



HighNoon: adaptation to changing water resources availability in northern India with Himalayan glacier retreat and changing monsoon pattern (FP7 project)

Dr. Eddy Moors – Prof. Ashvin Gosain, Dr. Ashok Mishra, Mrs. Suruchi Bhadwal and contributions of the other members of the HighNoon team

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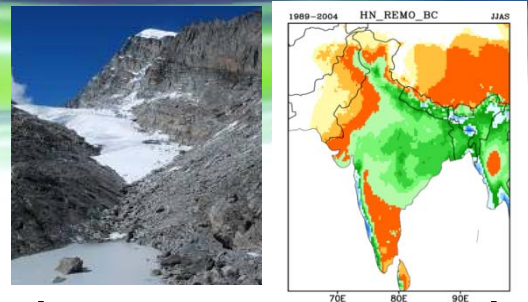
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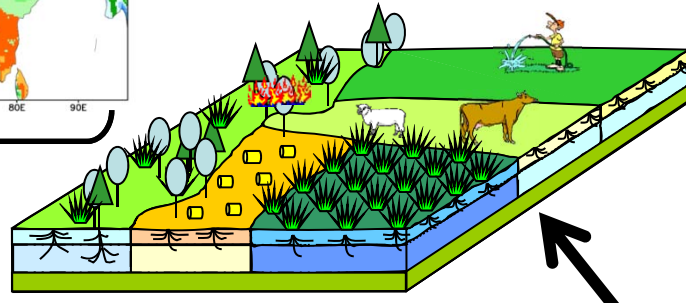
HighNoon Partners

Alterra Wageningen UR,	Netherlands
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Met Office,	UK
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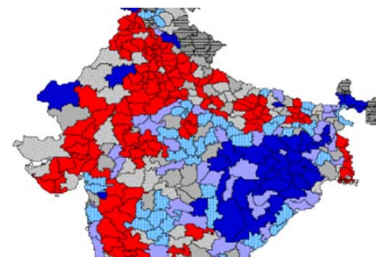
HighNoon Approach



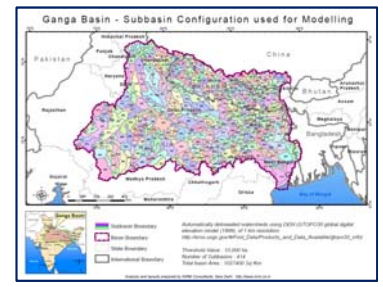
Downscaling of socio economic scenarios



Evaluation of impacts



Water demand



Water availability

Informing



Prioritization



Set of adaptation options

Informing



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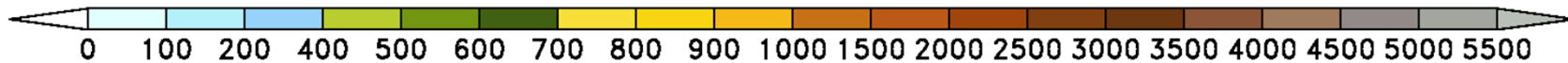
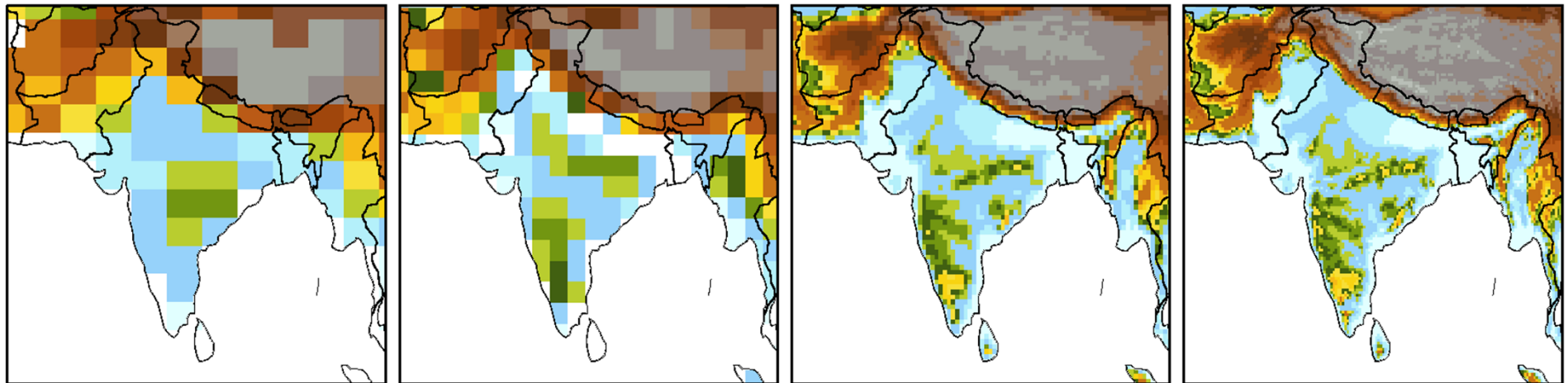
Regional Climate Projections: Orography

