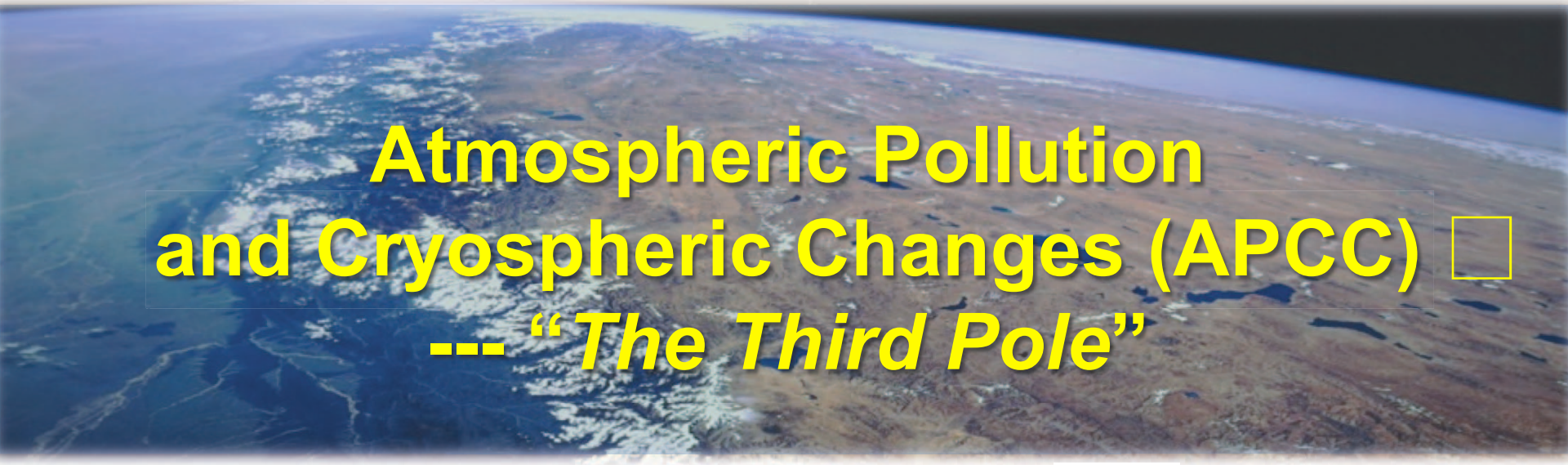


Atmospheric Pollution and Cryospheric Changes (APCC) --- "*The Third Pole*"

Shichang Kang
Yulan Zhang
Pengfei Chen
Junming Guo
Yang Li
Lekhendra Tripathee
Jizu Chen
Xiaofei Li

Qianggong Zhang
Zhiyuan Cong
Zhenming Ji
Chaoliu Li
Guishuai Zhang
Jie Huang
Dipesh Rupakheti

