

HIGHNOON: adaptation to changing water resources availability in northern India with Himalayan glacier retreat and changing monsoon pattern

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Outline

- Problem
- Challenge
- Approach
- Expected outcomes

Problem

- Glacier melt
- Changing monsoon patterns



Recent findings glacier melt

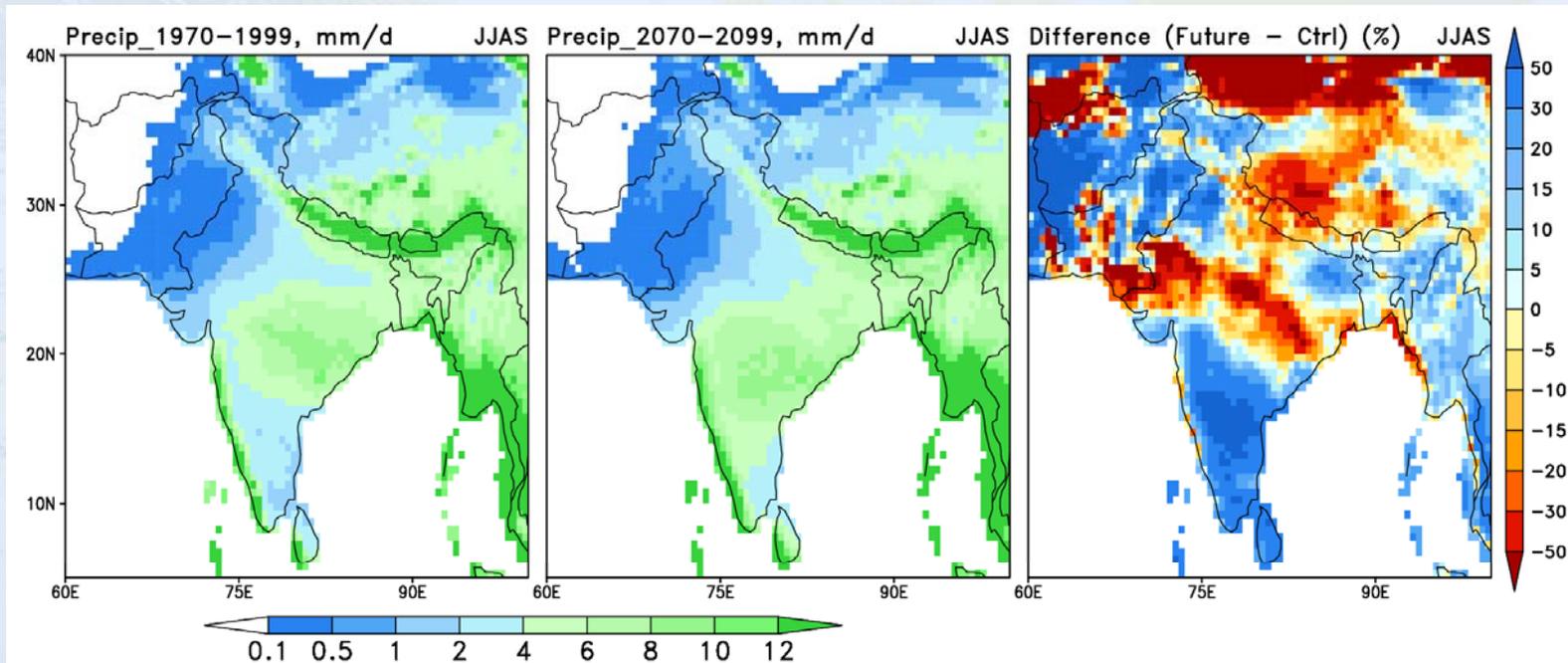
- Western Himalaya: annual ice thickness loss of about 0.8 m w.e. per year (1999 – 2004).
(Berthier et al., 2007 *Remote Sensing of Environment*)
- Global Glacier Changes: Facts and Figures
(UNEP/WGMS, 2008)
- Mass loss on Himalayan glacier endangers water resources
(Kehrwald et al, 2008. GRL)
- Climatic warming, glacier recession and runoff from Alpine basins after the Little Ice Age maximum
(Collins, 2008. *Annals of Glaciology*)
- This conference



(AX010 Fujita & Shresta)

Climate models disagree on future rainfall changes.

