NATURVIDENSKAB
KØBENHAVNS UNIVERSITET

HOBE

Hydrological Observatory- HOBE

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HOBE

Funding

- Donation from VILLUM KANN RASMUSSEN foundation
  - ➜ VKR Center of Excellence
- DKK 32.8 mill.
- 5 year project period (Sept. 1, 2007 – Aug. 31, 2012)

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Participating institutions

- University of Copenhagen
  - ➜ Department of Geography and Geology
- Aarhus University
  - ➜ Geological Institute
  - ➜ Department of Agroecology and Environment (DJF)
- Technical University of Denmark (DTU)
  - ➜ DTU Space
- GEUS
  - ➜ Hydrology department
- Danish Meteorological Institute (DMI)

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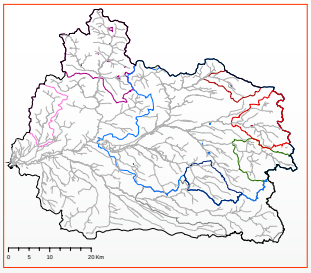
What is a hydrological observatory?



Overall objective:

- to obtain a better hydrological understanding at catchment scale

Key issues:

- water resources assessment
- water resources management
- climate change
- land use change

- A catchment or river basin where hydrological fluxes are measured and hydrological processes studied at multiple spatial and temporal scales
- Measurements go beyond traditional monitoring of baseline variables such as precipitation, evapotranspiration, stream flow, and water table
- Dedicated experiments to study processes and measure parameters and variables
- First Danish project of this kind in 30 years

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Water balance equation

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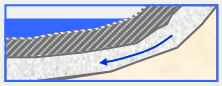
Precipitation = Evapotranspiration +
Stream flow +
Groundwater pumping +
Groundwater discharge to sea



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Flash back on water balance issues in Denmark

- 1971: First inventory of water balance on a regional basis – actual evapotranspiration computed as a deficit term
- 1979: Danish Meteorological Institute issues guidelines for correction of precipitation (+16%)
- 1980'es: Several studies of water balance based on hydrological modeling – water balance closed
- 1990'es: Underestimation of evapotranspiration estimates due to bias in vapor pressure deficit and wind speed (instrument problem)
- 1996: New guidelines from Danish Meteorological Institute for correction of precipitation (+21 %)
- 2005: National hydrological model for Denmark, excess runoff up to 100 mm/year

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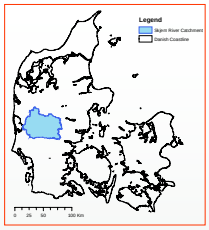
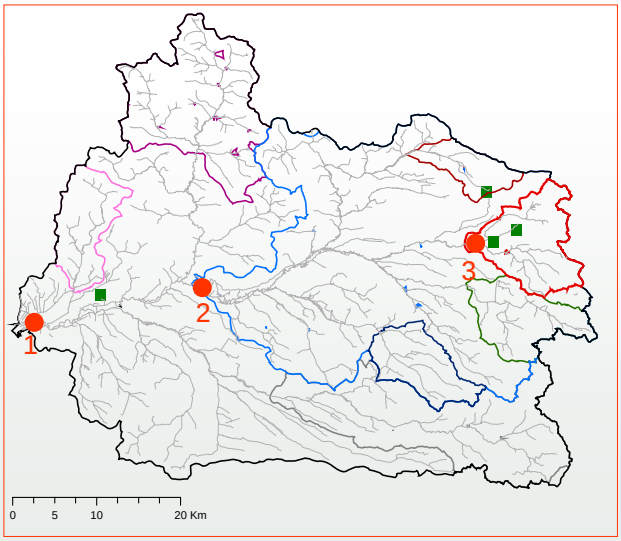
Study area - Skjern catchment and associated subcatchments – nested approach



