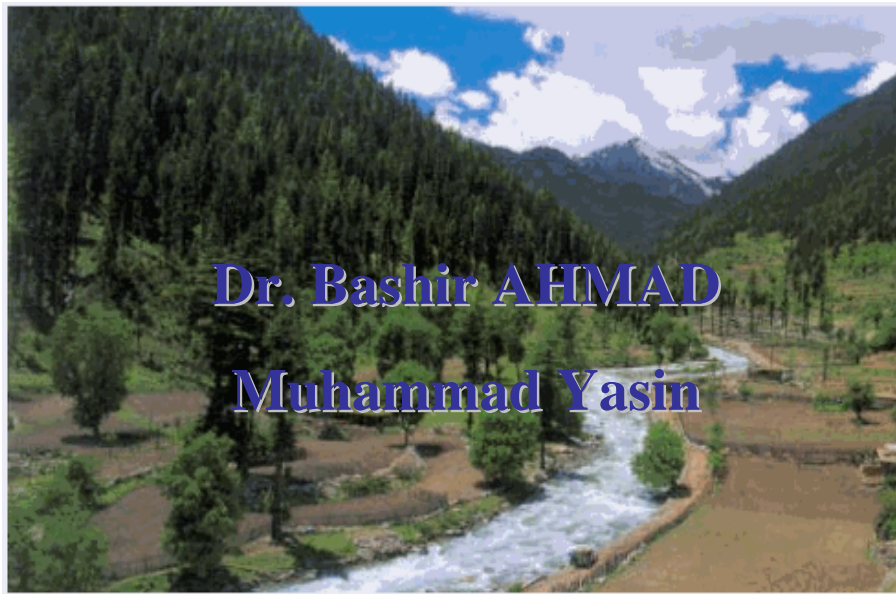
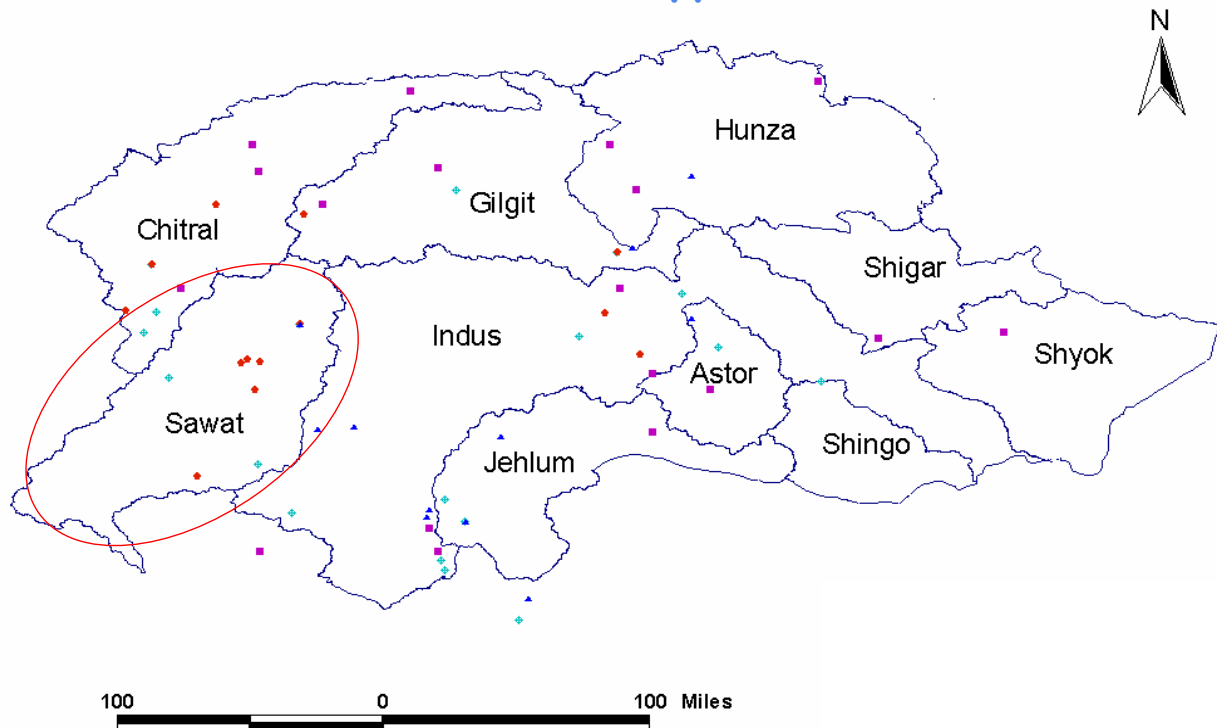


