The Northeastern Lowland Observatory

Achim Brauer, Oliver Bens, Gerd Helle, Knut Kaiser

TERENO Advisory Board Meeting
October 18/19th October 2009

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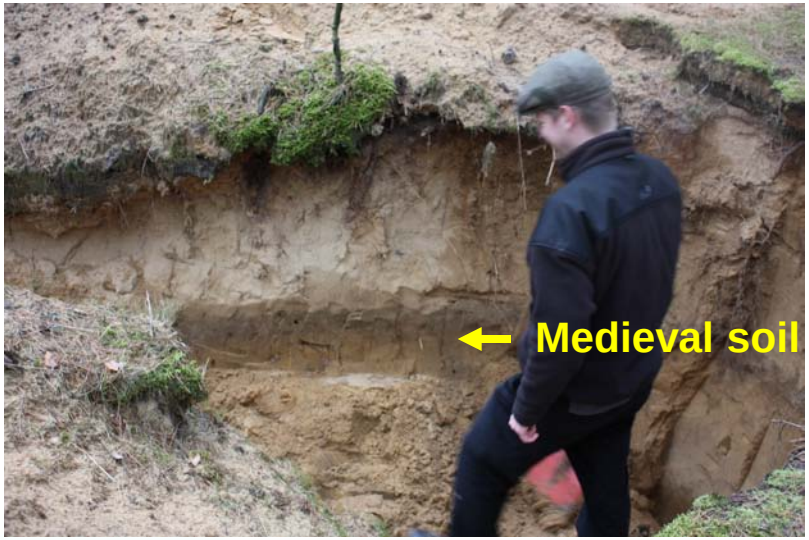
Location and sites of the Northeastern Lowland Observatory

landuse: from intensive agriculture to natural park (quasi-natural)



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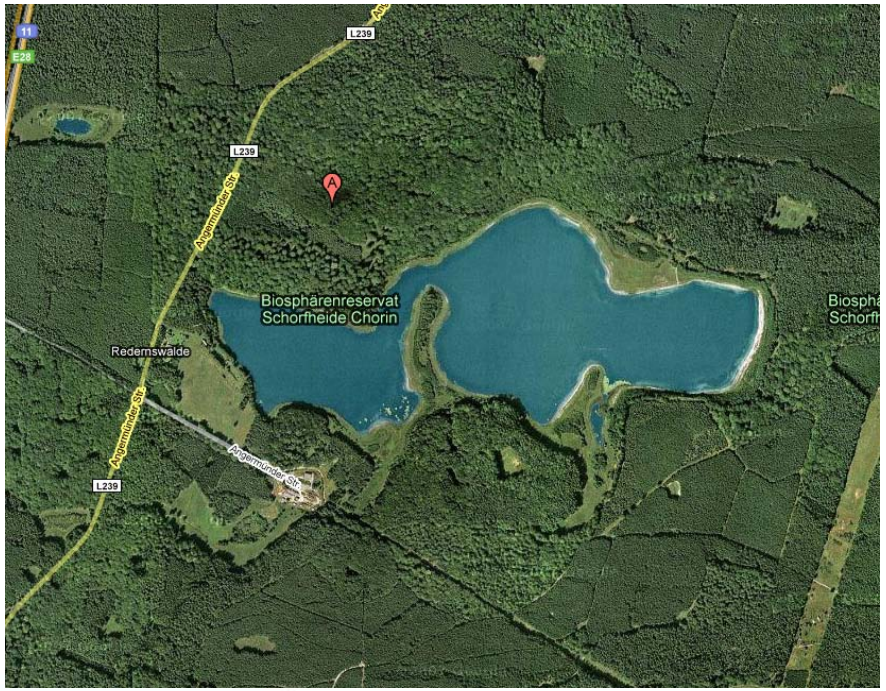
Climate and landscape hydrology: past - present - future