Maheswar Rupakheti

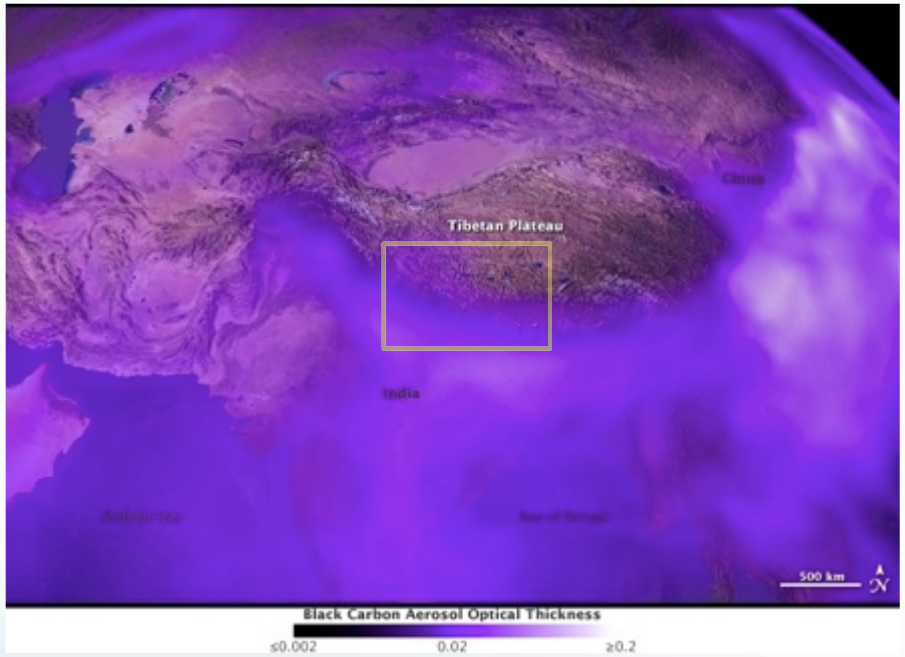
Arnico K. Panday

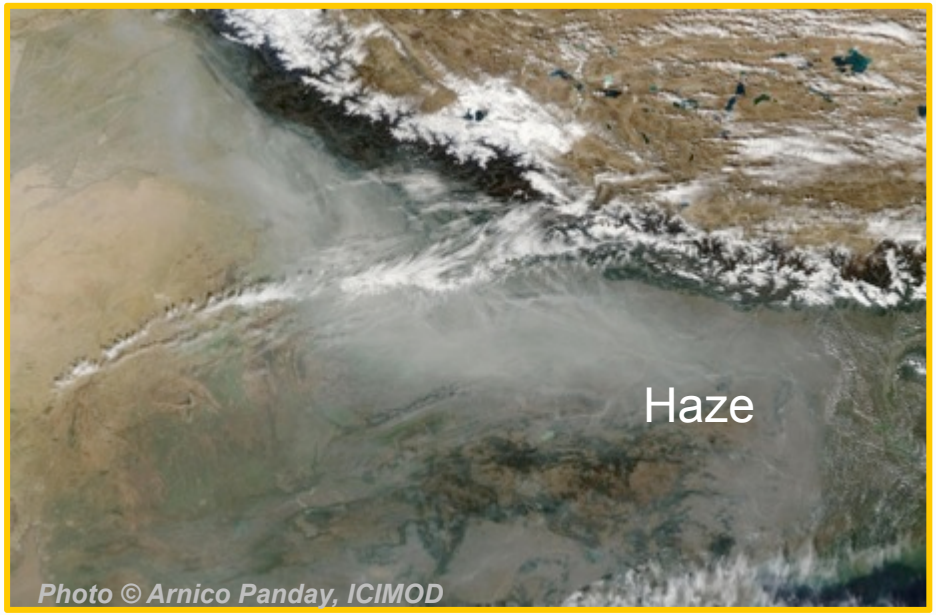
Örjan Gustafsson

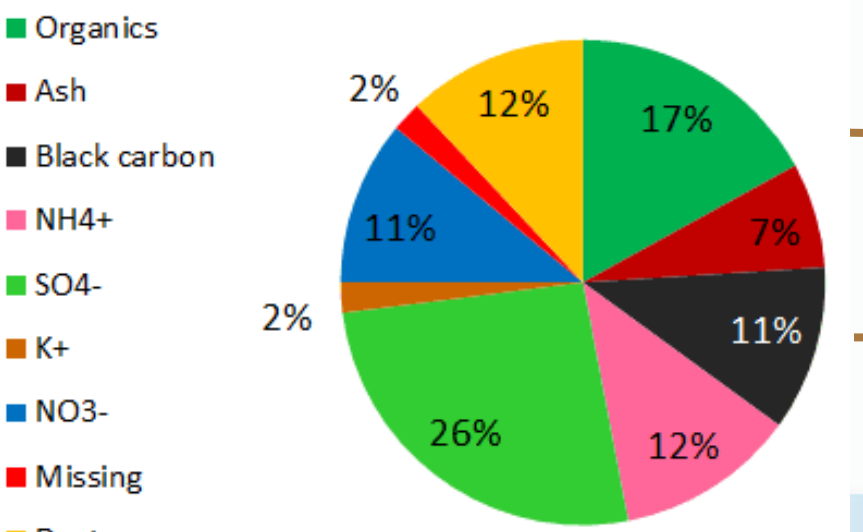
Yun Qian

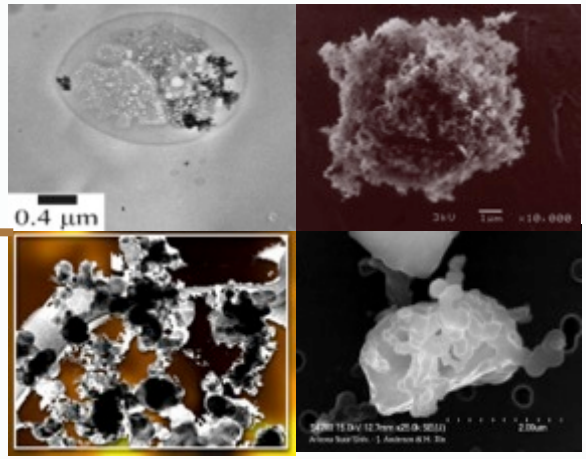
State Key Laboratory of Cryospheric Science, Chinese Academy of Sciences

Air Pollution & Atmospheric Brown Clouds









Atmospheric Brown Clouds – Major Composition

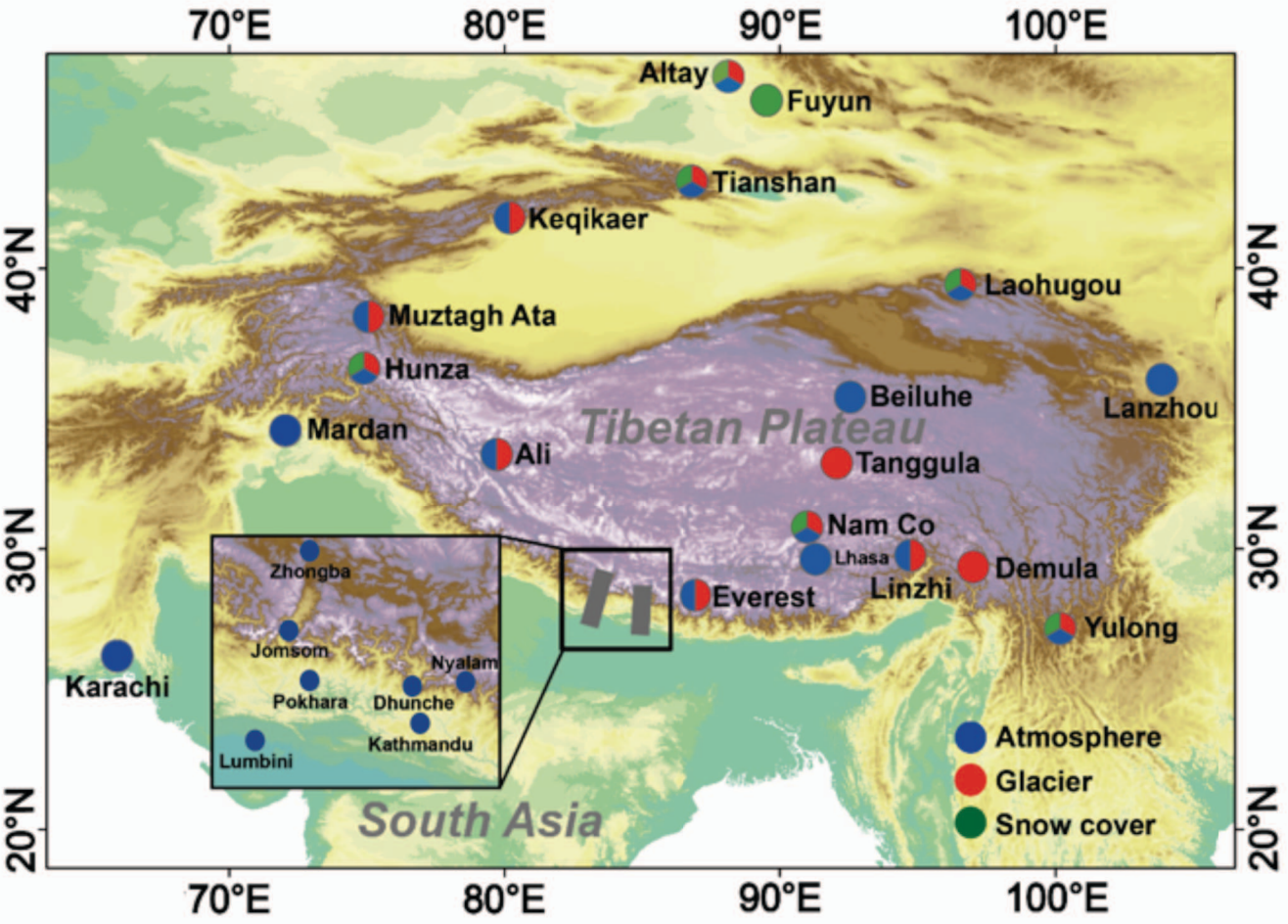
Ramanathan.,2004

冰冻圈科学国家重点实验室

Feature? Transport? Impact?

