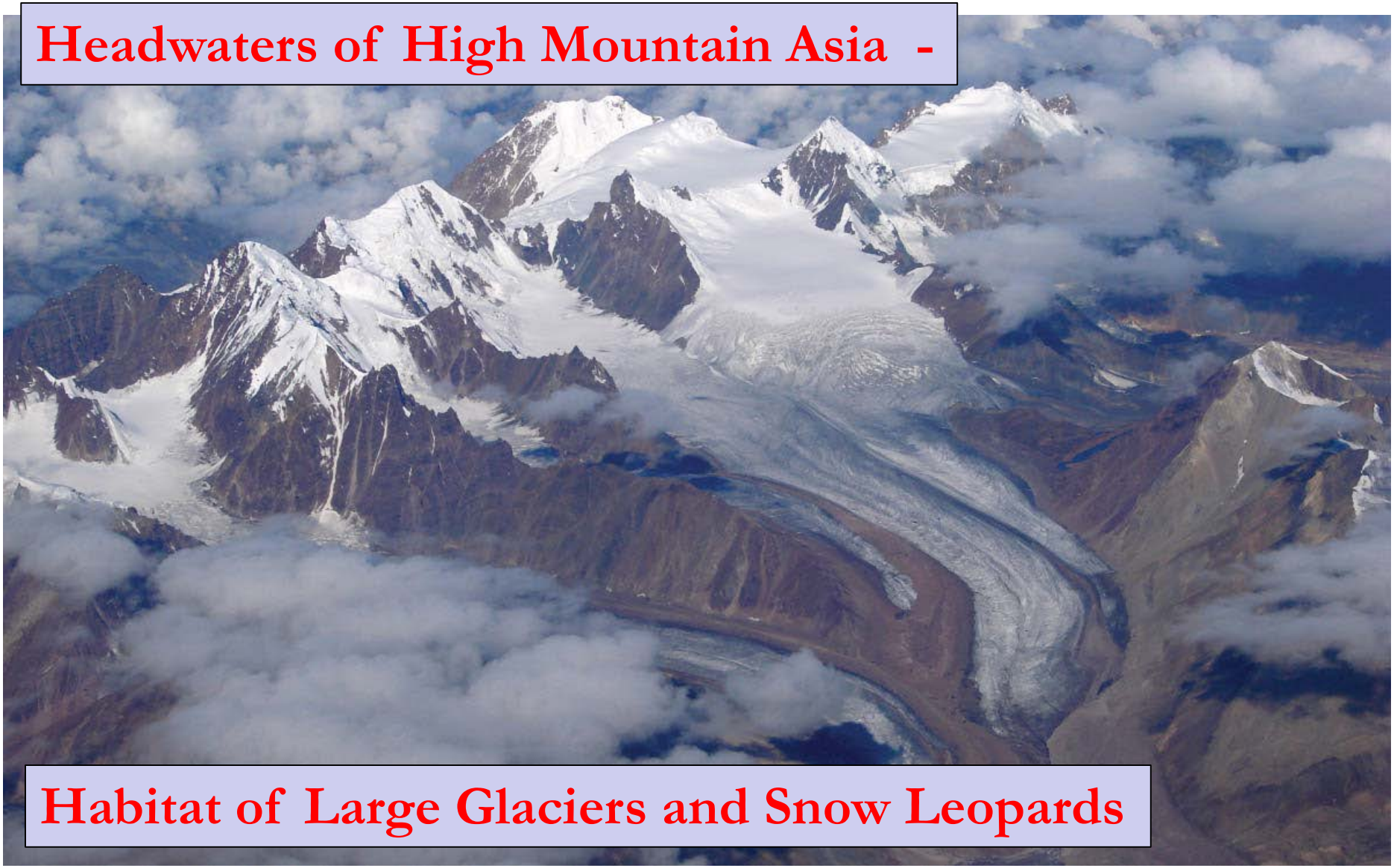
Headwaters of High Mountain Asia -



Habitat of Large Glaciers and Snow Leopards

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International Snow Leopard Day