2 test sites
similar observations



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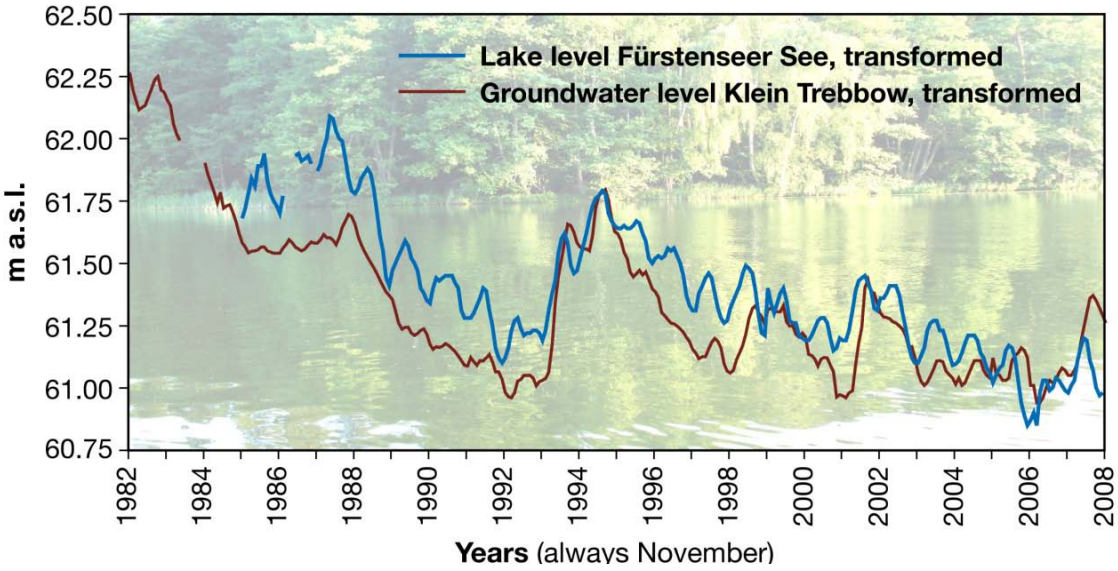
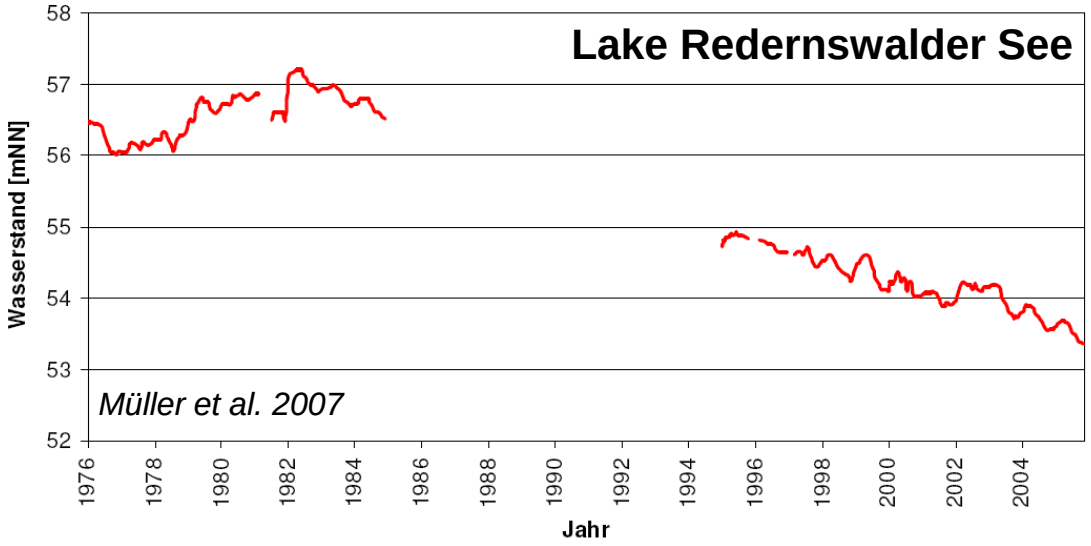
Recent lake level lowering: facts





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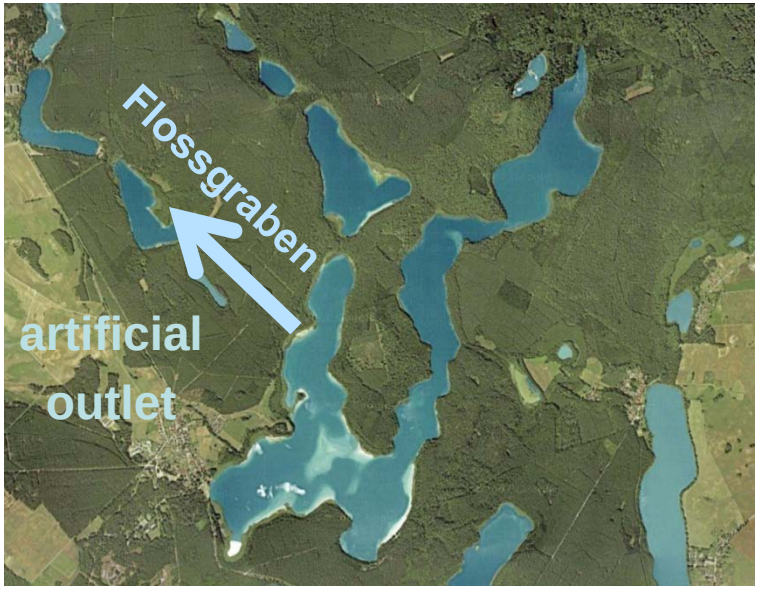
Causes of recent lake level lowering: climate or man?



Principle of the present water regulation concept = **drainage**

developed in a period of different climatic boundary conditions (cool, wet)

Hypothesis

Recent (and future) lake level changes are controlled by an interaction of climate and anthropogenic (water regulation and land use) effects

Open Question

How strong is the influence of climate and what is the role of anthropogenic impact?