APCC: Atmospheric Pollution and Cryospheric Change

Aerosol: 30 Glacier: 14 Snow cover: 6



Observational parameters, instrumentation, and temporal resolution

Research content	Sampling/Observational parameters	Instrumentation	Frequency
On-line measurement	Aerosol optical properties	CIMEL Sunphotometer	hourly
	Aerosol concentration: $PM_{2.5}$, PM_{10}	Thermo RP1400	hourly
	Gaseous precursors: SO_2, No_x, CO, O_3; Toxic gas (Atmospheric mercury)	Thermo 42I, 43I, 45I, 49I analyzer; Tekran 2537	hourly
	BC	Aethalometer AE33	hourly
Filters	Total suspend particles: EC/ OC, brown carbon (BrC), inorganic ions, trace element, and isotopes, and organic tracers.	TSP sampler (KC-120H)	3-6 days
Glacier & Snow cover	Snow/ice samples: Dust, EC/ OC, BrC, WSOC, inorganic ions, trace element, and isotopes, and organic tracers		1-2 times per year
	In-situ Albedo	ASD Handheld 2 spectroradiometer	

Atmospheric Pollution and Cryospheric Change

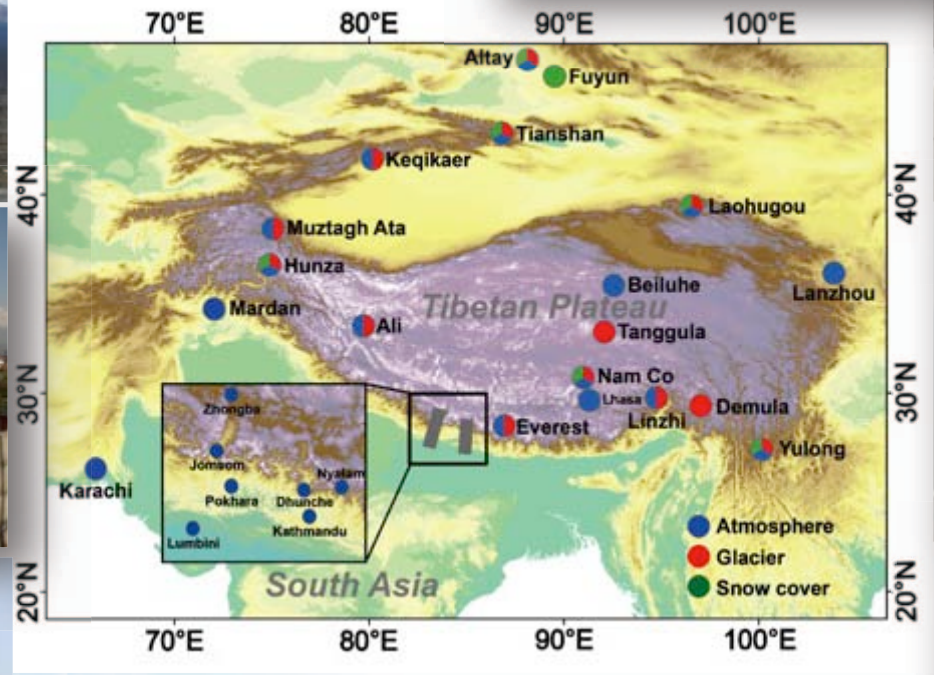
Logo	Name	Monitoring Content
	Super Station	Meteorology, Trace Gas, Active Aerosol sampling, Passive Sampling
	Station	Meteorology, Active Aerosol sampling, Passive Sampling
	Site	Low resolution active sampling + Passive sampling

