SHARE RIVERS: A long term monitoring of waters in central southern Himalaya (Nepal)

GLOBAL CRYOSPHERE WATCH

CryoNet Asia Workshop

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Beijing, China

3 -5 December 2013

www.evk2cnr.org/cms/en/evk2cnr_committee/presentation

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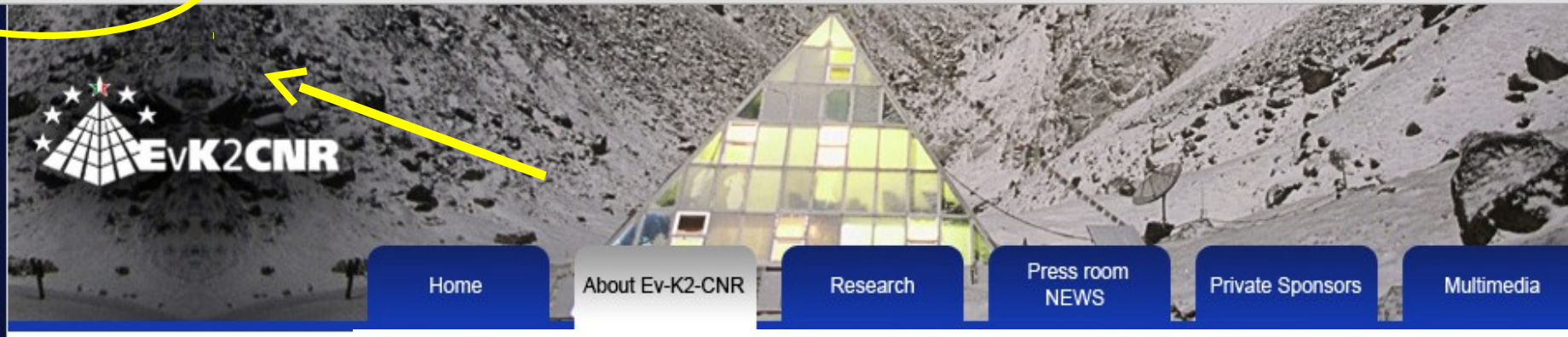


- The History of Ev-K2-CNR
- The Ev-K2-CNR Committee Today
- The Partners
- Our Objectives
- The Pyramid
- Contacts
- Jobs & Careers

The Ev-K2-CNR Committee is a non-profit association which promotes scientific and technological research in mountain areas. Particular emphasis is placed on the HKKH region (Nepal, Pakistan). Ev-K2-CNR is best represented by its **Pyramid Laboratory** located at 5,050 meters in Nepal at the base of Mount Everest. Ev-K2-CNR research is mainly focused onEnvironmental Sciences, and development of new technologies.

Ev-K2-CNR benefits mainly from the financial support of Italian Government.

Ev-K2-CNR works through a network of national and international scientific collaborations, in particular with the Italian **National Research Council (CNR)**.