~300 Km (HadCM3)

~200 Km (ECHAM)

~50 Km (REMO)

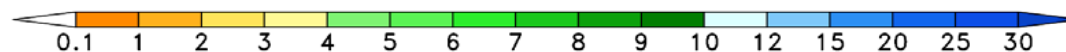
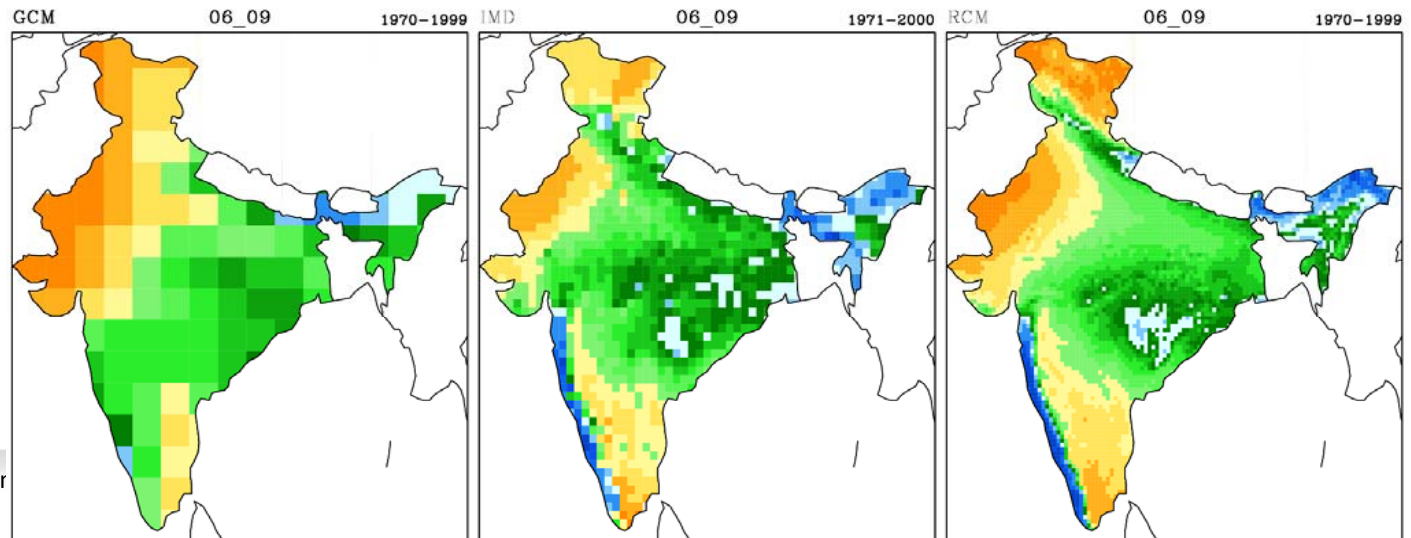
~25 Km (REMO)