Sites at a Glance

Everest

Nam Co

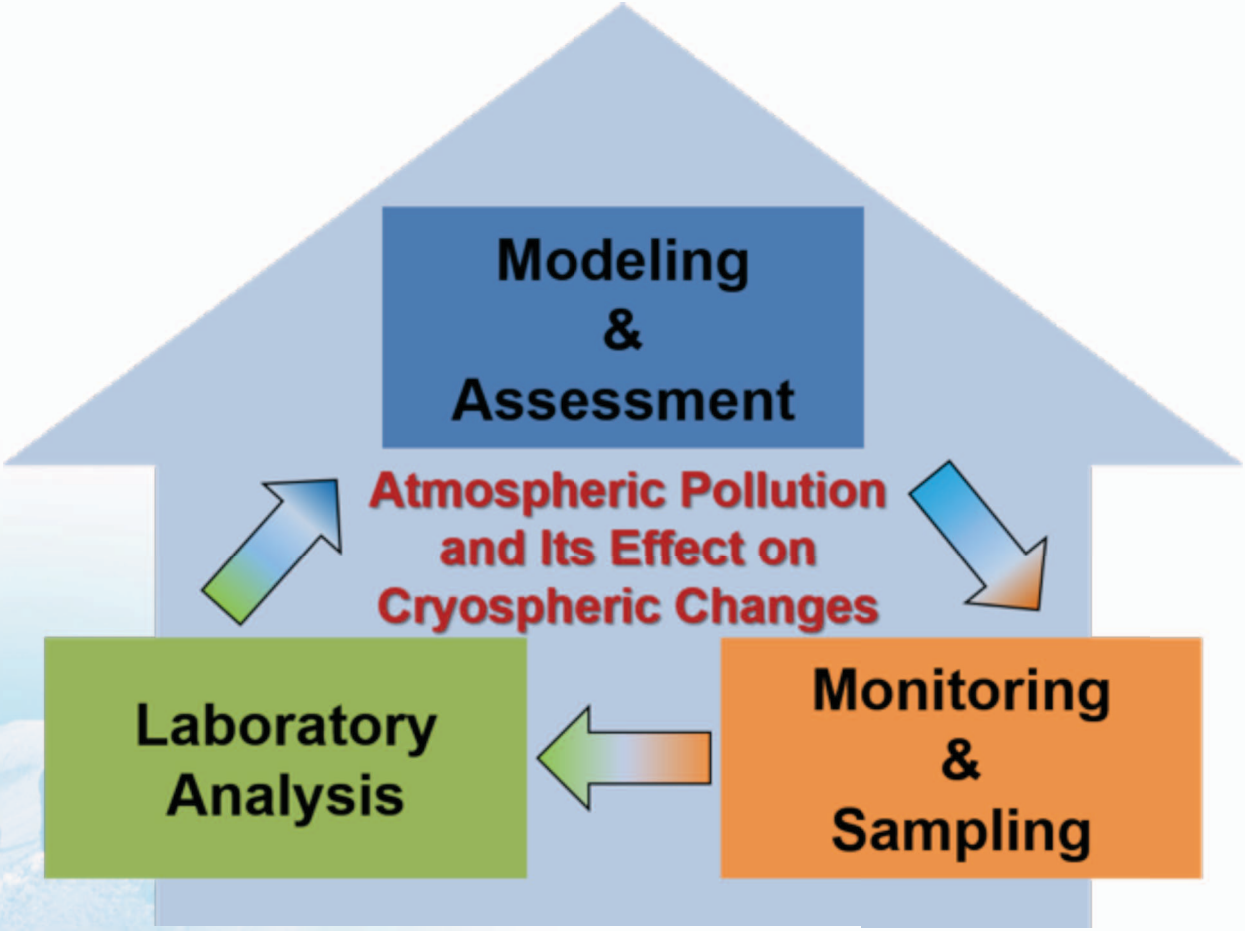
Sites at a Glance



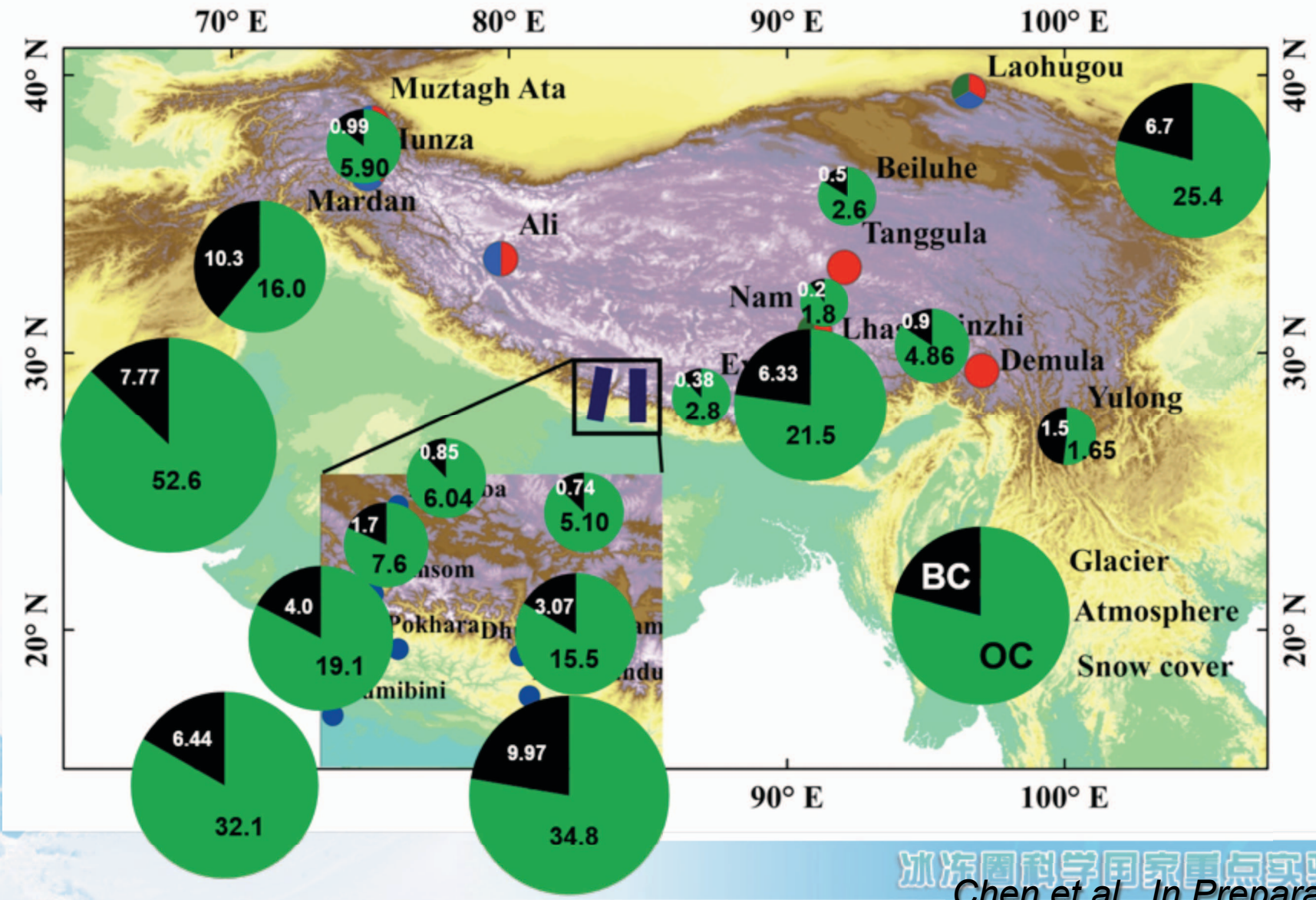
Aims and Tasks

- Characterize the chemical composition and levels of atmospheric pollutants, depict their spatial and seasonal variation over the TP.
- Identify the sources of atmospheric pollutants and reveal the transport pathway and mechanisms of trans-boundary atmospheric pollution to the TP.
- Assess the impact of atmospheric pollution (LAIs) on the cryospheric changes (glacier and snow melt) over the TP.
- Determine the fate of environment-toxic pollutants (Hg, POPs) within glacier and snowpack and their impacts on ecosystem downstream.

