

## Glacier Monitoring Research Centre (GMRC)

### Background

The Cryosphere (glacier and snow regime) of Upper Indus Basin (UIB) is a major source of the Indus River and its tributaries. WAPDA initiated hydrologic investigations into this region in early sixties by installing river gauging network and valley bottom weather stations. Snow surveys were also carried out in the Kaghan valley from 1961 to 1969. From 1971 to 1974, WAPDA estimated runoff from UIB Cryosphere using Remote Sensing. Later, from 1985 to 1989, WAPDA in collaboration with Canadian Universities carried out UIB snow and glacier field studies to develop flow forecasting system for UIB Rivers.



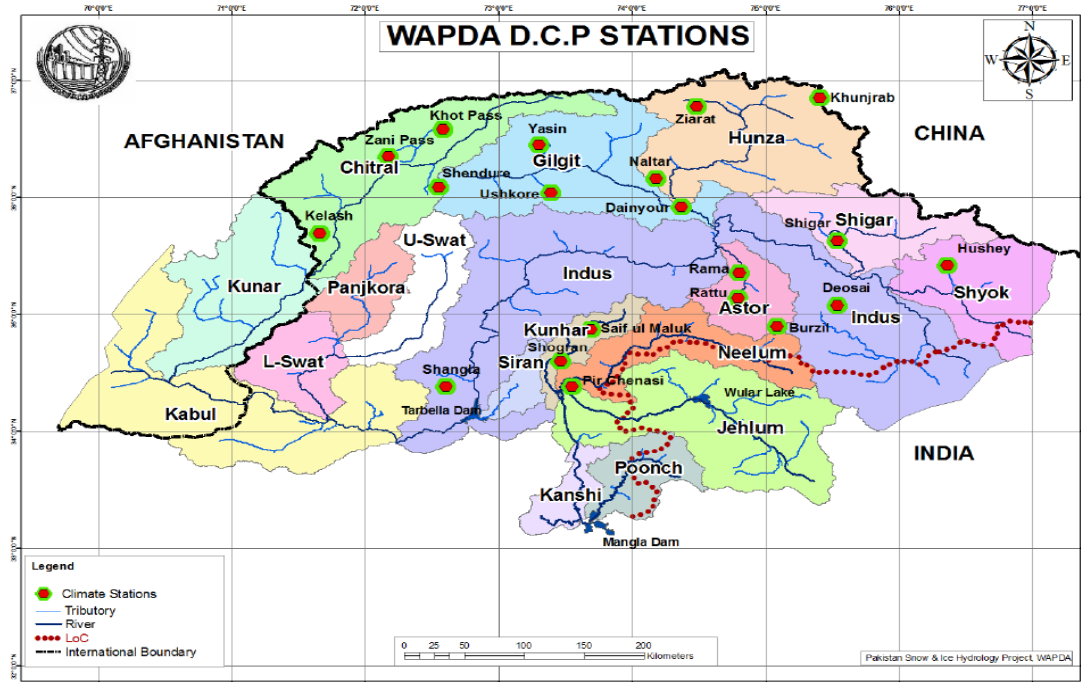
Ablation Measurements by GMRC Team on Biafo Glacier in Shigar Valley (Gilgit-Baltistan)

Hispar Pass -Central Karakoram  
Snow Pit Investigations - Glacial  
Accumulation Zone  
(6400 meters above sea level)



## High-Altitude Weather & Hydrologic Modeling

During 1991-1997, WAPDA established high-altitude (2200-4800 m.a.s.l.) network comprising 20 weather stations for collection & transmission of hourly data on temperature, precipitation, relative humidity, wind, solar radiation and snow water equivalent. This is one of world's highest (elevation) automated weather data collection and quasi-real-time transmission network.



High-Altitude Weather Data Network (DCP Stations) in the Upper Indus Basin)



GMRC Weather Station at Khunjerab (4750 m.a.s.l)



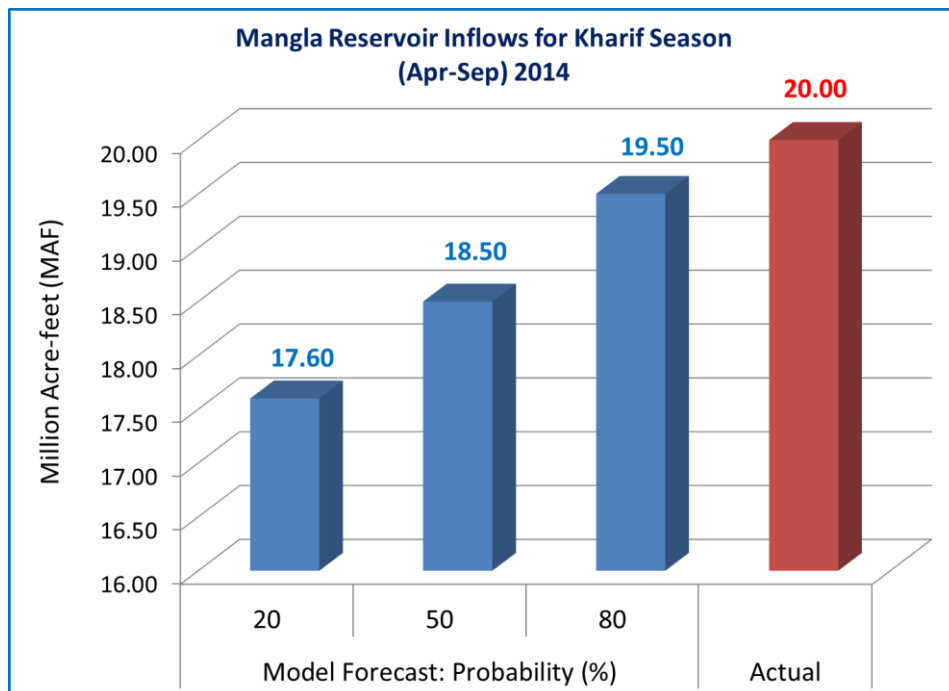
GMRC Team measuring Snow Water Equivalent (SWE) at Shogran in Kaghan Valley



GMRC Team at DCP Station Shogran in Kaghan Valley for Inspection and Data Validation

The high-altitude data and UBC Watershed Model are being used for forecasting flows on seasonal (*Rabi and Kharif*) and short-term(10-Daily) basis since 2003 for better water management of Indus River System. The seasonal and 10-daily flow forecasts for Indus River at Tarbela, Kbaul River at Nowshehra and Jhelum River at Mangla are provided to the Indus River System Authority (IRSA), WAPDA authorities at Tarbela Dam, Chashma Barrage and Mangla Dam and the Pakistan Meteorological Department (PMD) on regular basis.

In 1991, WAPDA in collaboration with University of Colorado, Boulder (USA) carried out a study on impacts of climate change on the Indus River System using the UBC Watershed Model and Global Circulation Models. Furthermore, the Snowmelt Runoff Model (SRM) was applied to the Mangla Dam catchment (Jhelum River) for flow forecasting with very encouraging results. SRM would now be used for Kabul and Chenab rivers.



### Glacier Monitoring Program

Climate change poses new challenges as it threatens the frozen water reserves of Pakistan. Glacier Monitoring Program (GMP) has recently been initiated to monitor changes in UIB glaciers by using advance remote sensing and GIS techniques. Mass-balance studies will be carried out in the field for five major glaciers. Fifty-two UIB glaciers have been selected for monitoring and mapping of fluctuations in their termini. A Field Office of GMRC is being established at Skardu to initiate activities beginning the summer season 2015.