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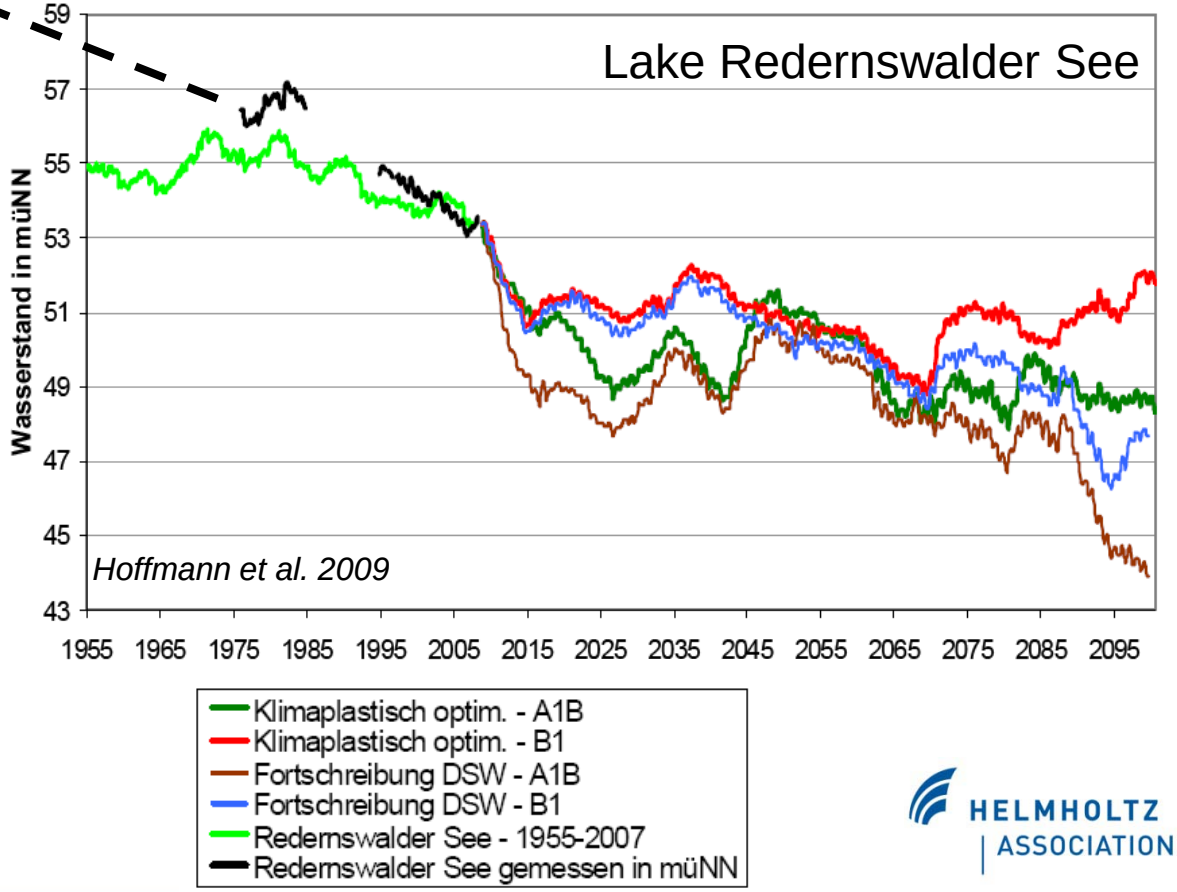
Lake level lowering: future projections

?

based on various climate scenarios

Model validation



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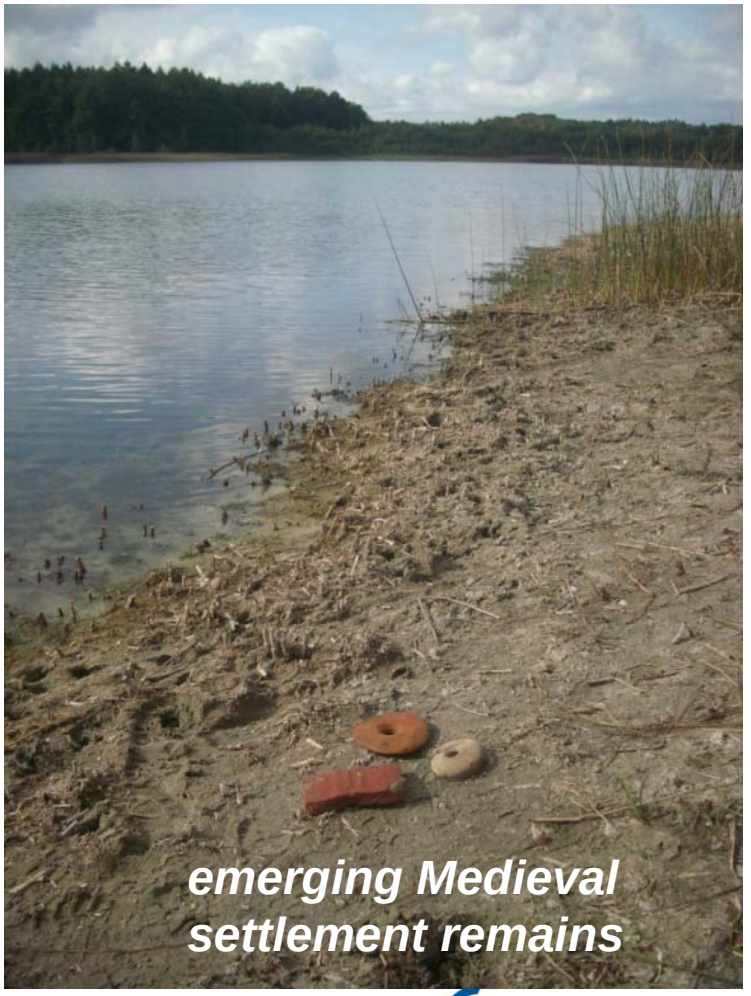
Evidence about historical changes