Basic Design

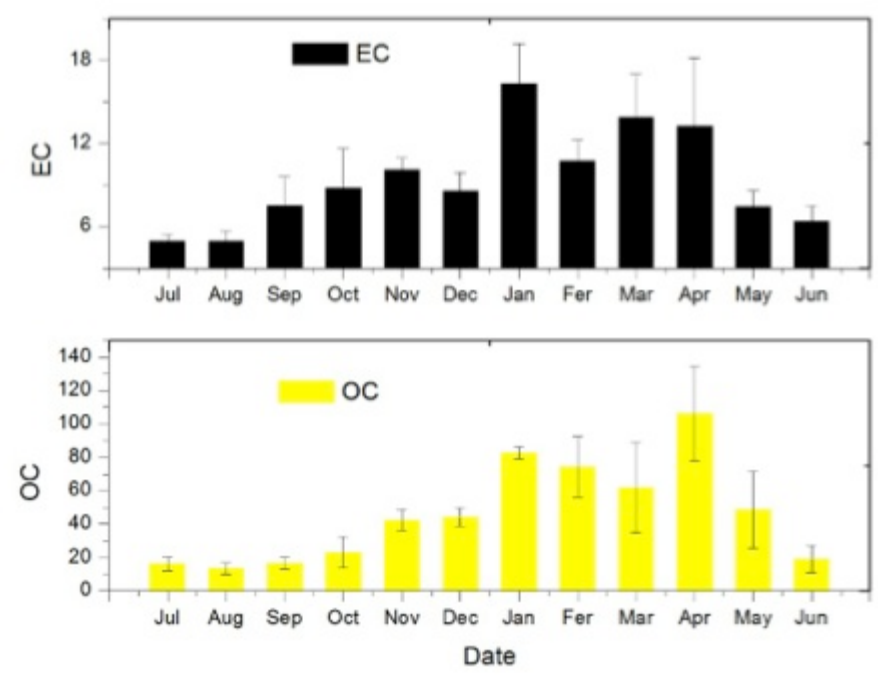


BC and OC in aerosols

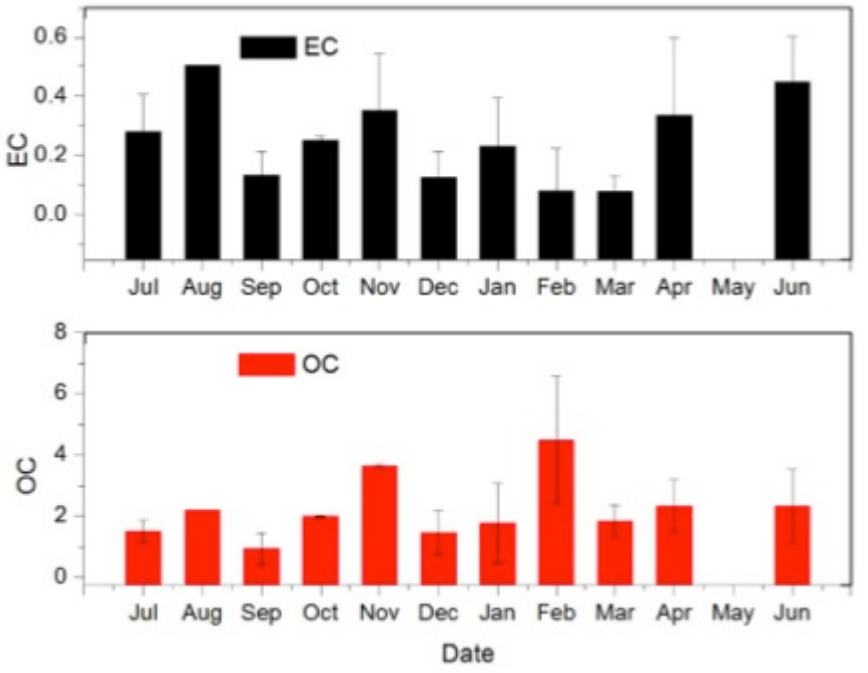


Chen et al., In Preparation

Seasonal variation of BC and OC



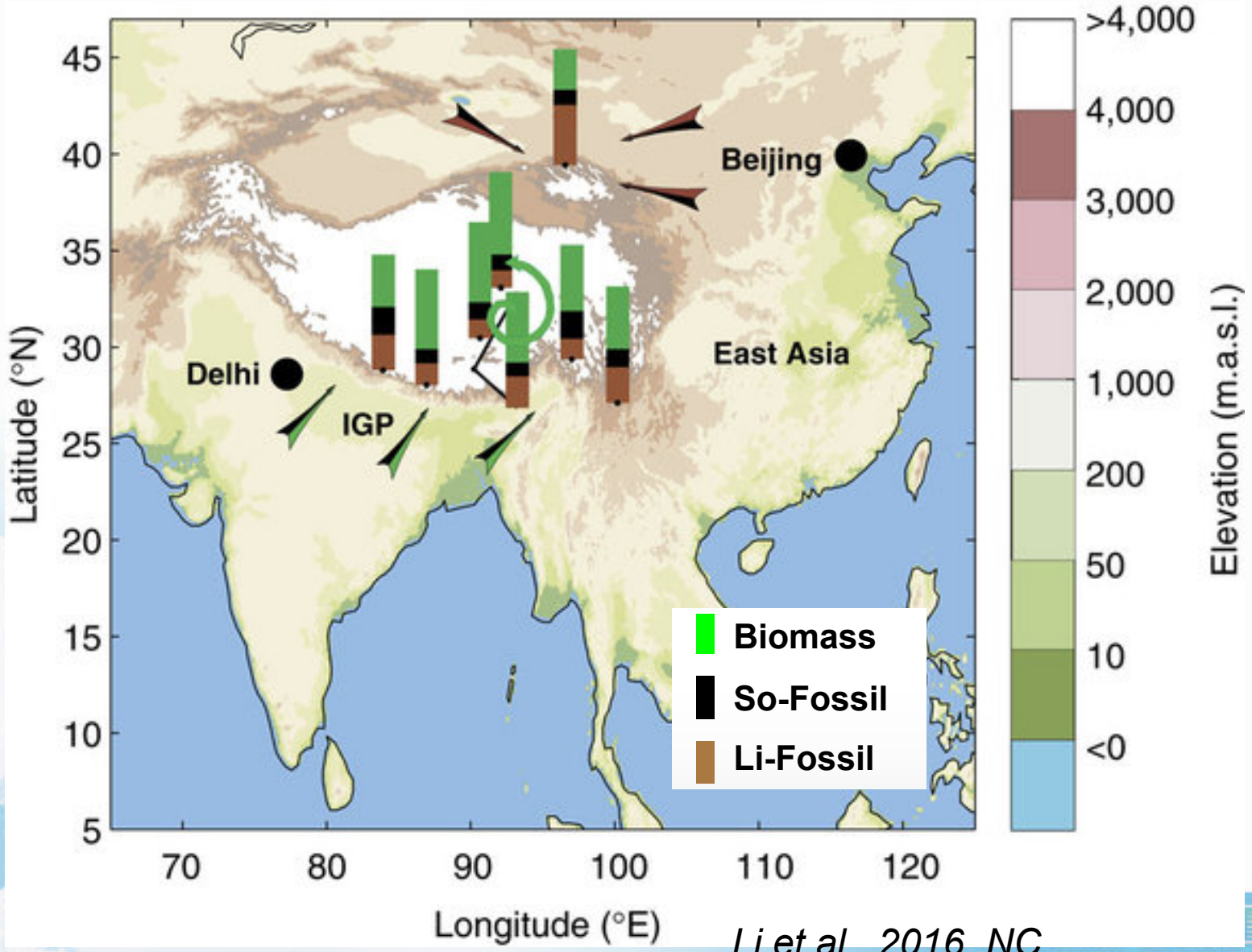