- ECHAM4 projects an increase of 13 percent in summer (kharif season) rainfall;
- HadCM2 projects a decline of 6 percent.



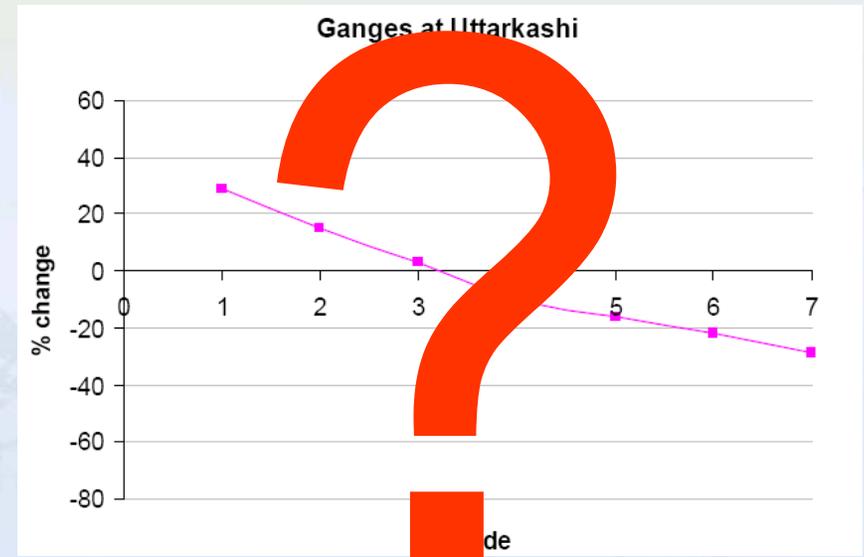
REMO precipitation Difference (%), A1B scenario – Control