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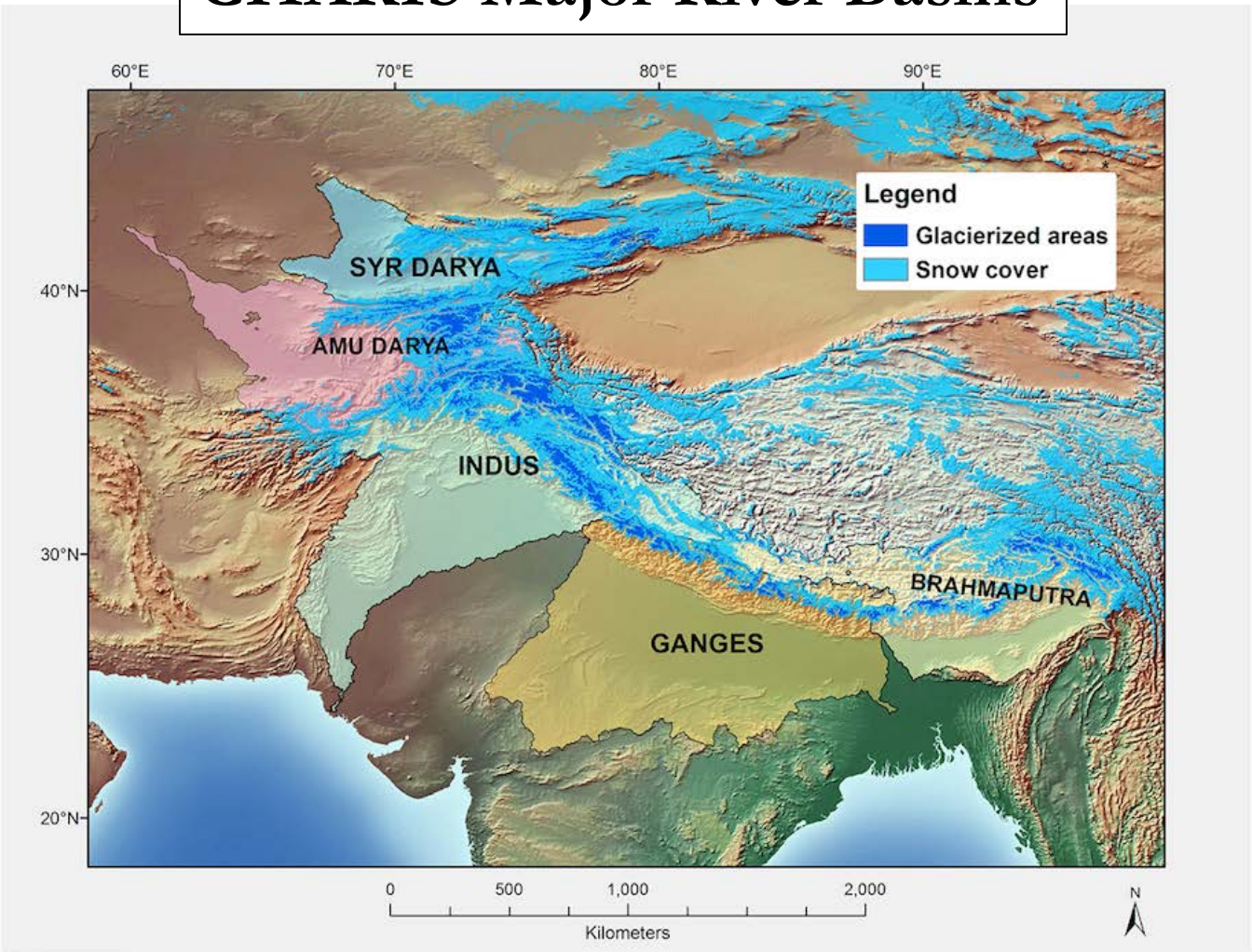
A Collaborative Effort to Assess the Role of Glaciers and Seasonal Snow Cover in the Hydrology of the Mountains of High Asia – The CHARIS Project

R. Armstrong, R. Kayastha, (Asian Project Manager)

M.J. Brodzik, K. Rittger, F. Fetterer, B. Raup, A. Barrett, S.J.S. Khalsa, A. Racoviteanu, A. Khan, A. Hill, A. Wilson, C. Minbaeva, H. Miller, M. Williams, B. Armstrong

CHARIS Major River Basins



Ganges

943,238 km²

Indus

816,846 km²

Brahmaputra

514,170 km2

Amu Darya

449,320 km²

Syr Darya

249,071 km²

Total =

2,972,645 km ²

Snow cover (light blue) represents areas covered with snow for 20% of the time, for the period of record (2001-2014) based on MODIS data; MOD10A1 - snow cover and MOD44W- water mask at 500m resolution.
Glacierized areas (dark blue) represent glaciers from the Randolph Glacier Inventory (RGI v.5)

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CHARIS Project - Contribution to High Asia Runoff from Ice and Snow

Project Concept –

- Realistic, accurate, estimates of future availability and vulnerability of water resources across this very large mountain region are not possible until we have achieved a better understanding of the current hydrologic regime: spatial and temporal patterns of various water sources.