GCM ~200Km

Obs ~ 55Km

RCM ~25Km



More realistic monsoon precipitation climate in RCM:1970-1999

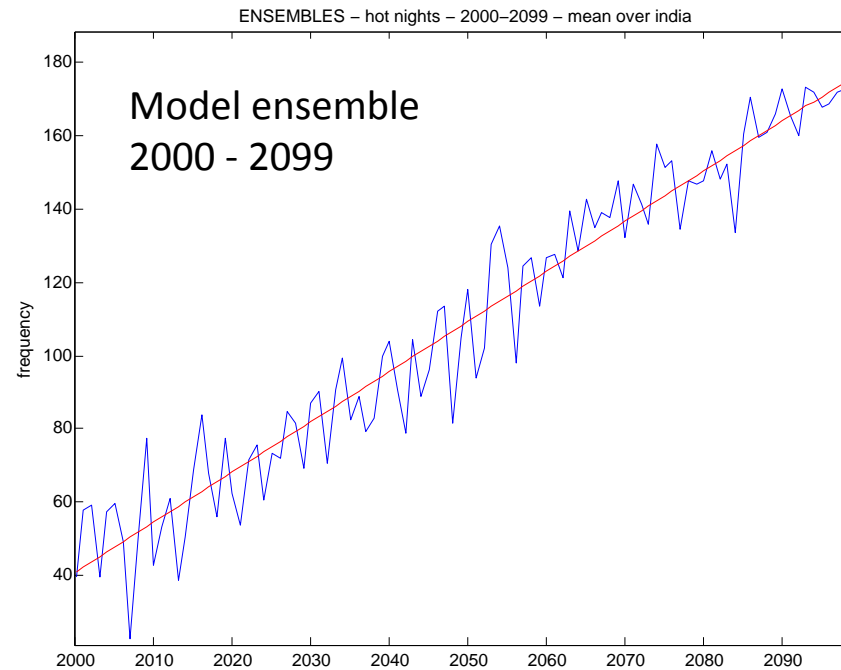
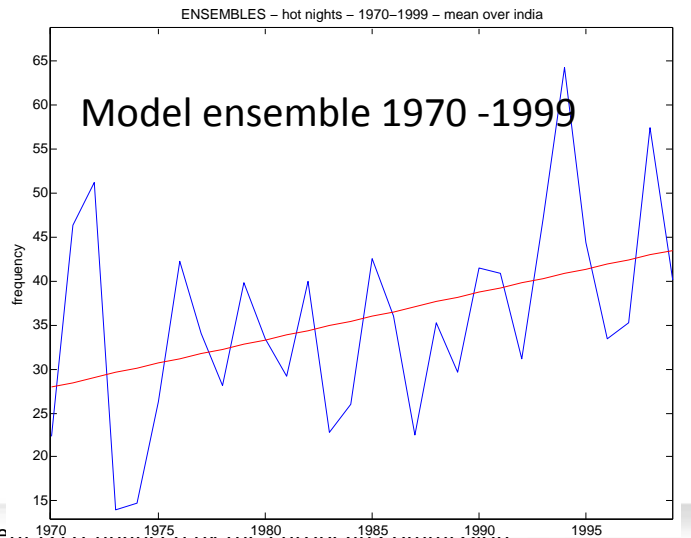
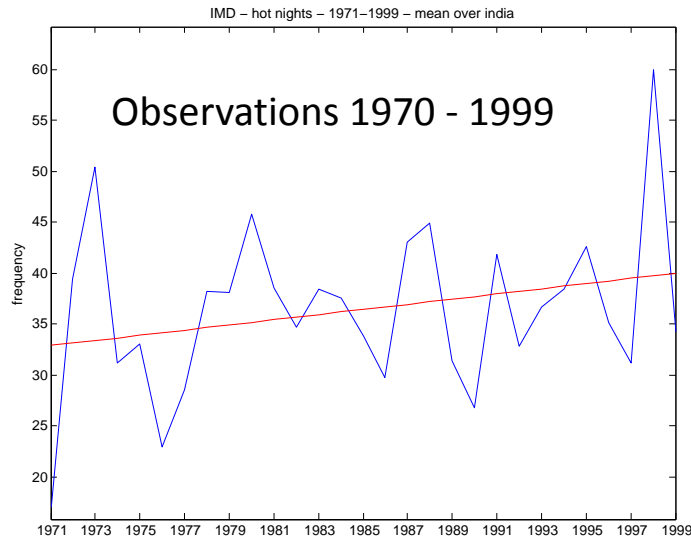
contact:
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Hot Nights

(minimum temperature above 90% percentile)



contact: pankaj.kumar@zmaw.de

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Outcome regional climate projections



- RCM add skill to the regional details
- RCM can not replace GCM
- The first complete Very high resolution (~25Km) multi (4) model RCM data set from 1960-2100.
- Best current Climate information for SA.
- Under A1B scenario, it is very likely to have more frequent hot days/night.
- Extreme precipitation events are likely to be increased