IRSA CNR

Stations at High Altitude for Researches on the Environment

SHARE

Clic here to visit the SHARE Project page

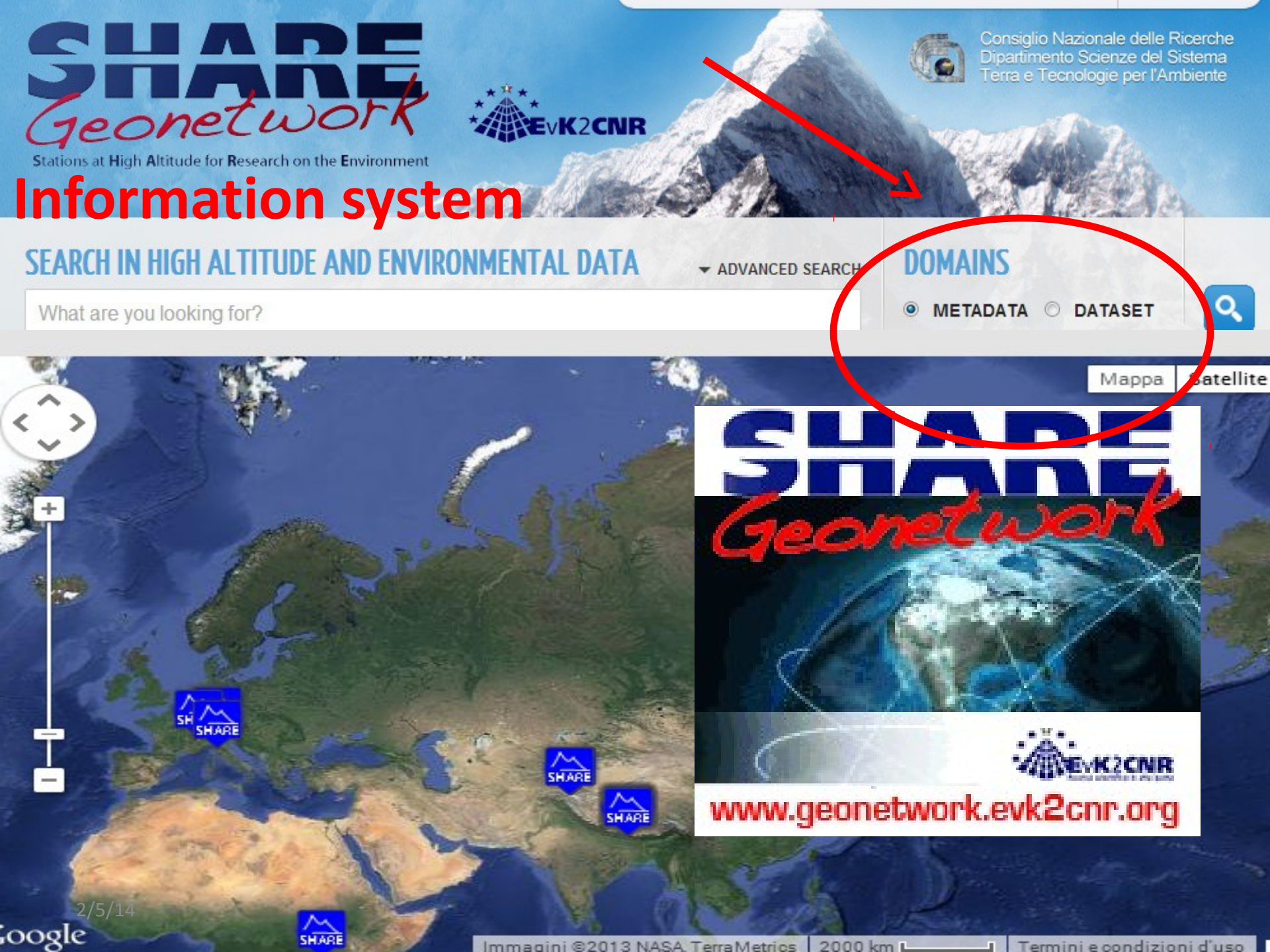
SHARE

Stations at **H**igh **A**ltitude for **R**esearch on the **E**nvironment

ACTIVITY SECTOR	WORK PACKAGE		THEMATIC AREA
Scientific Research and Climate **Reference Person** **P. Bonasoni** (CNR-ISAC)	**WP 1**	Integrated Project for climatic, environmental and geophysical monitoring, on local, regional and global scales: Asia (Himalaya-Karakorum) Africa (Ruwenzori) Europe (Alps and Apennines) South America (Cordillera Real)	WP 1.1 Atmosphere P. Cristofanelli (CNR-ISAC) WP 1.2 Glaciology C. Smiraglia (University of Milan) WP 1.3 Water resurce R. de Bernardi (CNR-ISE) WP 1.4 Biodiversity and natural resources S. Lovari (University of Siena) G. Rossi (University of Pavia) WP 1.5 Medicine A. Cogo (University of Ferrara)
Technological Research and Climate **Reference Person** **P. Laj** (CNRS-LGGE)	**WP 2**	Scientific research and industrial design for the development of a state-of-the-art technological system for environmental monitoring in mountain areas	
Information System **Reference Person** **M.T. Melis** (Università di Cagliari)	**WP 3**	Multidisciplinary Information System concerning scientific and technological research activities in mountain areas, for use by scientific bodies, governments and inter-governmental agencies.	
Capacity building **Reference Person** **to be difine**	**WP 4**	Program supporting government level decision-making processes regarding the environment; transfer of skills and technologies to promote and ensure sustainable development; technology transfer, promotion of business and institutional participation.	

An integrated scientific and technological research project devoted to environmental monitoring and climatic studies in mountain regions

Information system

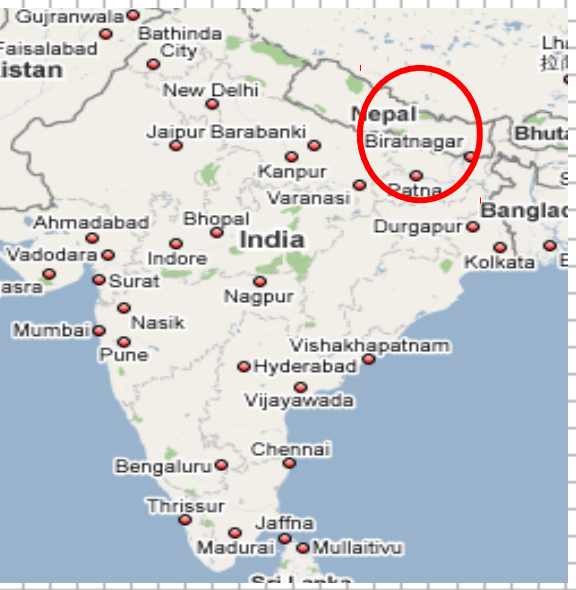


Capacity building

1) **Involving local parter in the meteorological monitoring (Nepal, Pakistan, Uganda).**

2) Supporting the sustainable development of mountain regions.

Nepal



DHM

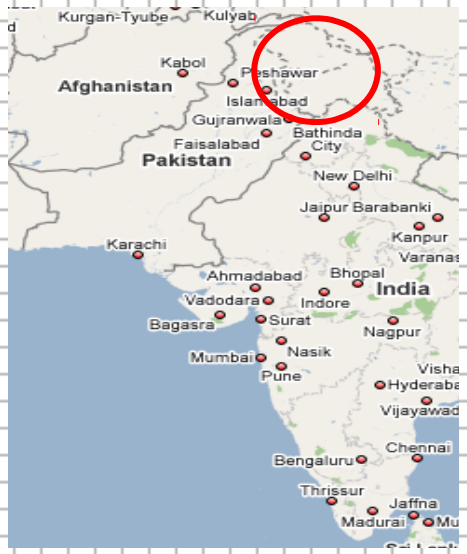
Department of Hydrology and Metereology

Memorandum of understanding signed on January 2008

A) Training courses for local staff on meterological stations managment

B) Creation of a team of 7 Nepali technicians

Pakistan



PMD

Pakistan Metereological Department

Memorandum of Understanding signed on March 2008

A) The collaboration with the PMD includes a protocol of periodic maintenance (every 45 days) of the metereological stations: Urdukas (3926 m), Baltoro glacier, Askole (3015 m).

b) Training courses on meterological stations managment.