Kumar and Jacob

Expected changes in discharge Ganges

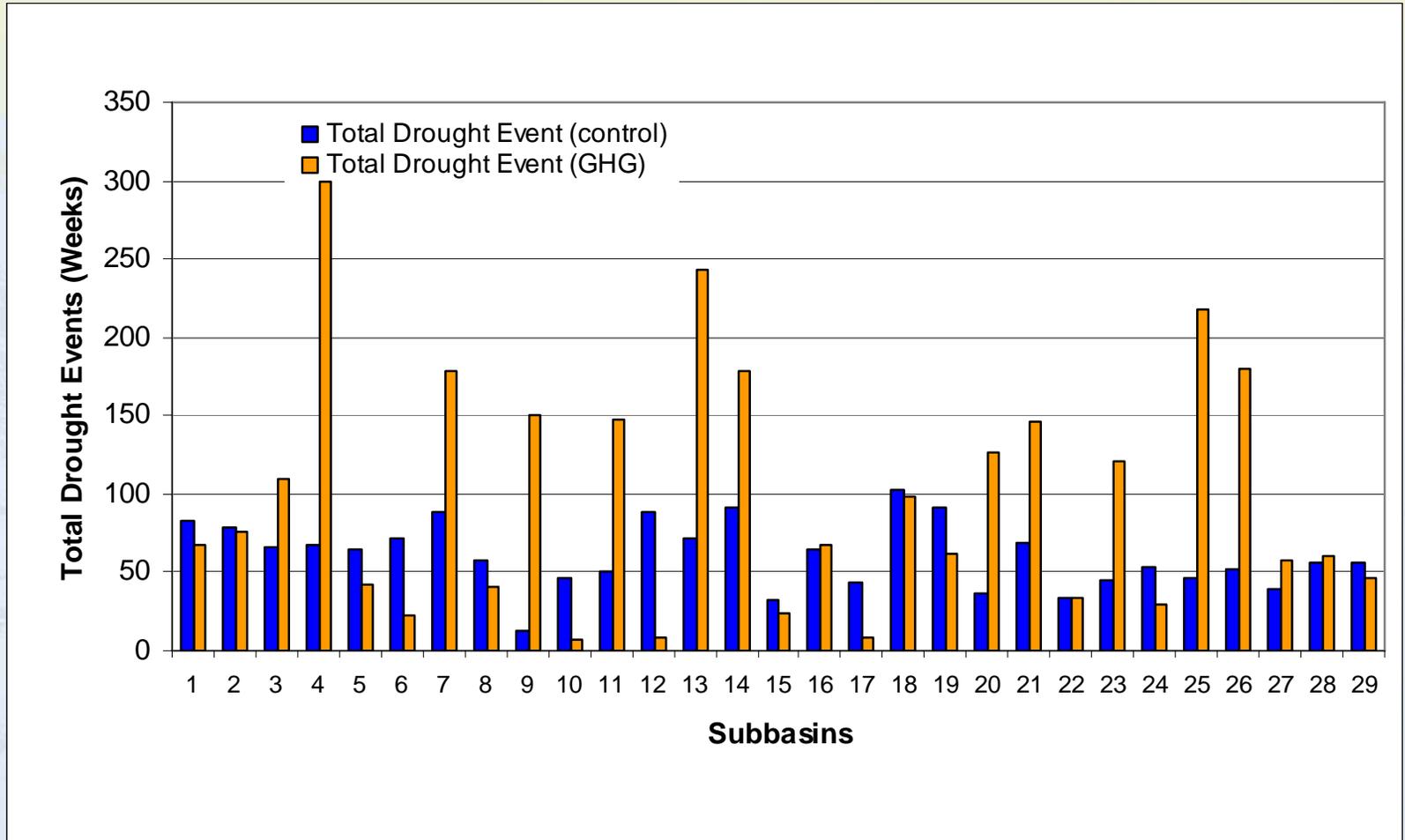
■ Trends

- Glaciers retreating (e.g. Gangotri glacier 20-22 m per year)
- Projected change in flow of Ganges



(e.g. Hasnain May 2004 New Scientist & Rees, June 2004. New scientist)

Number of drought weeks in Sub-basins of Ganga for Current (1981-2000) & GHG scenarios (HadRm2 2041-2060)