Demonstration Basin Activities in Pakistan



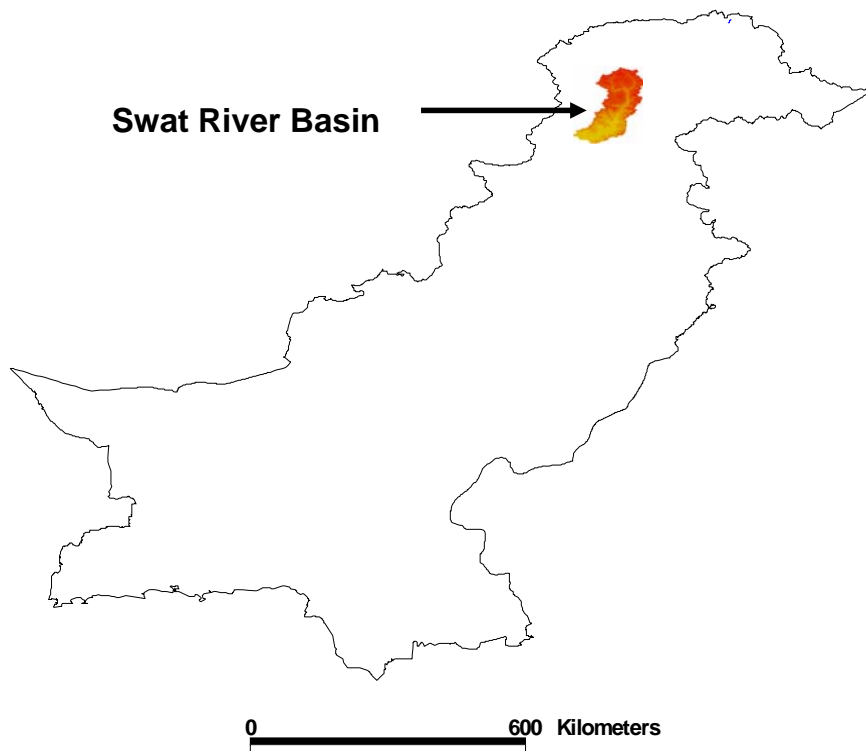
The 3rd GEOSS Asian Water Cycle Symposium

Sub-basins in Upper Indus



Demonstration Basin in Pakistan

Swat River Basins



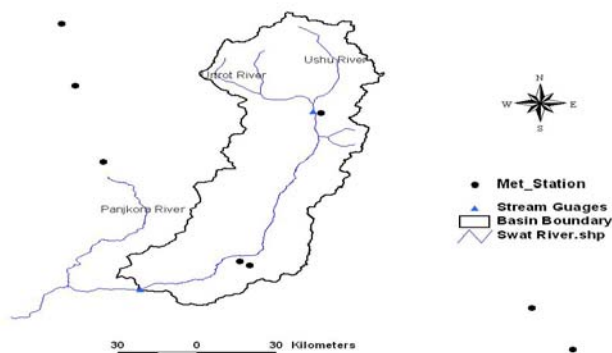
Background

- **Increasing water scarcity and pollution, environmental degradation including desertification are increasing seriously**
- **Possible impacts of the global climate change on fresh water resources of glaciers and snow cover**
- **Present and future water scarcity in the country has overwhelming economical and political implications**
- **Integrated temporal and spatial water resources modeling is required for decision making and long-term planning**

Objectives

- Water resources assessment using Remote Sensing data
- Temporal mapping and database development of Cryosphere based on Remote Sensing data and field validation
- Impact of climate change on snow cover and glacier resources
- Impact of land use system changes in response to climate change
- Water resources management both for operational use and scenario based assessments for planning purposes

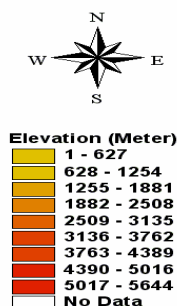
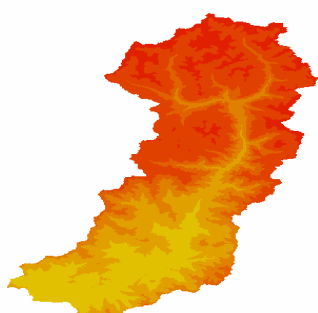
Swat River Basin



Characteristics

- Area (sq. km) 5894
- Maximum elevation (m) 5644
- Upper part mostly covered by snow in winter
- Few Glaciers
- Meteorological stations = 4

Digital Elevation Model
(Swat River)