Project Goals for CHARIS -

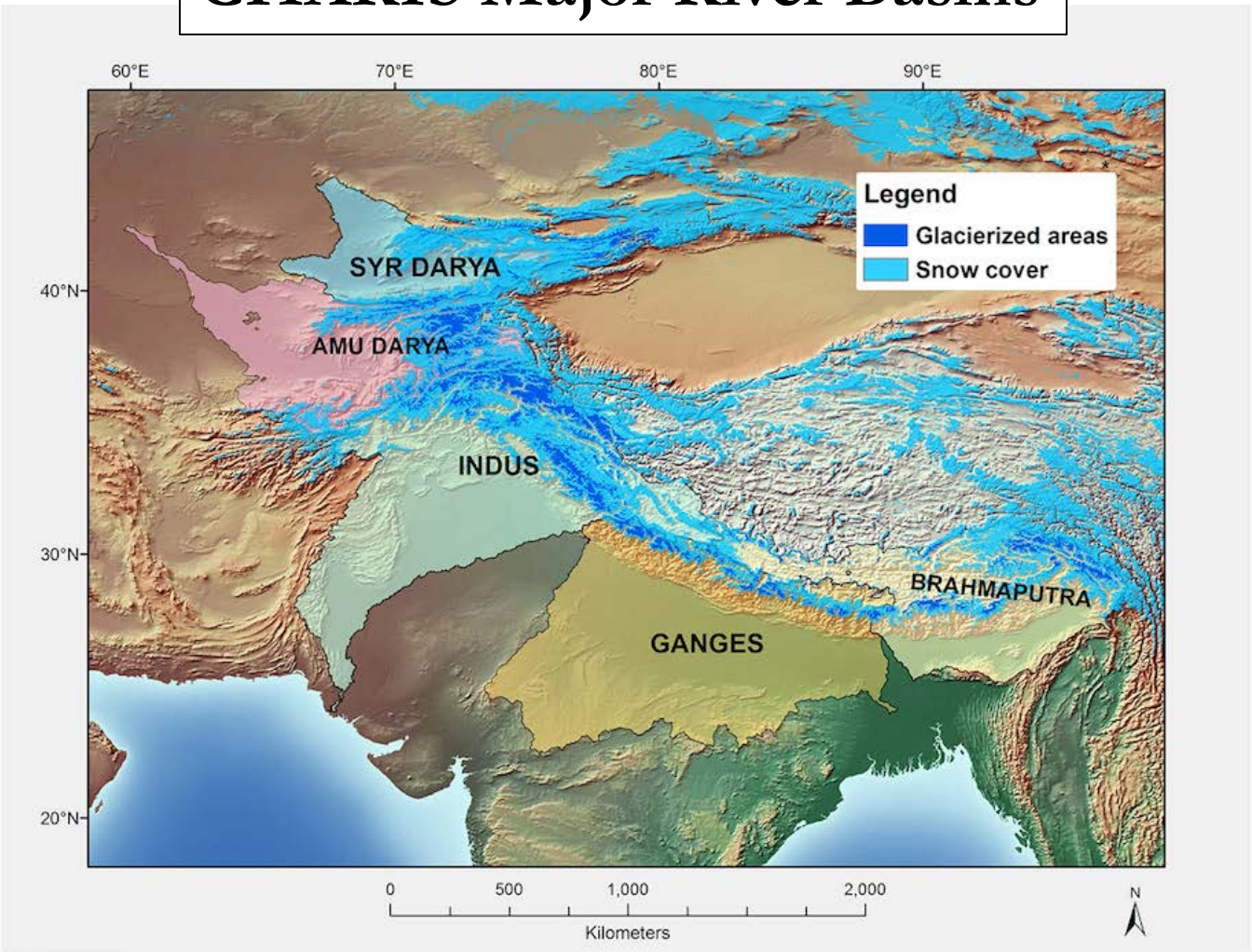
- Apply satellite remote sensing data to develop a thorough and systematic assessment of extent of snow and ice resources.
- Estimate the amount, timing and spatial patterns of snow melt and ice melt, which play a key role in providing water for downstream irrigation, hydropower and general consumption.
- Collaborate with Asian partner institutions: recognize common goals, share methods and data, compare results.