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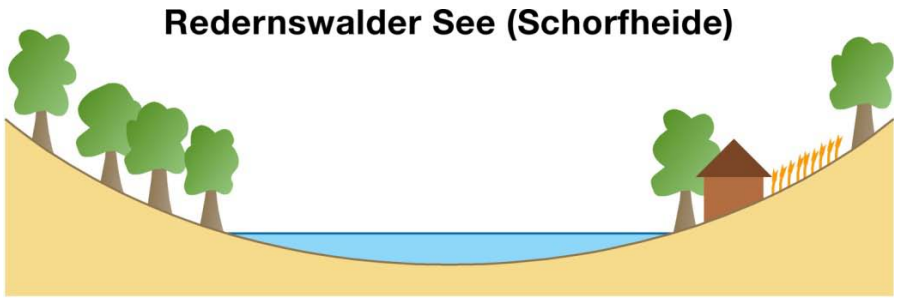
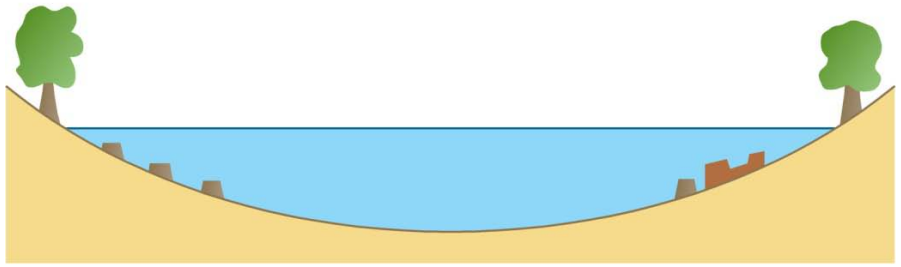
Long-term landscape evolution

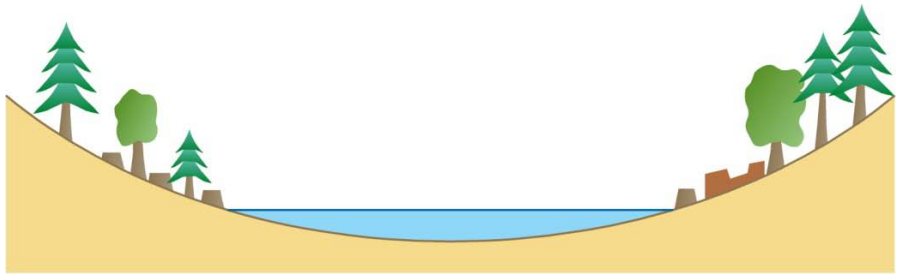
Testing hypothesis and quantification



Middle Ages: Low lake level
Settlement on the lake shore



Modern Period: High lake level
Settlement abandoned und submerged



Current: 3.5 m lake level drop since 1980s
Emerging tree stumps

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Causes and consequences of lake level lowering: Understanding long-term processes

Scientific questions

- What were the maxima and minima lake levels in the past? Did lakes completely dried out during warmer periods?
- How does vegetation cover (*i.e.* landuse) in combination with geological and geomorphological factors affect groundwater recharge rates?
- **Are there analogue situations in the past that help to better evaluate future developments of lake and catchment ecosystems?**
- **What are the critical thresholds of lake and tree responses to global change?**
- **What is the ‘memory‘ of lake systems and trees, *i.e.* how do the past developments influence present day processes?**

