

# 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