WATCH-HighNoon Open Science Seminar
Future of water resources in India under a changing climate
13-14 May 2009

Impacts of glacier retreat on Himalayan water resources

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Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

SAGARMATHA Project

Snow And Glacier Aspects of water Resources MAnagement in The HimalayA

DFID Department For International Development

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

JAWAHARLAL NEHRU UNIVERSITY

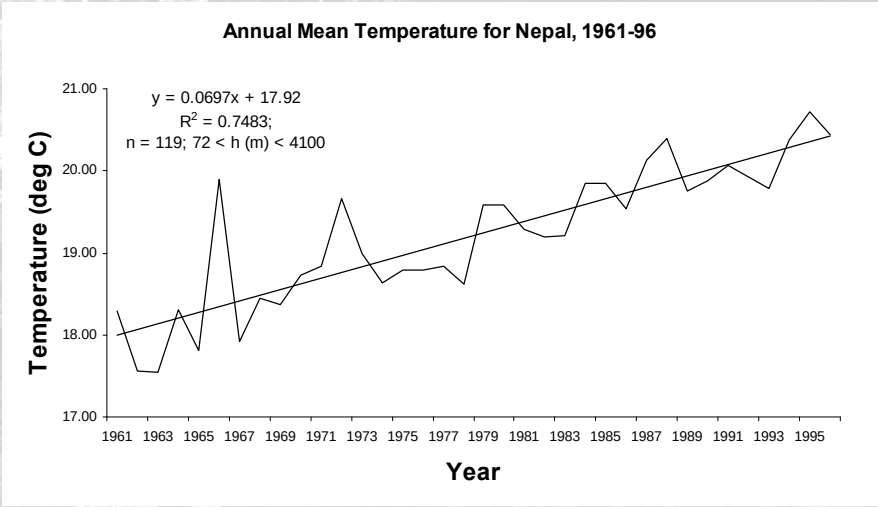
THE UNIVERSITY OF SALFORD

His Majesty's Government of Nepal
Department of Hydrology & Meteorology

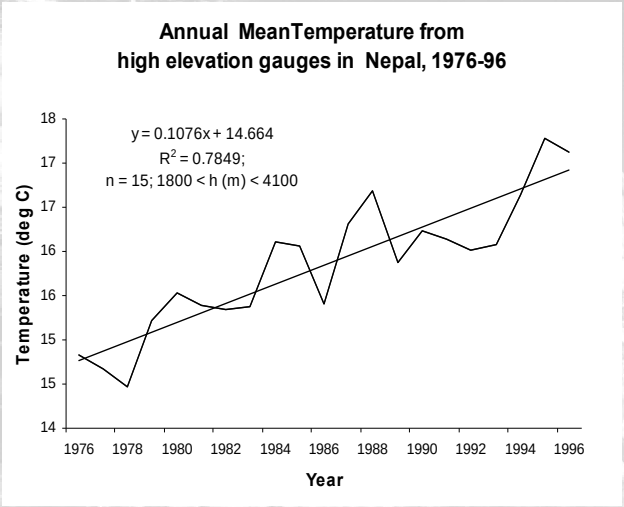
ICIMOD

Tribhuvan University
Kathmandu

Hydrometeorological observations across Nepal



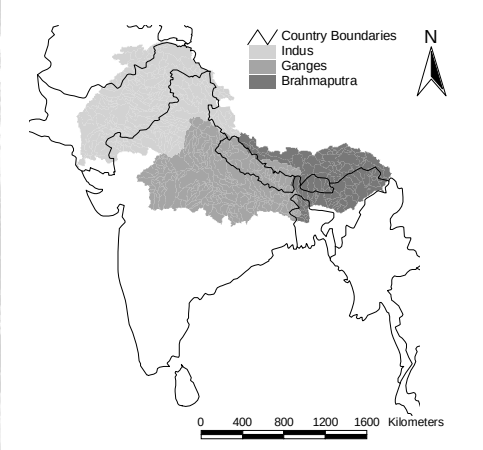
Hydrometeorological observations across Nepal



