



Hydrological Observatory- HOBE

VKR Center of Excellence

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Funding

- ▶ Donation from VILLUM KANN RASMUSSEN foundation
 - VKR Center of Excellence
- ▶ DKK 32.8 mill.
 - Salaries: DKK 20.0 mill.
 - Equipment and running costs: DKK 12.8 mill.
- ▶ 5 year project period (Sept. 1, 2007 – Aug. 31, 2012)

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)

- ▶ PhDs
 - on-going: 7
 - associated: 1
 - to be hired: 2
- ▶ Postdocs
 - on-going: 4
 - to be hired: 1
- ▶ Full-time technician and administrative secretary

Issues

- ▶ Global change
 - Hydrological impacts
- ▶ Land use and land cover changes
 - EU agricultural policies
- ▶ Water resources management
 - EU Water Framework Directive

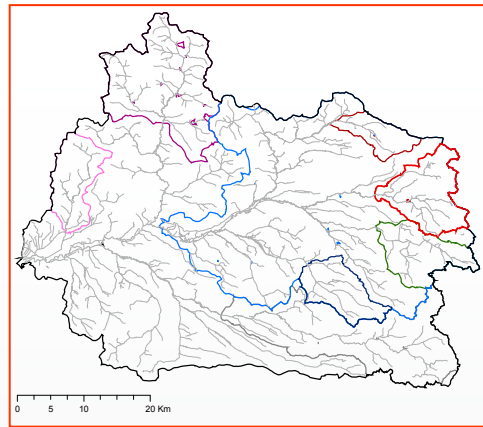
- ▶ These problems are manifested or require solution at larger scale → catchment scale
- ▶ Addressing these issues must be underpinned by a good understanding of the hydrological processes and of the water balance at catchment scale



Challenges

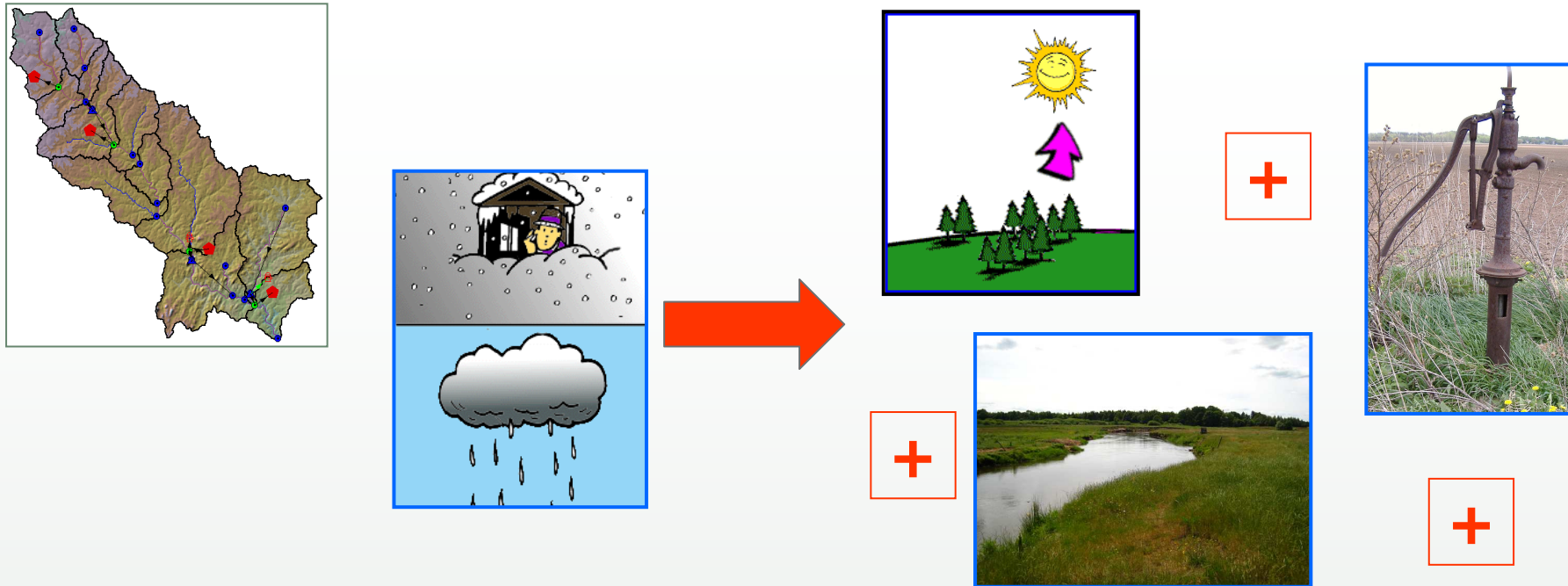
- ▶ In the past most investigations on small-scale systems and for short-term periods
- ▶ Gap between the scale at which we understand the functioning of terrestrial and lower atmosphere systems and the scale at which management strategies need to be developed
- ▶ Processes exhibit variability, are acting on different spatial and temporal scales, and are coupled through feedback mechanisms
- ▶ Expanding knowledge of system behavior requires integration of monitoring, measurements, experiments, modeling and scaling