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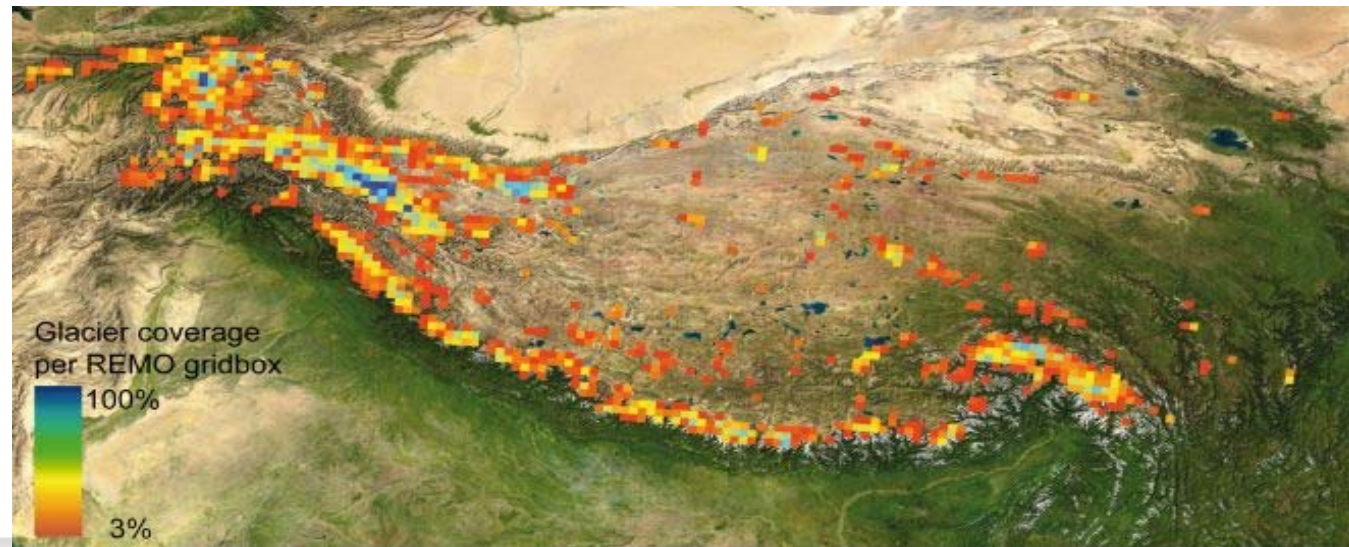


Glacier inventory



HighNoon collected glacier outlines from various databases and compiled a comprehensive inventory of the best available glacier data for Himalayas.

(Science paper May 2012)



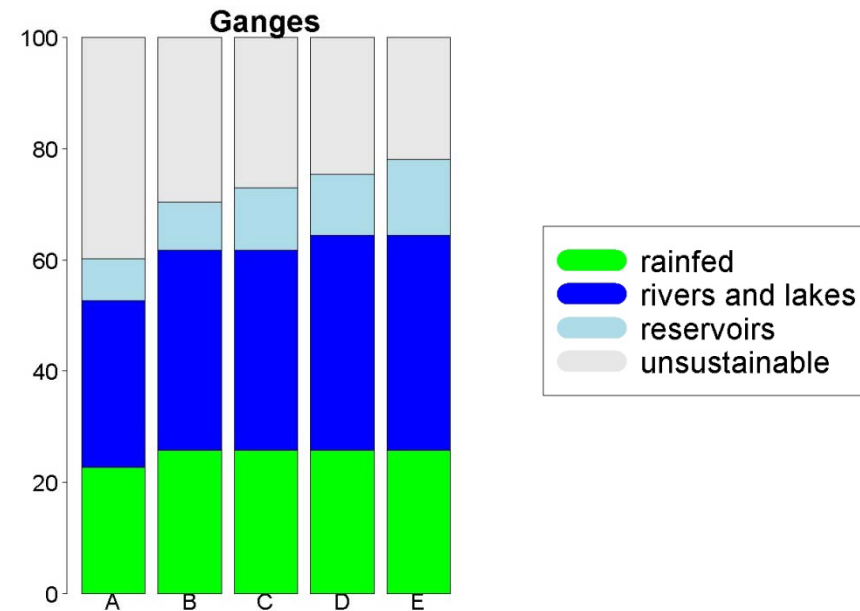
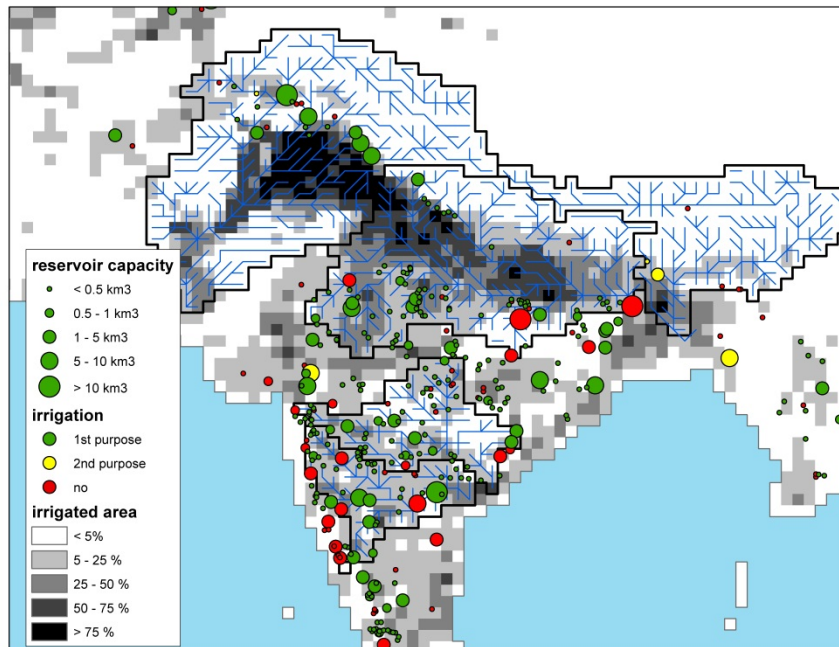
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Water demand