Assessing impacts on water resources

Develop a macro-scale model for the Indus, Ganges and Brahmaputra basins

… incorporating the first regional glacier-melt model



Assessing impacts on water resources

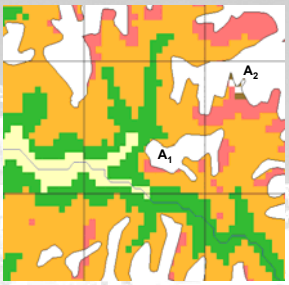
Develop a macro-scale model for the Indus, Ganges and Brahmaputra basins…

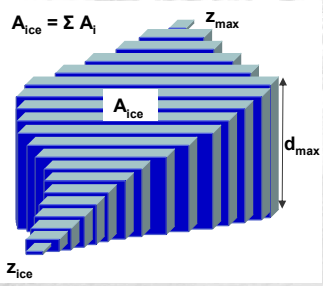
… incorporating the first regional glacier-melt model

… representing varying meltwater contribution from retreating glaciers

Glaciers "contributing" runoff to a cell "idealised" as a single glacier

… dimensions allowed to vary over time



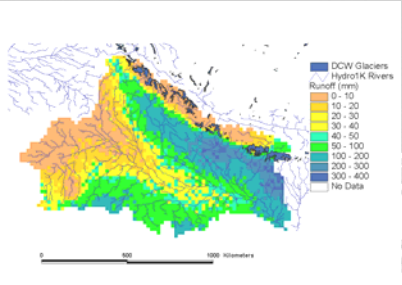


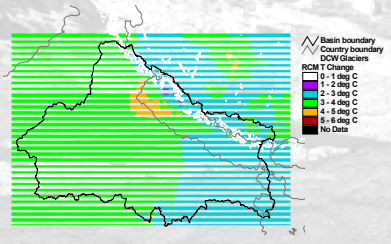
Assessing impacts on water resources

Estimate baseline (1961-90) conditions (average annual and seasonal runoff) at 20km x 20km grid resolution

Apply variety of climate change scenarios: hypothetical (e.g. +0.06ºC.a^{-1}) and RCM-based (HadRM2)

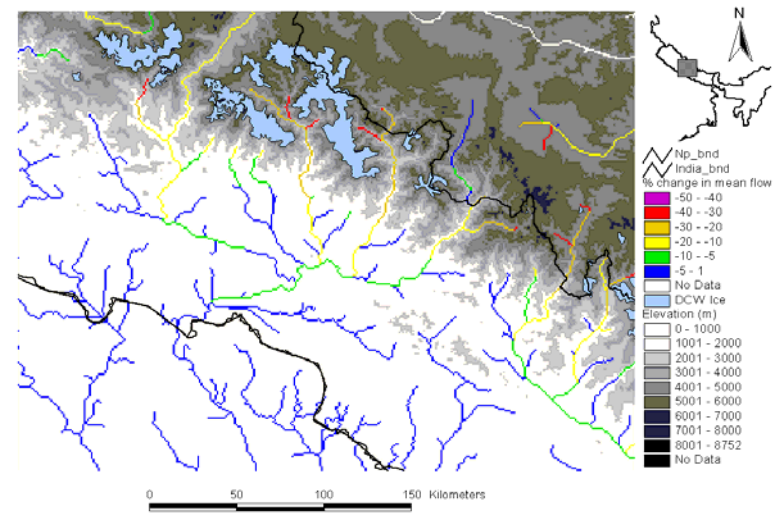
Impacts assessed in terms of relative changes in long-term river flows, at decadal time-steps for the next 100 years