Kathmandu



Nam Co

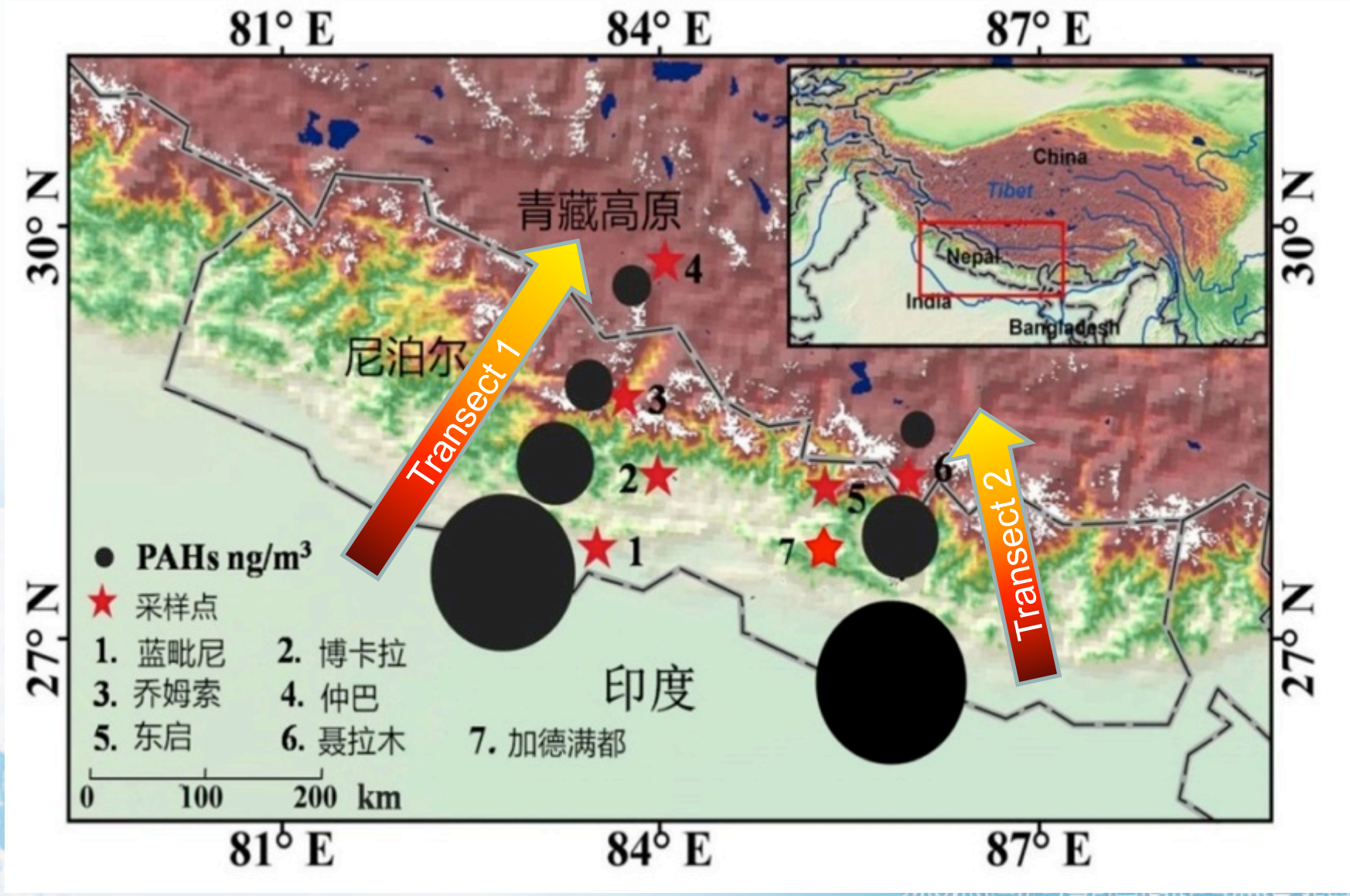
Chen et al., In Preparation

BC in glacier

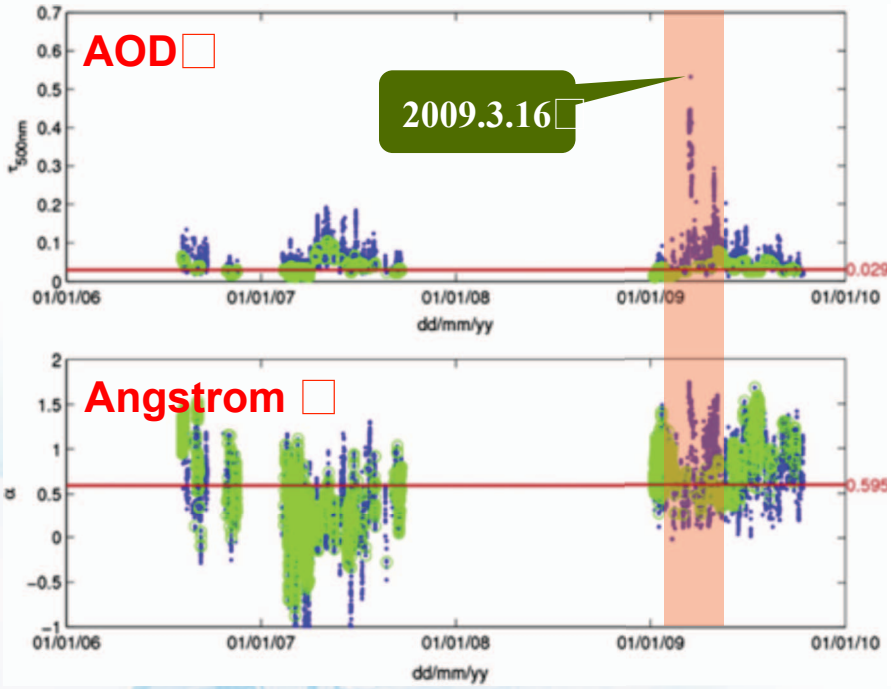


Li et al., 2016, NC

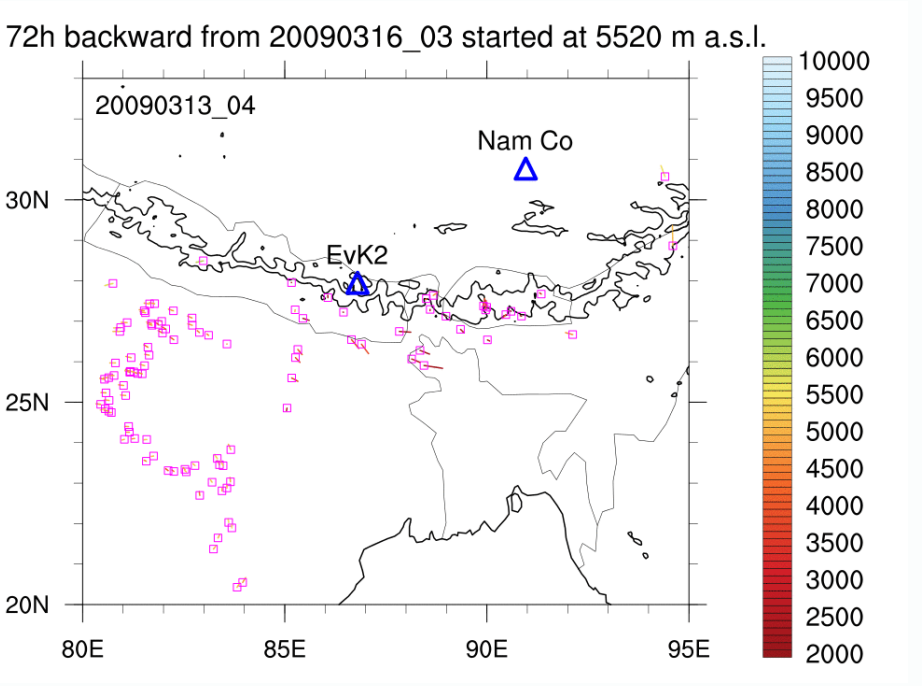
PAHs in aerosols