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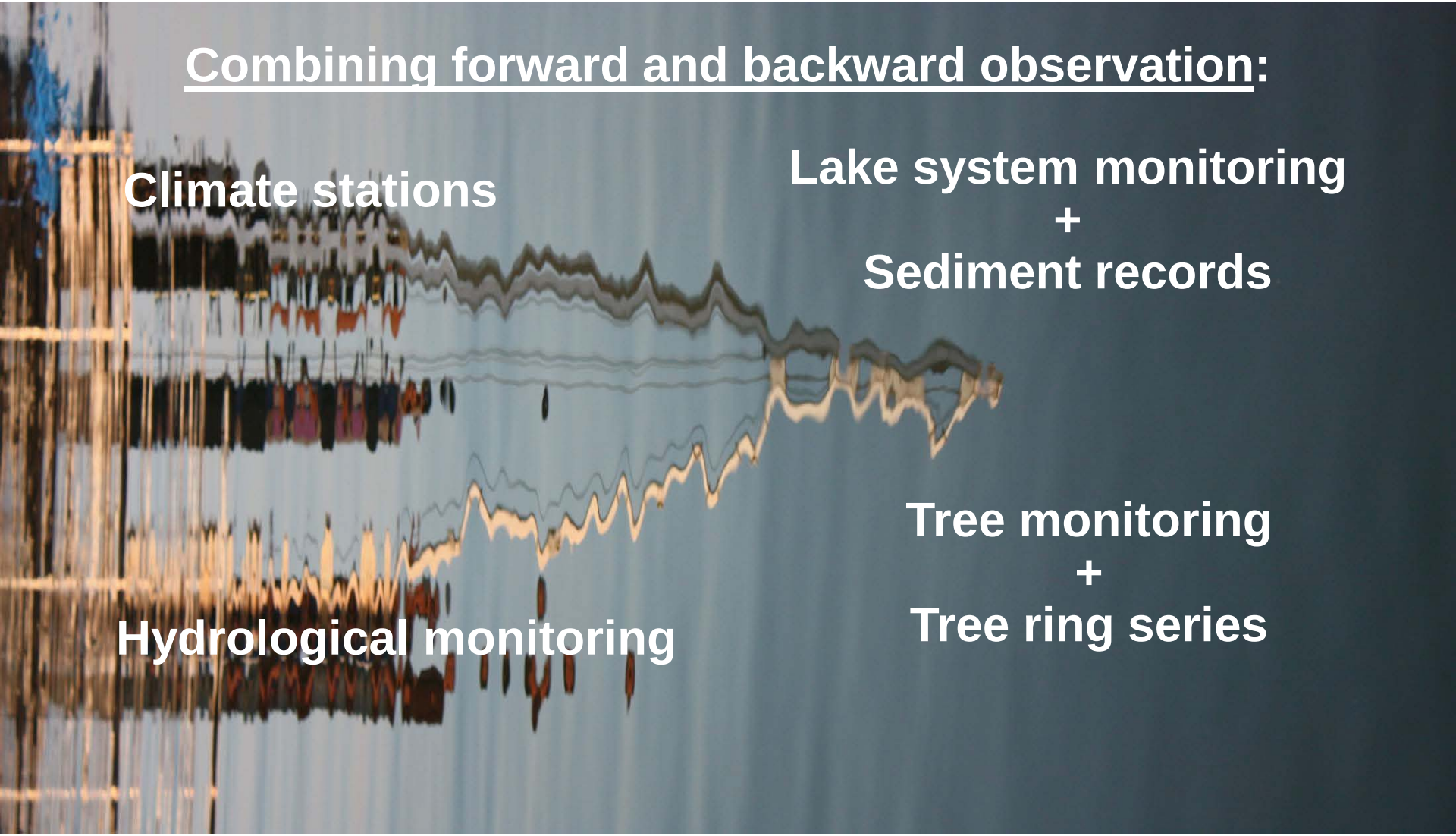
Scientific strategy: extending time scales into the past



Combining forward and backward observation:

Climate stations

Lake system monitoring
+
Sediment records

Tree monitoring
+
Tree ring series

Hydrological monitoring

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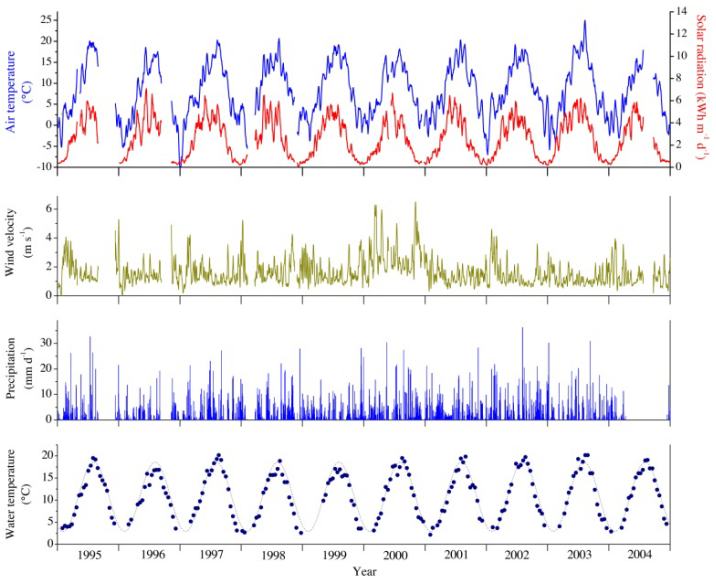
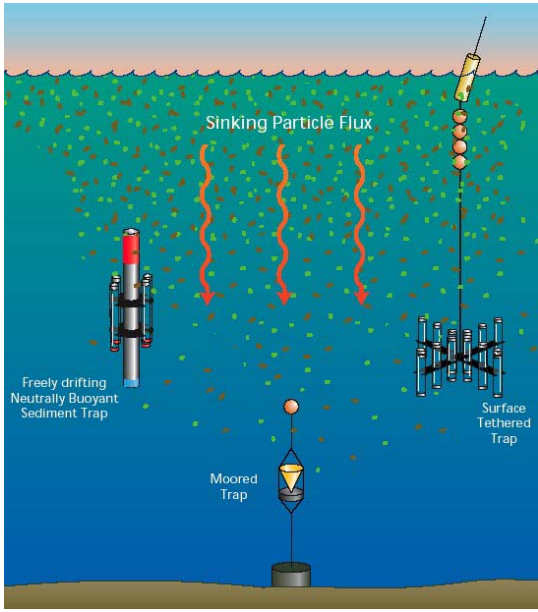
Lake sediment archives