What is a hydrological observatory?

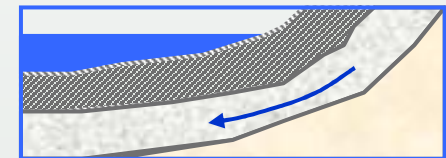


- ▶ A catchment or river basin where hydrological fluxes are measured over long time periods
- ▶ Hydrological processes studied at multiple spatial and temporal scales
- ▶ Measurements go beyond traditional monitoring of baseline variables such as precipitation, evapotranspiration, stream flow, and water table
- ▶ Dedicated experiments to study processes and measure parameters and variables at multiple spatial and temporal scales
- ▶ Application of modern state-of-the-art measurement and modeling techniques

Water balance equation



$$\text{Precipitation} = \text{Evapotranspiration} + \text{Stream flow} + \text{Groundwater pumping} + \text{Groundwater discharge to sea}$$

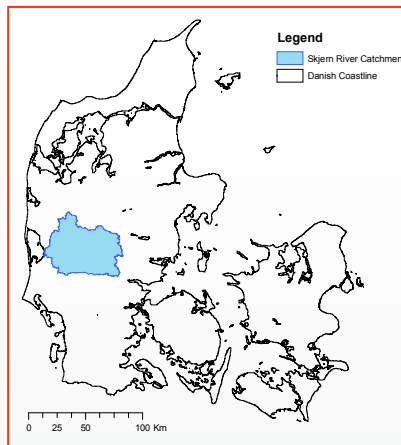


Motivations for a hydrological observatory in Denmark

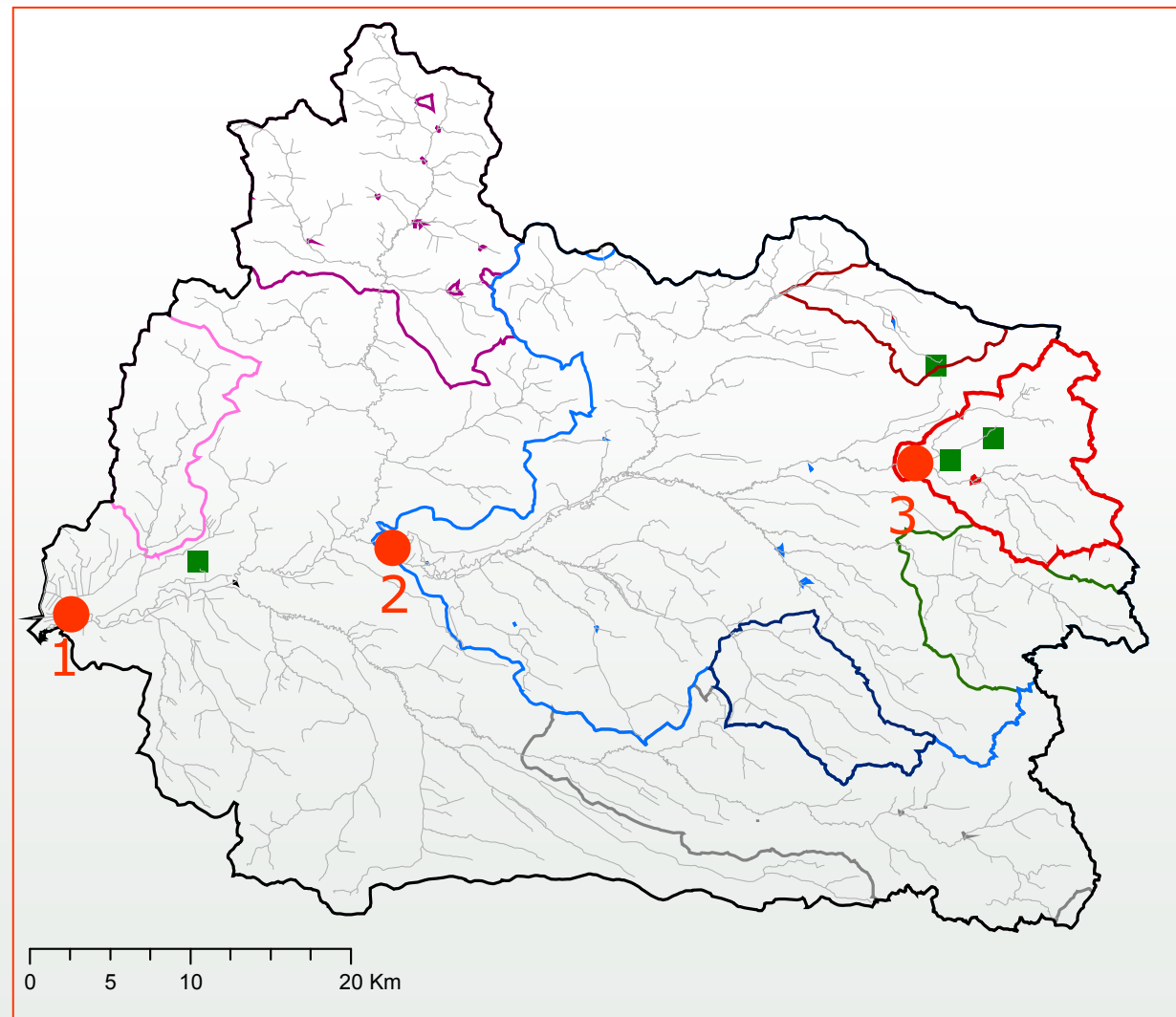
- ▶ Obtain a better understanding of the hydrological fluxes at catchment scale to help resolve the current water balance problems
- ▶ Improve the scientific basis for better water resources management decisions – sustainable use of groundwater
- ▶ Create a high density multi-disciplinary and multi-scale data set that can provide a platform for long-term interdisciplinary hydrological research
- ▶ Strengthen graduate education and training program within hydrology

- ▶ The Danish hydrological observatory will contribute to current international activities within the area
 - particular focus on subsurface processes
- ▶ First Danish project of this kind in 30 years