Results

%change in mean flow - Narayani basin - 50% deglaciation

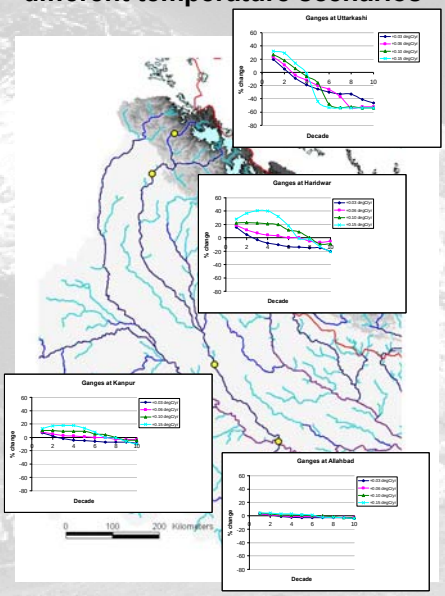


Results

%change in mean flow - Indus basin - 50% deglaciation

Results

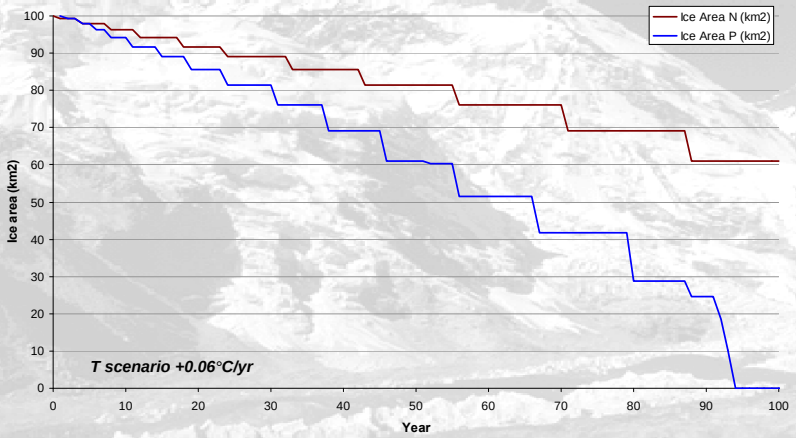
%change in decadal mean flow for Ganges for different temperature scenarios



Results

Comparison of deglaciation rates between two identical "hypothetical" glaciers in

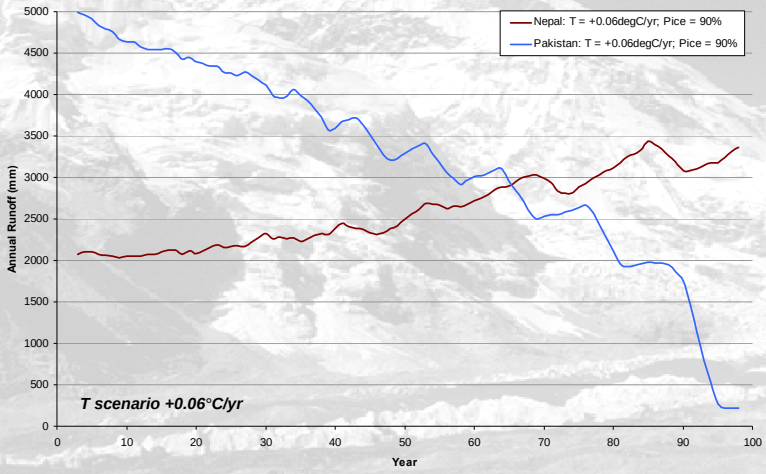
eastern Nepal (red) and northern Pakistan (blue)



Results

Comparison of annual runoff between two identical "hypothetical" glaciers in

eastern Nepal (red) and northern Pakistan (blue)



Conclusions

Impacts differ regionally (E-W) and within catchments

Highly glacierised catchments and catchments where glacier meltwater is significant are most vulnerable

Variation in precipitation is an important factor (protects glaciers from melting; mitigates downstream impacts)

Rivers in humid east less susceptible to deglaciation impacts than those in the arid west

Some areas could benefit from increased water availability; others may suffer significant reductions

Unlikely that *all* glaciers will vanish by 2035!


Thank you!