A: current, B: baseline, C: dam cap, D: efficiency, E: dam-eff

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Example of an adaptation option

Agricultural vulnerability to climate change



Sources Google images

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Objective: Improve water and fertilizer use efficiency



Rice and Wheat crops experimentation at IIT Kharagpur to optimize management levels

- Management levels (combination of water and fertilizer)
 - » 3 varieties (early, medium and late maturity)
 - » Irrigated and non irrigated rice crop
 - » Fully irrigated and critical period water application to wheat
 - » Varied fertilizer-N (0 to 250 kg/ha) for both the crops

- The results will be available in May 2012

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Future perspectives

Improved 5-day forecasts may potentially save irrigation water by 20-50% depending on prevailing condition, field management,

Seasonal forecast (3-6 months lead time) may provide opportunity to farmers to make decisions on crop/variety selection,

MAJOR FINDINGS and RECOMMENDATIONS

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Glacier and snow melt

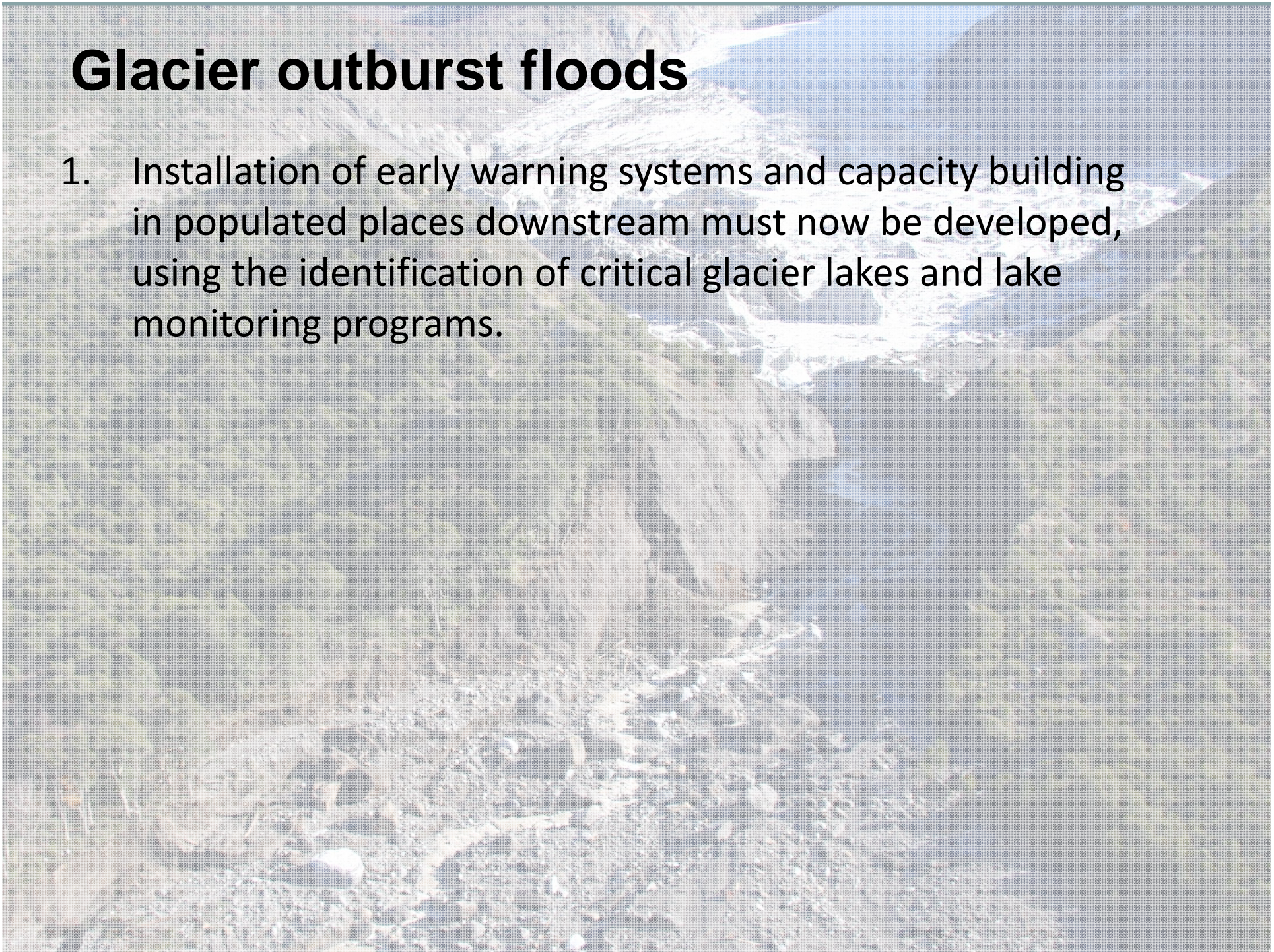
1. More research is needed on benchmark glaciers so as to better understand their dynamics, evolution, and response to climate change.
2. Better understanding of dynamics of snow-rainfall line in Himalayas will greatly improve the value of precipitation input for hydrological models