Uganda

UMD

THE REPUBLIC OF UGANDA

Uganda Metereological Department

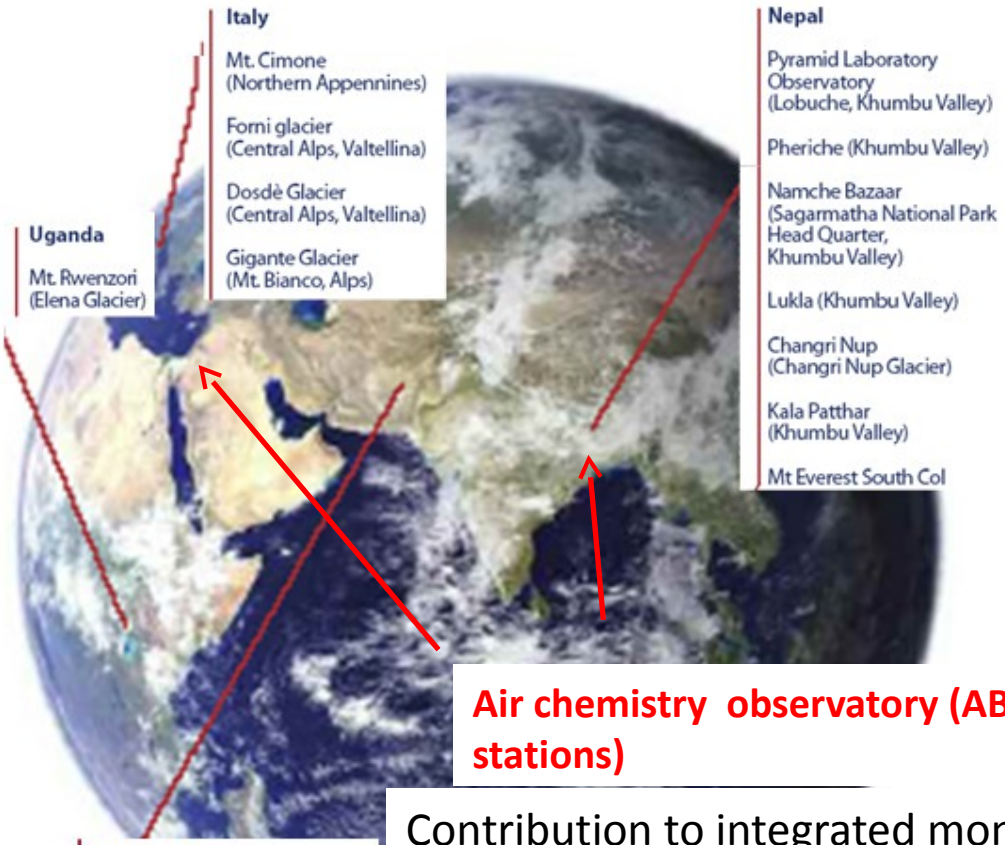
Memorandum of understanding signed on March 2009

A) The collaboration with the umd includes a protocol of periodic maintenance (every 2 months) of the highest metereologic station in Africa (Ruwenzori, 4750 m).

B) Training courses on meterological stations managment for the park rangers.

Stations at High Altitude for Research on the Environment

Metereological stations at high elevations



Air chemistry observatory (ABC UNEP stations)

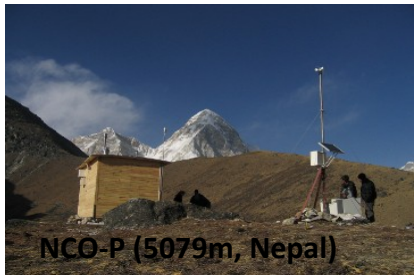
Contribution to integrated monitoring programs such as **UNEP-ABC, WMO-GAW, WCRP-GEWEX-CEOP, NASA-AERONET, ILTER , EUSAAR, ACCENT**

Pakistan

Urdukas (Baltoro glacier, Baltistan)

Askole (Baltistan, Pakistan)

Concordia (Baltoro glacier, Baltistan)



SHARE EVEREST 2011: REAL TIME DATA

SHARE Everest 2011
Stations at High Altitude for Research on the Environment

EVEREST LIVE WEB CAM
da 5.600 m.s.l.m.

REAL TIME DATA
COLLE SUD

REAL TIME DATA
KALA PATTHAR

WARNING! Due to technical maintena

COLLE SUD - Last Update: **2011-11-01** at **23:20** (UTC/GMT: +5.45)

Temp. C -28.04

SHARE Everest 2011
Stations at High Altitude for Research on the Environment

Glob.Rad.W/m^2 0.00

Rel Humidity % 14.20

UVA Rad. W/M^2 -

SHARE WATER RESOURCES

***An integrate action for climate change impact studies on water resources* in central southern Himalaya (Nepal)**

The SHARE WATERS aims answering to the following questions:

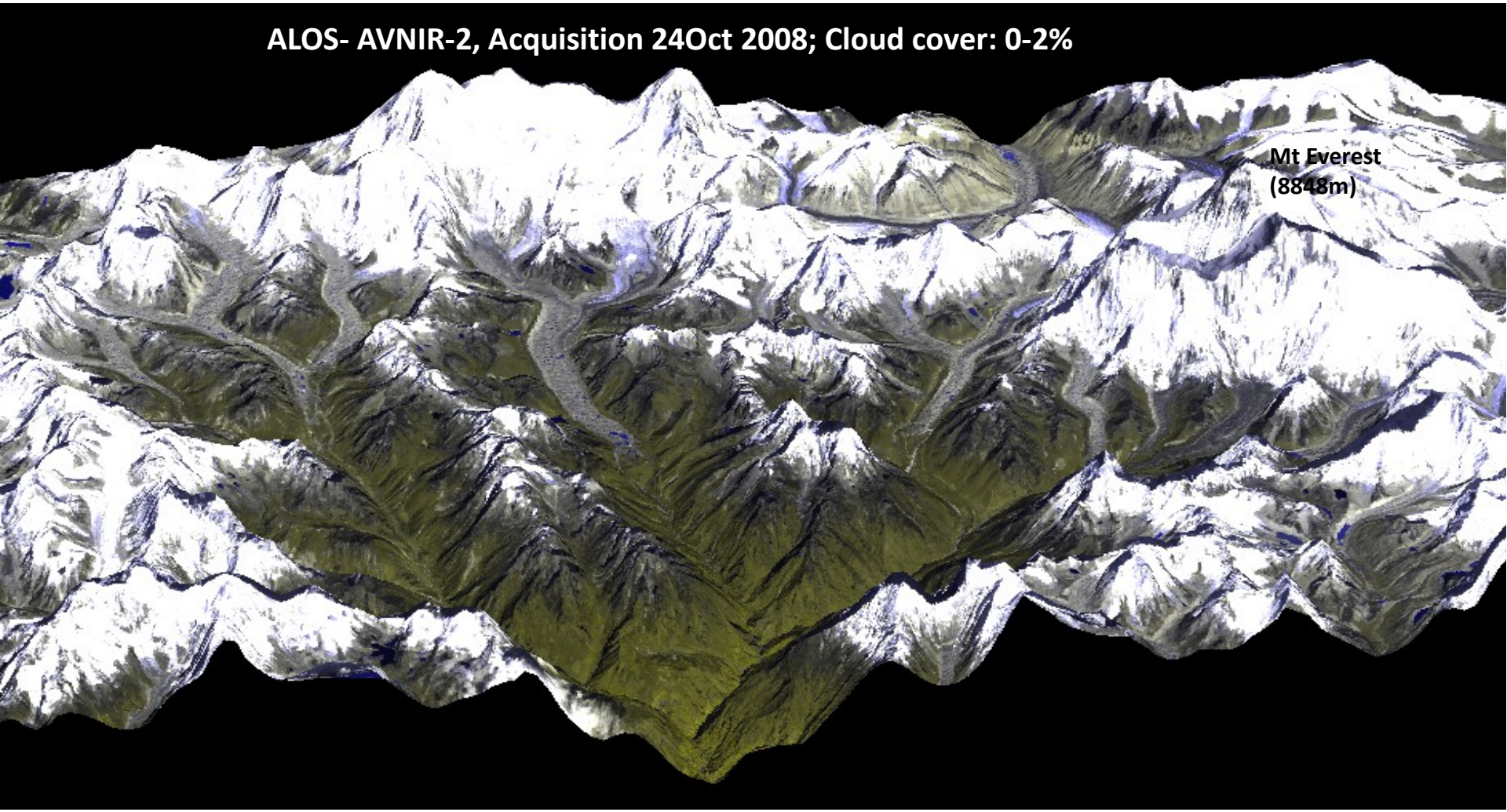
1. How is the climate change impacting the hydrologic cycle of glacial basins and the consequent availability of water?
2. How is the climate change affecting the main biogeochemical processes (nutrients and solutes) from glaciers, through soils and streams to glacial lakes?
3. How is the climate change affecting **the biodiversity and functioning of mountain lakes?**

