Report on Demonstration River Basin Activities

Gilgit Basin

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The 6th International Coordination Group (ICG) Meeting
GEOSS Asian Water Cycle Initiative (AWCI)
Tokyo, Japan, 5-6, November 2010

Upper Indus Basins

Glaciers:

5,218
Covered Area:
15,040 Sq. km
Total ice reserves:
2,738.5km^3

*Shyok, Shigar and Hunza Basins contain **83%** of total ice reserves*

Glacial lakes:

Total Glacial Lakes:
2,420
Covered Area:
126 Sq. km

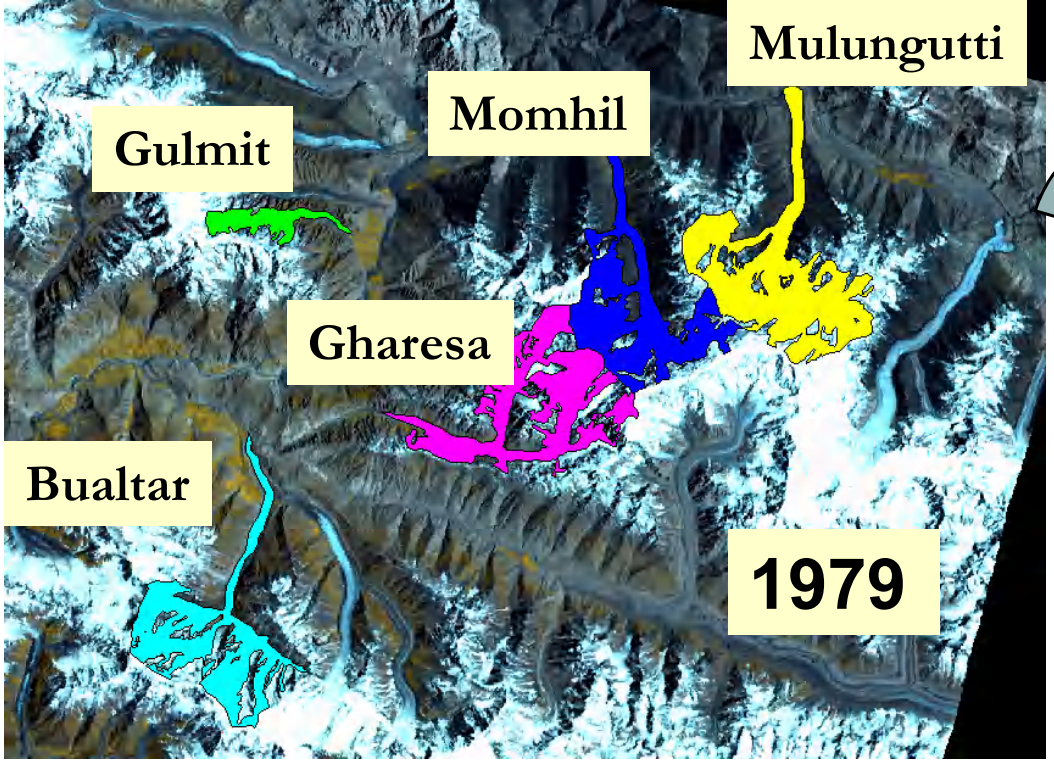
Potentially dangerous lakes:

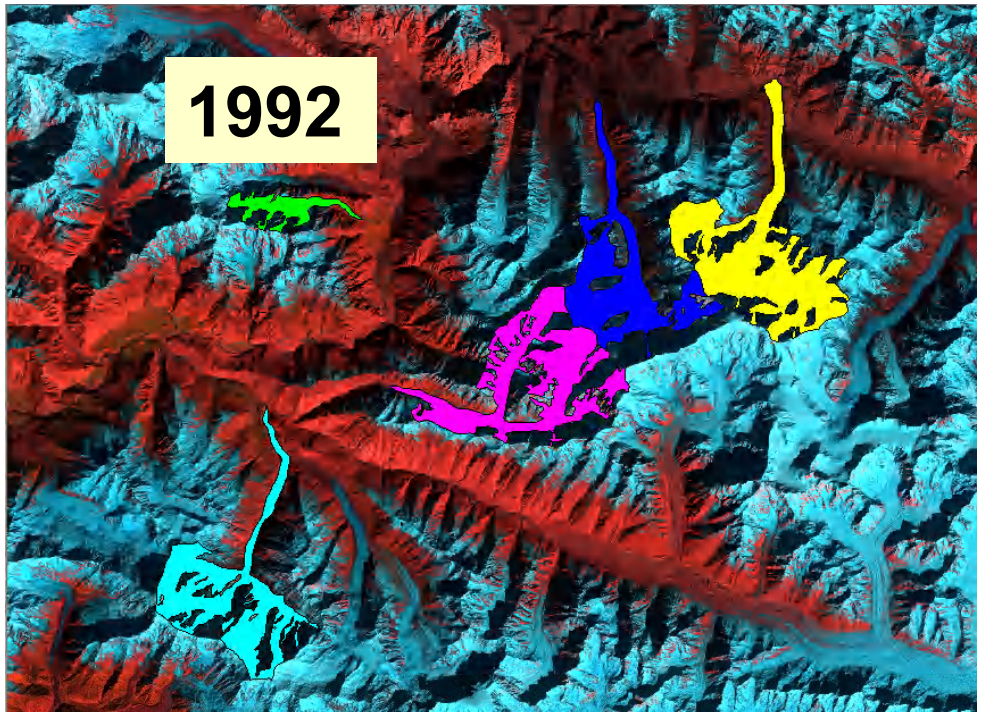
52

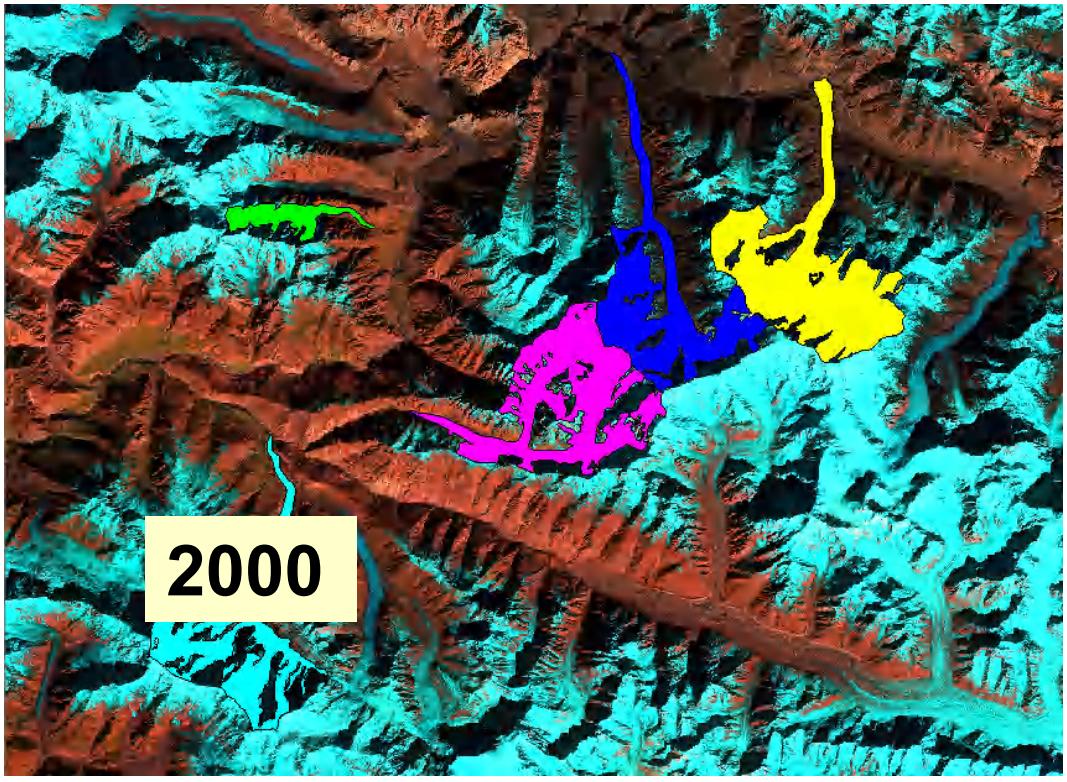
CLIMATE CHANGE IMPACTS ON GLACIER ENVIRONMENT

KARAKORAM GLACIERS

Five KARAKORAM GLACIERS





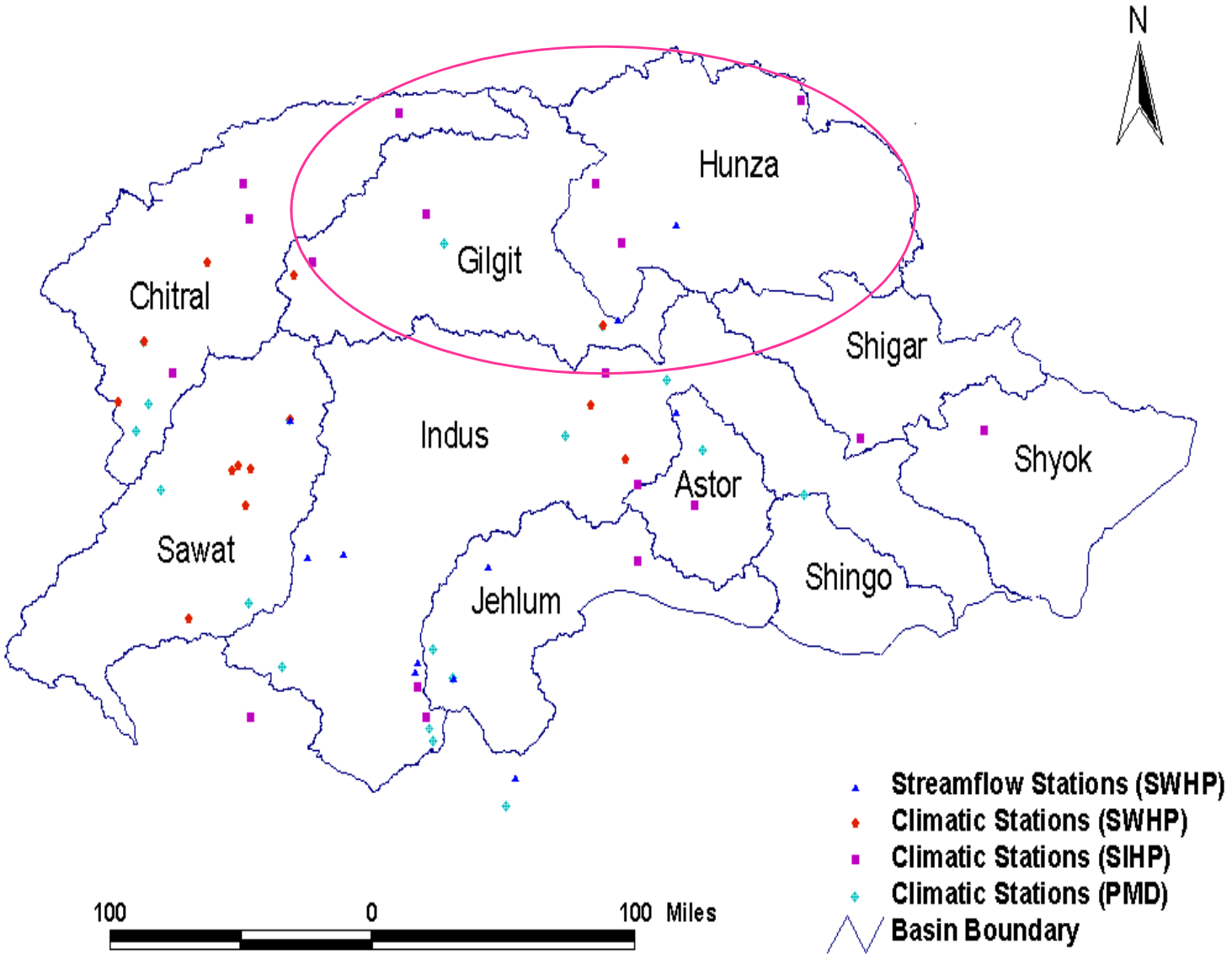


Five Karakoram…Glaciers Area (sq.km)