Trans-Himalaya Pollution Plume: An Event



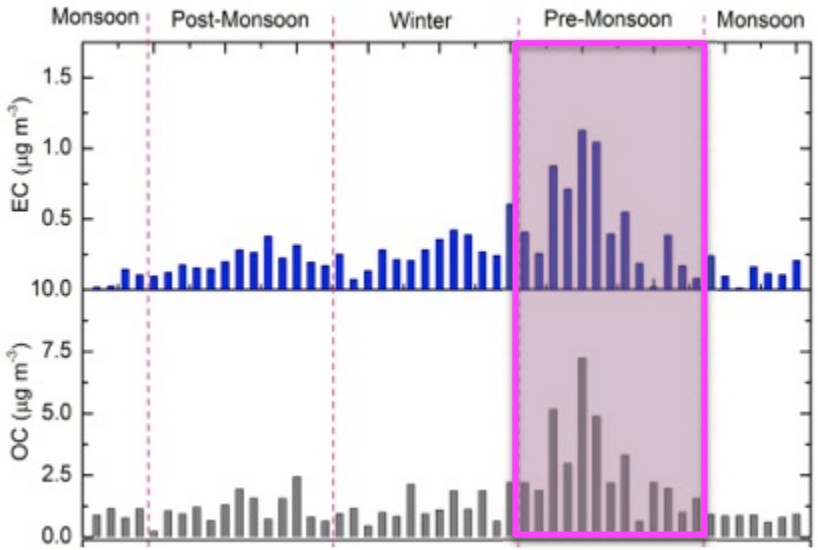
AOD at Nam Co Station

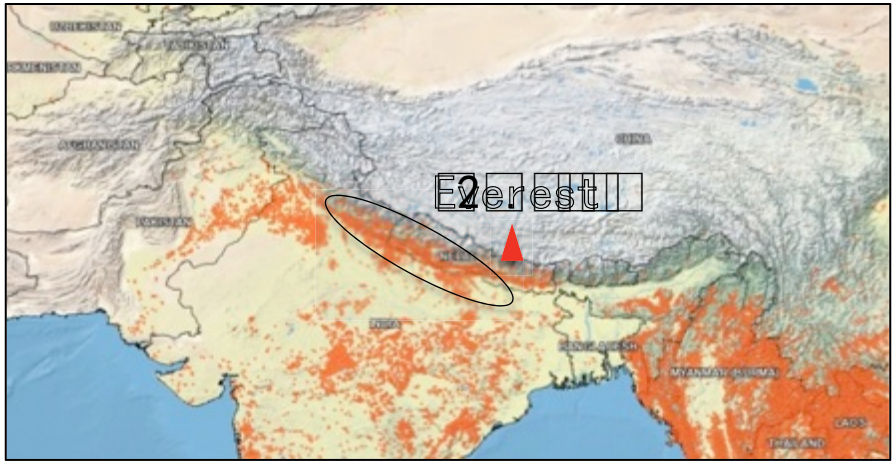


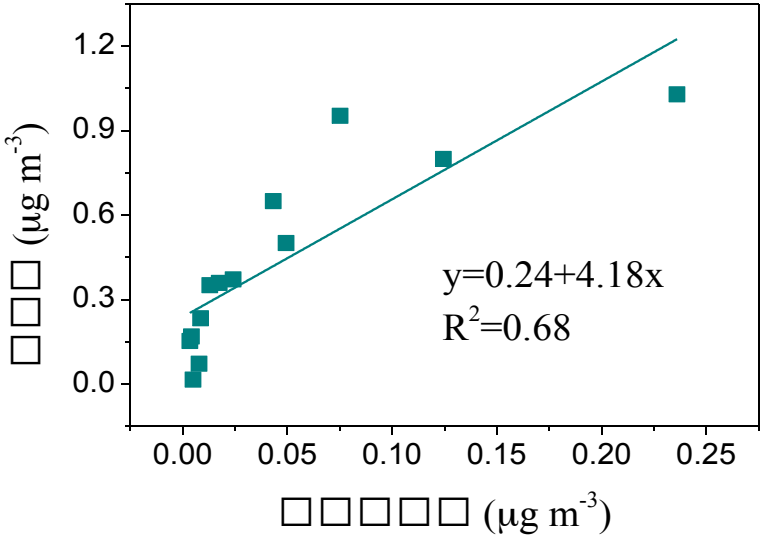
Air mass trajectories simulated by COSMO