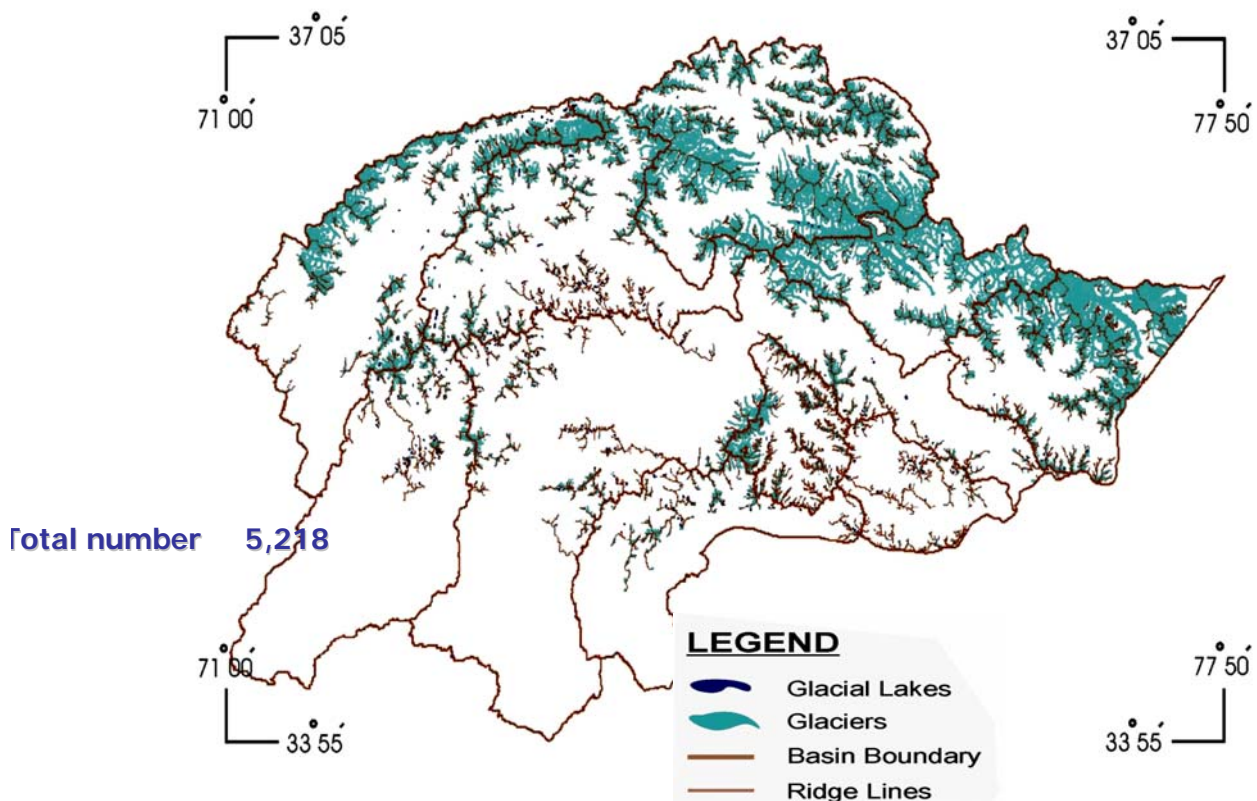
ISSUES

- Water scarcity
- Deforestation
- Snowmelt floods/flash floods
- Soil erosion
- Sedimentation
- Water quality
- Monitoring at high altitude

Observation System

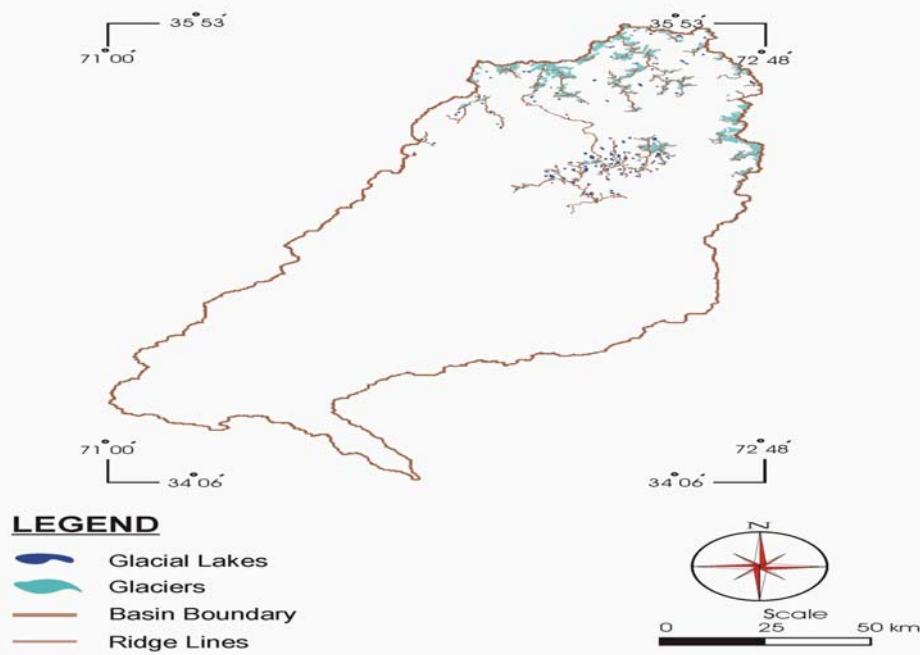
SURFACE	Number	HYDROLOGICAL	Number
Air Temperature	4	Streamflow	2
Humidity	4	Reservoir (Water level, Outflow)	
Wind	4	Groundwater Table	
Pressure	4	Evaporation	3
Precipitation	4	Soil Temperature	
Snow Depth	1	Soil Moisture	
Skin Temperature		Atmosphere	Number
Upward Shortwave Radiation		Planetary Boundary Layer Tower	
Downward Shortwave Radiation	1	Pilot Balloon	1
Upward Longwave Radiation		Radiosonde	1
Downward Longwave Radiation		Radar	1
Net Radiation		Water Quality	Number
Sensible Heat Flux		Groundwater quality indicators	
Latent Heat Flux		Surface water quality indicators	2
Ground Heat Flux		Others	Number
CO2 Flux			