Glacier	1979	1992	2000
Mulungutti	97.96	97.25	96.35
Bualtar	63.69	63.63	63.46
Gulmit	14.21	14.05	14.07
Momhil	73.48	75.59	75.04
Gharesa	70.23	81.77	83.05

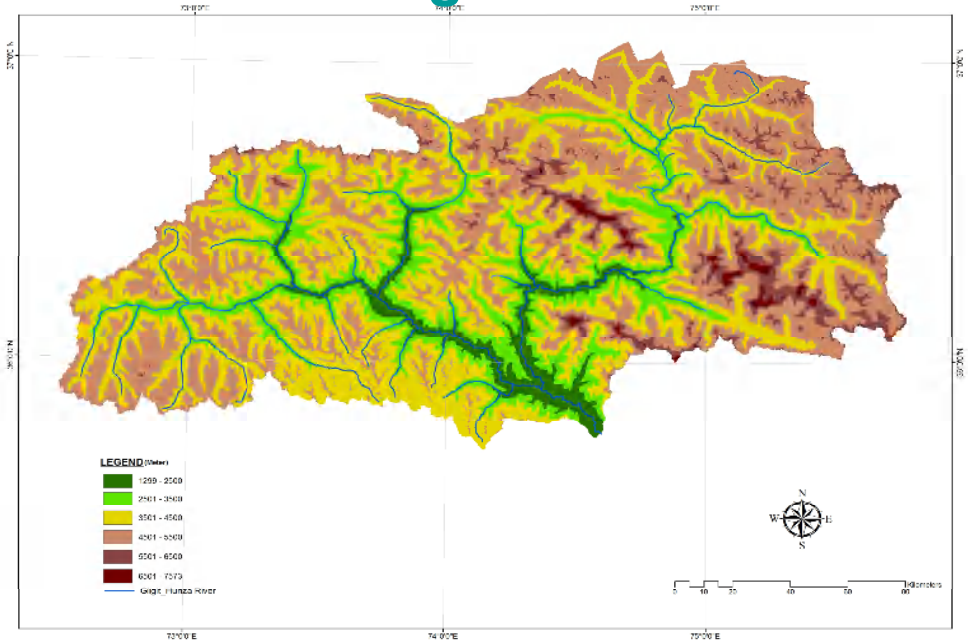
Demonstration River Basin in PAKISTAN

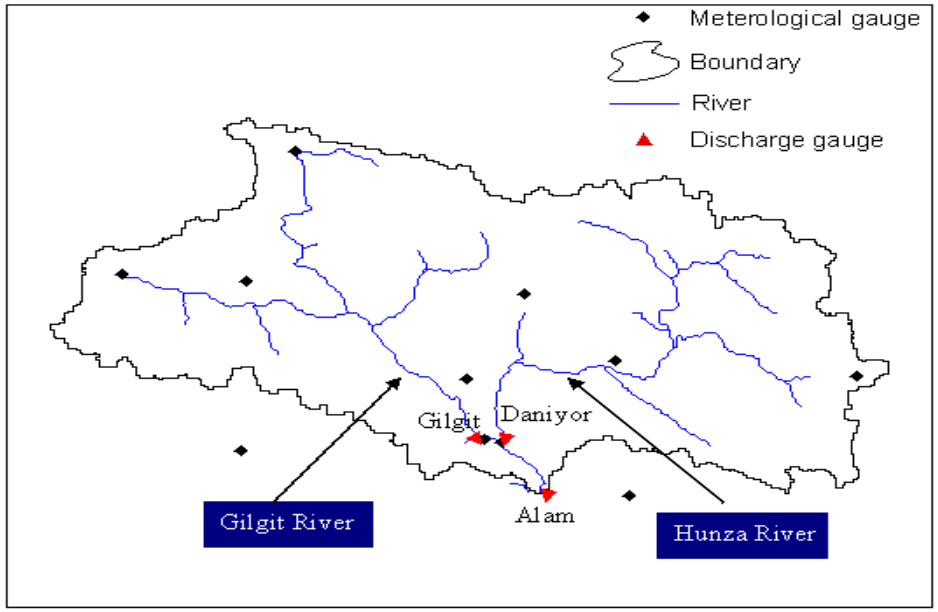
Gilgit River Basin at Alam bridge (Gilgit & Hunza)

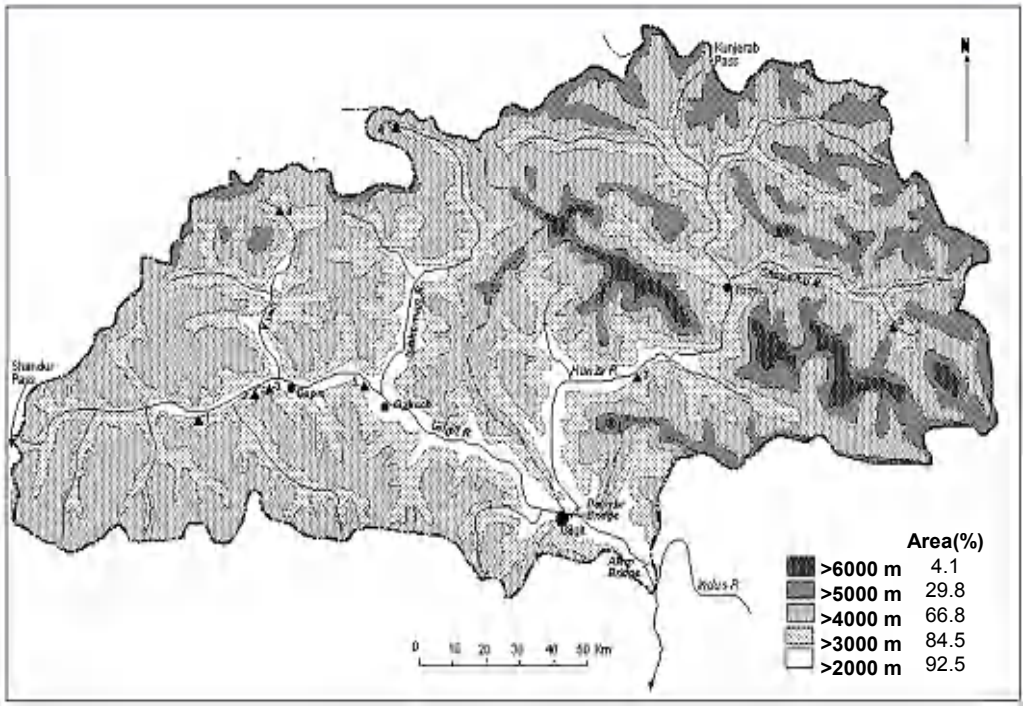


Demonstration Basin = Gilgit & HUnza

DEM of Gilgit River Basin

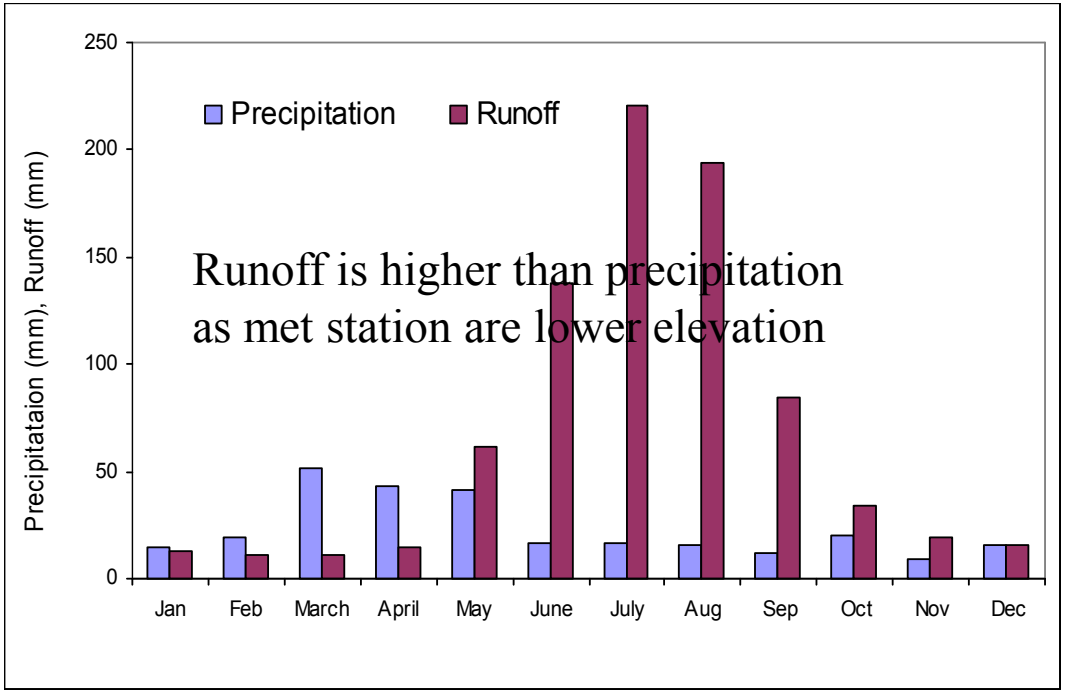




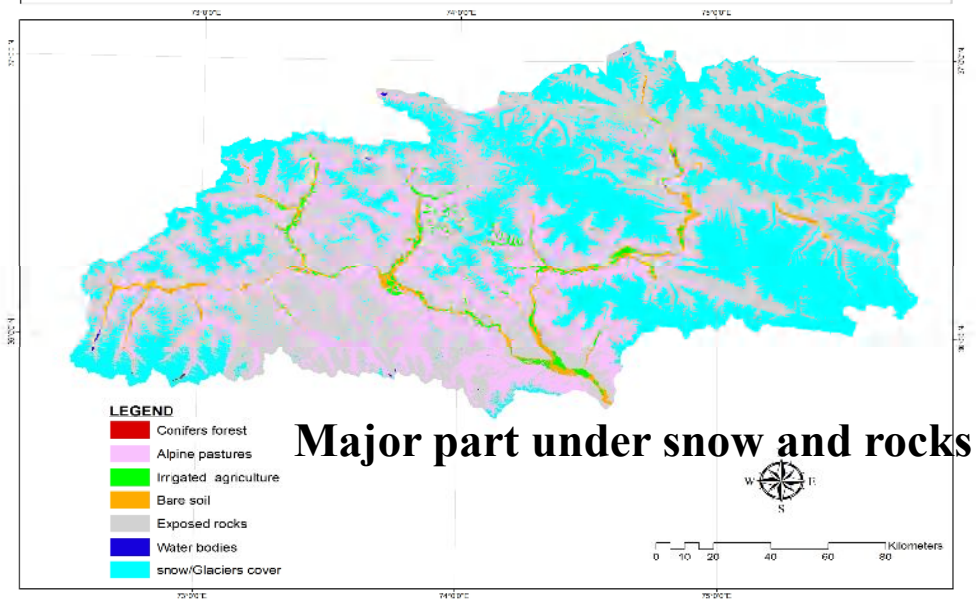


- Gilgit basin area 26200 km^2
- Annual precipitation = 300 mm
- Annual runoff = 800 mm
- Two main tributaries, Gilgit and Hunza
- Hunza River at Daniyor 13157 km^2
- Gilgit River at Gilgit 12095 km^2

