

INDUS-FORUM JOINT RESEARCH PROPOSAL

Understanding and Assessing the Impact of Climate Change in the Indus Basin

Work Package 1: Baseline observations

LEAD INSTITUTES: KU AND KIU

Other collaborating partners:

TERI, India; PMD, Pakistan; WAPDA, Pakistan, UIB NETWORK;
Xinjiang, China

SCEIENTIFIC CHALLENGES

- Uncertainty regarding the accurate glacier volumes, distribution & amount of snow packs, and future river discharge projections in the basin.
- How much water is stored in cryosphere and how it moves through the system
- Scarcity of data constrains model studies for accurate prediction of long term runoff.
- The impacts of BC due to higher radiative forcing and albedo changes on snow and glacier melting

WP 1.1: Statistical analysis of the past hydro-meteorological, bio-physical and social data

The WP seeks to understand historical meteorological, cryosphere and hydrologic observations. Additionally, the analysis of land system changes and historic socio-economic data will allow researchers to understand the historic relationship between water availability, demand and social wellbeing

Methods:

- Trend analysis of the hydro-meteorological data in the basin
- Change detection analysis of the LULC from satellite data
- Socio-economic data analysis
- Past/present and future water demand for various sectors (WEAP)

WP 1.1: Statistical analysis of the past hydro-meteorological, bio-physical and social data

Output

- Spatio-temporal variability of all hydro-meteorological variables in the Indus basin,
- Land system changes in the basin
- Socio-economic dynamics in the basin
- Improved understanding of the past and present trends in climate, hydrology, land system, socio-economics etc.
- Water demand for various sectors

Implementation:

- KU/TERI/PMD/WAPDA will be involved in the implementation of the WP
- The processed data will be shared even in cases where the original data cannot be.

WP 1.2: Establishment of long-term benchmark glacier monitoring sites

A key knowledge gap in the UIB is due to the low density of long-term heavily monitored cryosphere study sites. The observations are required to understand how climate, black carbon, snow, glaciers and runoff are distributed throughout the Indus basin and how they interact with each other. The WP will establish several long-term benchmark glacier sites

Methods:

- Glacial/hydrologic/meteorological studies at various spatial levels
- Glacier mass balance studies
 - Glaciological, Hydrological, Remote Sensing, etc.
 - Energy balance studies
- Ice thickness estimations (Models and GPR)
- Glacier velocity estimates
- Black Carbon and albedo change studies

WP 1.2: Establishment of long-term benchmark glacier monitoring sites

OUTPUT

- Strengthening the sparse network of hydro-meteorological, hydrological and glaciological observations in the basin.
- Glacier mass balance and glacier volume estimates;
- Spatio-temporal variation of BC concentration and albedo
- Assessment studies, research based articles published in high quality open access international journals based on new and improved data from benchmark glaciers.

Implementation:

- At least one benchmark glacier in each of the Indus basin country

WP 1.3: Streamflow partitioning using isotope fingerprinting and modelling

The modelling and isotopic composition of streamflow at various sites in the basin will be determined to understand relative contributions from baseflow, rain, snow and glacier melt

Methods:

- Tracer based field observations will be used to partition streamflow (Uhlenbrook et al., 2002).
- Isotope fingerprinting to identify contributions of rain, snowmelt, baseflow and glacier melt water to streamflow

Output

- Partitioning of streamflow into snowmelt, ice melt, rain and baseflow in various sub-basin of the Indus
- CC vs BC influences on HKH cryosphere

Implementation

Multiple sub-basins of the Indus basin. The isotope analysis will be conducted at KU

MEMBERS

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WP1

- SCANTY OBSERVATION SITES (& LOW ALTITUDE STATIONS AND SHORTER RECORDS)
- TRANSECT OBSERVATIONS
- UNCERTAINTIES IN THE PAST OBSERVED DATA NEED TO BE ADDRESSED (META DATA/STANDARDS)
- HIGHLIGHT THE ISSUES WITH THE PAST OBSERVATIONS
- E-WATER RESOURCE MODEL OPEN SOURCE

WP2

- PERMAFROST OBSERVATION
- DIFFERENTIAL BEHAVIOR OF THE GLACIERS, THEREFORE CHOOSE GLACIERS ON THE BASIS OF TYPOLOGY (DEBRIS-NON DEBRIS, SIZE, SOCIO-ECONOMIC IMPORTANCE, CLEANLINESS ETC)
- SYNERGISING WITH THE EXISTING BENCHMARK OBSERVATIONS
- BENCHMARK CATCHMENT APPROACH FOR INSTRUMENTATION
- INCLUDE MORE PARTNERS FROM THE BASIN COUNTRIES (NIH) AND INTERNATIONAL PARTNERS (CSIRO)

WP3

- INCLUDE PERMAPROST CONTRIBUTION TO STREAMFLOWS
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GENERAL SUGGESTION

- WG PAKAGES LEADS TO MEET AND MEET THE LEADS OF THE UIBN
- CO-LEADS FOR OTHER WORKING PACKAGES (UIB-N)

Discussion

- Various Spatial scales
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