

**WCRP CORDEX South Asia Planning Meeting, IITM, Pune 25-26 February 2012**

# **Climate Change Impacts and Adaptation – Water Resources and Air Quality**

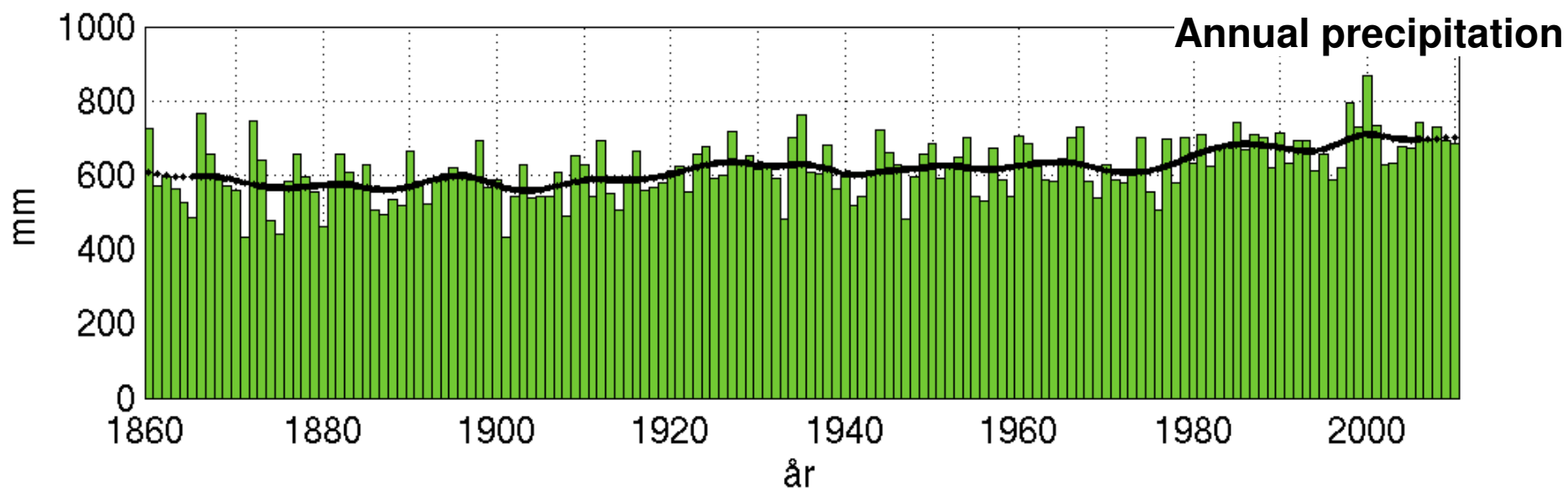
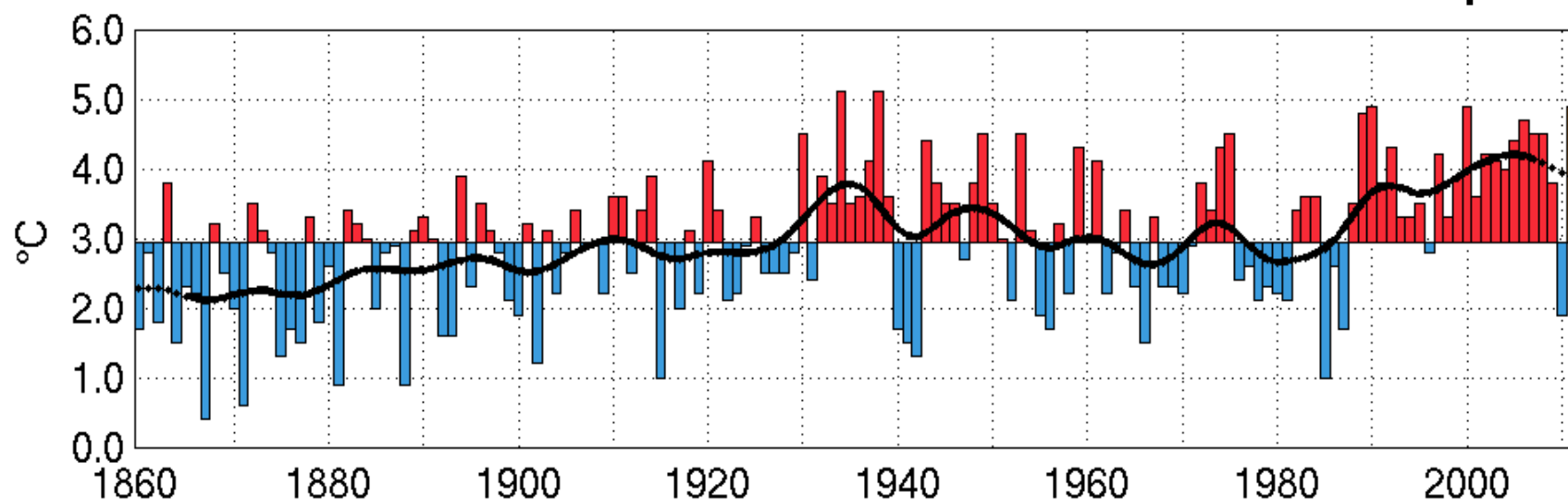
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## **Work on climate at SMHI**

- Observations
- Provision of climate information and interaction with government agencies. From 2012 SMHI is tasked by the Govt. to run a Climate Adaptation Information Centre
- Climate modelling research at the Rossby Centre
- Additional climate related research, e.g. impacts on water resources, marine environment and air quality
- Consultancy (e.g. climate adaptation studies)
- Capacity building in developing countries