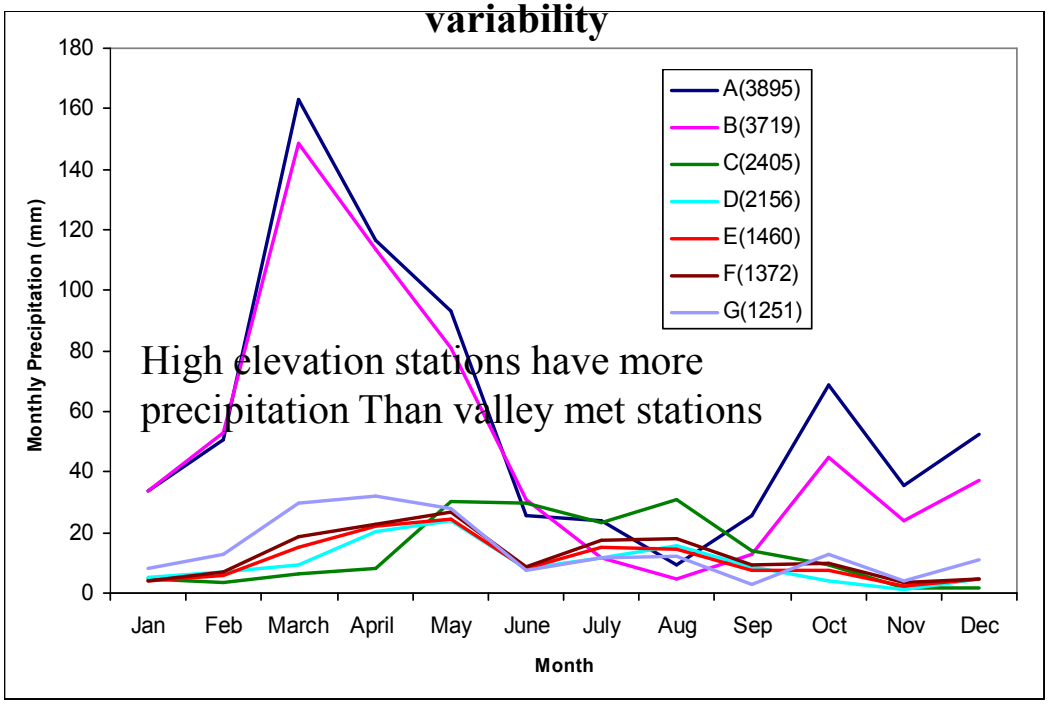
Monthly runoff and precipitation comparison



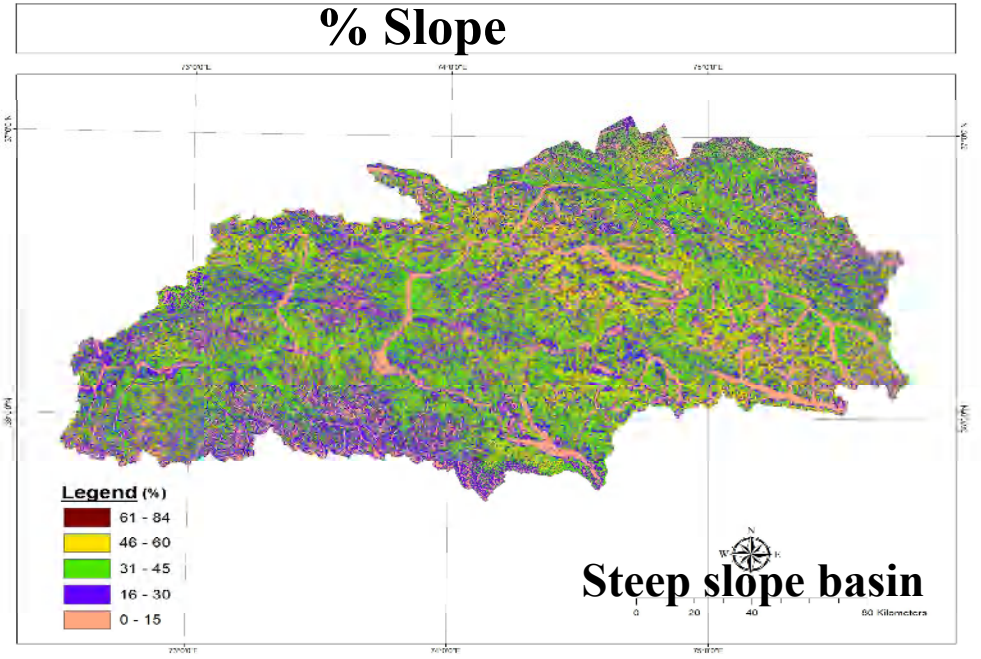
Land Use / Landcover



Inter-station and seasonal precipitation variability



% Slope



Observation Information Status of Gilgit River Basin

SURFACE	Number	HYDROLOGICAL	Number
Air Temperature	14	Streamflow	3
Humidity	14	Reservoir (Water level, Outflow)	
Wind	14	Groundwater Table	
Pressure	5	Evapolation	**3**
Precipitation	14	Soil Temperature	
Snow Depth	5	Soil Moisture	
Skin Temperature		**Atmosphere**	**Number**
Upward Shortwave Radiation	5	Planetary Boundary Layer Tower	
Downward Shortwave Radiation	5	Pilot Baloon	
Upward Longwave Radiation		Radiosonde	
Downward Longwave Radiation		Radar	1
Net Radiation		**Water Quality**	**Number**
Sensible Heat Flux		Groundwater quality indicators	1
Latent Heat Flux		Surface water quality indicators	3
Ground Heat Flux		**Others**	**Number**
CO2 Flux			10