CHARIS Partner Institutions – (mutual benefits)

Nepal, Kathmandu University
Afghanistan, Kabul University
Bhutan, National Center for Hydrology and Meteorology
Bhutan, Sherubtse College, Royal University of Bhutan
India, Jawaharlal Nehru University
India, Sharda University
Kazakhstan, Institute of Geography
Kyrgyz Republic, Institute of Water Problems and Hydropower
Pakistan, Karakoram International University
Pakistan, Water and Power Development Authority WAPDA
Tajikistan, Institute of Water Problems, Hydropower, Ecology

CHARIS Partner Training and Capacity Building Workshops

CHARIS Major River Basins



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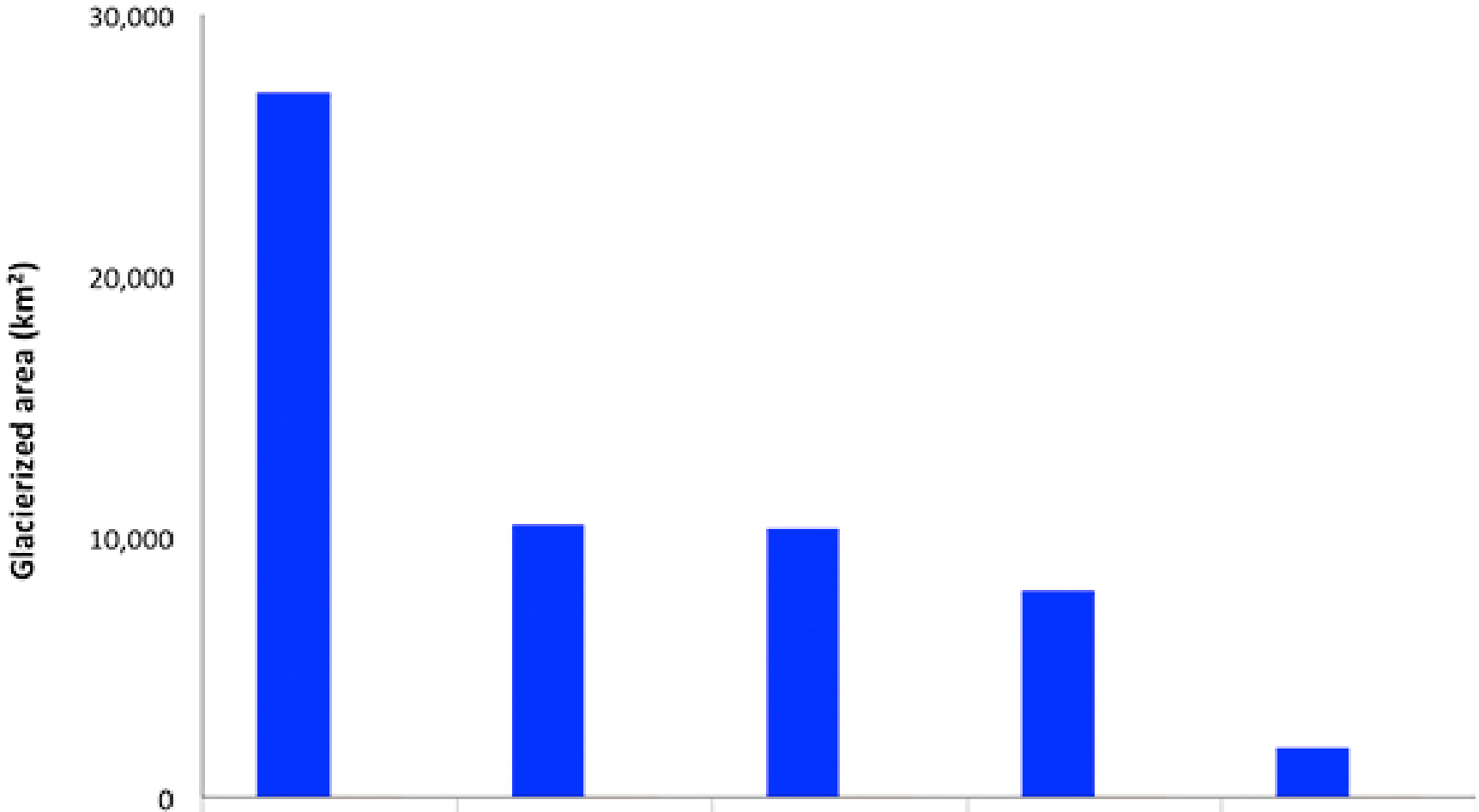
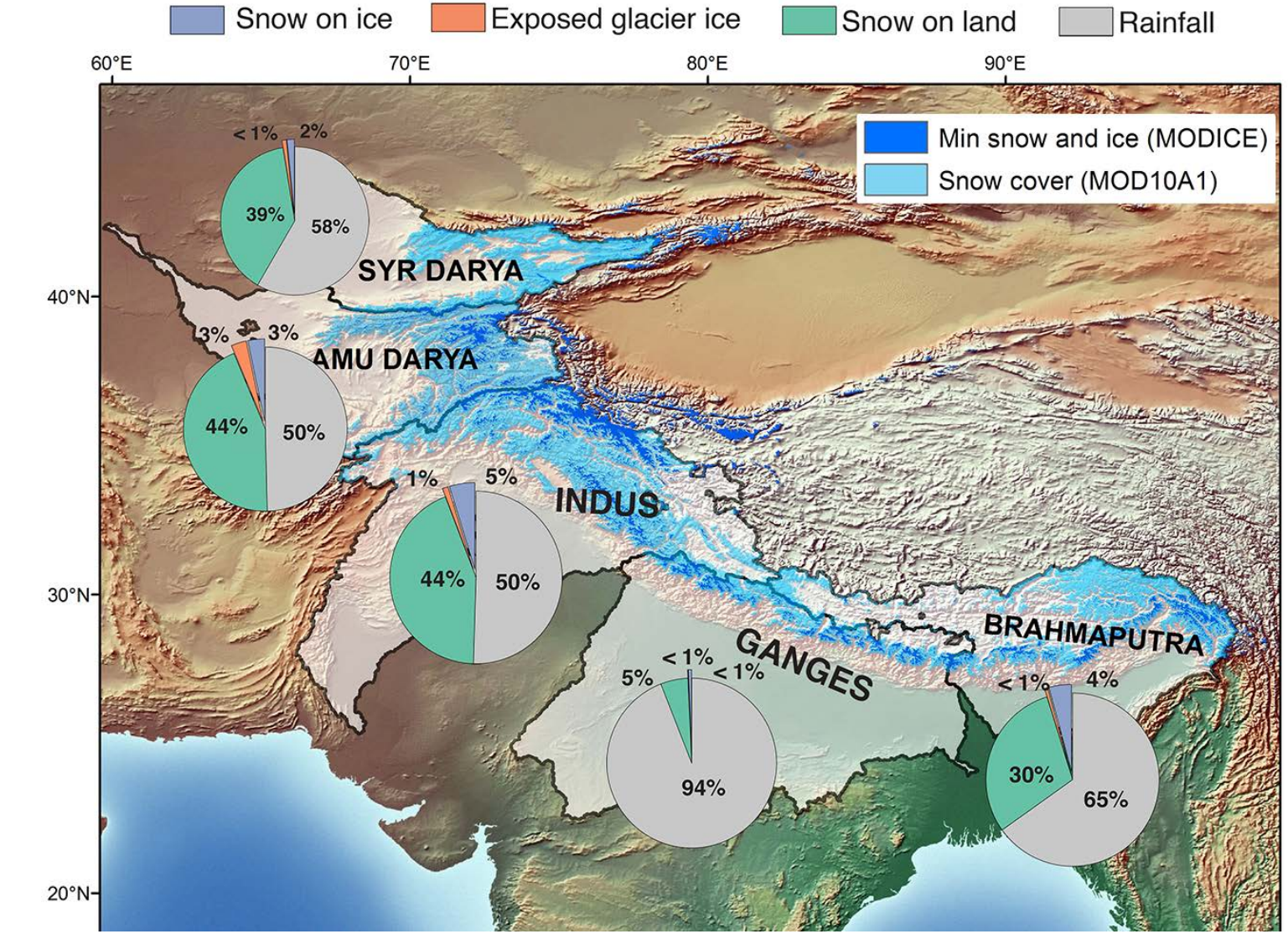
Glacier area by basin in the CHARIS region