Aims

We are looking for COUPLING climatic trends with glacial and periglacial environment response to understand the impact on hydrologic process and create a reasonable future water availability scenario

How the climate change impacts the cryosphere in central southern Himalaya (Nepal). In particular we are interested in the behavior of glaciers, permafrost, lakes and rivers.

Reference site

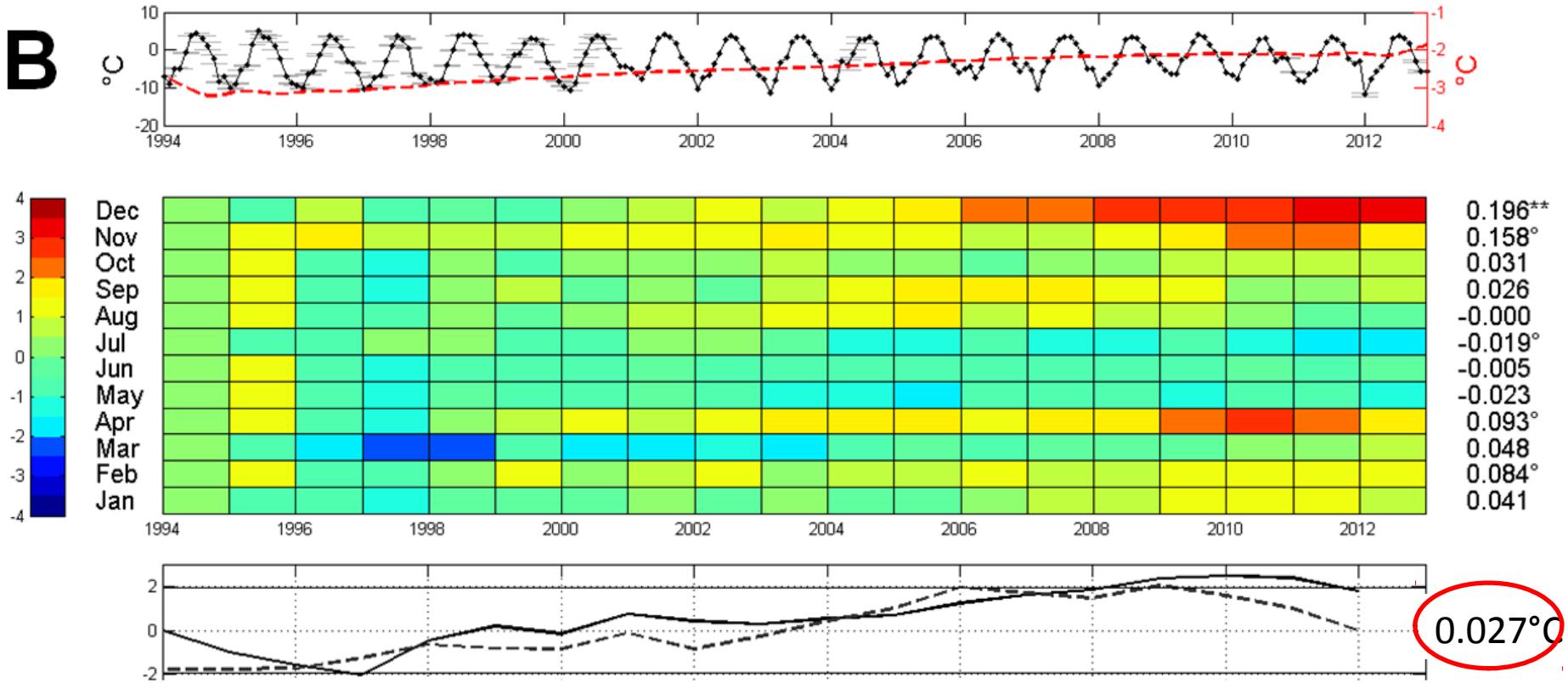


Temperature and precipitation time series

Station ID	Location	Latitude (°N)	Longitude (°E)	Altitude (m asl)	Frequency	Data Availability		% of Missing Data										
						From	To	AT	RR	RH	AP	WS	WD	ISWR	OSWR	ILWR	OLWR	SL
AWS0	Pyramid	27.96	86.81	5035	2 hours	01/01/1994	31/12/2005	18	23	8	13	13	53	84	-	-	-	-
AWS1	Pyramid	27.96	86.81	5035	1 hour	01/01/2000	31/12/2012	9	35	9	10	12	25	20	53	53	53	54
AWS2	Pheriche	27.90	86.82	4260	1 hour	25/10/2001	31/12/2012	14	34	14	11	20	25	34	-	-	-	-
AWSN	Namche	27.80	86.71	3570	1 hour	27/10/2001	31/12/2012	16	23	19	16	20	31	34	-	-	-	-
AWS3	Lukla (Chaurikharka)	27.70	86.72	2660	1 hour	02/11/2004	31/12/2012	24	29	39	24	28	43	41	-	-	-	-
ABC	Pyramid	27.96	86.82	5079	1 hour	01/03/2006	31/12/2011	3	0	2	1	1	3	-	-	-	-	-
AWS4	Kala Patthar	27.99	86.83	5600	10 minutes	01/01/2009	31/12/2011	8	6	5	8	12	13	-	-	-	-	-
AWS5	South Col	27.96	86.93	7986	10 minutes	01/05/2008	31/10/2011	39	100	65	26	44	47	-	-	-	-	-