Modern lake monitoring

Holzmaar 1995 - 2004



Moschen et al., 2009



Extending time series into the past

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Tree-ring archives

Mixed stands: Pine (*P. sylvestris*), Beech (*F. sylvatica*), Oak (*Q. petraea*)

Living trees (Fürstenseer See)

Pine (*P. sylvestris*) monocultures

Tree remains (Redernswalder See)

Historical/Archaeological timber (Neustrelitz)

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Hydrological monitoring concept: groundwater dominated lakes

Transport processes

- **Geochemical tracers, Stable isotopes**
- **Fluorescent dye tracers**

- **Subsurface characterisation:**

- **Soil physical characterisation**
- **Geophyiscal techniques**
  (Electric resistivity tomography, Ground penetrating radar**)**

Groundwater recharge

- **Climate station**
- **Throughfall and stemflow collectors**
- **Soil moisture dynamics:** TDR clusters, cosmic ray neutron probe, gravimeter
- **Groundwater dynamics:** Wireless sensor network – observation wells
- **Water chemistry**

Groundwater- surface water interactions

- **water level dynamics – lake and groundwater**
- **Geochemical tracers, Stable isotopes**
- **Heat as a tracer (distributed temperature sensing - fibre optic cable)**
- **Seepage meters**

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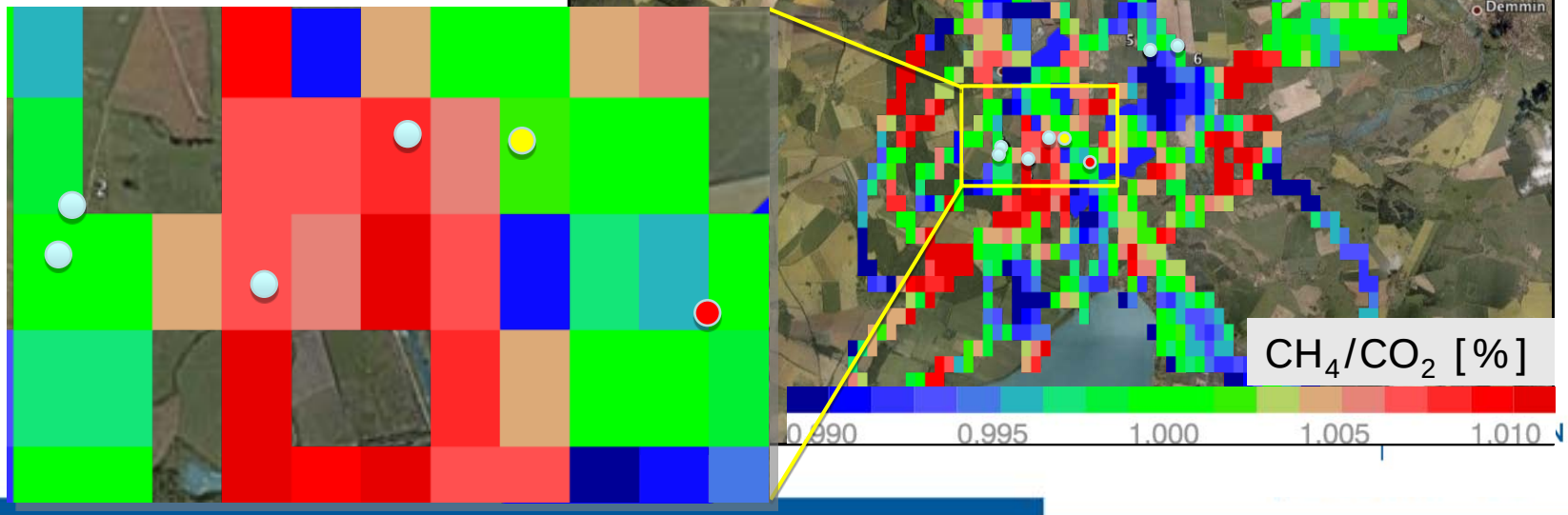
Methane Airborne Mapper (MAMap)
Measurements at Zarnekow (Peene River floodplain)

- Detecting even small natural methane emissions and concentrations
- Comparison with ground truth data (*sampled at 2 m height, GC analysis by University Greifswald and ZALF*)

- Dots = ground-truth plots
- Blue = flooded area
- Red = elevated CH_4
- Flight pattern