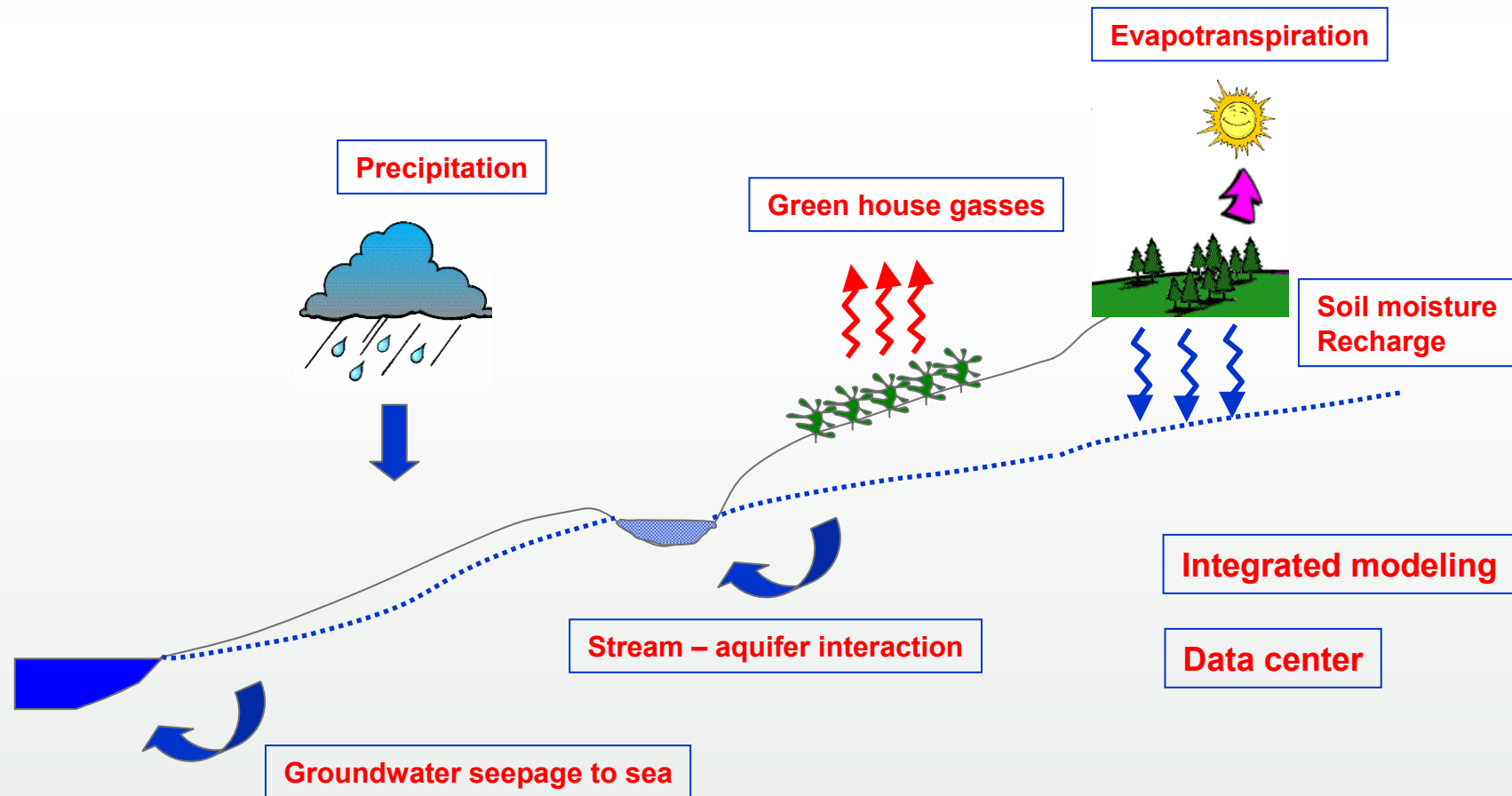
Study area - Skjern catchment and associated subcatchments – nested approach



1. Large scale $\sim 2500 \text{ km}^2$
2. Medium scale $\sim 1050 \text{ km}^2$
3. Small scale $\sim 80 \text{ km}^2$
4. Plot scale