Glacier study Hunza Basin

Location map of Hunza River Basin

Basin Area (Km²): 16389

Glaciated area (Km²): 4677.34

No. of Glaciers: 1050

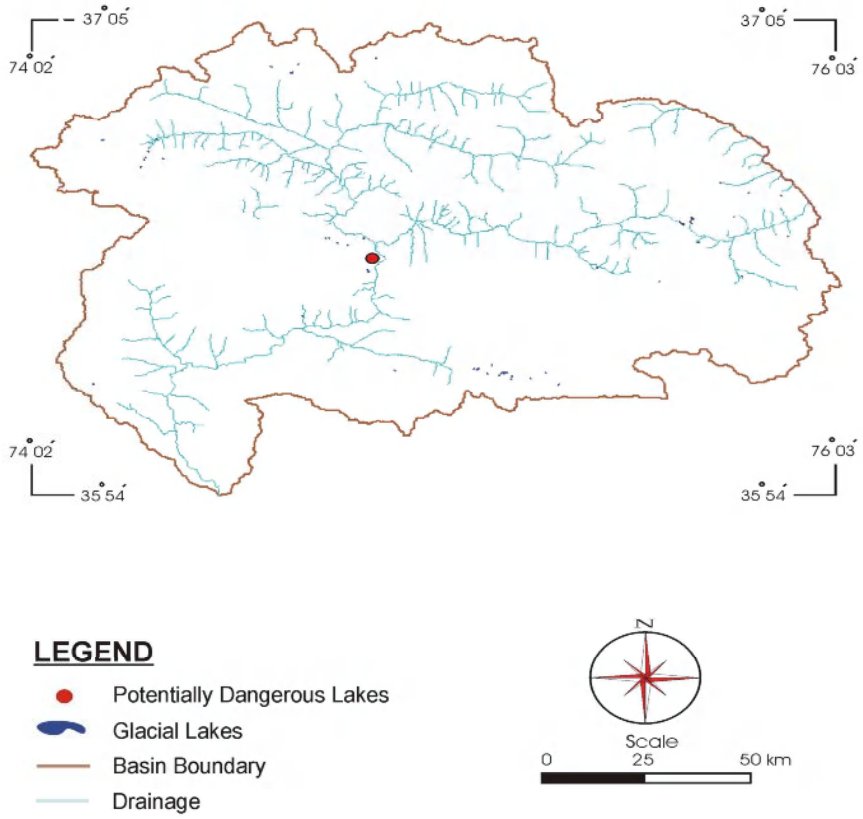
Glacier study Hunza Basin

Glacier Lakes

Basin Area (Km²): 16389

No. of Lakes: 110

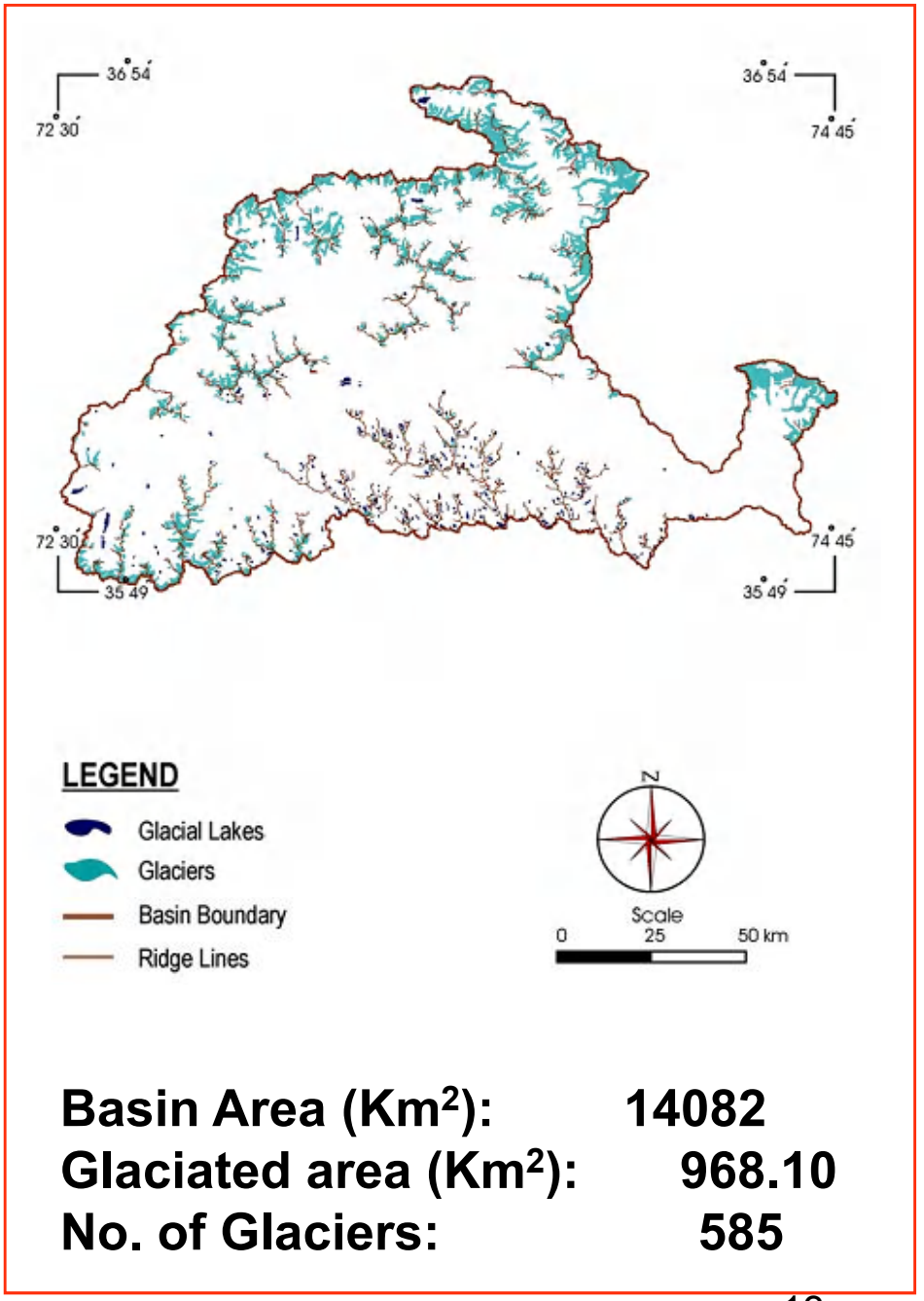
Potentially Dangerous Glacier Lakes



Basin Area (Km²): 16389

No. of Dangerous Lakes: 1

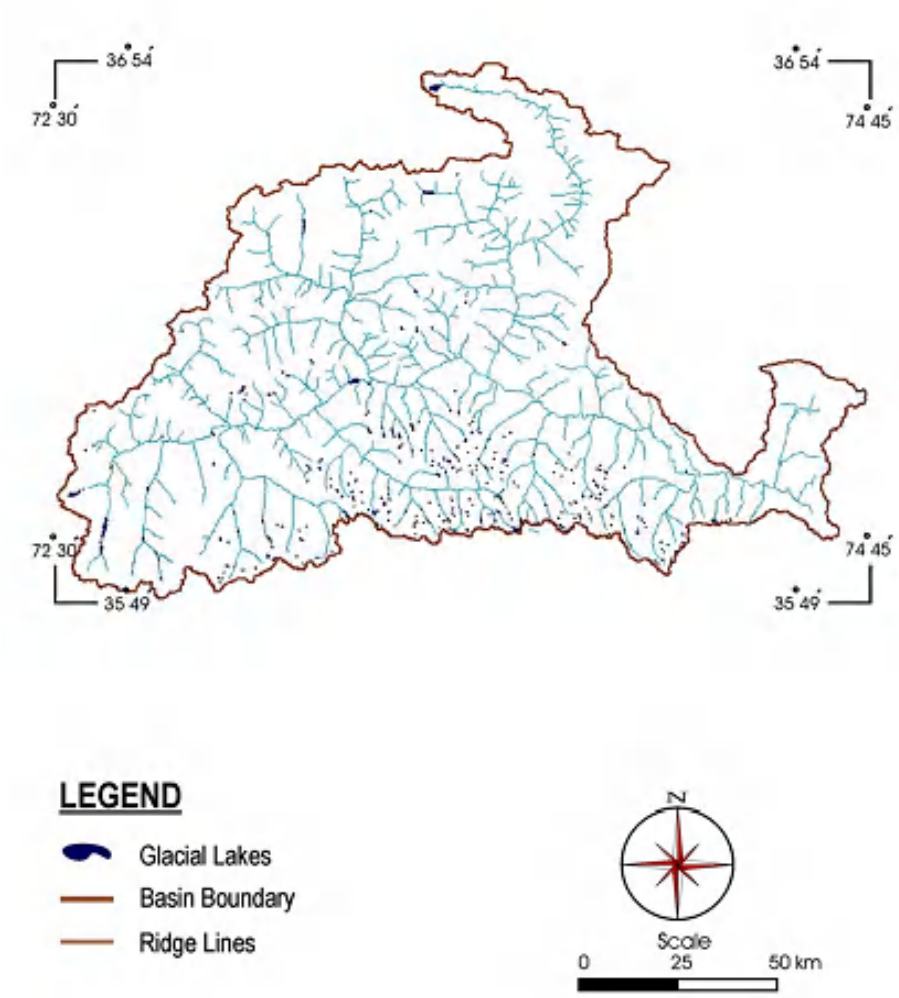
Glacier study Gilgit Basin



Basin Area (Km²): 14082
Glaciated area (Km²): 968.10
No. of Glaciers: 585

Glacier study Gilgit Basin

Glacier Lakes



Basin Area (Km²): 14082
No. of Lakes: 608

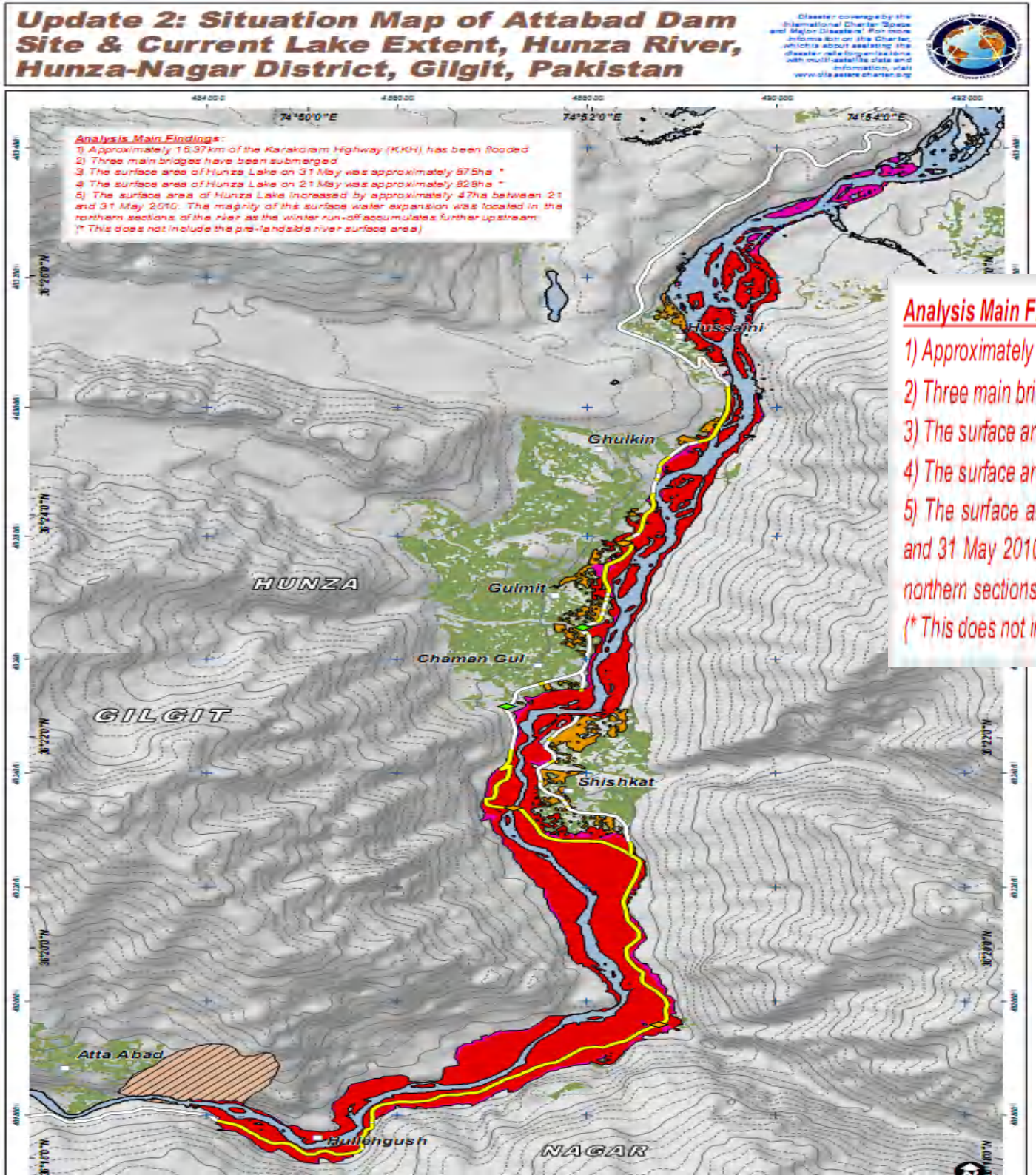
Potentially Dangerous Glacier Lakes

Basin Area (Km²): 14082
No. of Lakes: 8

Hunza River Landslide – Lake formation Attabad, Hunza

Location	Attabad Gojal, Hunza Basin
Landslide	January 02,2010
Primary inflows	Hunza River, 2,800 cu ft/s (79 m^3/s) On 26 May 2010
Primary outflows	Hunza River overflowing landslide dam, 3,700 cu ft/s (100 m^3/s), 4 June 2010
Max. length	13 miles (21 km)
Max. depth	358 feet (109 m)
Water volume	330,000 acre feet (4.1E+8 m^3), 26 May 2010
People Affected	15,000

Hunza River Landslide – Lake formation Attabad, Hunza



Analysis Main Findings:

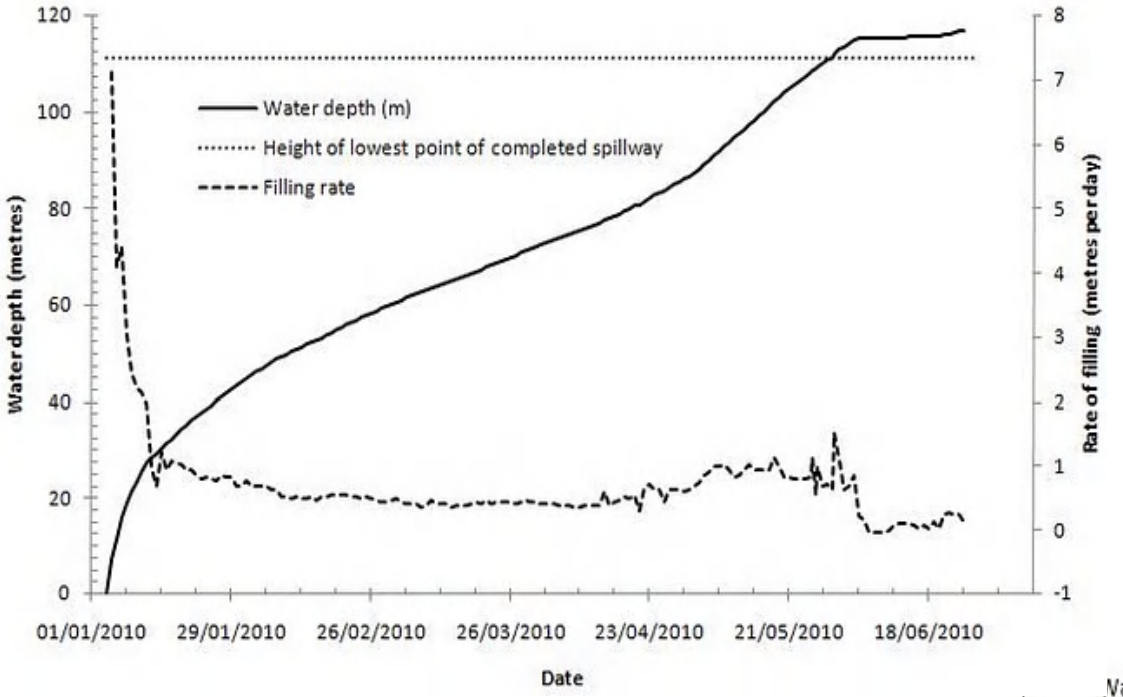
1) Approximately 16.37km of the Karakoram Highway (KKH) has been flooded
2) Three main bridges have been submerged
3) The surface area of Hunza Lake on 31 May was approximately 875ha *
4) The surface area of Hunza Lake on 21 May was approximately 828ha *
5) The surface area of Hunza Lake increased by approximately 47ha between 21 and 31 May 2010. The majority of this surface water expansion was located in the northern sections of the river as the winter run-off accumulates further upstream