Challenges

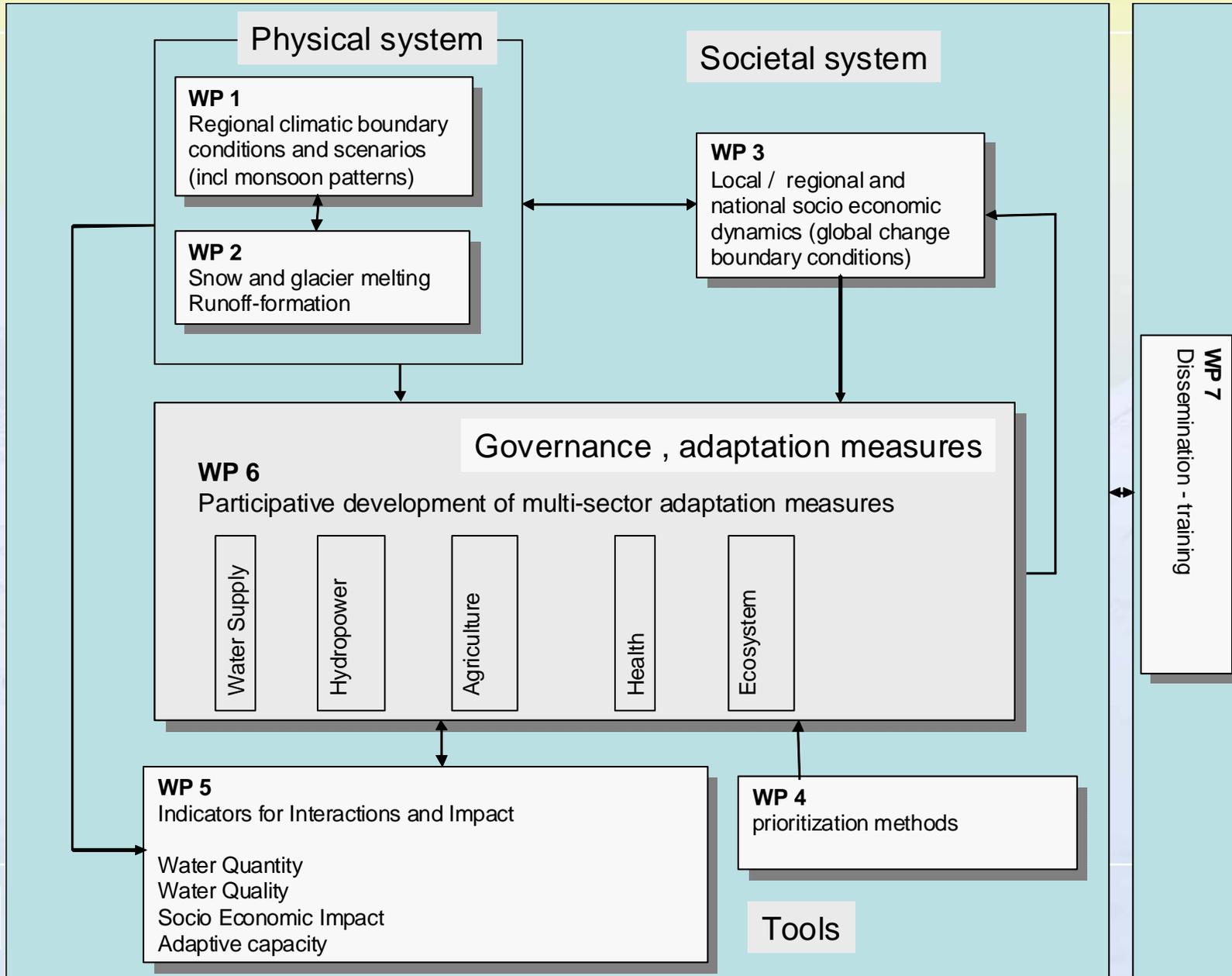
To support adaptation measures for different sectors:

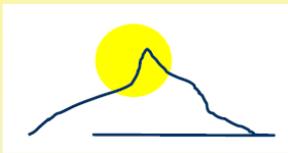
- There is a need for time and space specific CC predictions.

To achieve this we need to:

- Improve climate forecast skills at the regional scale by improving process knowledge and down-scaling techniques;
- Integrate socio-economic drivers in our studies to enable the assessment of other drivers than climate change and possible feedback mechanisms between them.