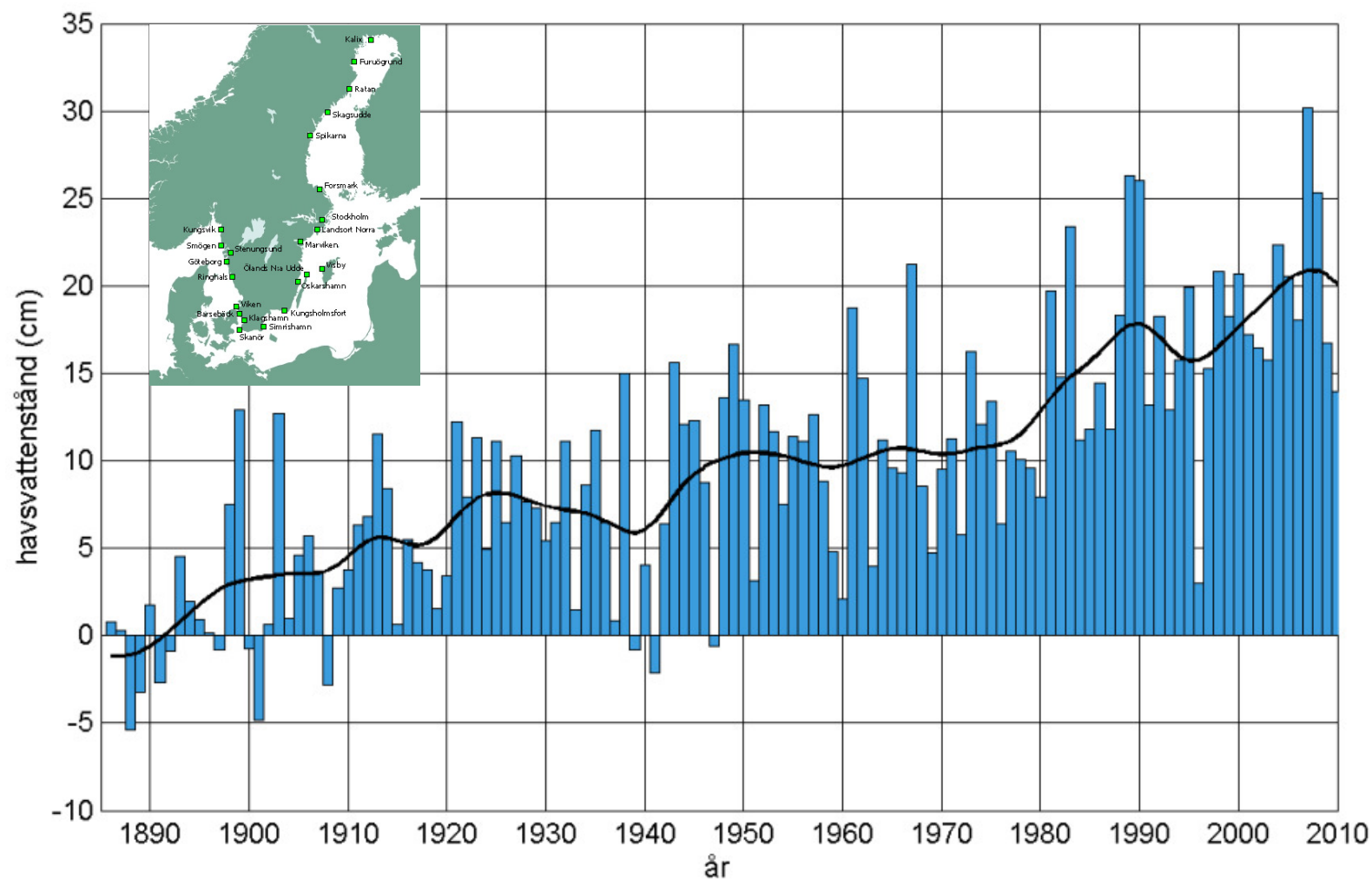
# Observed changes in Sweden

Mean temperature



# Sea level change 1886-2010

Corrected for landrise



## **Increased risk for flooding and sea level rise are important in swedish adaptation**



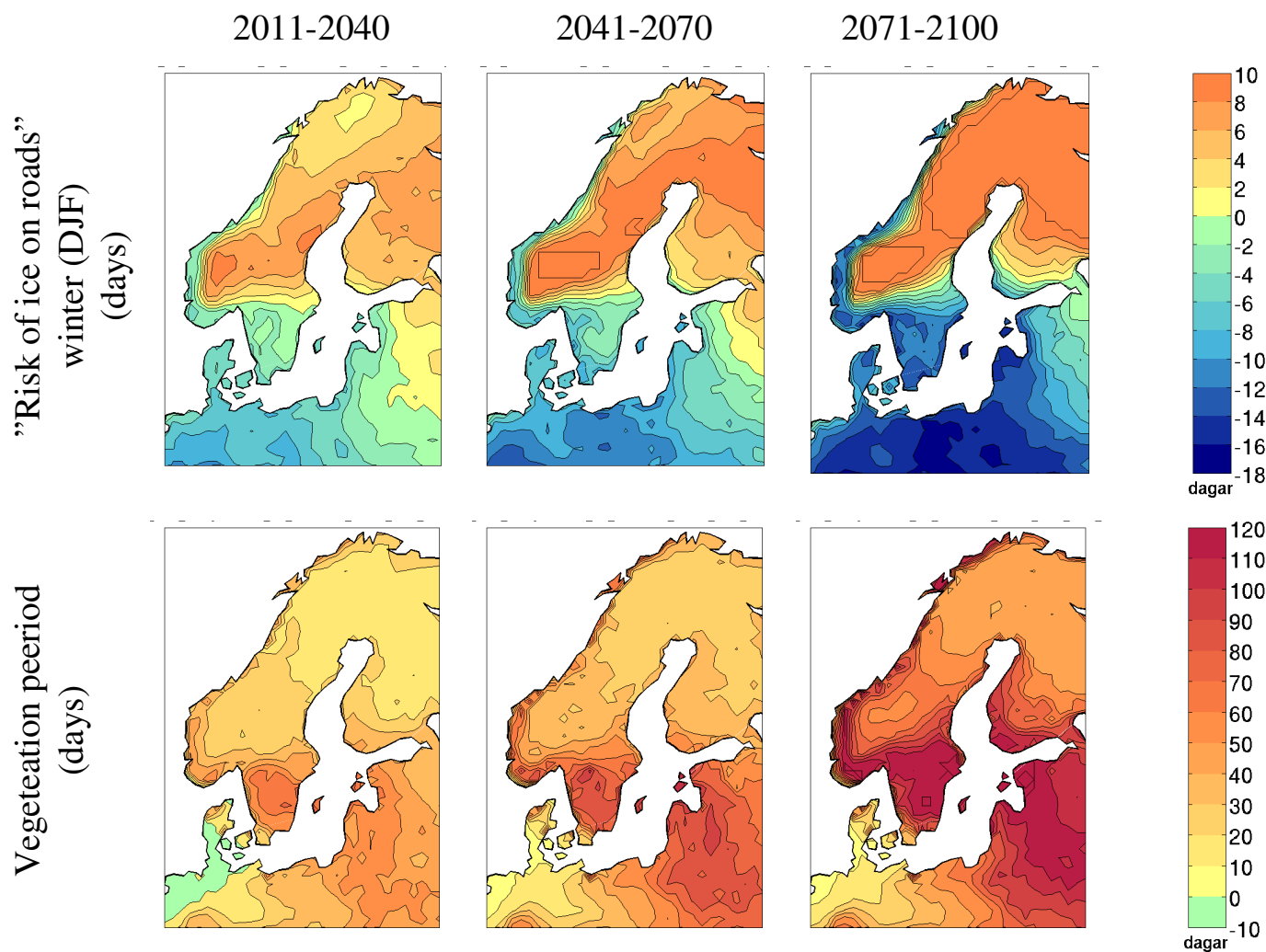


Photo: Sten Bergström, SMHI



# Results delivered to the Swedish Government investigation on climate change and vulnerability

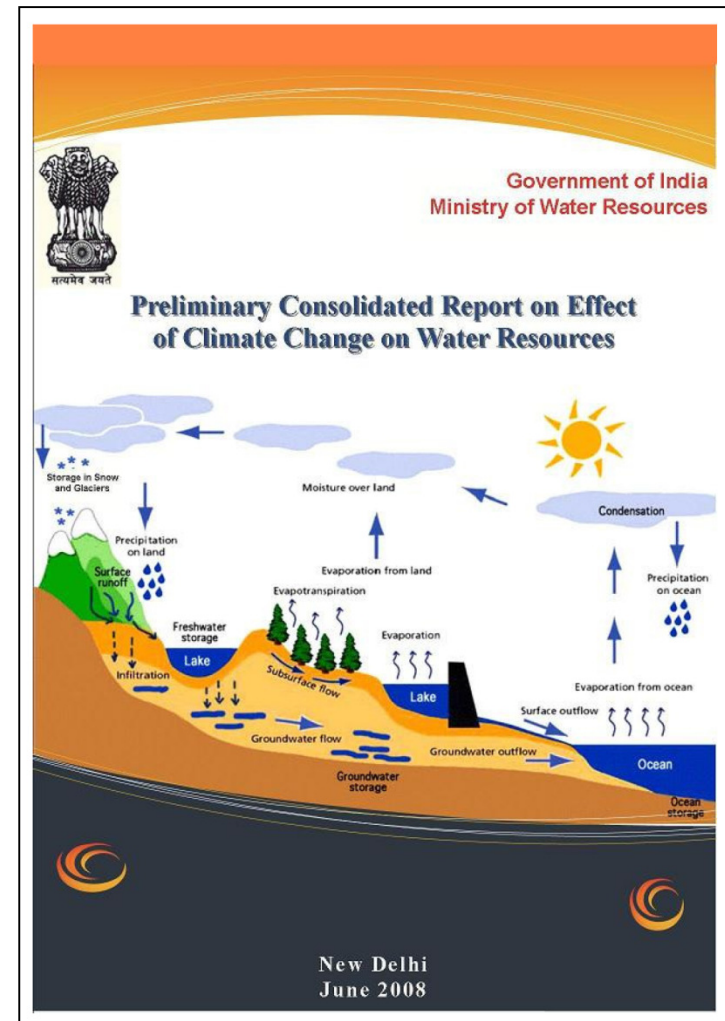