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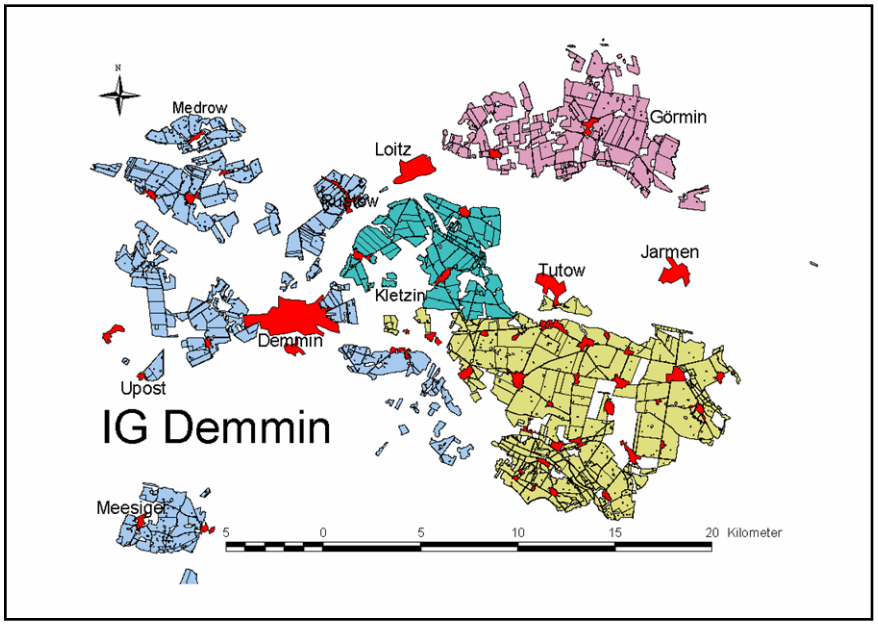
Durable Environmental Multidisciplinary Monitoring Information Network (DEMMIN)



Cooperation with DLR and IG-Demmin

- ca. 25.000 ha, 5 agricultural companies

Highlights

Combined flight campaigns (radar and hyperspectral) and in-situ measurements (*e.g.* soil, vegetation) as part of the international AgriSAR campaign (ESA).





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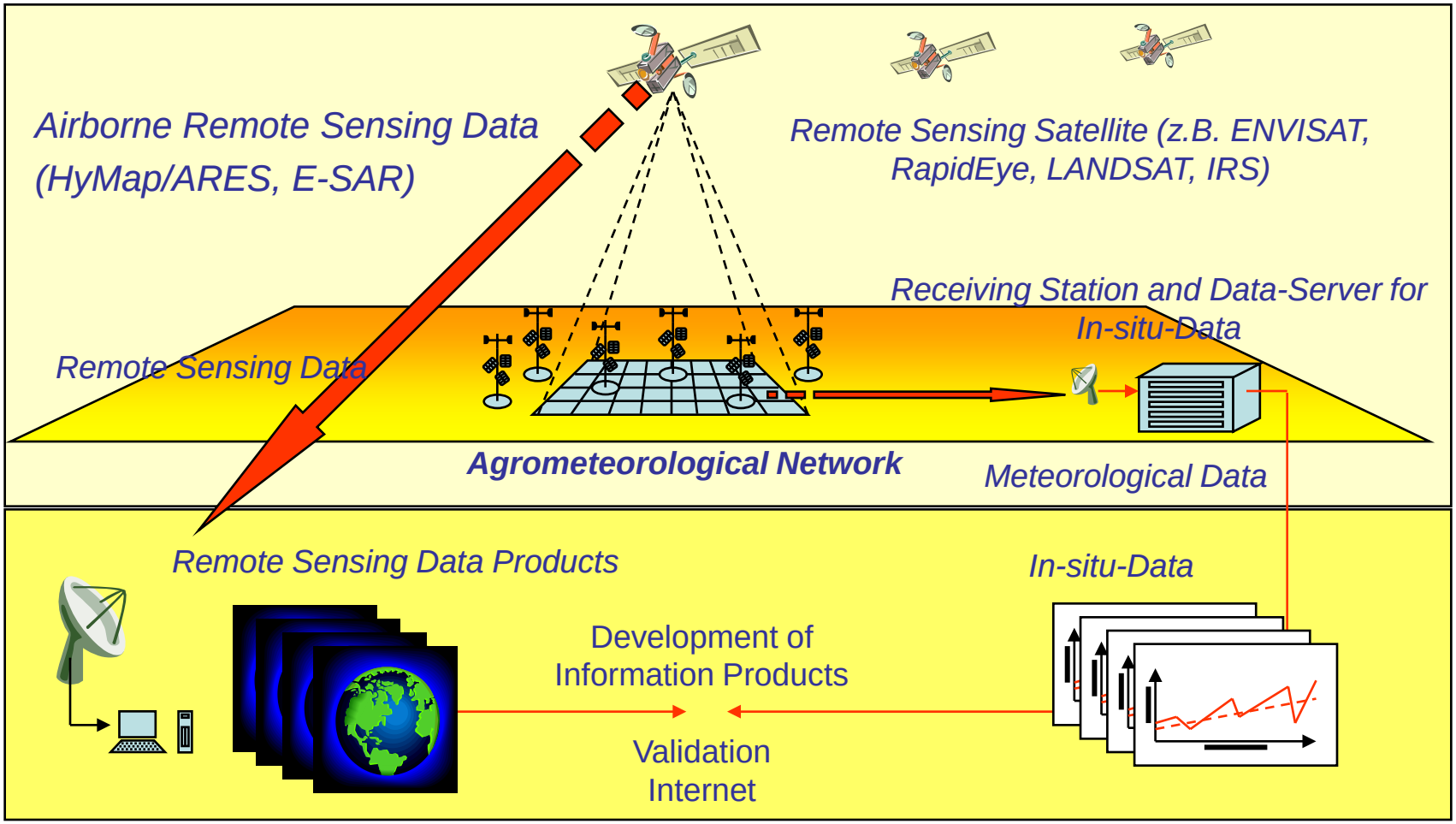
Combining agrometeorological networks and remote sensing