1. Large scale ~ 2500 km²
2. Medium scale ~ 1100 km²
3. Small scale ~ 80 km²
4. Plot scale



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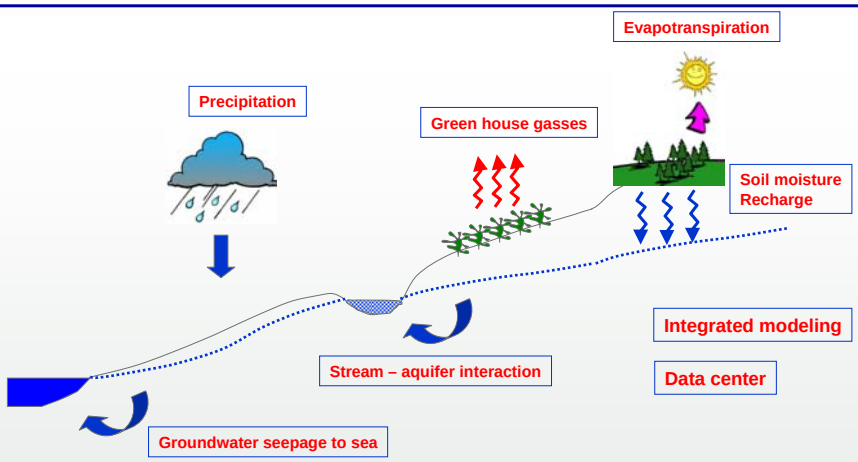
Structure of project



- Focus on measurements and experiments of hydrological fluxes and variables
- Take advantage of new developments in ground-based, air-borne and space-borne non-invasive geophysical, meteorological and remote sensing sensors

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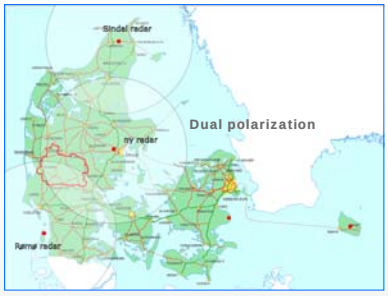
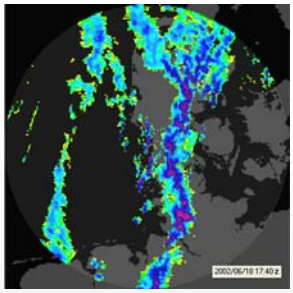
Precipitation





- Development of revised correction factors for point precipitation measurements to make optimum use of historical data
  - ➜ establish test fields with high resolution measurements of precipitation and meteorological variables
- Improve spatial and temporal resolution of precipitation estimation using weather radar

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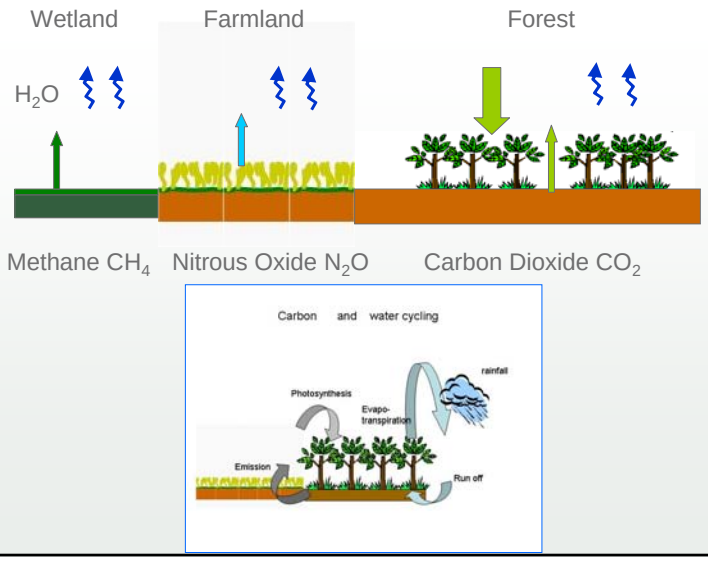
Impact of vegetation on evapotranspiration and exchange of GHGs



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Meadow – Agricultural – Forest sites

Eddy covariance measurements of H_2O, CO_2, CH_4 and N_2O

Chamber measurements of soil evaporation and respiration

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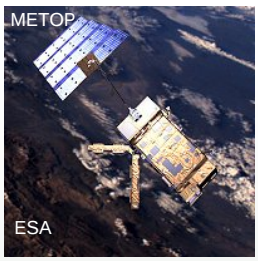
Spatial coverage of evapotranspiration



- Remote sensing based estimation of ET
  - ➜ global radiation, albedo, temperature a.o. derived from satellite data and used as input to an energy-based SVAT model
  - ➜ triangle methods (evaporative fraction from surface temperature/vegetation index space)

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Soil moisture and recharge

- Measurements of soil moisture at different spatial scales
- Indirect estimation of recharge using inversion techniques for different land use classes based on measurements of
  - soil moisture
  - tracer concentrations (added and stable isotopes)
  - temperature
  - geophysical parameters
  - water table fluctuations