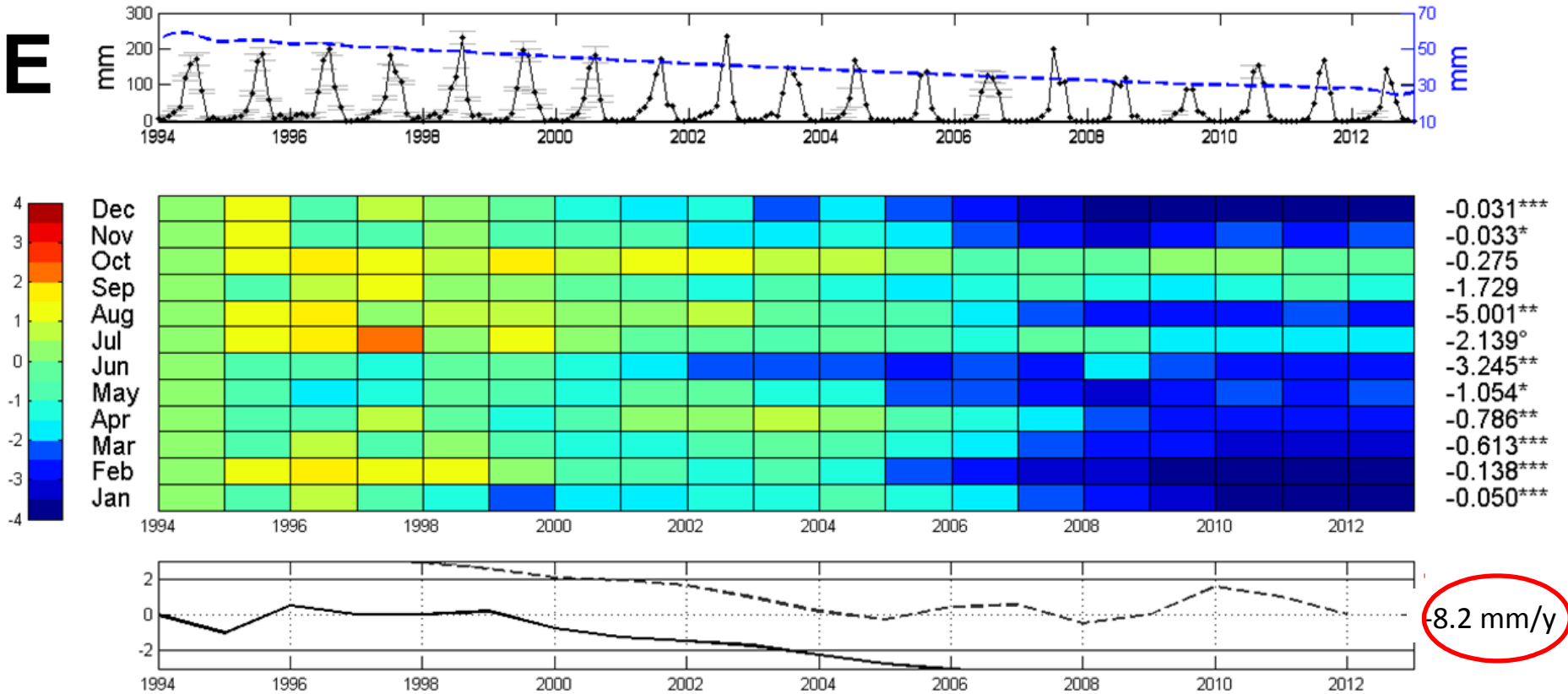
AT Atmospheric Temperature; RR Rainfall Rate; RH Relative Humidity; AP Atmospheric Pressure; WS Wind Speed; WD Wind Direction; ISWR Incoming Shortwave Radiation; OSWR Outgoing Shortwave Radiation; ILWR Incoming Longwave Radiation; OLWR Outgoing Longwave Radiation; SL Snow Level

A. Temperature (AWS 1994-2011): SeqMK test and SSA

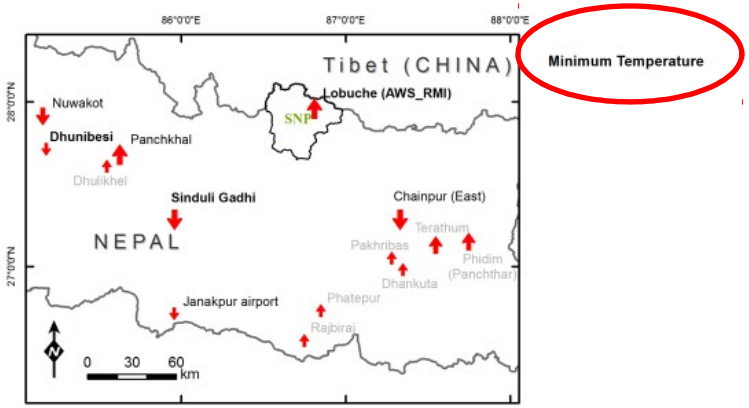


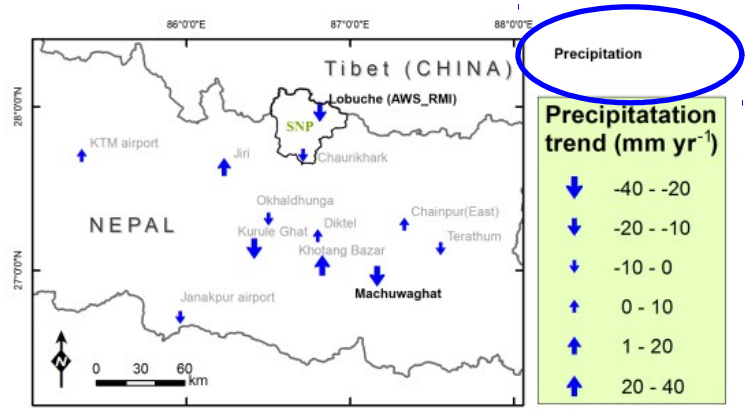
Winter and pre-monsoon temperature change

