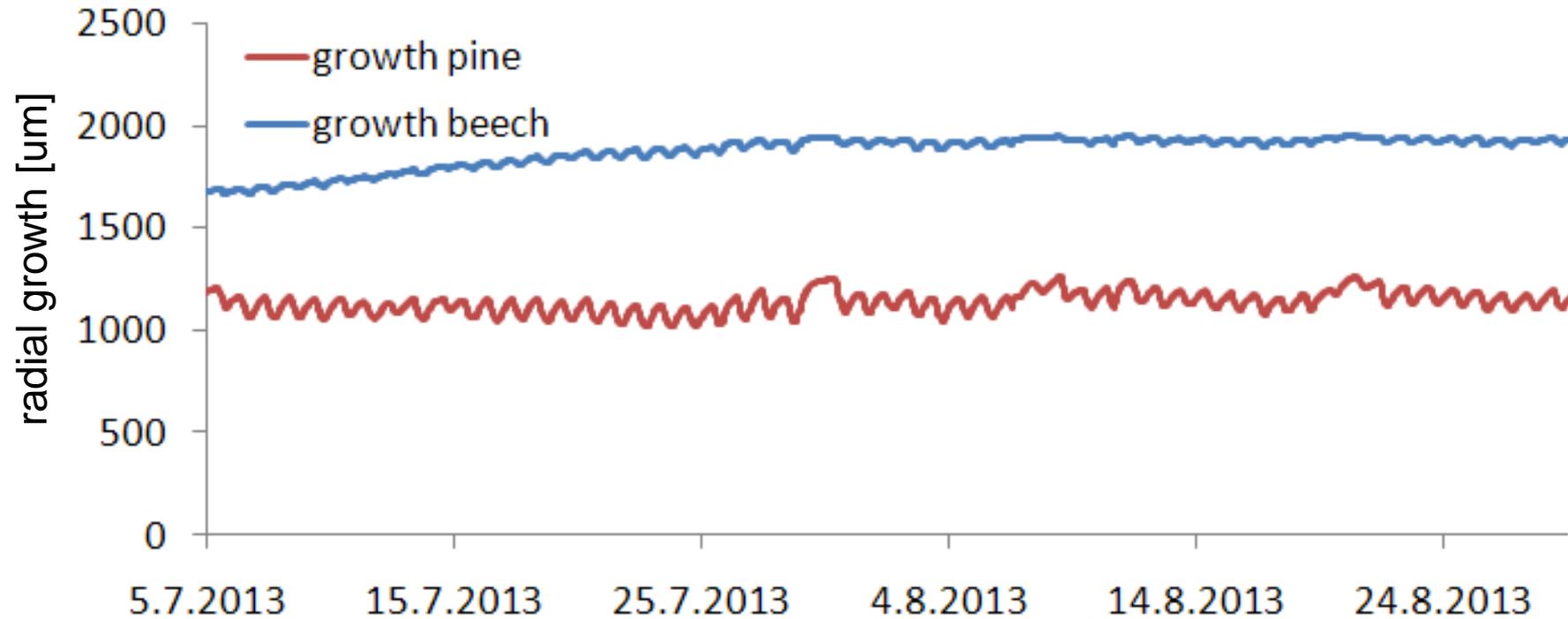


Tree growth



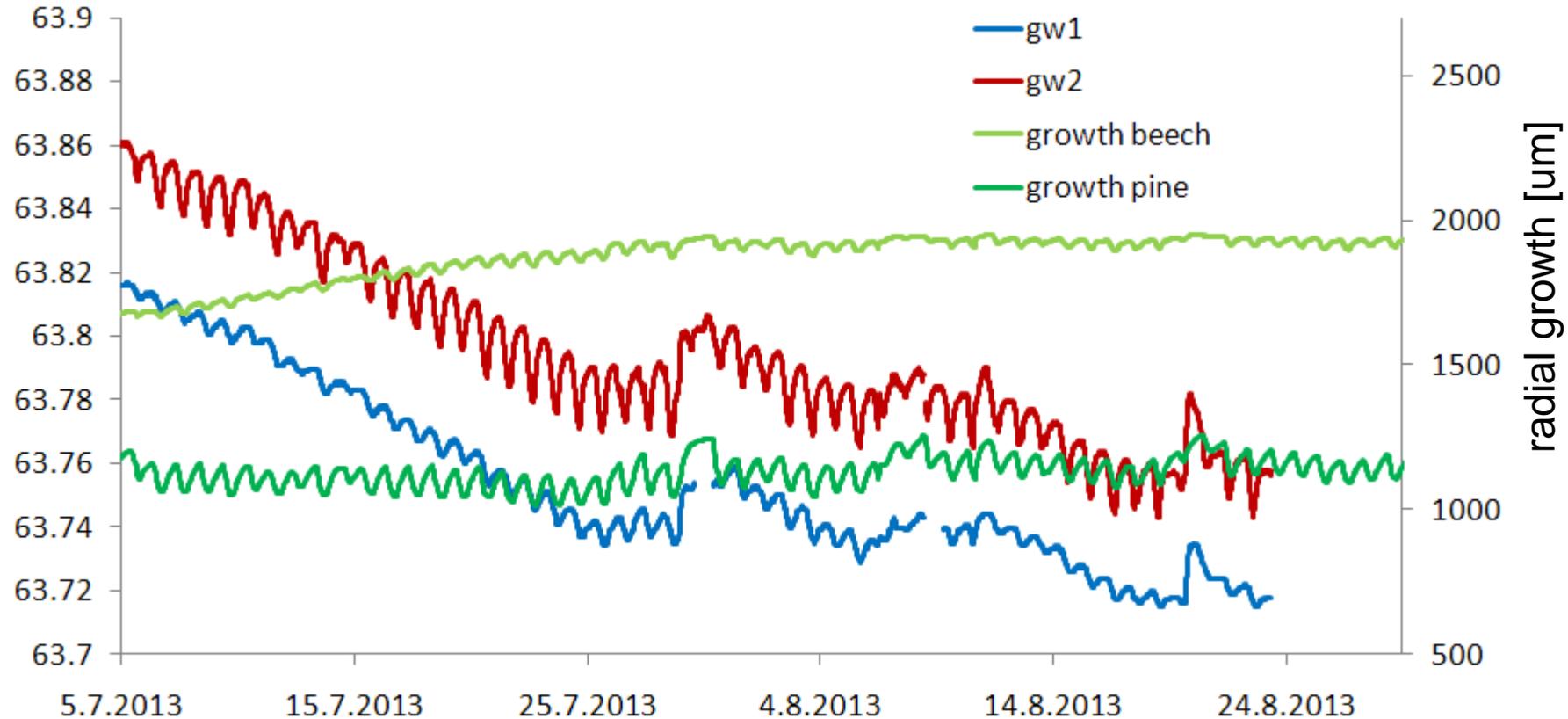


Tree growth in summer