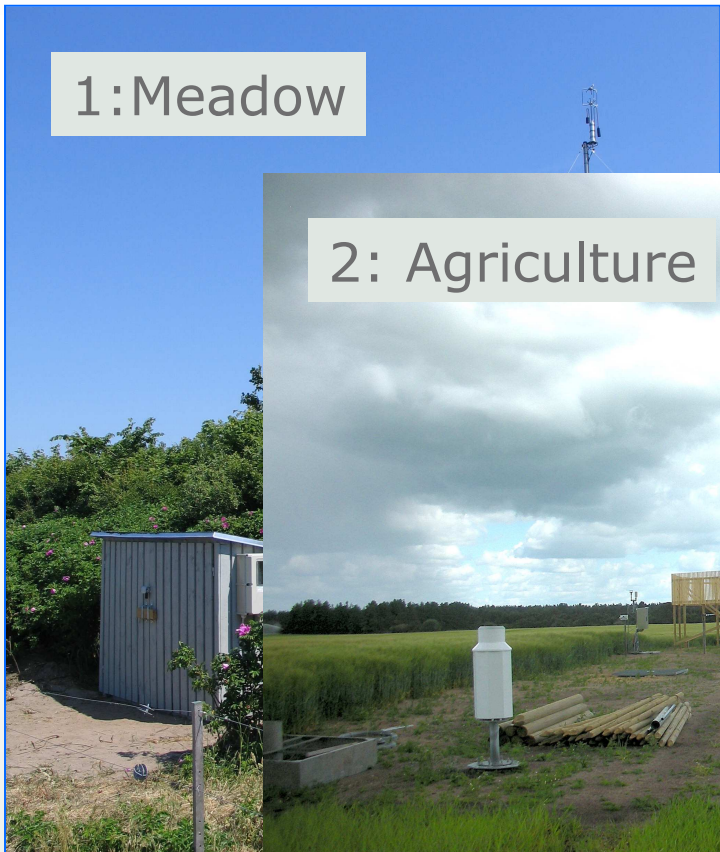
Structure of project



- 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 measuring platforms

Field sites

1: Meadow



2: Agriculture



3: Forest

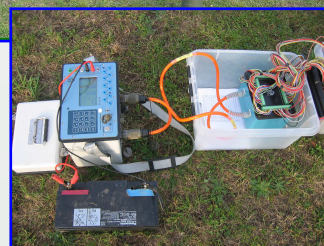
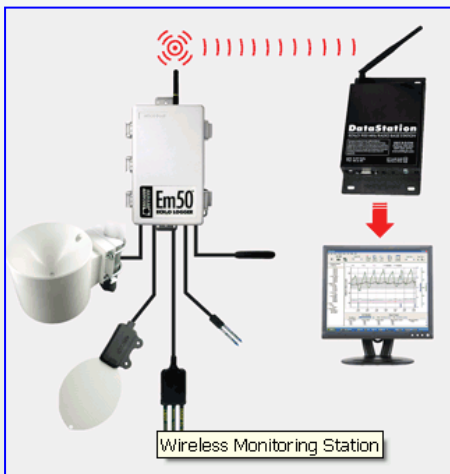
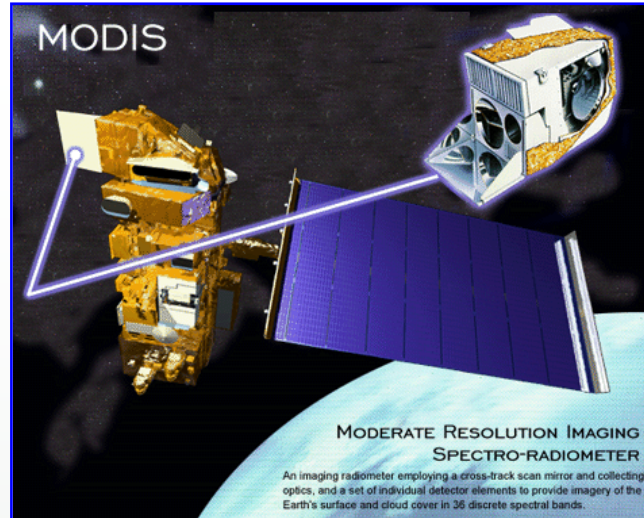