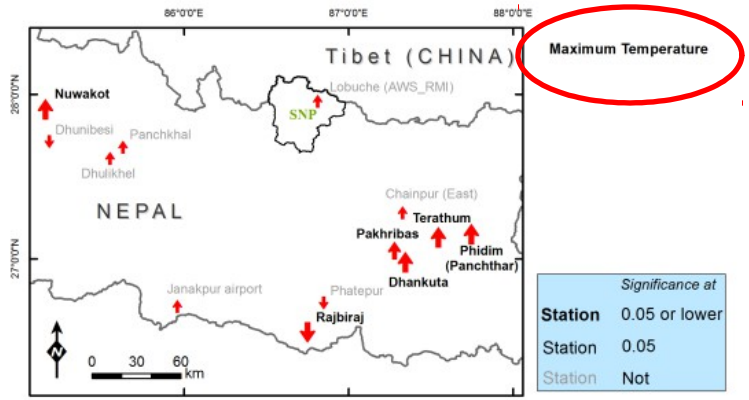
B. Precipitation (AWS 1994-2011)

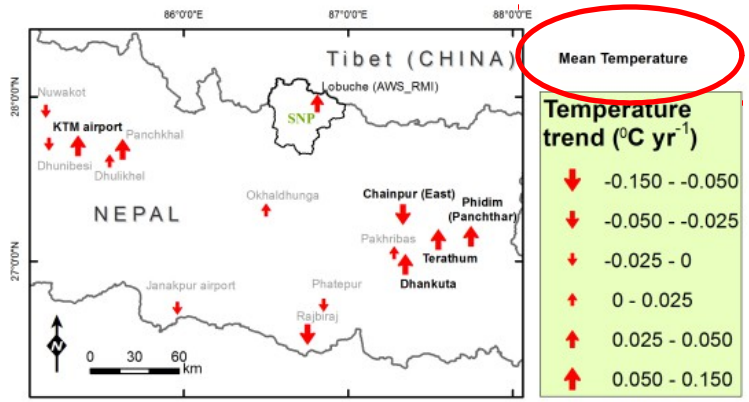


Significance for all months









Comparison with other series

Spatio-temporal analysis of glaciers

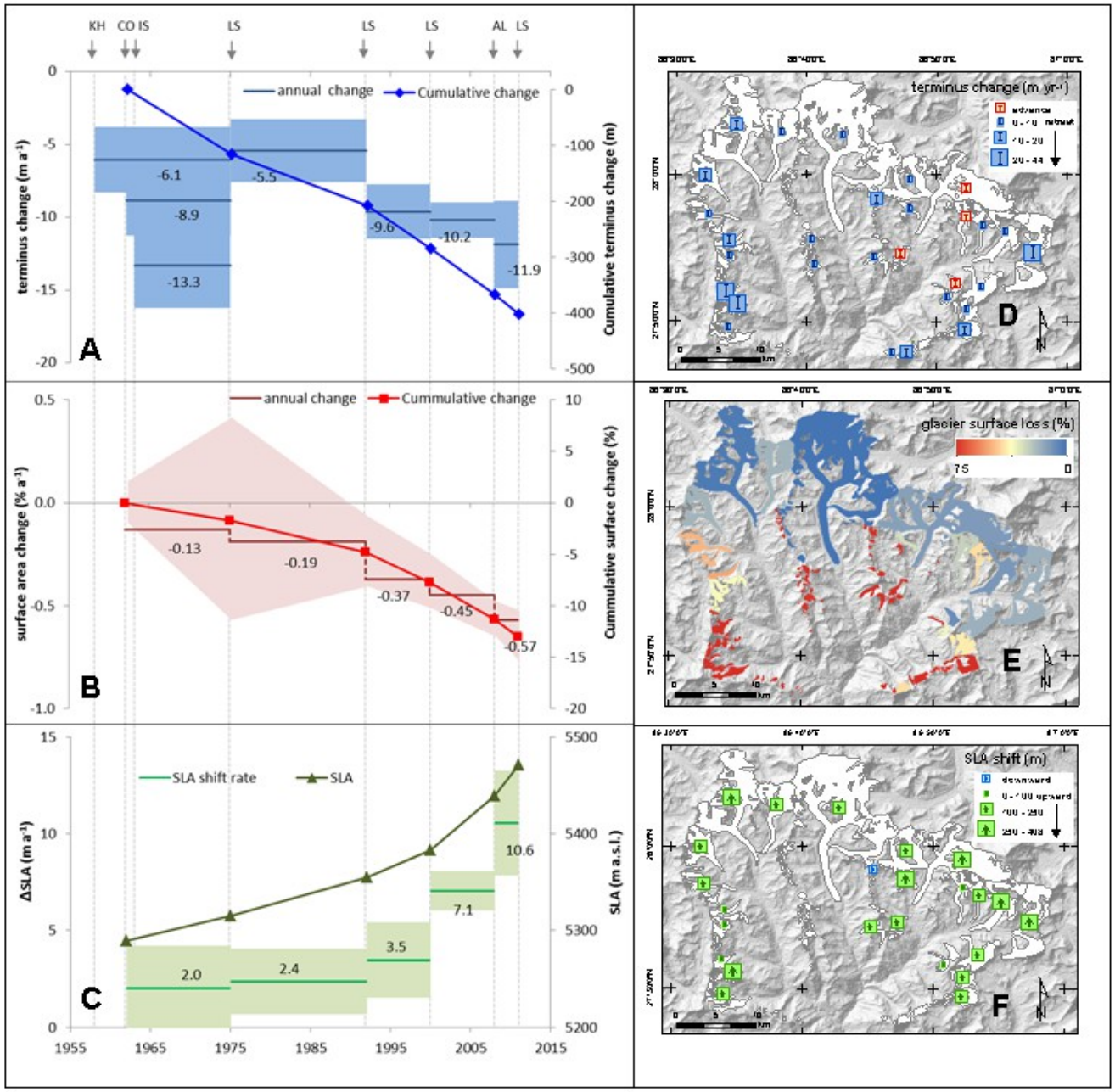
Satellite images	Sensor	Spatial resolution (m)	Acquisition date	Analysis purpose
Corona	Corona KH-4	8	15 Dec1962	Glacier
Corona	Corona KH-9	8	20 Nov 1970	Glacier
Landsat	MSS	60	2 Nov 1975	Glacier
Landsat	TM	30	7 Nov 1992	Glacier and Lake
Landsat	ETM+	30	30 Oct 2000	Glacier and Lake
ALOS	AVNIR-2	10	24 Oct 2008	Glacier and Lake
Landsat	ETM+	15*	30 Nov 2011	Glacier and Lake
Topographic maps	**Scale**	**Year**		
Khumbu Himal (Schneider Map)	1:50000	1958		Glacier
Topographic map (Indian Survey)	1:50000	1963		Glacier and Lake
Official topographic map,(Gov. of Nepal)	1:50000	1992		Glacier and Lake
Digital Elevation Model (DEM)				
ASTER DGEM 2	ASTER	30		Glacier, Lake and Model