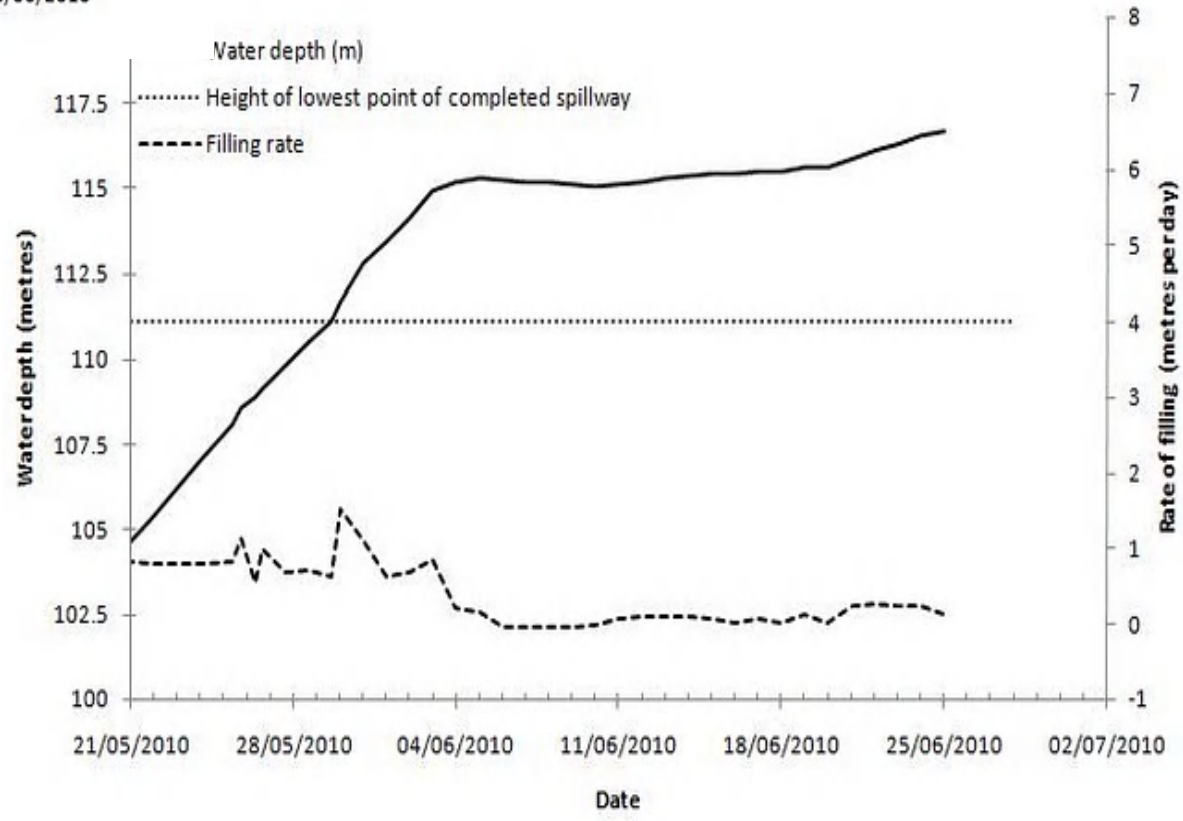
(* This does not include the pre-landslide river surface area)

SATELLITE ASSESSMENT CLASSIFICATION:

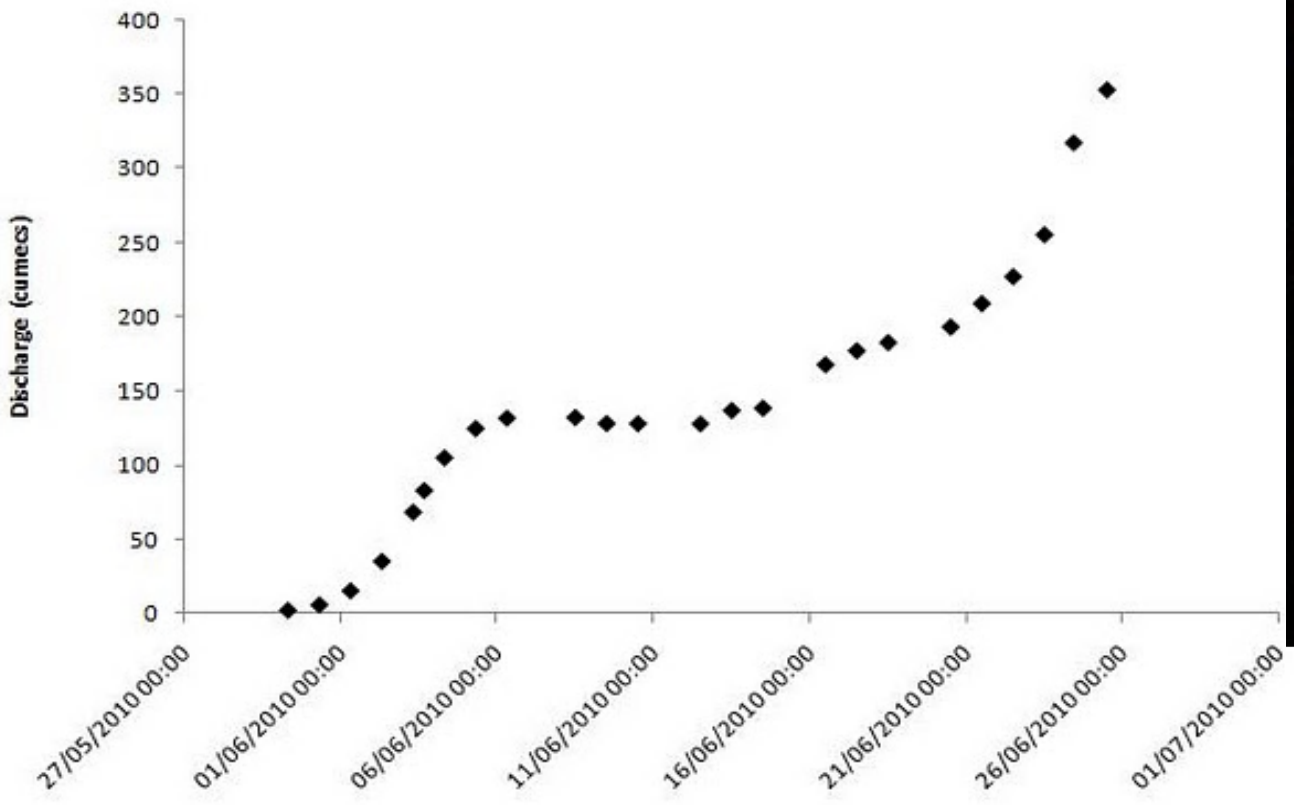
- Probable Areas of Flood Water Expansion as on 31 May 2010
- Potentially Flood-Affected Land as on 21 May 2010
- Probable Flood Waters (Attabad Dam Lake) as on 21 May 2010
- Pre-Landslide Hunza River Extent as on 10 September 2009
- Cultivated Lands as on 10 September 2009
- Ataabad Landslide Zone