Glaciers of Upper Indus Basins



Source: WRII, NARC (2005) "Inventory of glaciers"

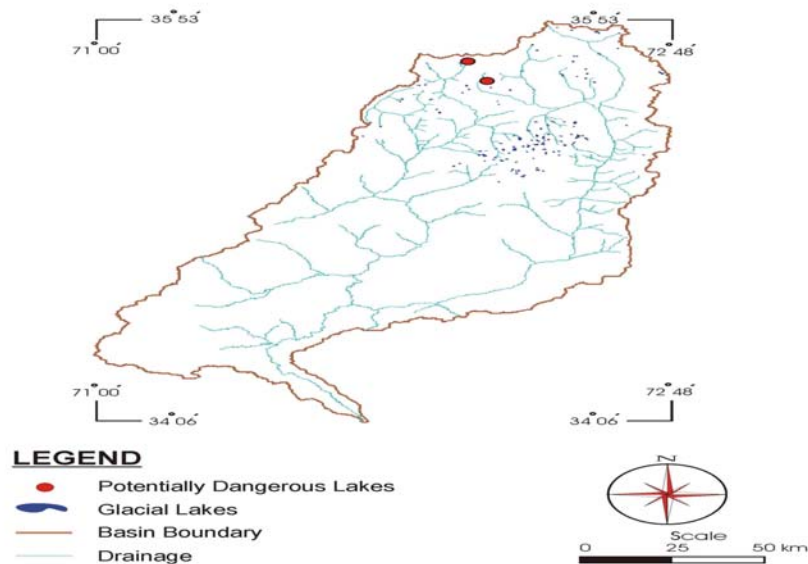
Glaciers of Swat River Basins



The upper reaches of the Kohistan-Swat ranges are mostly covered with snow and glaciers. Glacier area is about 223.55 sq. km. Less information are available about glacier mass balance and snowcover extent.

Source: WRR, NARC (2005) "Inventory of glaciers"

Glacial and Dangerous Glacial Lakes of Swat River Basins



Glacial lakes = 255

Glacial lakes area of more than 15. 86 sq. km .

Glacial lakes are distributed in the north-central parts of the basin

Two potentially dangerous lakes.

Source: WRR, NARC (2005) "Inventory of glaciers"

Implementation Schedule of the Demonstration Project

ACTIVITIES	2008/I	2008/II	2009/I	2009/II	2010/I	2010/II	2011/I	2011/II
Hydro-meteorological & water quality monitoring	—							→
Data integration system (input data preparation, quality check)	—			→				
Improvement of in-situ observation network system	—			→				
Setting-up a Distributed Hydrological Model (optional LSS)	—			→				
Scenario Studies: Land use change analysis, dry periods, etc.				—				→
Capacity building on Floods, Droughts & Water Quality	—							→
Parallel testing of the system at operational stage				—				→
IWRM plan development of floods, droughts & water quality	—							→

Capacity Building Requirements/Programs

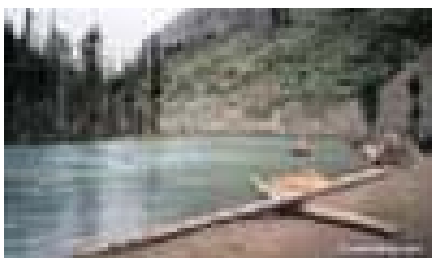
- **Flood & Drought Forecasting and Warning**
- **Flood and Drought Risk Map**
- **Climate Change Scenario**
- **RS Data Availability**

Collaborative Institutes

Pakistan Meteorological Department Climate Change Impact Study Center



Swat River near Kalam Valley



Utrot Valley

Thank you