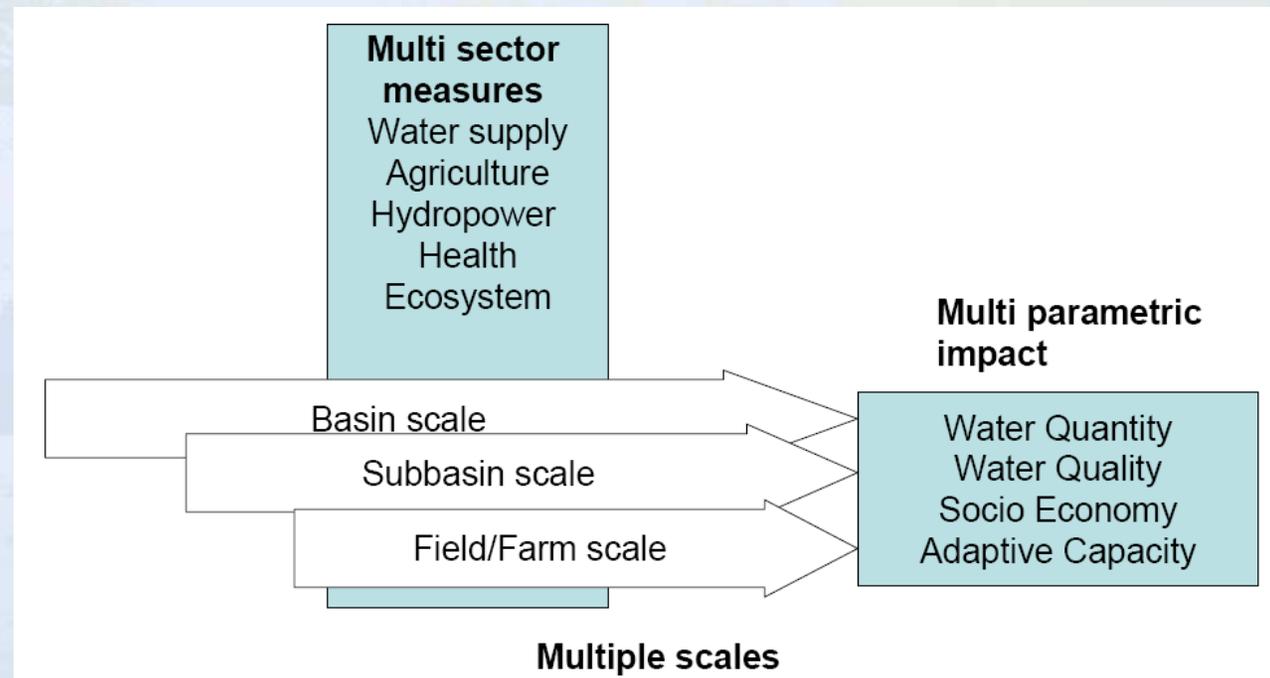
Approach





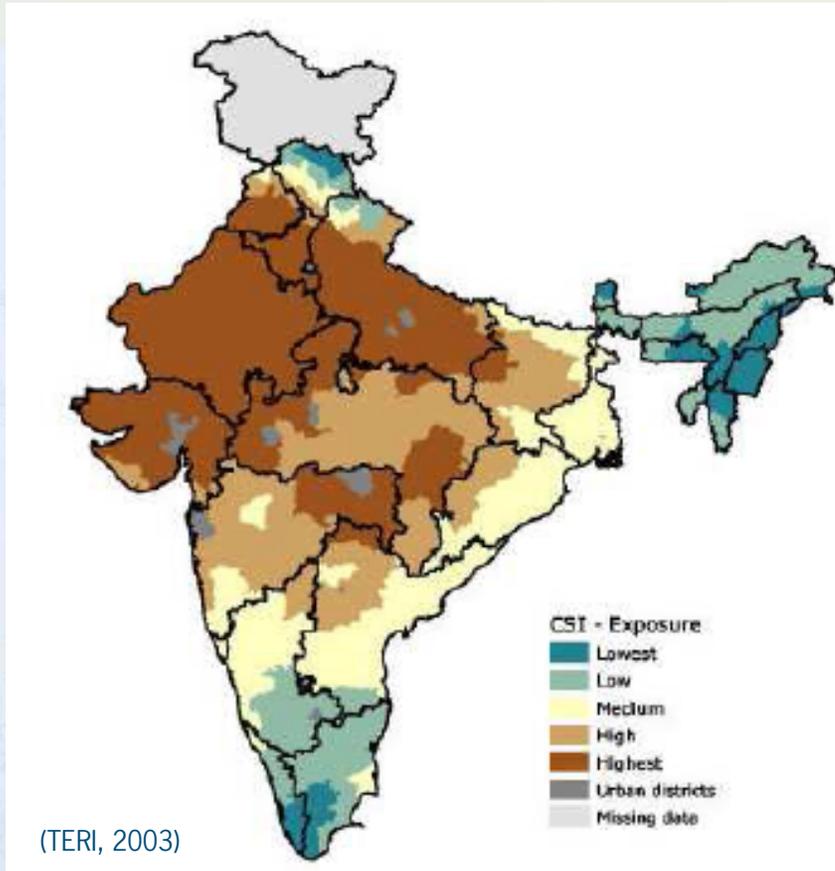
Approach: Adaptation strategy

- Improved boundary conditions (CC & socio-economic)
- Consideration and integration of relevant dimensions in the development of adaptation measures
- Transdisciplinary approach – combining tacit knowledge with scientific discovery