** SLC-off corrected and pan-sharpened image*

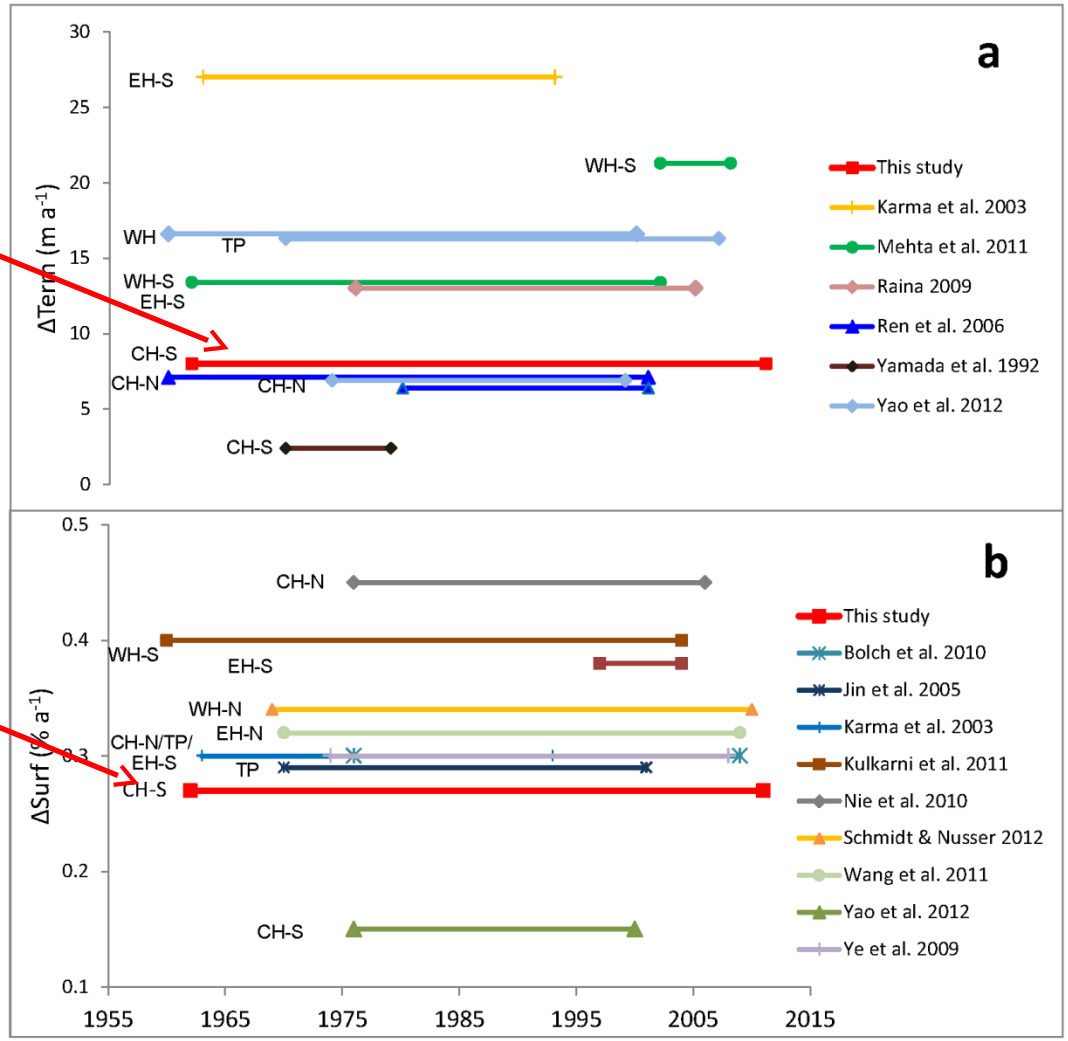
Δterm = -403±9 m (1962-2011)
Rate: 6.1±0.2 m yr-1