4: Stream

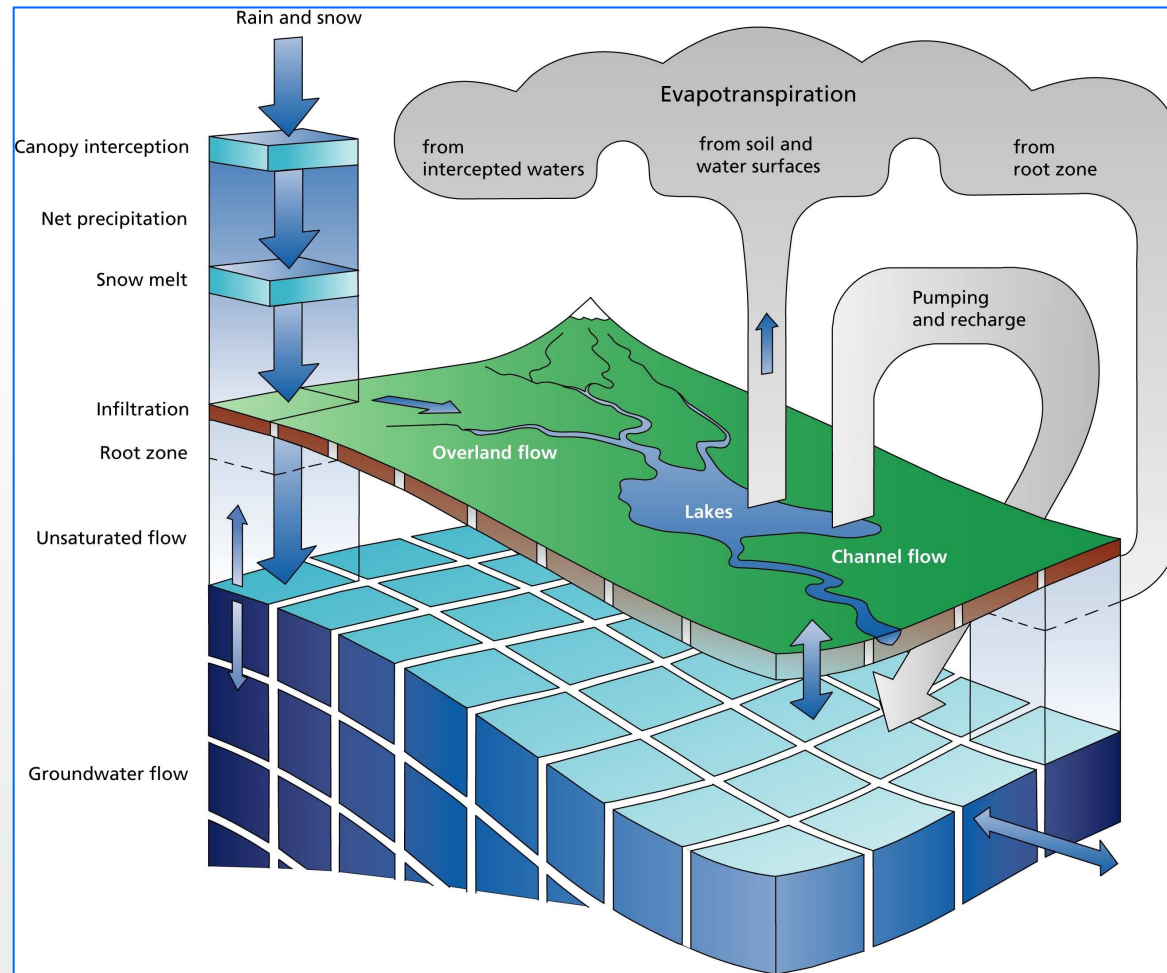


New measurement techniques

- improved spatial coverage of measurements



Modeling platform – MIKE SHE



Innovative contributions

- ▶ Precipitation
 - more accurate correction factors
 - better estimates of areal precipitation based on weather radar
- ▶ Evapotranspiration
 - better estimates of ET for different vegetation types
 - better estimates of areal ET
- ▶ Recharge
 - better estimates of recharge for different vegetation types
 - better estimates of areal recharge
- ▶ Groundwater – surface interaction
 - better estimates of interaction dynamics
- ▶ Green house gasses
 - better estimates of emissions from different vegetation types
- ▶ Deep groundwater seepage to sea
 - better estimate of hitherto unknown flow component
- ▶ Hydrological modeling
 - better scaling techniques and integrated modeling

Web site

A screenshot of the HOBE website homepage. The header features the HOBE logo and the text "Center for Hydrology Hydrological Observatory" over a background image of a field with monitoring equipment. Navigation links for "Contact Us", "Links", and "News" are in the top right. A left sidebar contains a "Main Menu" with links for Home, Organizations, Research, Field Sites, Staff, Management Board, Advisory Board, Funding, and Events, along with a search box and "User Menu". The main content area has a "Welcome to HOBE" heading, a date "Thursday, 08 May 2008", and three paragraphs of introductory text about the center's mission and activities.

HOBE Center for Hydrology
Hydrological Observatory

Contact Us Links News

Foto: Claus Kern-Hansen

Main Menu

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User Menu

Welcome to HOBE

Thursday, 08 May 2008

The HOBE research center is a Danish initiative bringing together 7 multidisciplinary research groups in order to enhance the scientific understanding of large-scale hydrological processes. A hydrological observatory is being established in the Skjern river catchment in Denmark and is bringing into play integrated monitoring, time-lapse measurements, experiments and modeling at a hierarchy of nested temporal and spatial scales within the 1500 km² catchment region.

In addition to investigating the land surface and the atmosphere exchange processes, the HOBE-scientists are paying particular attention to expanding the knowledge of recharge and groundwater dynamics and how groundwater interacts with surface- and sea water.

The center will educate 7 PhD students and 6 Postdocs. In this regard close collaboration has been established to the International Research School of Water Resources (FIVA). It is expected that a number of MSc thesis projects will also be connected to HOBE. Information will be exchanged and collaborated with similar initiatives in the US and in the EU.

The scientific results will be published in international peer-reviewed journals and presented at international conferences. Results will be communicated to a wider audience through publications in popular scientific journals and magazines and by presentations at meetings for professionals in water authorities, consulting firms, industry, and other organizations.

<http://www.hobecenter.dk/>