Hunza River Landslide – Water depth and filling rate



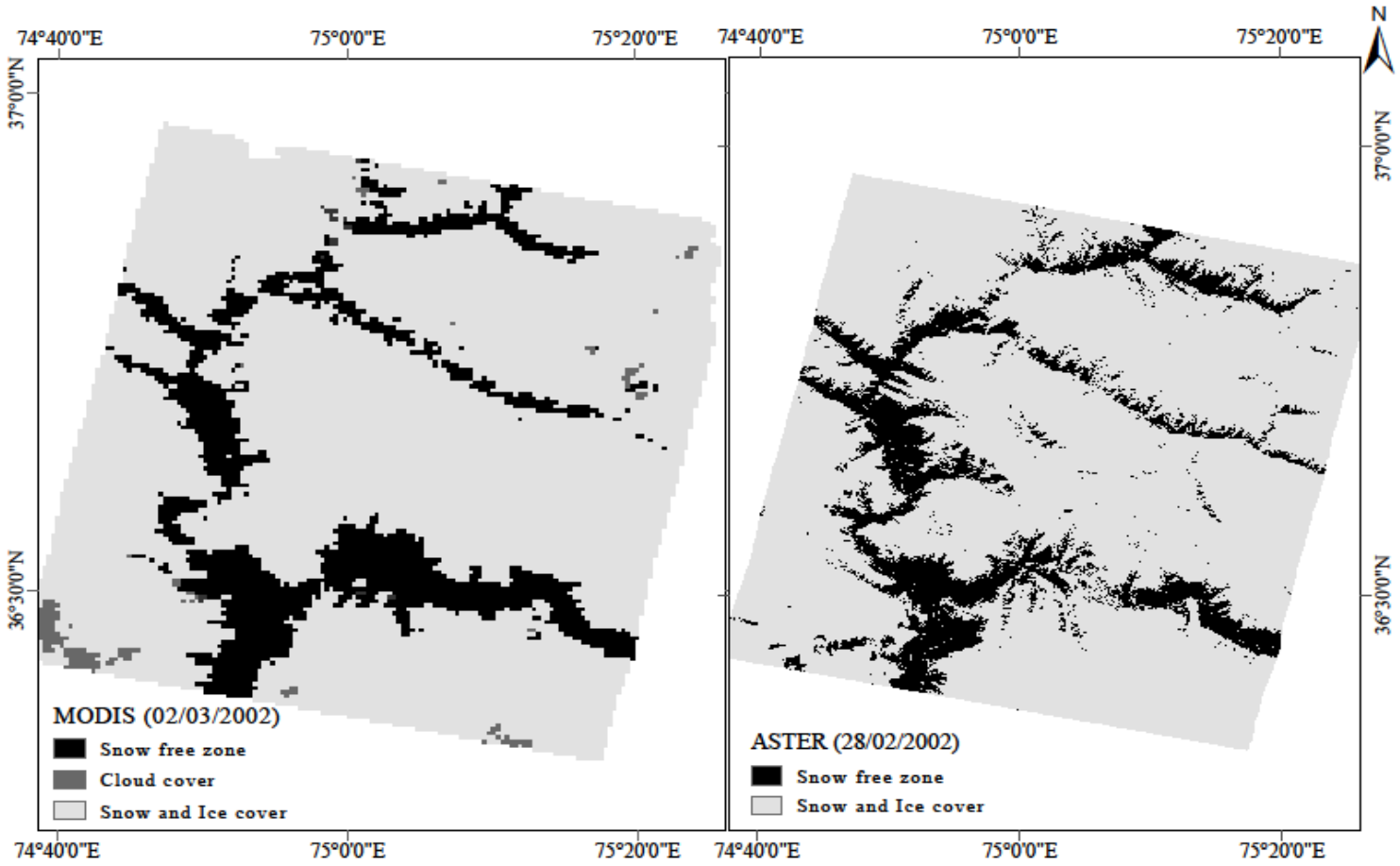


Hunza River Landslide – Lake formation Attabad, Hunza



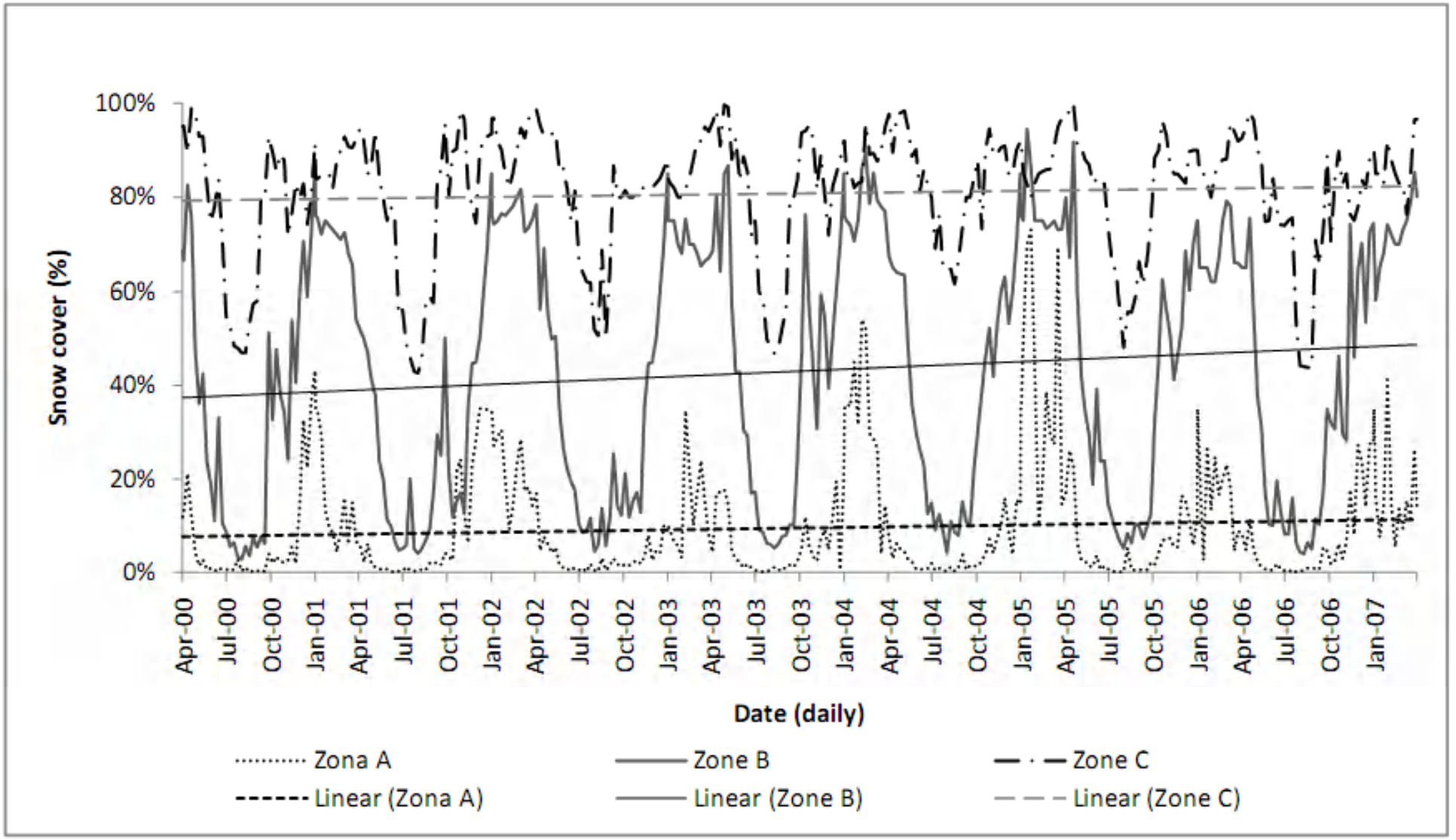
Snowcover and Snowmelt Modeling in Hunza Basin using

SRM model application using MODIS data

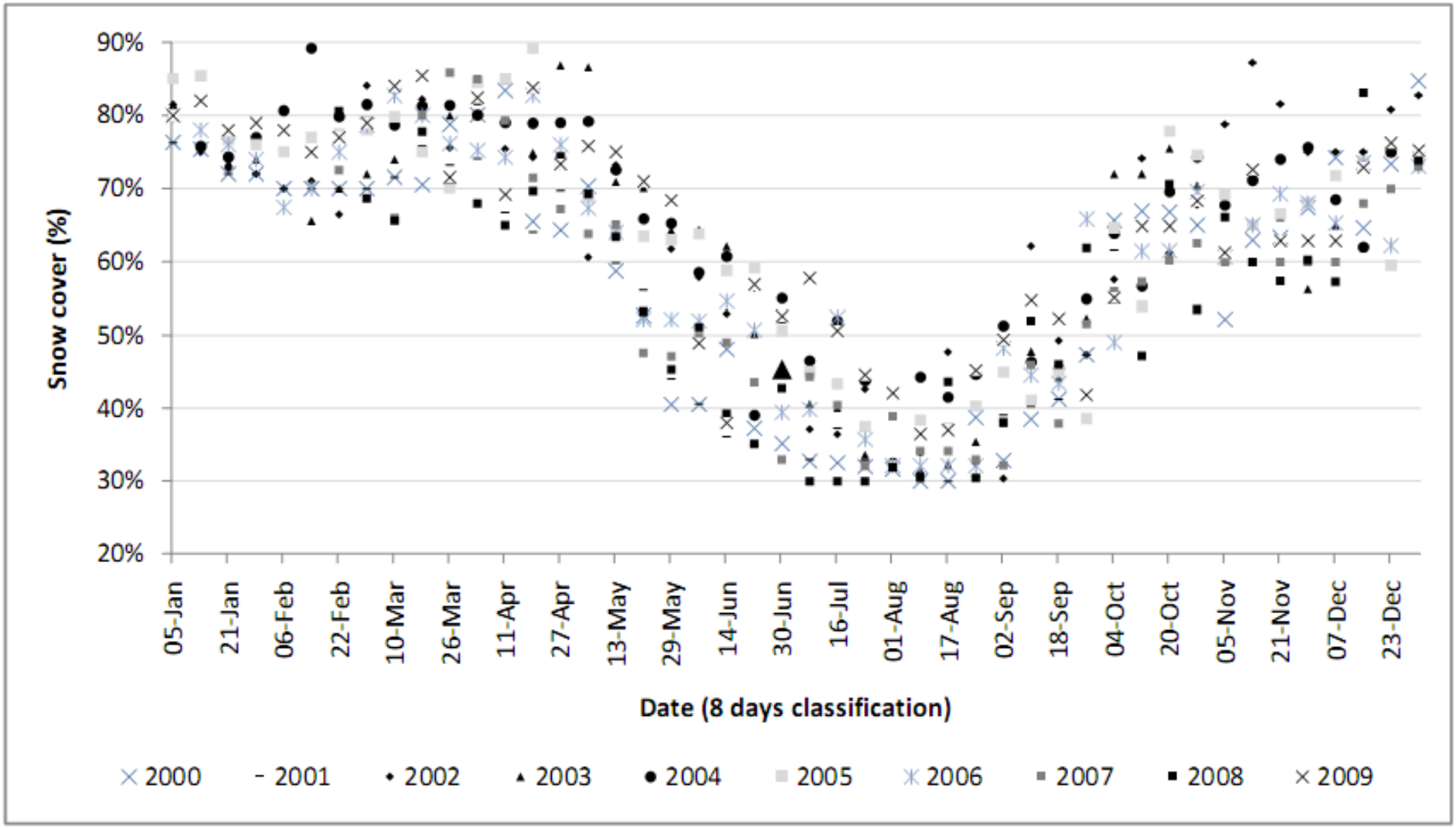


(on left) MODIS image and 5b (on right) ASTER image for Hunza River Basin

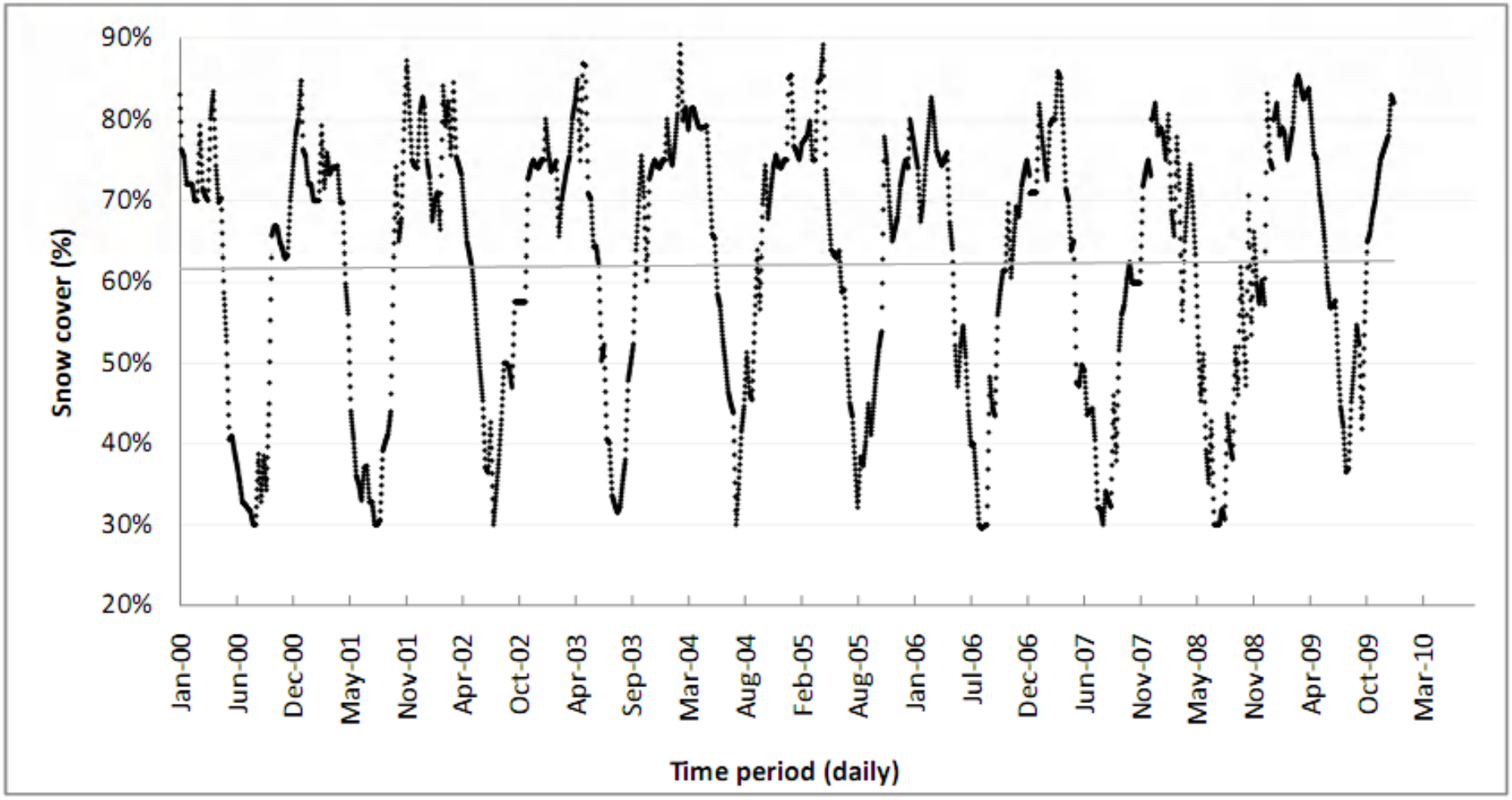
Snowcover and Snowmelt Modeling in Hunza Basin