ΔSurf = -13.0±3.1 %; 404.6 to 351.8 km2 (1962-2011)
Rate: 0.42±0.06 % y-1

ΔSLA = +182±9 m; (1962-2011)
Rate: 3.9±0.17 m y-1

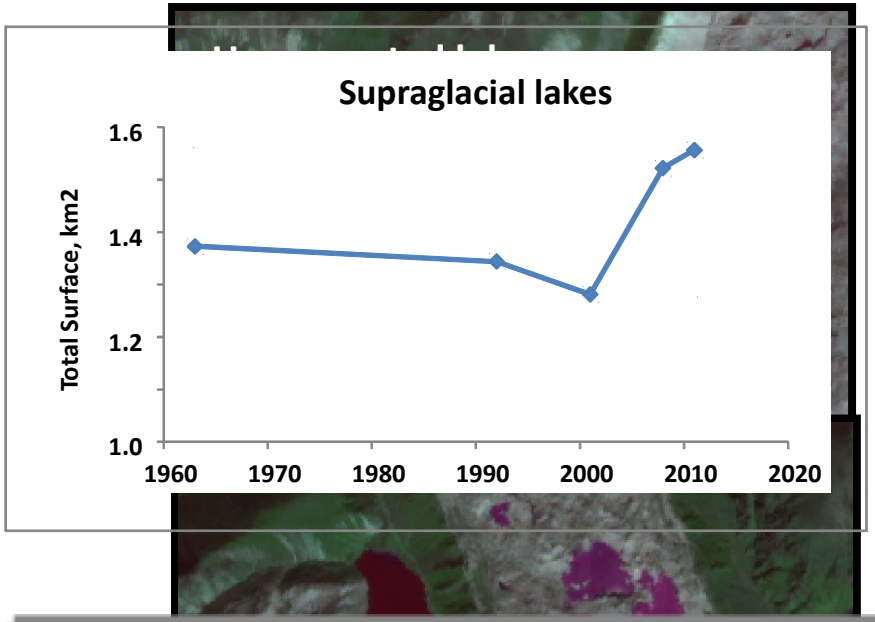


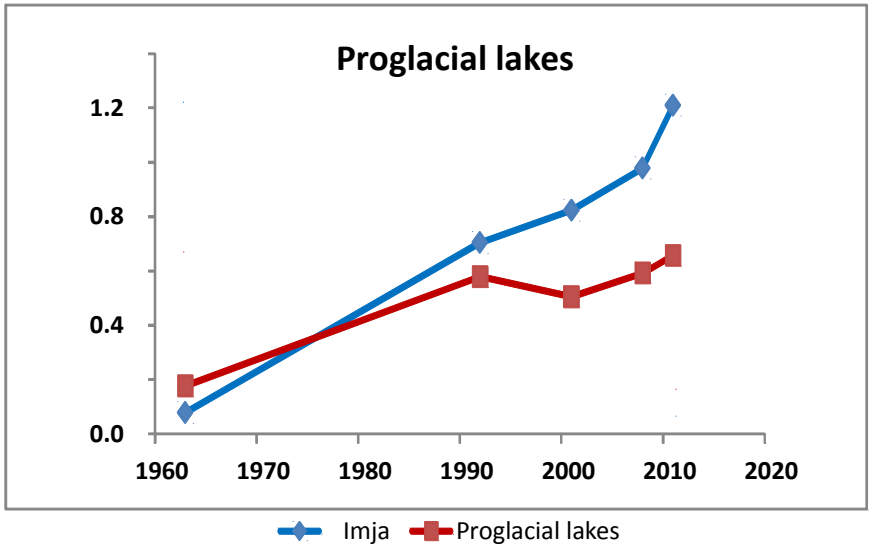
Comparison with other regions



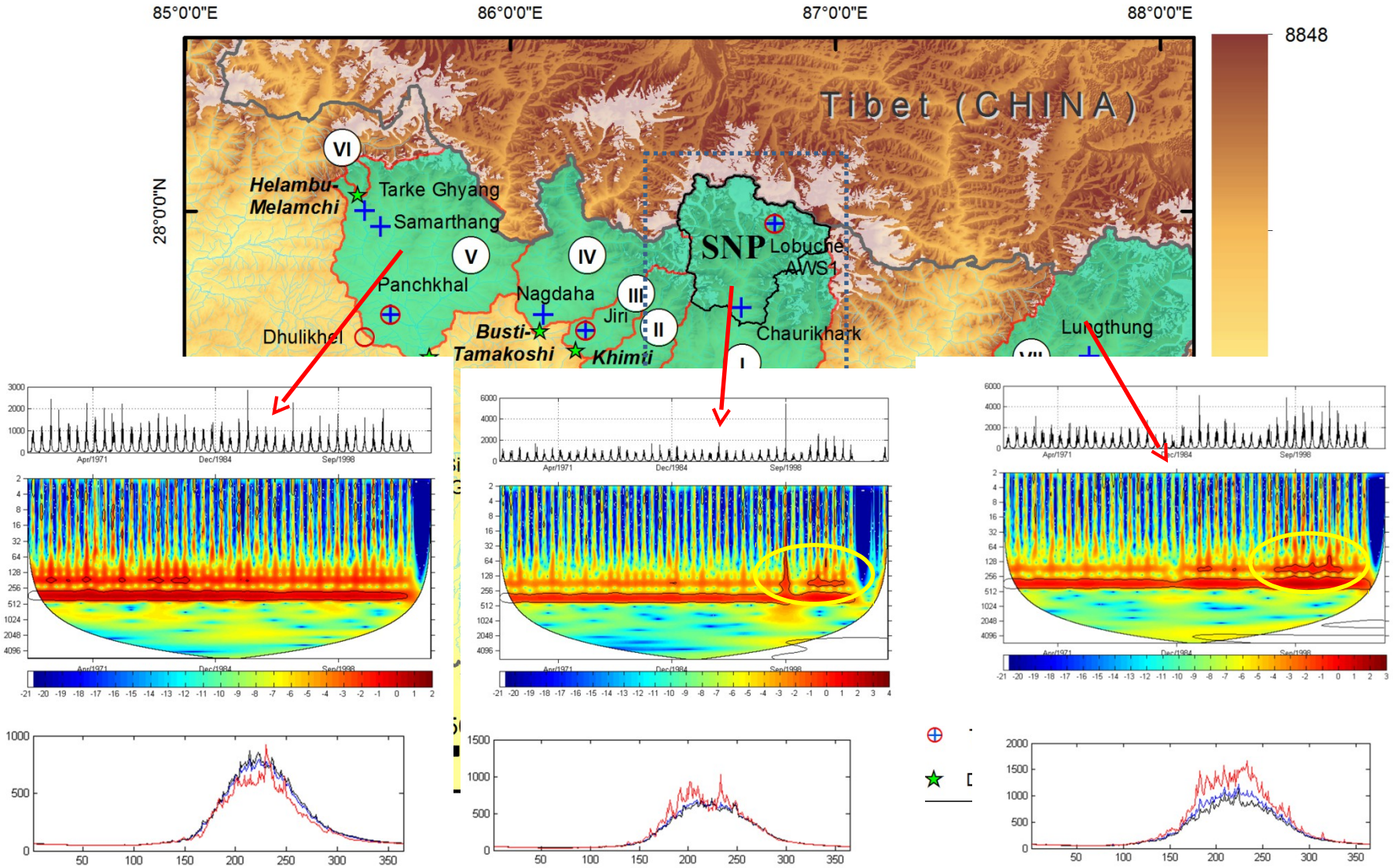
Temporal analysis of Lakes

(1960s to 2011)





River discharges



FIELD DATA (since 2011)

Meteo

- Installation of a pan evaporimeter

Rivers

- Selection of a reference site
- Stream level measurements close to glacier front (1 stations)
  - Velocity measurements
  - Isotophe measurements (altitudinal gradients of snow, rain, glaciers and rivers)
  - Water quality measurements (multiparameter probes and weekly grab samples)

Lakes

  - Selection of a reference lake
  - Batimetry, lake level , inflow, outflow level)
  - Water quality measurements (multiparameter probes and weekly grab samples)

Permafrost

- 200 thermistors and umidity probes at three depths along and altitudinal gradient (2800-5600 m)

Comments and suggestions….