Change compared to the reference period 1961-1990



# Impact of climate change on water resources

## Future directions

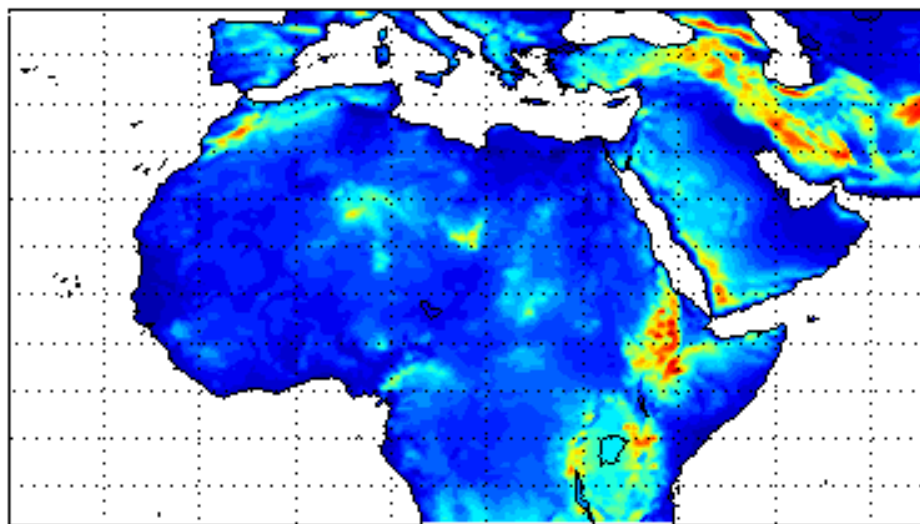
- Data collection
- Scientific studies
- Networking of the institutions
- Watch on impact on the other sectors
- River basin-wise studies
- Adaptation measures
- River basin organisation
- Flood management
- Involvement of academicians and capacity building
- Awareness programme