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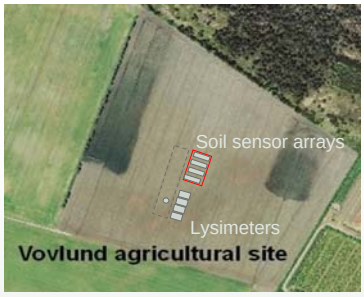
Agricultural site



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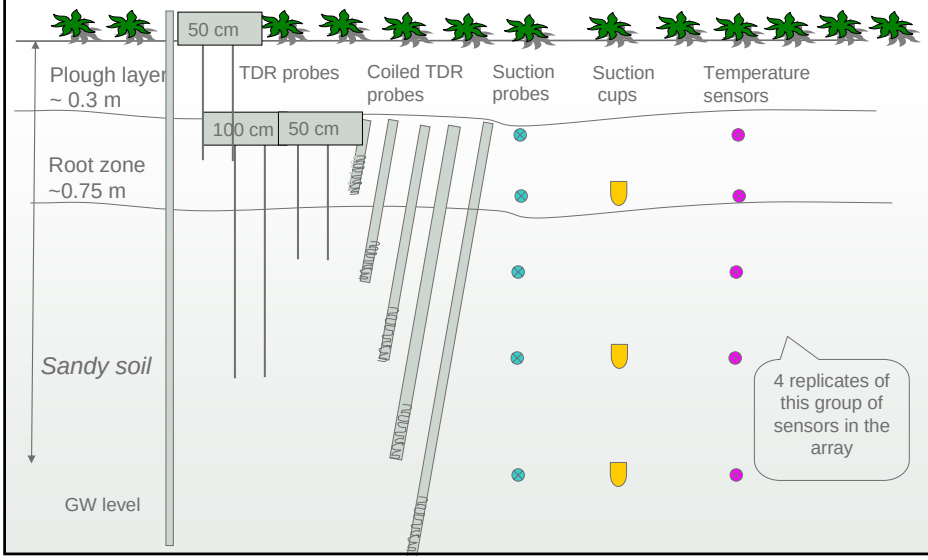
Installation at farmland site



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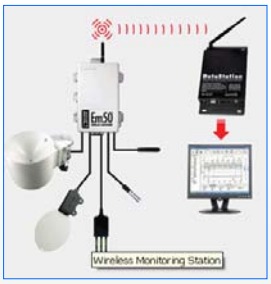
Large-scale soil moisture



- Soil moisture and tracer measurements using geophysical instrumentation – surface and cross-borehole
- Distributed wireless sensor network of soil moisture probes
- Airborne remote sensing of soil moisture (L-band microwave radiometer)
- Satellite remote sensing of soil moisture (MODIS, METOP, SAR, SMOS)

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Stream – aquifer interactions

- 8 measuring stations
- Discharge, Q
- Temperature sticks (heat as a tracer)
- Seepage meter, q
- Stable isotopes
- Stream level, h

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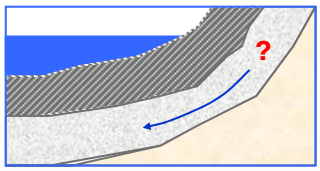
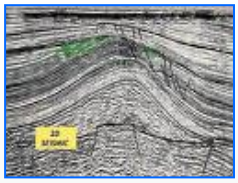
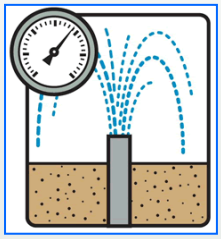
Sub-marine discharge to the sea





- SkyTEM survey to identify saltwater-fresh water interface
- Seismic investigations
- Deep wells
- Pumping tests
- Stable isotopes



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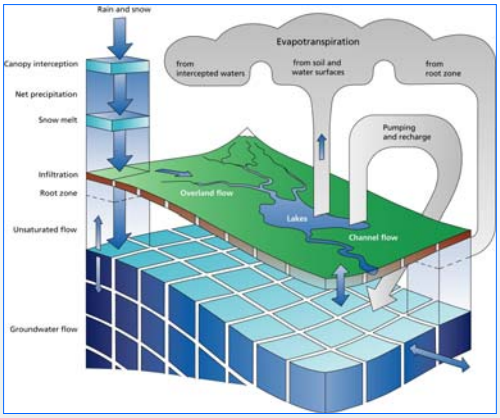
Modeling platform



- Integrated hydrological modeling (MIKE SHE)
- Hydrological modeling of climate and land-use change
  - ➜ coupling to regional climate model (HIRHAM)

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Web site

http://www.hobecenter.dk/

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