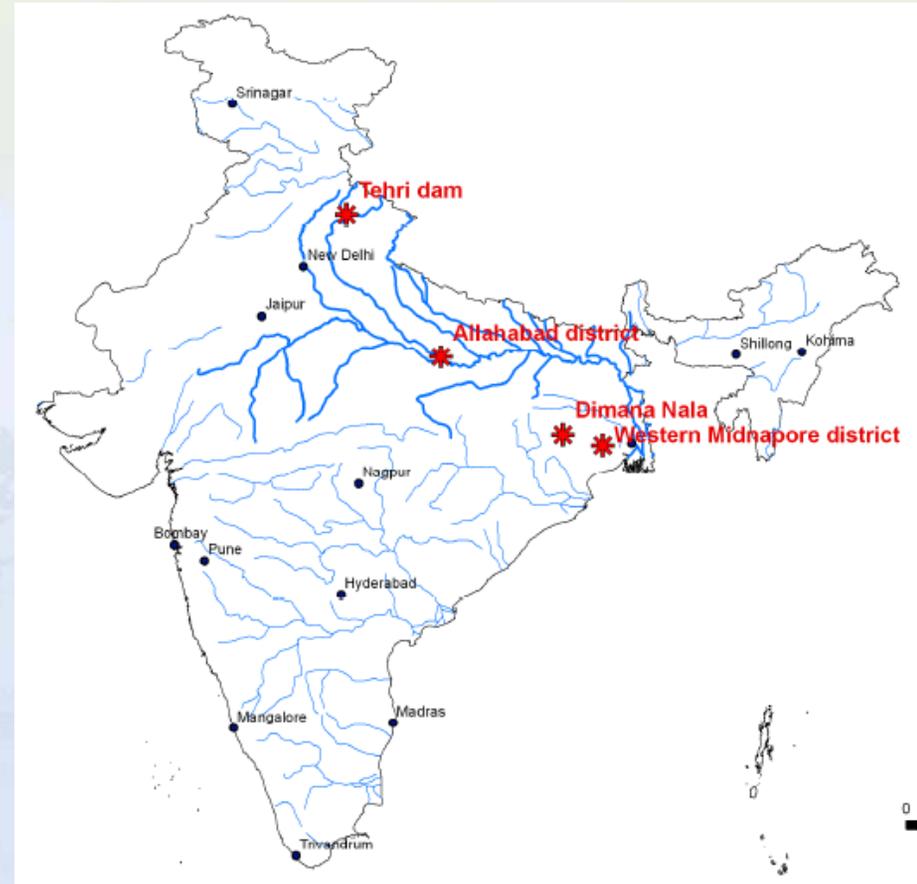


Different scales

Exposure to CC impact



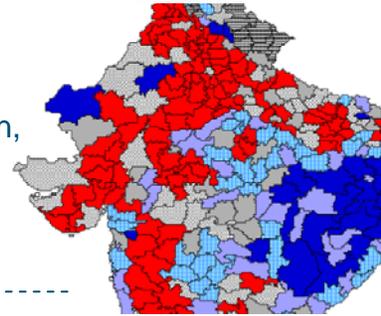
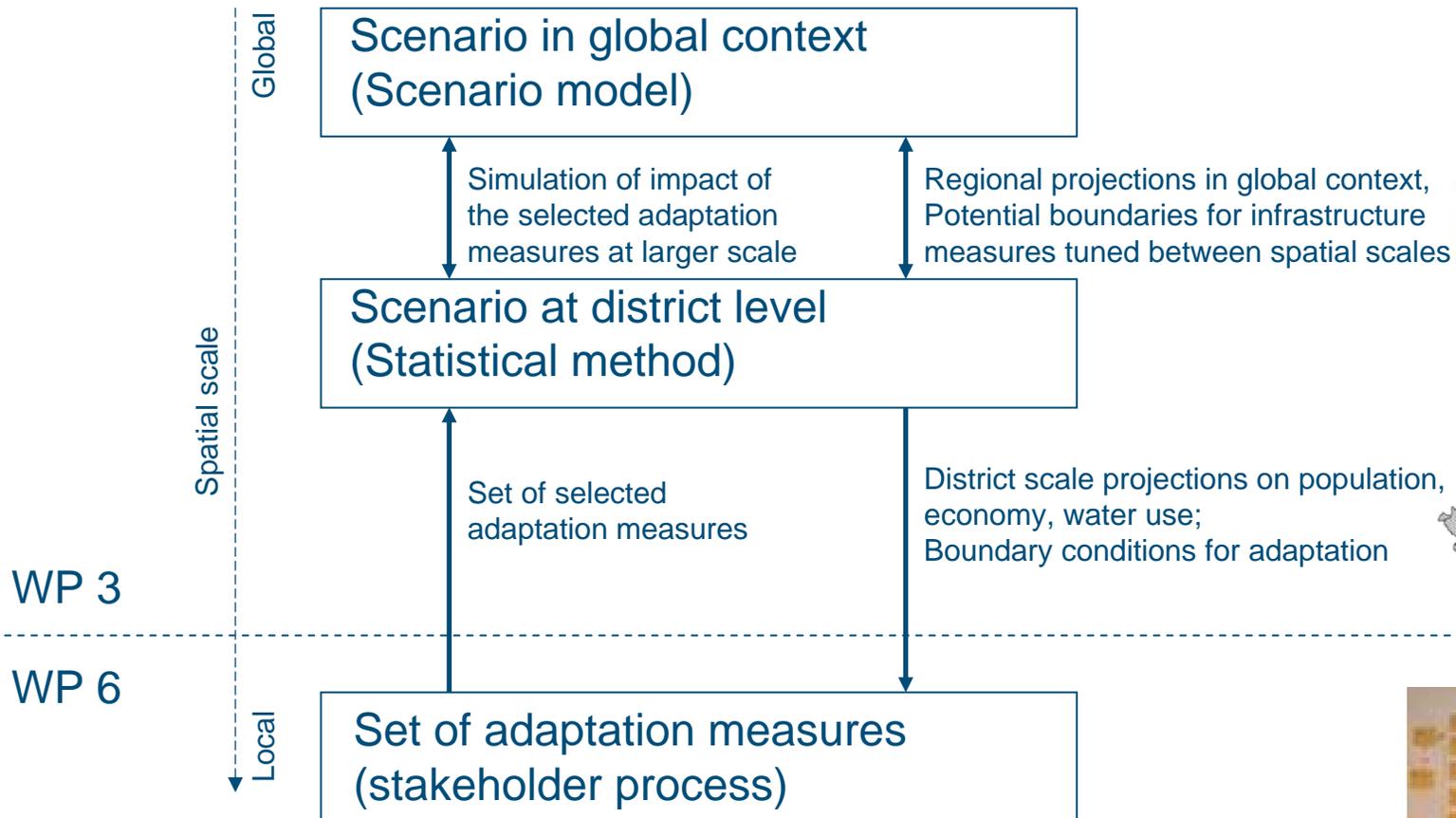
Location of case study sites



Socio economic dynamics

- Make consistent scenarios for socio-economic changes in the region (large scale model)
 - Population and GDP
 - Food and water demand
 - Land use changes
- Explore physical boundary conditions for adaptation options in these scenarios.
- Refinement of geographical and management detail to local level scenarios
- Evaluate impacts of adaptation measures

Use of a nested approach to assure consistency amongst scales.



Expected outcomes:

Improved knowledge of:

- Glacier melt, lake formation and glacier lake outburst floods;
- CC affecting monsoon patterns
- Impacts on water resources

Products:

- Improved ice/snow feedbacks routine for RCM's (PRECIS & REMO)
- Consistent modelling results of ice/snow between RCM's and hydrological models
- Assessment of water resources for consistent scenario's at different scales
- Set of tools to facilitate prioritization of adaptation measures
- Extension of indicator framework to assess impact of adaptation measures
- Adaptation strategies over multiple scales and sectors

Some examples of questions and remarks:

- “What kind of policy measures to regulate demand and allocation are necessary to successfully adapt to change?”
- “Policy makers can help to make data available that are urgently needed to improve the scientific results”
- On the use of water pricing: “There are real interest e.g. can you raise the price for water if it is a human right?”
- Not always the desired solution can be found, in some cases decision makers may need the have the courage to tell people they need to change.