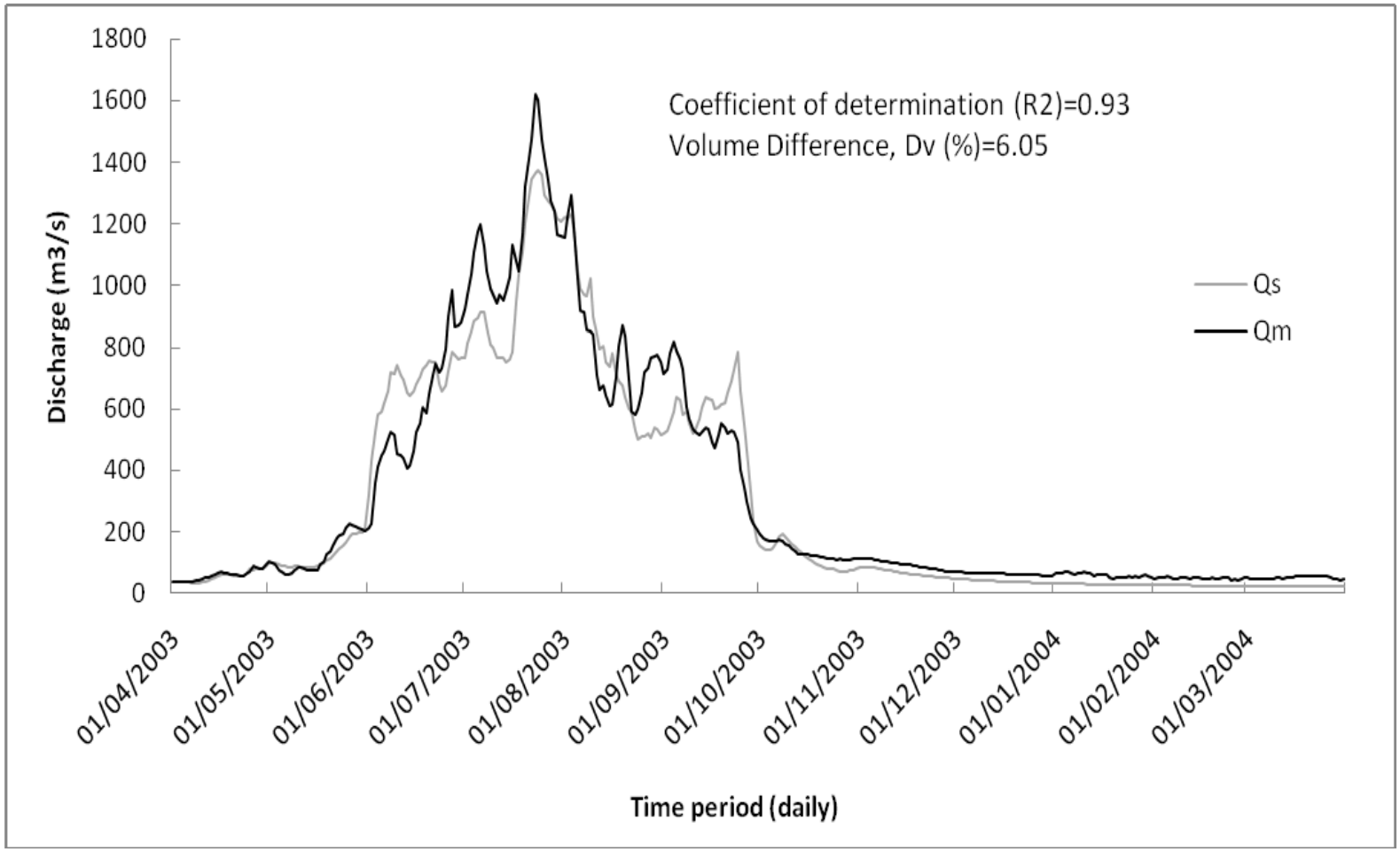
Snow cover distribution in three different altitudinal zones of Hunza River Basin. Expansion can be noted in all the three zones, particularly zone B.



Percentage snow cover in Hunza River Basin calculated by analysing 450 MODIS images

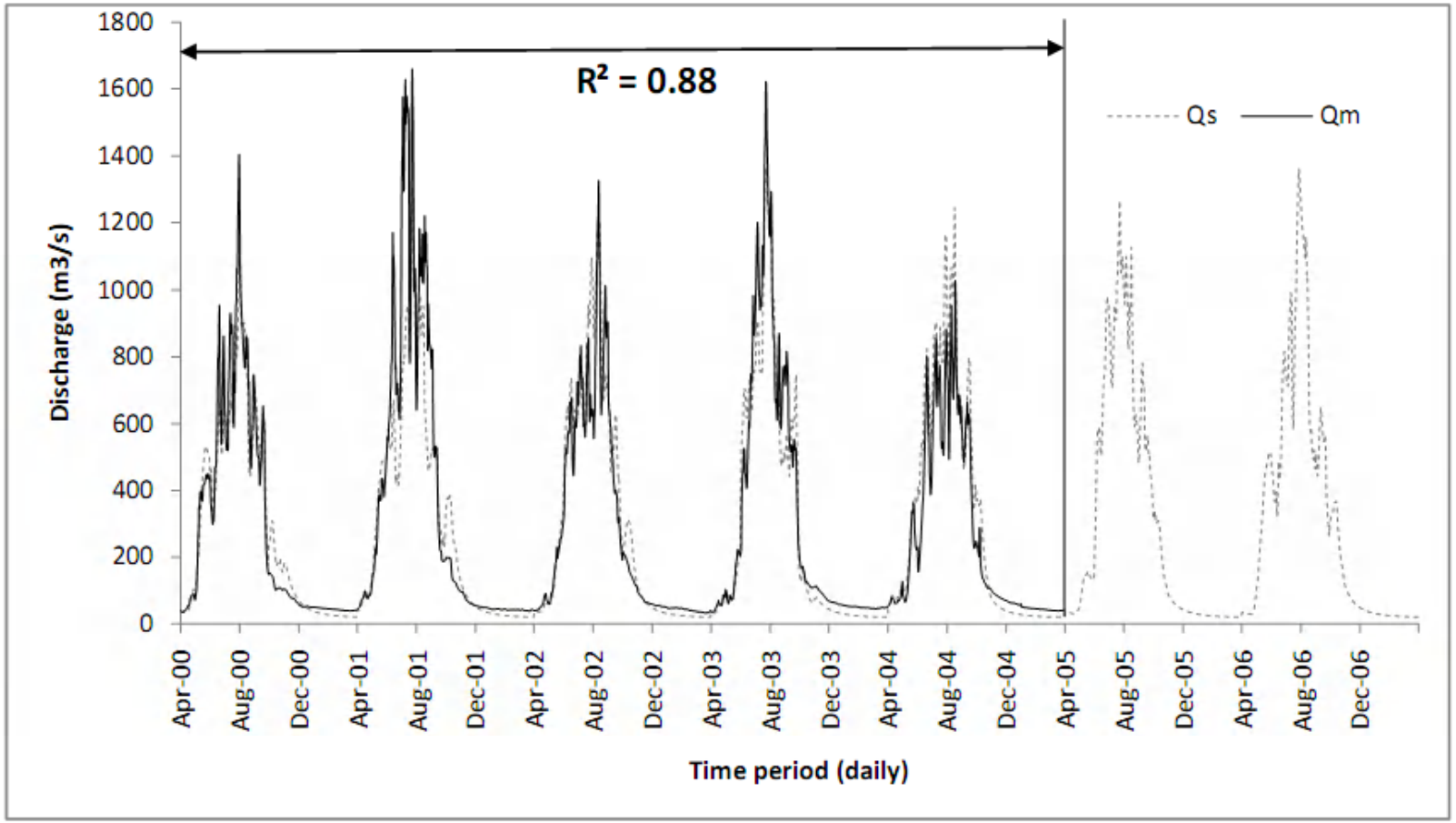


Dynamics of snow cover in Hunza River Basin over 10 years: March 2000 to December 2009 (daily data is estimated by the linear interpolation of 8 days MODIS images). A slight expansion is shown by linear trend line, 2000 2009.



Evaluation of basin wide SRM application over the hydrological year 2003-04 in Hunza river basin

Glacier study Gilgit Basin



Daily measured (Qm) and simulated (Qs) discharges from 2000 to 2007 for basin-wide simulations in Hunza River Basin.