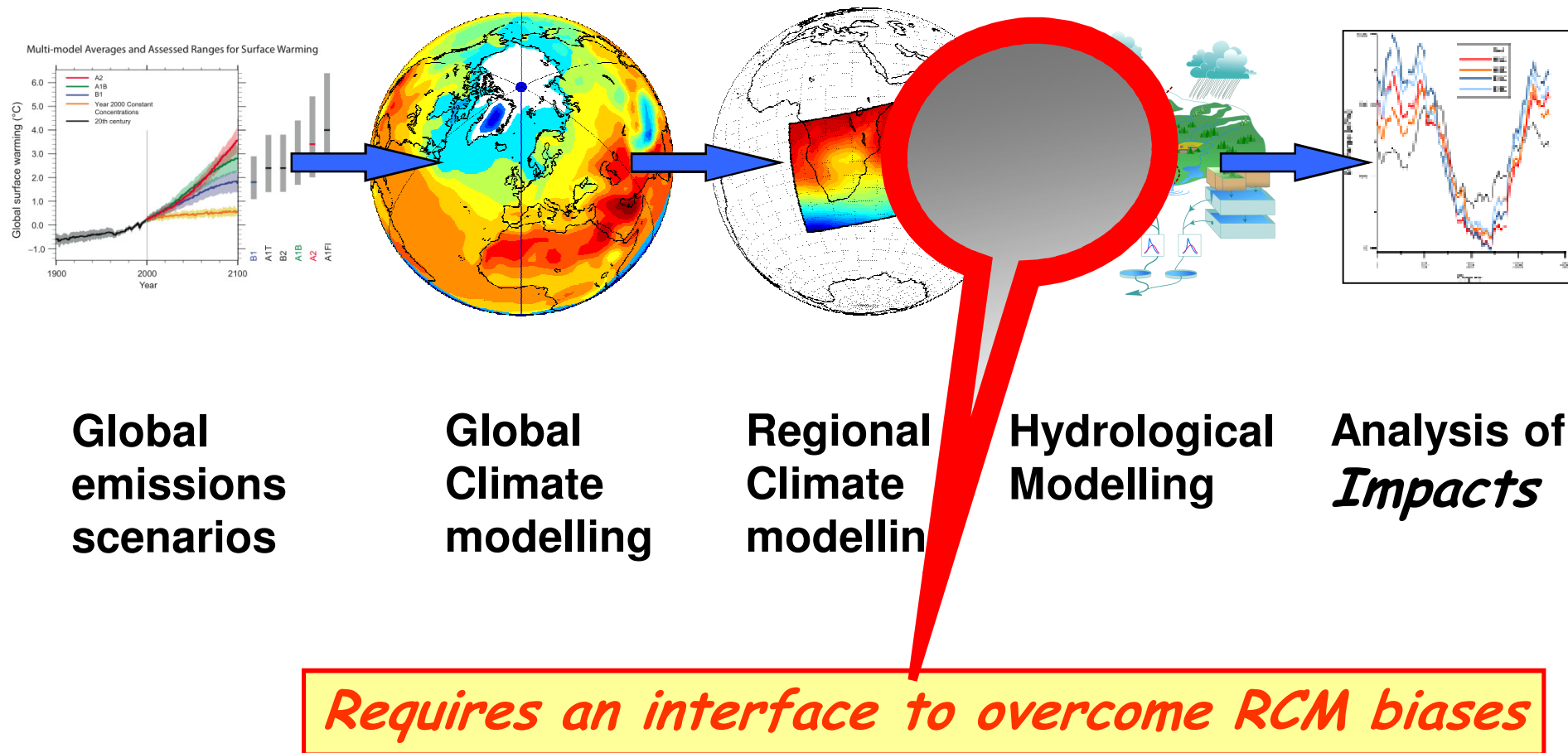


## Regional hydrological modelling for the Arab Region

- Regional scale
- Ensemble of several hydrological models
- Coupled to outputs from RCM projections
- Production of regional hydrological impacts