Climate projections

1. More research is needed to understand the regional and global mechanisms driving the Indian Monsoon. In particular to understand the reasons behind past changes in the Monsoon
2. Robust climate adaptation decision making needs to account for both the uncertainty in future climate projections and for natural climate variability, which may lead to short-term variation in climate change trends.
3. When limited in financial resources, invest in regional climate models for spatial detail and in multiple general circulation models for spread in emission scenario outcomes.

Glacier outburst floods

1. Installation of early warning systems and capacity building in populated places downstream must now be developed, using the identification of critical glacier lakes and lake monitoring programs.



Adaptation planning

1. Planning should be tailor-made at the river basin scale.
2. At present, adaptation measures in India are planned at national and state level, not taking into account the physical boundaries of water systems.

Adaptation options

1. Results from the HighNoon project could be transferred to other countries trying to achieve the Millennium Development Goals and Green Economic Growth.
2. Forecasts may provide important information to decision makers.
3. Recent scientific developments have led to an increasing skill in long-term forecasting on the seasonal, annual and decadal scales.

Stakeholder involvement

1. To increase resilience, adaptation plans should be made locally specific. Enabling the exchange of case studies and good practices will facilitate the development of robust solutions (e.g. climate-adapt.eea.europa.eu)
2. To support decision making on climate change adaptation, climate science information need to be made available to stakeholders at all levels in an understandable format and at a scale and detail which is relevant to stakeholders.
3. More empirical research is needed integrating participatory qualitative methods and quantitative model based outcomes

Remarks by different EU and Indian team members

Exchanges less than a month are just a visit! (EU)

European partners far more empowered (good for research) than Indian partners (India)

Distance was not a problem (EU)

More interaction would have been welcomed (India)

All decisions and output had to first pass by head of the group, this slowed down the exchange (EU)

Working with social scientists in the case studies was good, because they were sensitive towards cultural differences (India)

Watching cricket created a bonding outside working ours (statement by non-UK European)

Surprise: Thought I was eating yoghurt, but turned out to be beef ... (India)

Thank you for your attention

See for info:

- www.eu-highnoon.org
- gissserver.civil.iitd.ac.in/HighNoon/HighNoon.aspx (indicator toolbox)

Science policy brief:

Moors & Siderius, 2012.

Overview paper:

Moors et al., 2011. Adaptation to changing water resources of the Ganges basin in northern India. *Ecology and policy*, **14**: 758-769

In depth papers:

HighNoon Special Issue, 2012. *Science of the total environment* (In preparation)

What is in a name?

High Mountains
+
Monsoon } HighNoon

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