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Next steps towards establishing the Northeastern Observatory

2009/2010 finalisation of the concept

- Integrating partner institutions
- Adjustment to the other Tereno observatories (*i.e.* SoilCan; ICOS)
- Planning of instrumentation

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Regional Networking

Technical University of Cottbus
University of Potsdam
University of Greifswald
University of Rostock
University of Szczecin (PL)

DLR Neustrelitz
ZALF Leibniz Centre For Agricultural Landscape Research
IGB Leibniz Institute of Freshwater Ecology and Inland Fisheries
ATB Leibniz Institute for Agricultural Engineering

Nationalpark Müritz
Biosphere Reserve Schorfheide-Chorin
Natural Park Uckermärkische Seen
Ministry for Environment Brandenburg (LUA)
State Department for Environment Mecklenburg-Vorpommern (StAUN)

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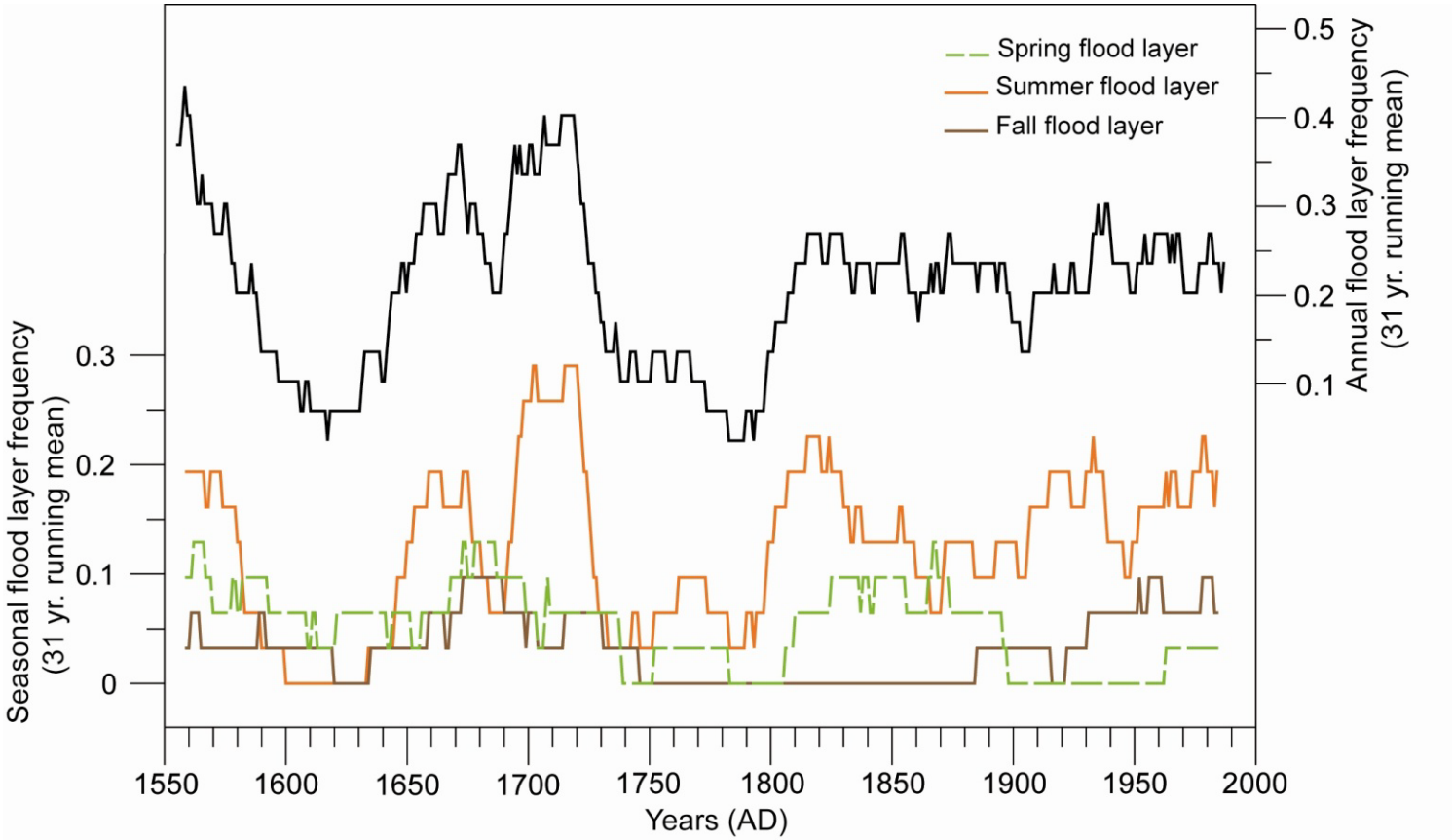
Investigating archives in all observatories

Lake Ammersee flood layers:
an archive for extreme floods and past catchment erosion



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