# Assessing Climate Change impacts on hydrological systems



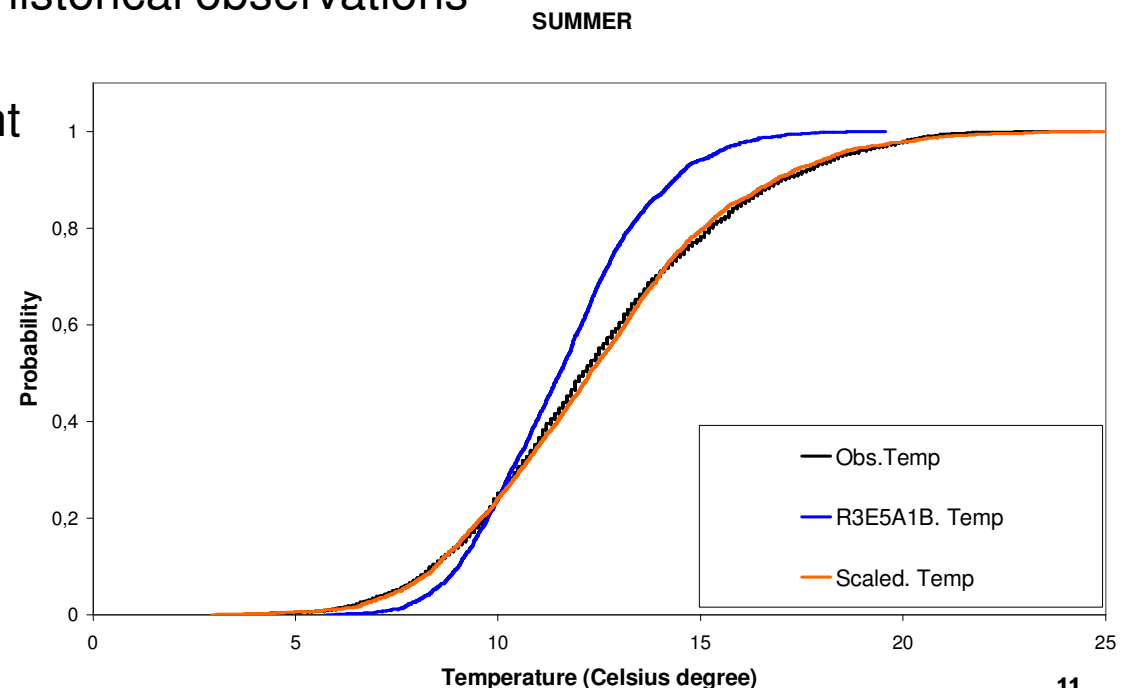
# From RCM output to hydrological input

## Delta Change

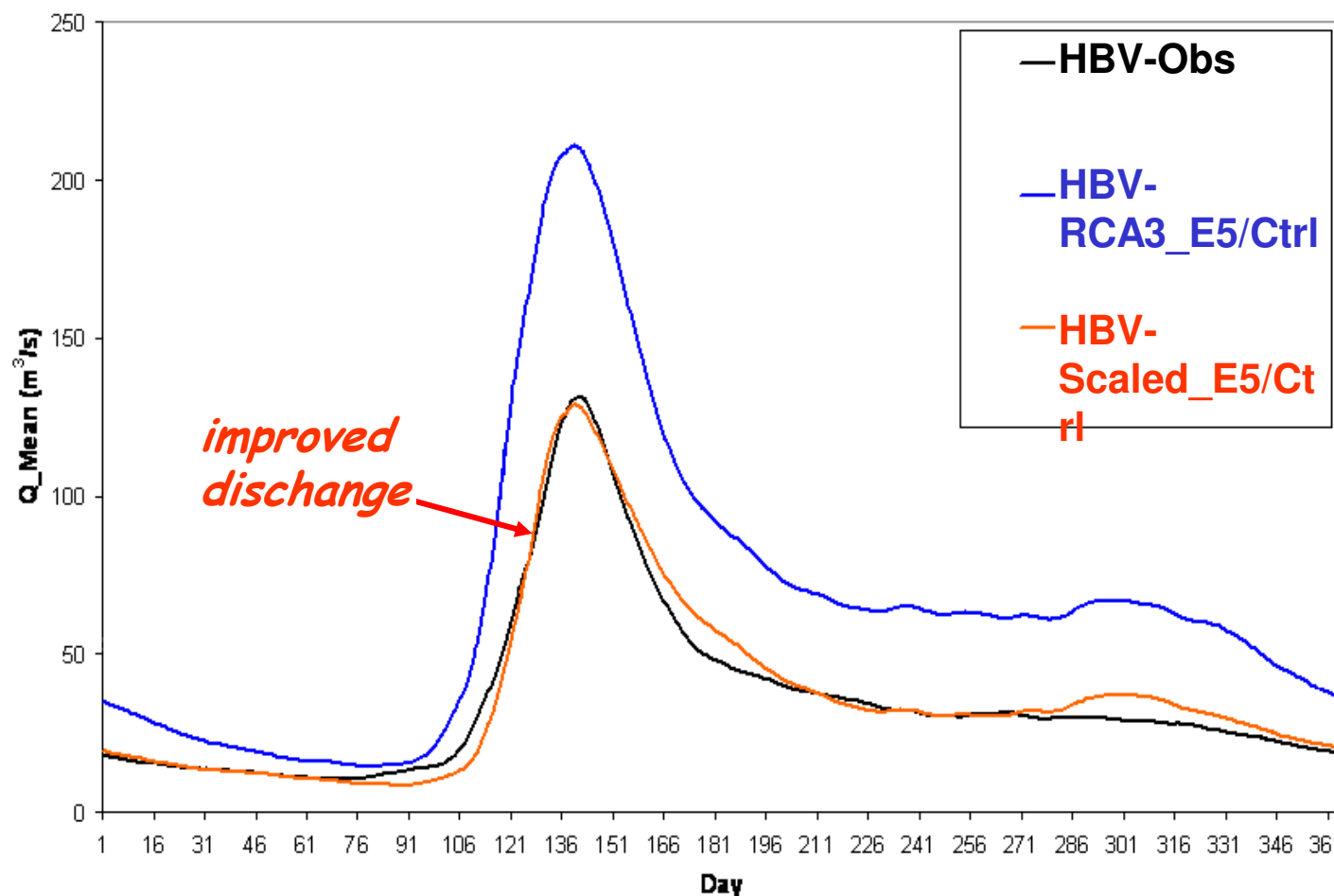
- Modify historical observations in line with the changes in the climate scenarios
- Use the ***modified observations*** in impact studies

## Scaling

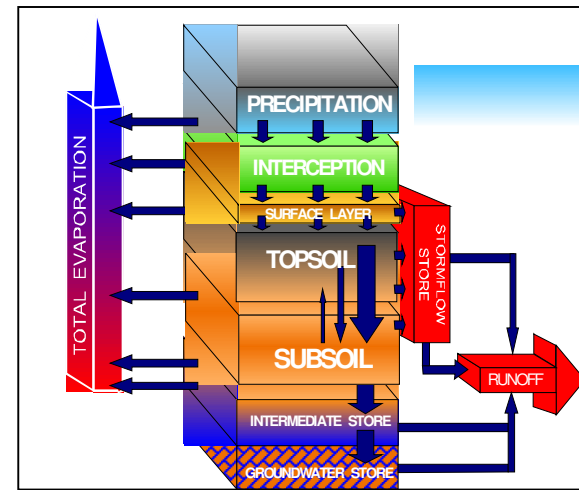
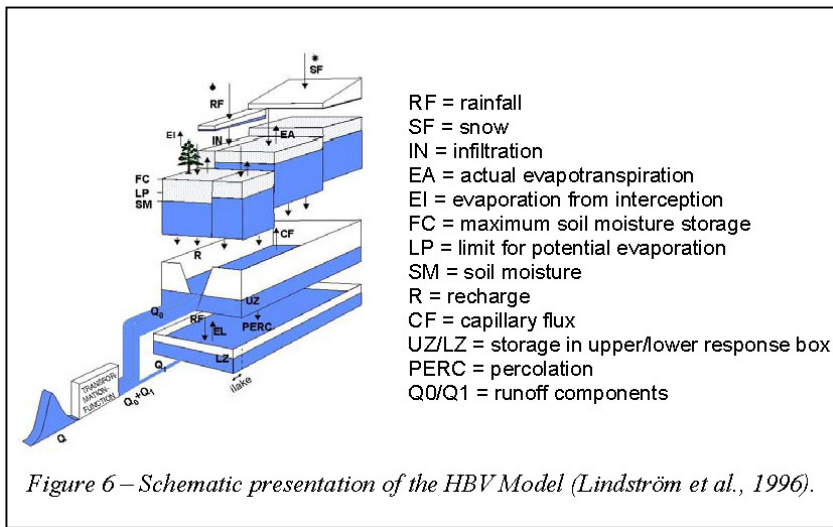
- Compare RCM output with historical observations in a control period
- Define a suitable adjustment that makes them match
- Apply the same adjustment to future scenarios
- Use the ***adjusted RCM output*** in impact studies