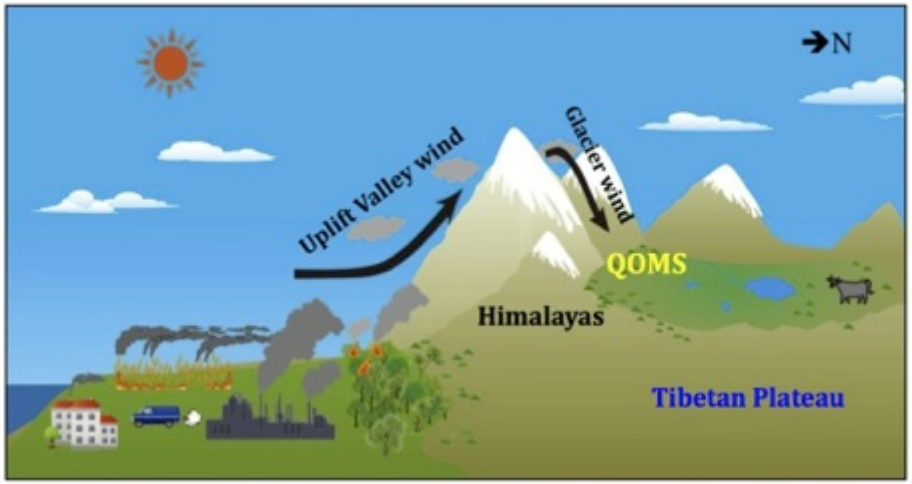
Lüthi et al. 2015 ACP

Trans-Himalayan Pollution through the Valleys





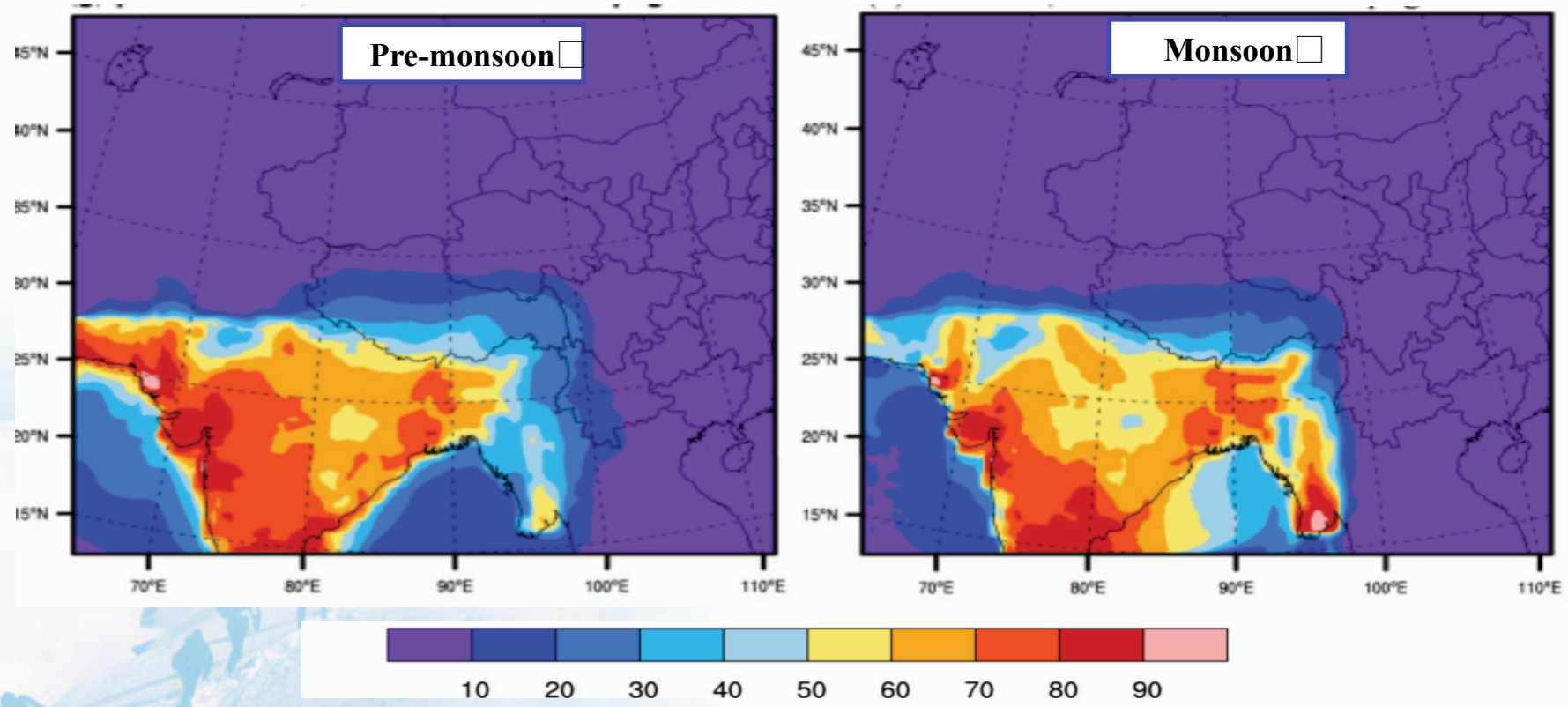




Cong et al., 2015, Atmos. Chem. Phys.

Carbonaceous Aerosols & Climatic Effects

- About 10-40% of atmospheric BC in the southern TP is from anthropogenic emission from South Asian



WRF-Chem simulating in 2013

Yang et al., 2016. In preparation