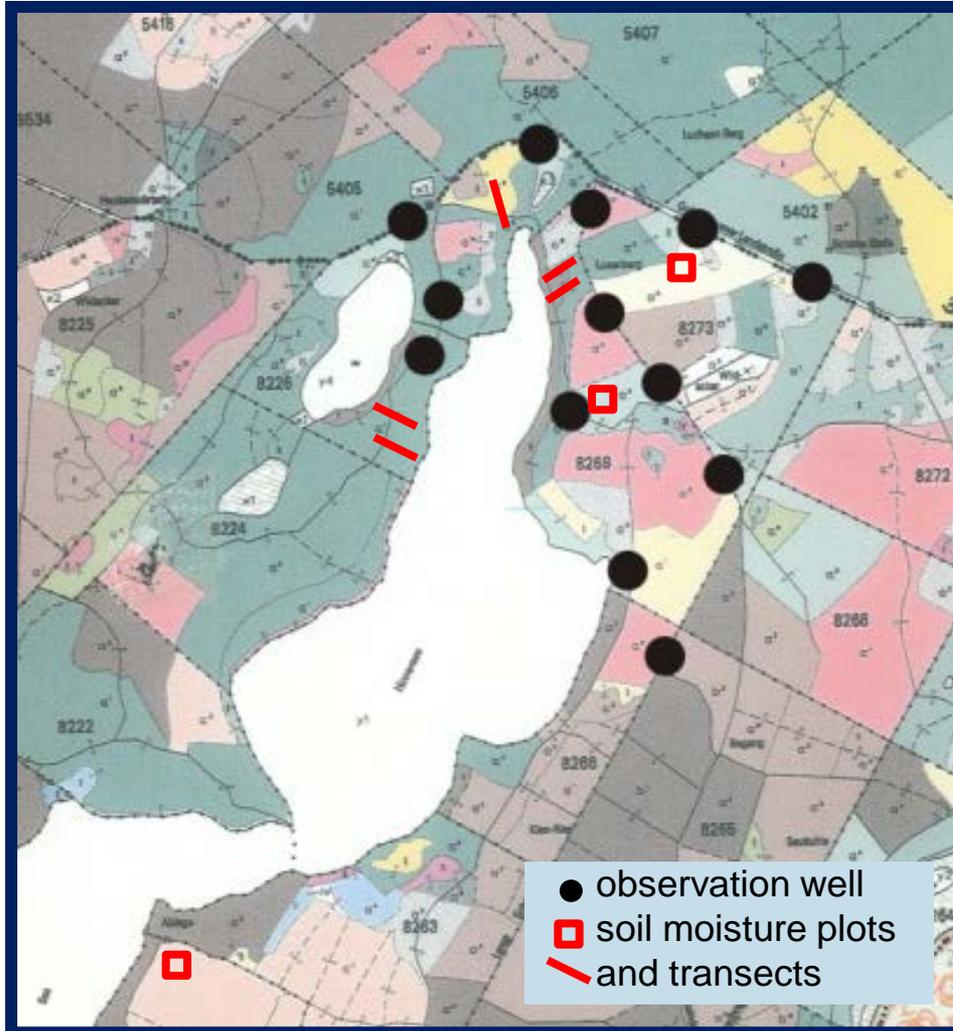


Tree growth and piezometer data





Soil moisture monitoring network



18 sensor clusters in different settings:

- upslope/downslope
- different tree species and tree ages

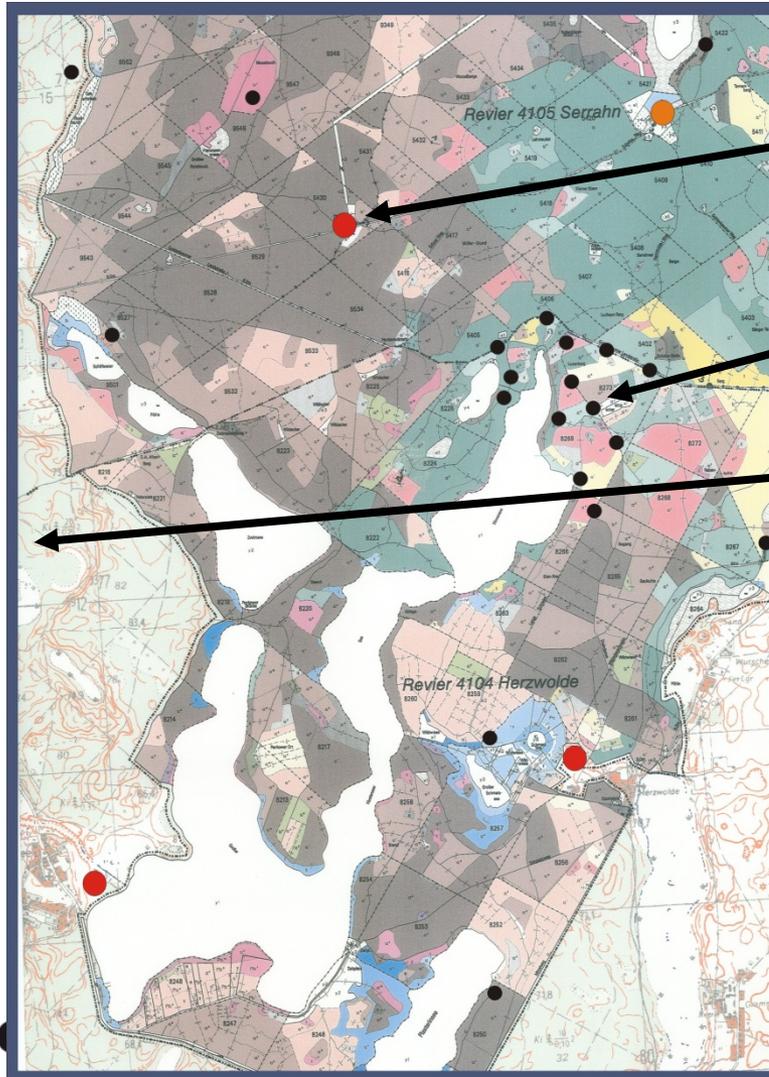
per cluster:

- 5 soil moisture profiles
(2 profiles with 2m depth, 2 with 1.2m depth and 1 with 0.5m depth)
- 10 topsoil soil moisture sensors
(540 sensors in total)
- 5 tensiometers
- soil temperature

- air temperature
- relative humidity
- sapflow
- groundwater levels



Sensor network



planned: Gravimeter, Climate Station, Soil moisture, Interception and Stemflow

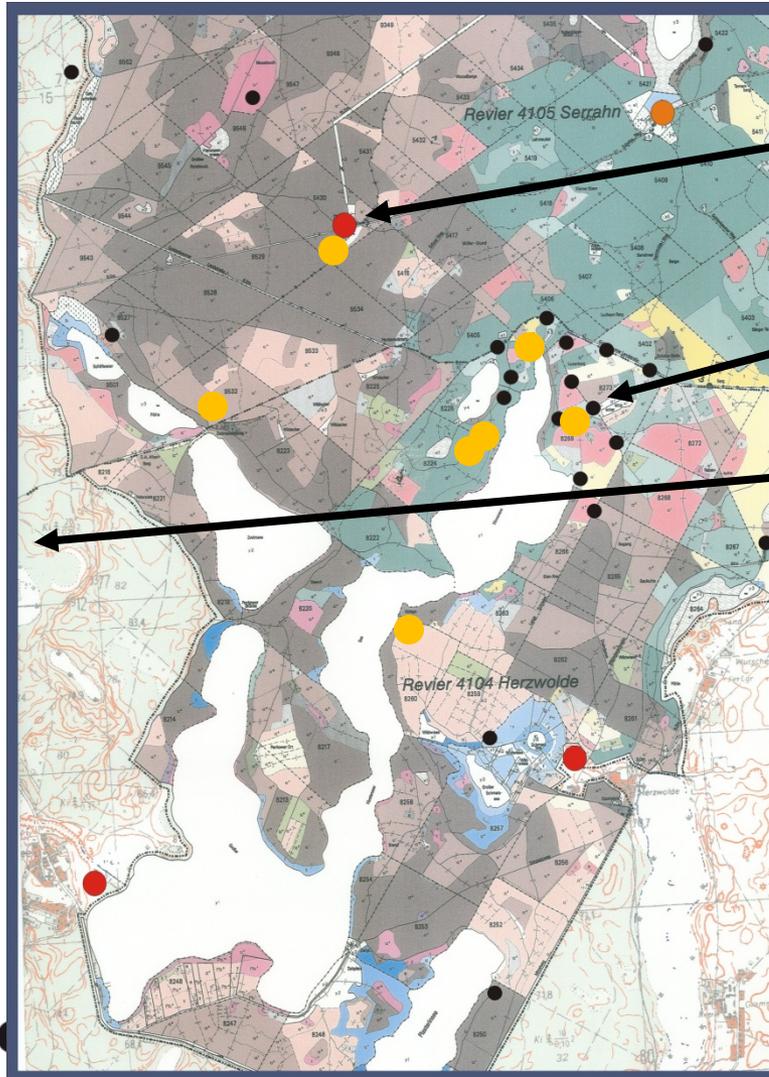
installed: Cosmic Ray Neutron Probe, Rain gauge

planned: GPS reflectometry, Cosmic Ray Neutron Probe, Climate Station, Soil moisture

- Climate Station (planned and installed)
- Observation Well (installed; additional wells planned)