## Scaled input of Prec. & Temp. from RCM control period: 1961-1990

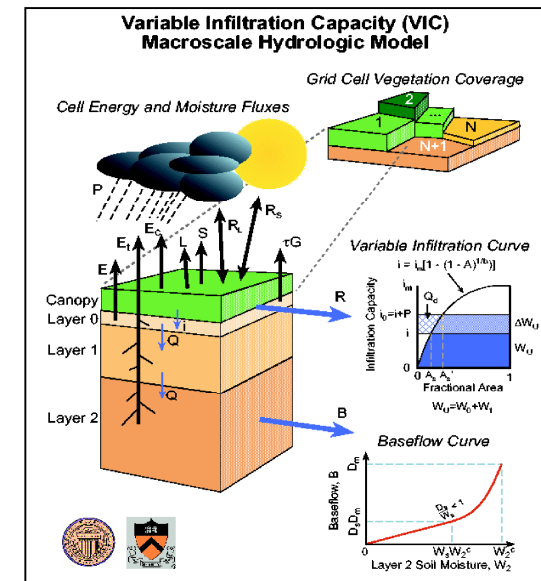
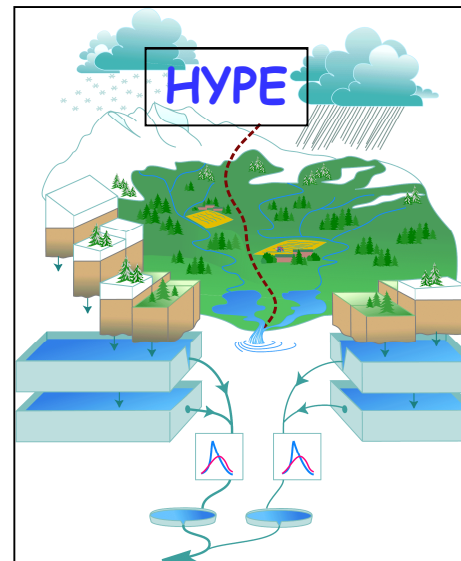
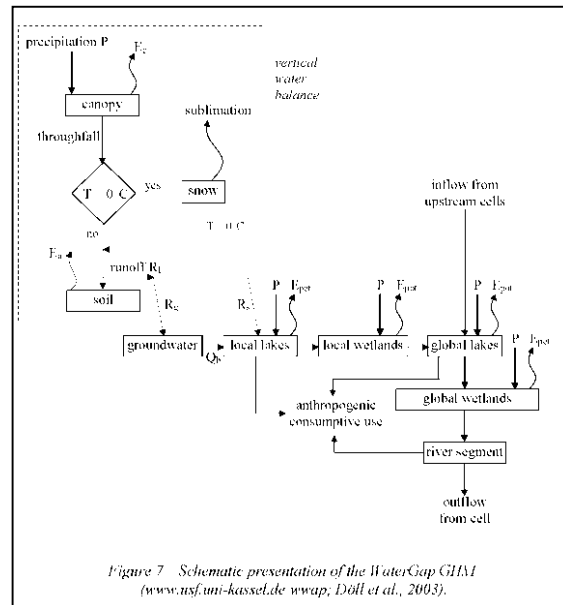


HBV model runs for Torpshammar River Basin in Sweden  
(Observations & RCA-ECHAM5)



SMHI

## Choosing appropriate Hydrological Models? > Regional



# Climate change has the potential to affect air quality

Climate Change's Effect	Ozone	Particulate Matter
↑ Stagnation	↑	↑
↑ Temperature	↑	↓
? Mixing Depth	=	↑
? Precipitation	=	↑
? Cloud Cover	↓	↓
? Humidity	=	↑
Meteorology	→ Air Quality	