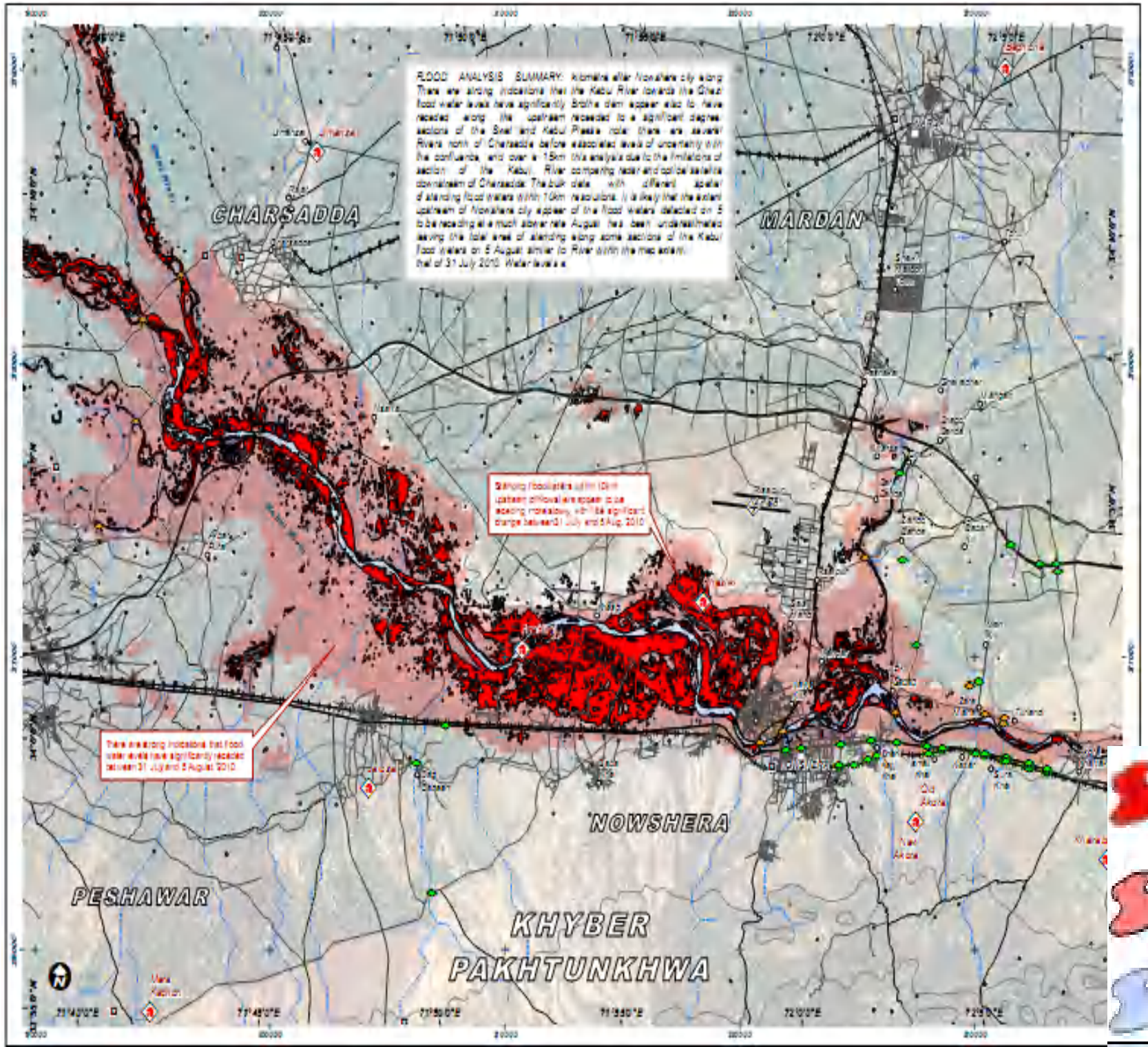
Flood 2010
In
Gilgit Basin

Flood 2010 - Gilgit Basin

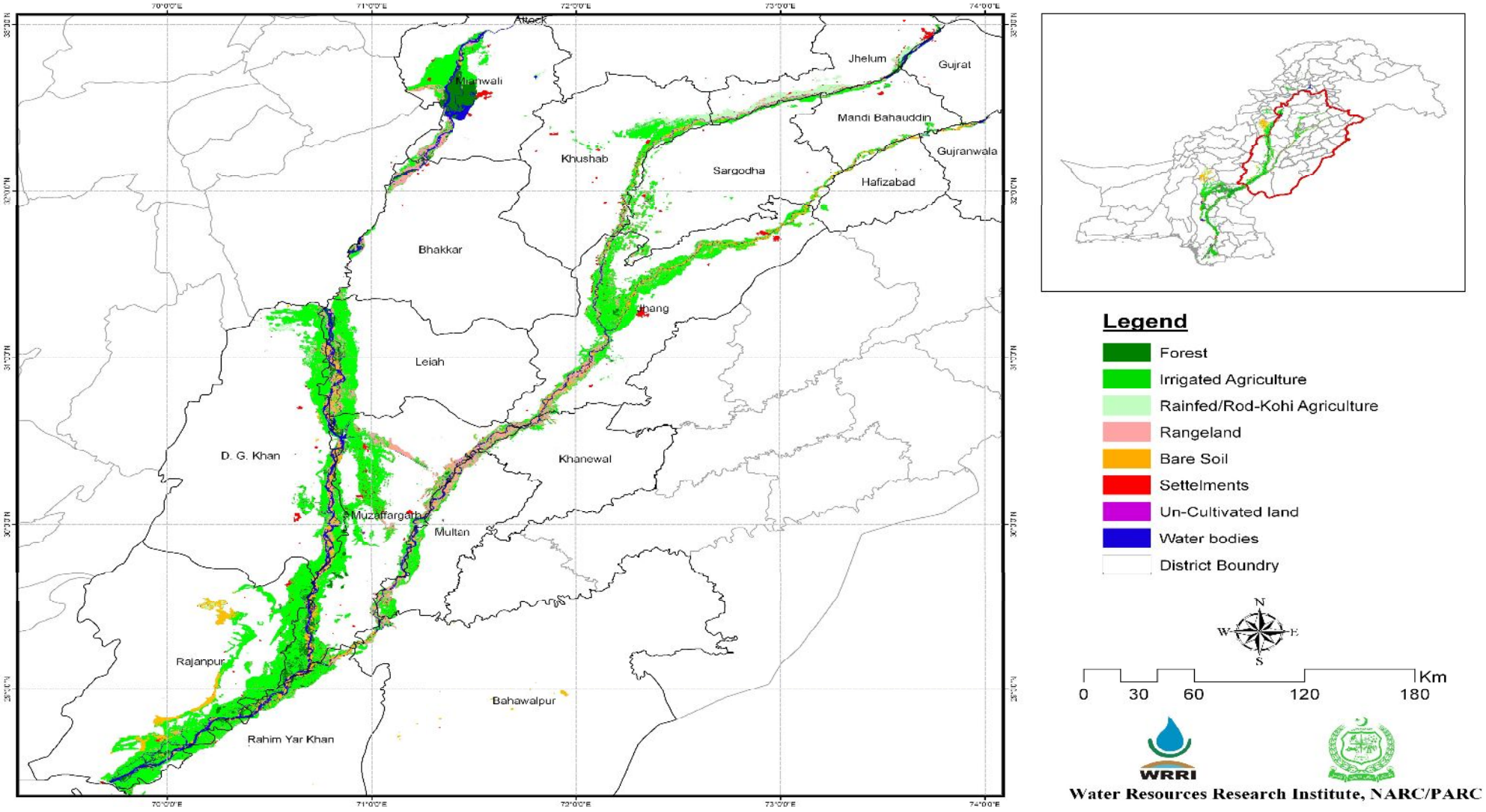
Losses Due to Floods

District	Deaths	Villages Affected	Houses Damage	IDPs (Directly Affected)	Population Affected	Roads Affected (km)	Land Affected (Acres)	Channels Affected	Bridges Affected	Trees Affected	Cattle Head
Gilgit	5	74	761	6,849	7,429	160	2042	92	8	15,000	112
Skardu	56	29	112	1,008	4,877	170	1144	43	7	1,012	1,213
Diamer	103	71	953	8,577	42,500	237	1699	84	40	9,000	1,558
Ghizer	5	68	528	4,752	7,855	115	1783	108	105	50,000	1,500
Ghanche	13	35	253	2,277	4,200	65	777	59	4	10,000	210
Astore	1	33	79	711	2,006	110	902	48	6	2,000	50
Hunzar Nagar	-	37	144	1,296	12,738	90	639	67	12	13,100	26
Total	**183**	**347**	**2,830**	**25,470**	**81,605**	**947**	**8986**	**501**	**182**	**100,112**	**4,669**

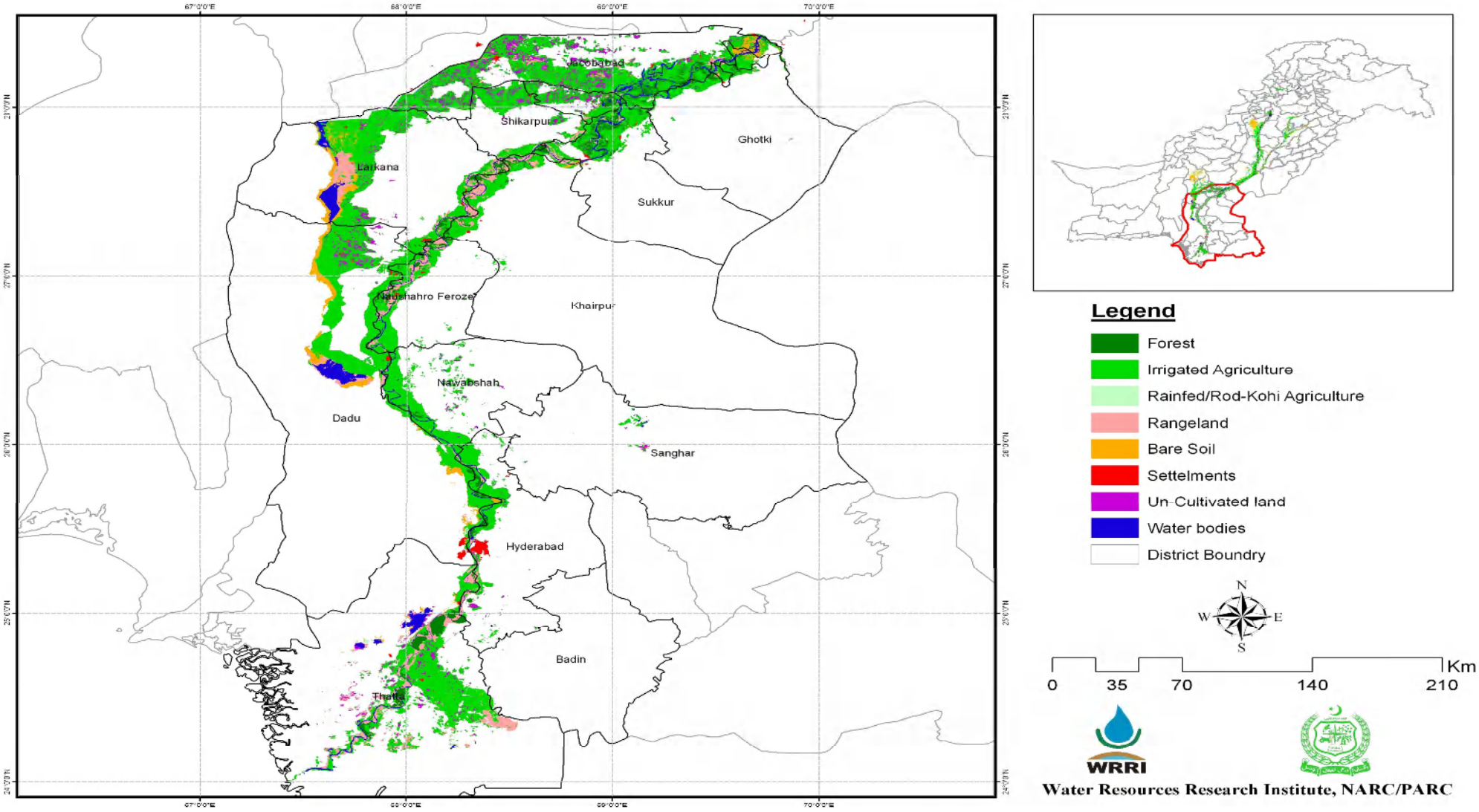
Severely damaged city of Nowshera



Landuse Map of Flood Affected Areas of Punjab



Landuse Map of Flood Affected Areas of Sindh



Pakistan Flood Losses Summary
as of 30 September 2010)

Millions of hectares (acres) of cropland were submerged by the floods (Source: United Nations)

Flooding in the city of Multan in Punjab Province (Source: United Nations)

Flooding in Punjab Province (Source: United Nations)


Thank you