(Randolph Glacier Inventory, RGIv5/GLIMS/NSIDC)



	INDUS	BRAHMAPUTRA	AMU DARYA	GANGES	SYR DARYA
Glacier Area [km2]	26,982	10,483	10,321	7,931	1,881
% Basin glacierized	3.24	1.65	2.29	0.94	0.86

Annual mean melt contribution of snow, ice and rainfall to runoff in full CHARIS basins – 2001 - 2015



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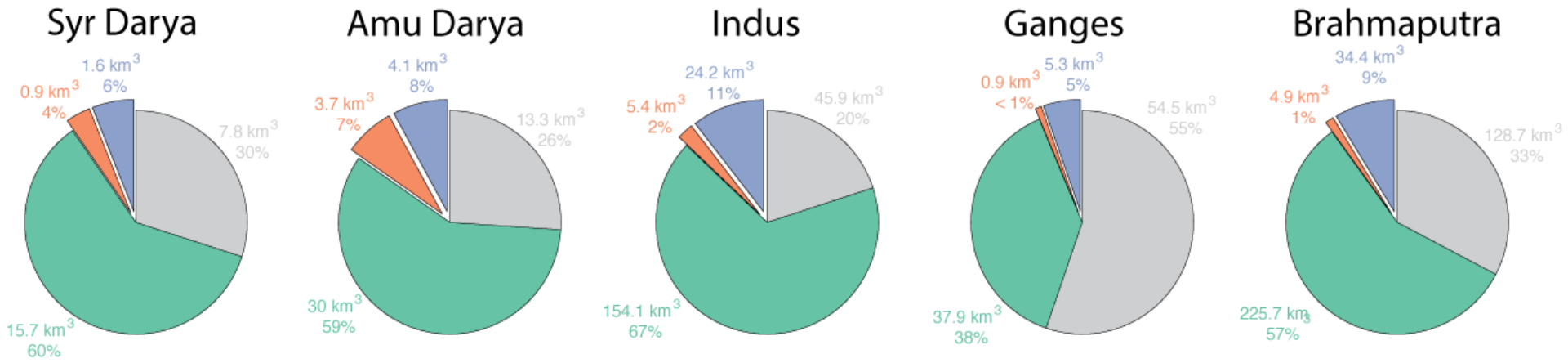
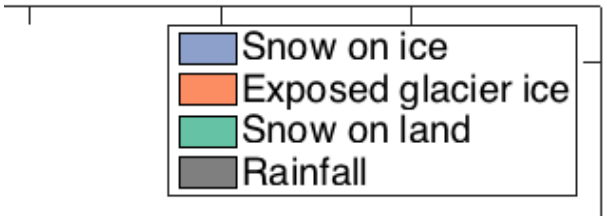
Calibrated model results: annual averages across 5 full basins - what clearly stands out in general

- Contribution from glacier ice melt approximately 1-5 % for SY, AM and IN, with less than 1% for GA and BR
- Contribution from snow on land in the west, SY, AM, IN approx. 40%
- Minimum contribution from snow on land in GA, approx. 5% due to large area at lower elevations, major contribution from monsoon rainfall, more than 90%
- Significant contribution from snow on land in BR, approx. 30%, because of the greater area at higher elevations

Annual mean melt contribution from snow on ice, exposed glacier ice, snow on land and rainfall to the 5 CHARIS study basins – 3,000 m to 6,000 m. (9,840 ft. to 19,680 ft.)



EGI + SOI%				
~10	~15	~13	~6	~10



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Basic Conclusions

- Primary contribution from glacier melt across region is consistently limited to June-July-August.

- Contribution from glacier ice melt significant in western High Asia (15-20%) but less significant in eastern High Asian (<5%) regions that are dominated by monsoon.

- In general, snowmelt contributes 10 times more water than glacier ice melt. (March to September)

- No statistically significant decrease in seasonal snow covered area has been observed over the past 15 years.

- Frequent media reports of rapidly melting glaciers are factual but typically refer to the glaciers at the lowest elevation range.

- Lowest elevations of the glaciers in HMA are generally above the highest elevations of glaciers in North America and Europe.

- Under current climate conditions, the higher elevation Asian glaciers are not melting.

- With increased global warming, that will change.


Thank you from the CHARIS team
http://nsidc.org/charis
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Kyrgyz Republic