Sensor network



planned: Gravimeter, Climate Station, Soil moisture, Interception and Stemflow

installed: Cosmic Ray Neutron Probe, Rain gauge

planned: GPS reflectometry, Cosmic Ray Neutron Probe, Climate Station, Soil moisture

- Climate Station (planned and installed)
- Observation Well (installed)
- Throughfall and Stemflow plots (planned)



Measurements of throughfall and stemflow



Pine forest

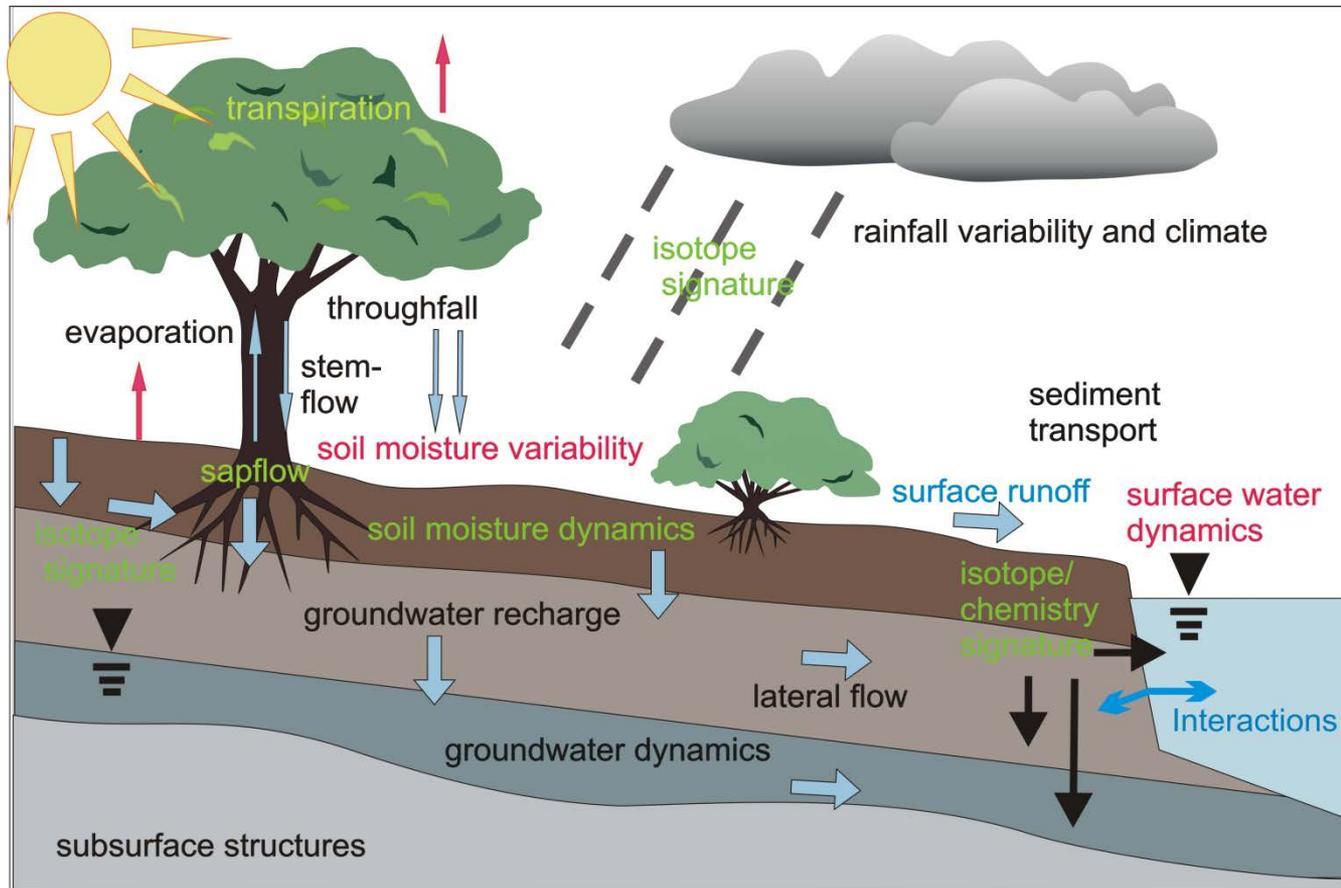
Oak forest



Janek Dreibrodt

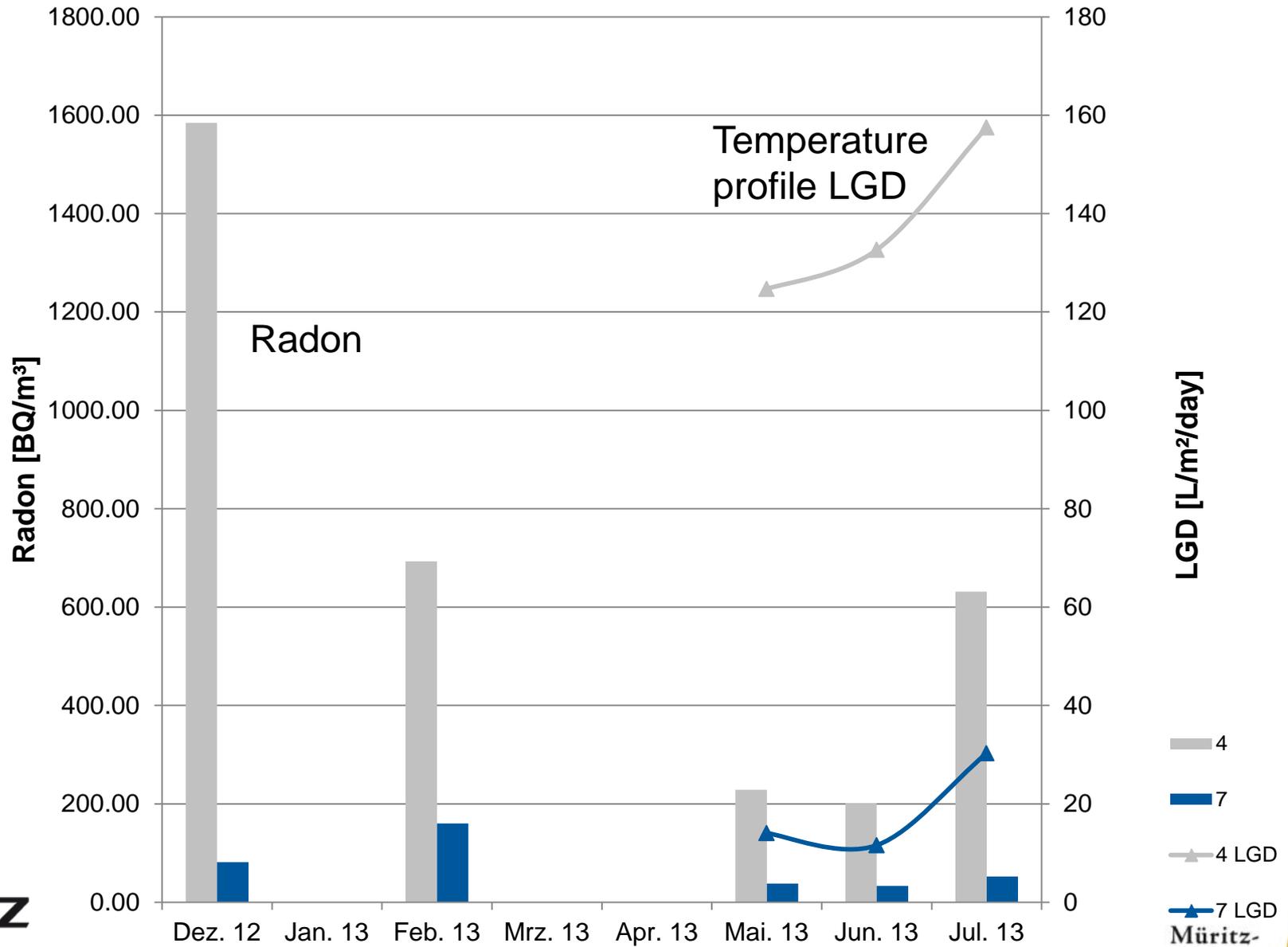


Hydrology of a forested groundwater-dominated lake system: structures and processes











Tree growth in summer and water deficit