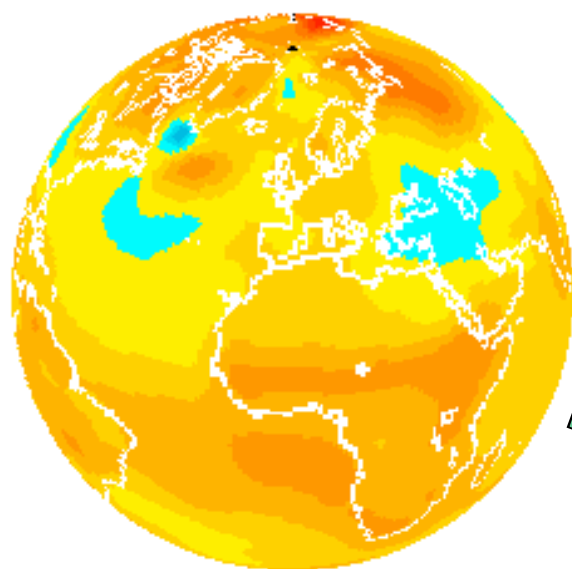


Jacob and Winner 2009 AE



# Impact of climate change on European air pollution

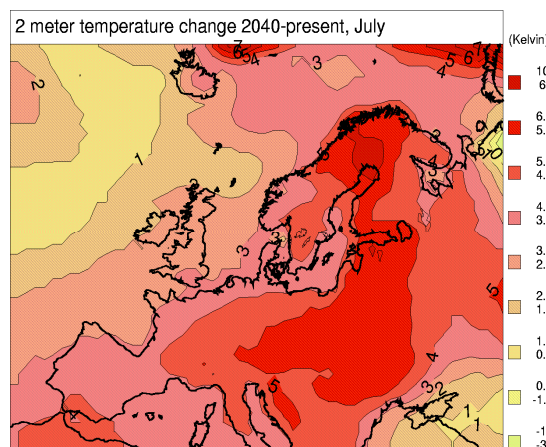
Global climate change



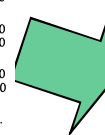
AOGCM simulations



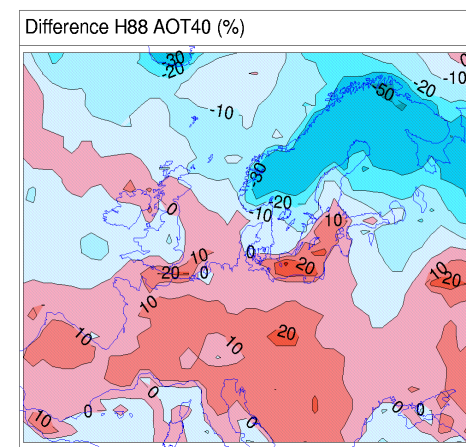
Regional climate change



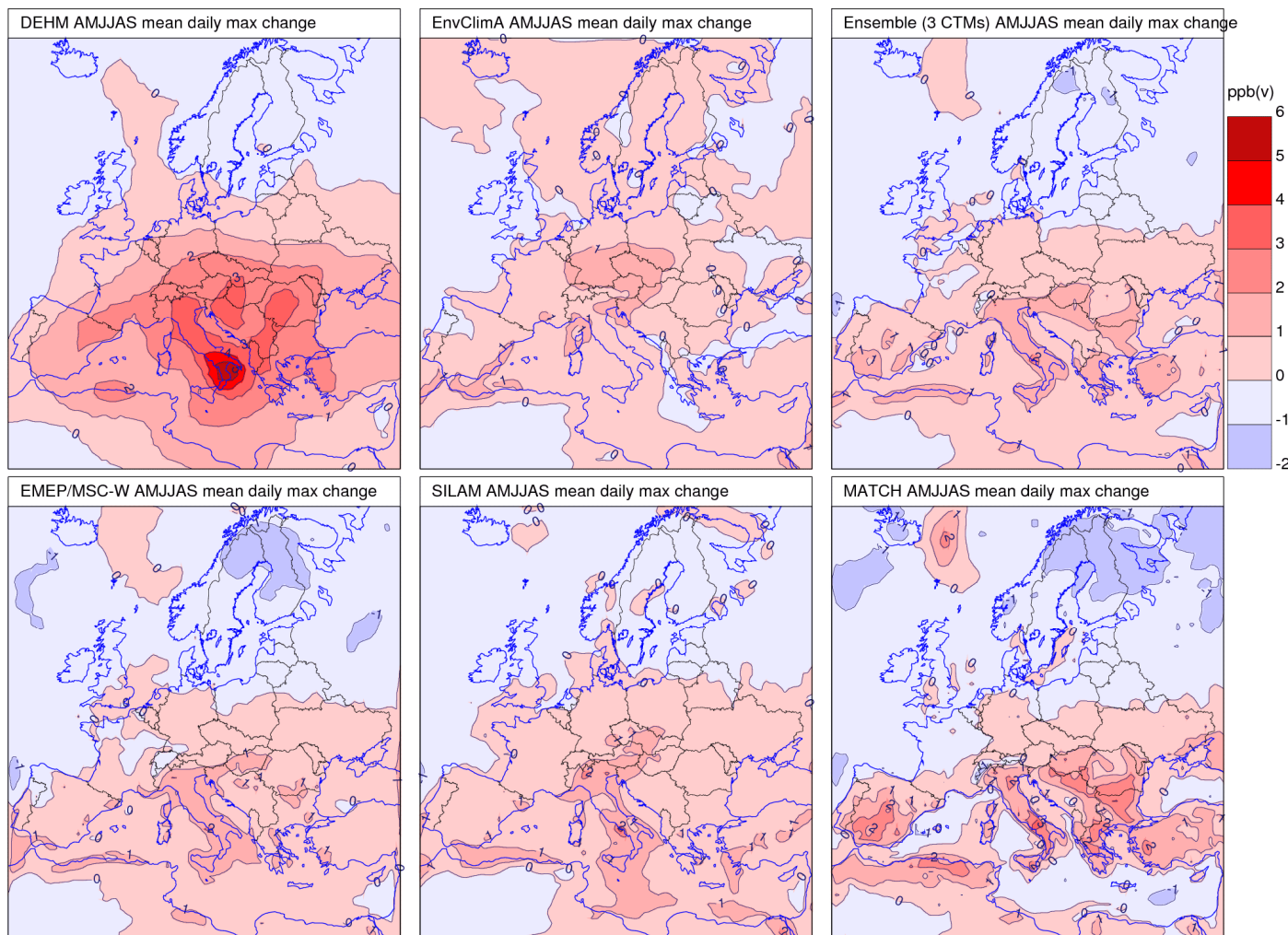
Dynamical downscaling using RCA3,  
Rossby Centre, SMHI



Impact on e.g. ozone  
AOT40 (%)

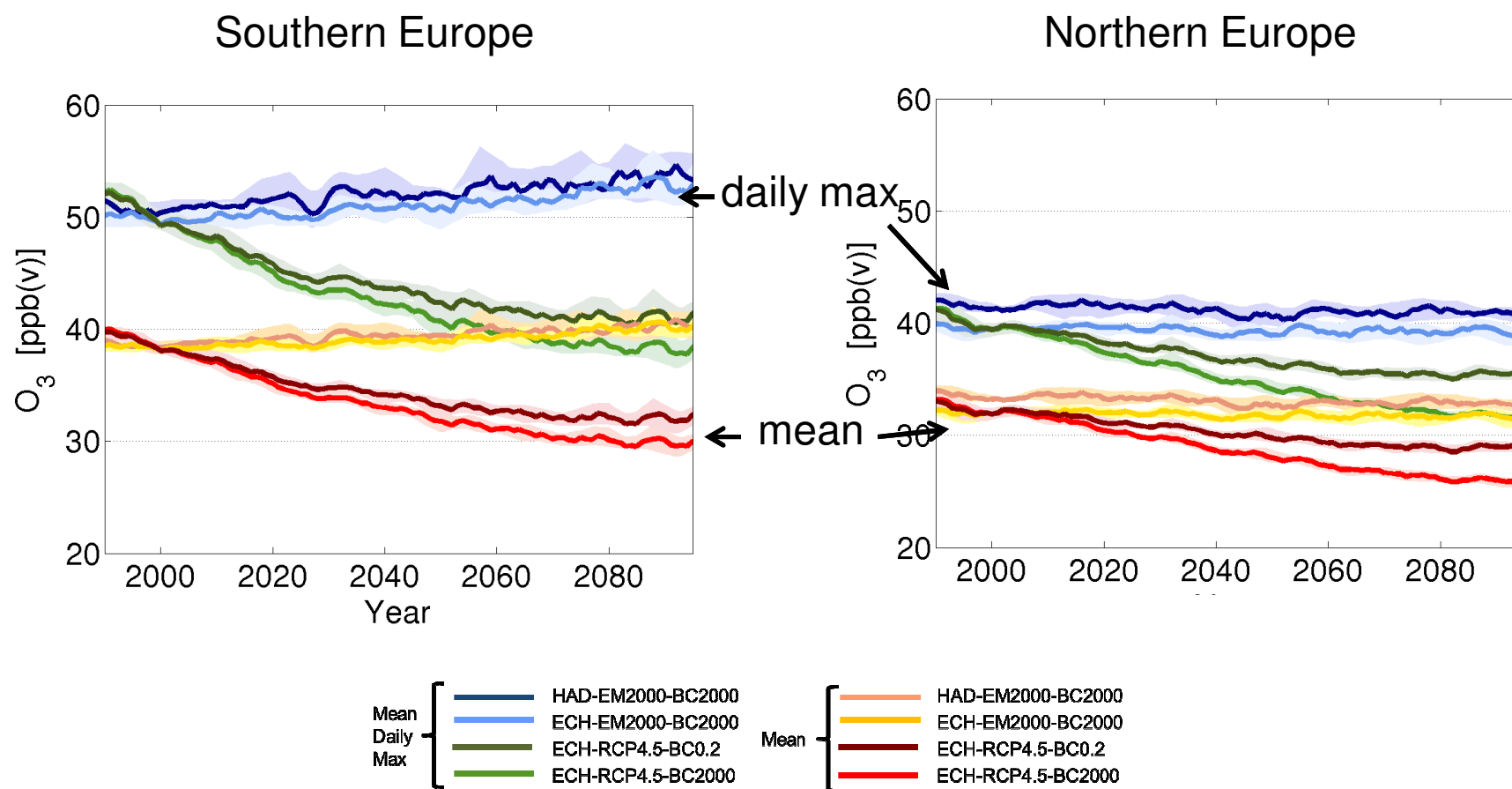


# Multi model changes of daily max summer ozone, 2000-2040, RCA3-ECHAM5-A1B



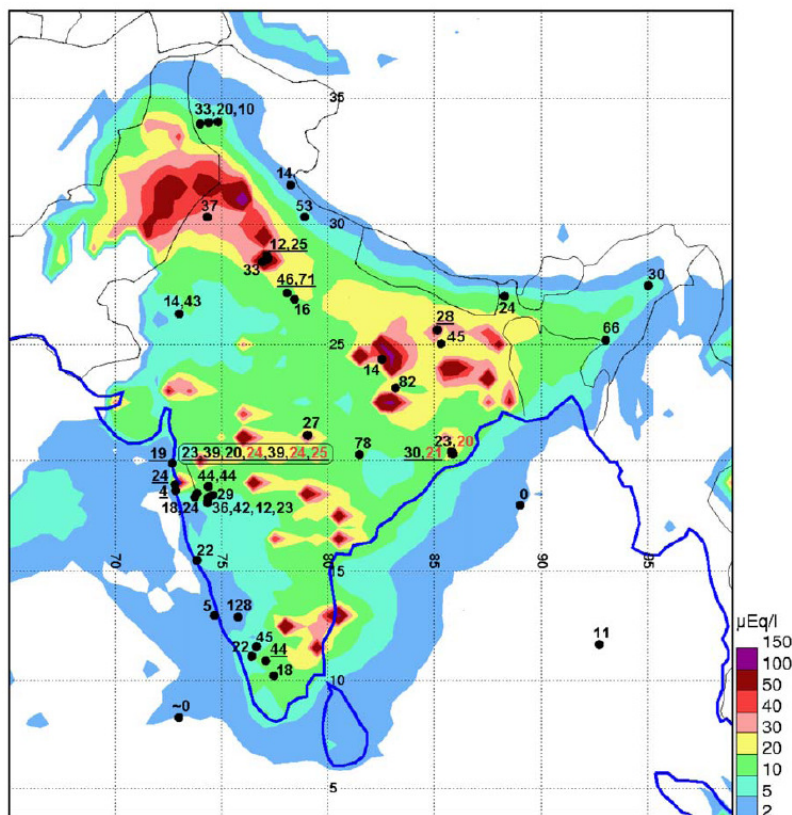
# Simulated changes of surface ozone 1990-2100

Apr-Sep, RCA3-ECHAM5-A1B and RCA3-HadCM3-A1B



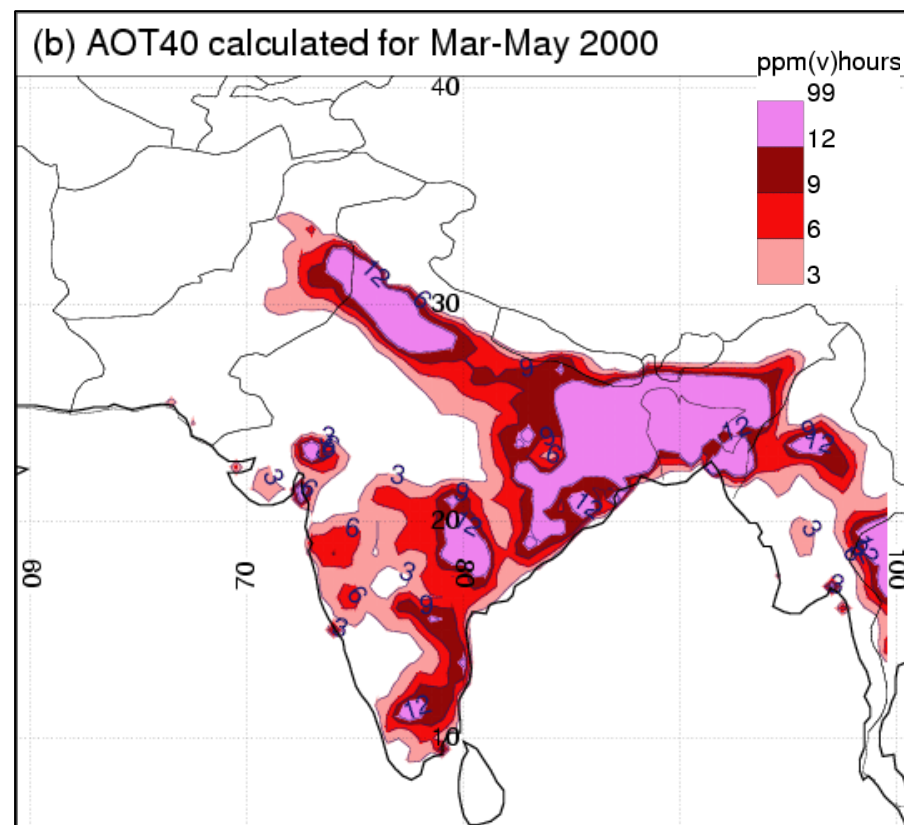
# Some previous work on air quality in South Asia

Sulphate in rainwater 2000



Kulshrestha et al. 2005 AE

Surface ozone, AOT40



Emberson et al. 2009 AE

## **Potential SMHI activities (to be discussed)**

- **Capacity building climate analysis - water resources - CORDEX**  
Support the development of expert skills for analysis and use of climate model output data for - water resources
- **Capacity building climate analysis – regional air quality - CORDEX**  
Support the development of expert skills for analysis and use of climate model output data for – air quality
- **Climate - air quality research collaboration** ozone and effects on crops and health, black carbon in a changing climate
- **Similar for water resources**

## **Suggested mode of operation**

- Start with workshops in 2012 and 2013 coordinated with other CORDEX South Asia activities
- Researchers should use their own tools and impact models
- SMHI could provide access to e.g. hydrological models and related tools set up for the region for those interested



## **Potential next steps**

- Identify partners in the region for WR and AQ
- Apply for funding, e.g. Sida (Swedish International Development Authority)

**Thanks!**