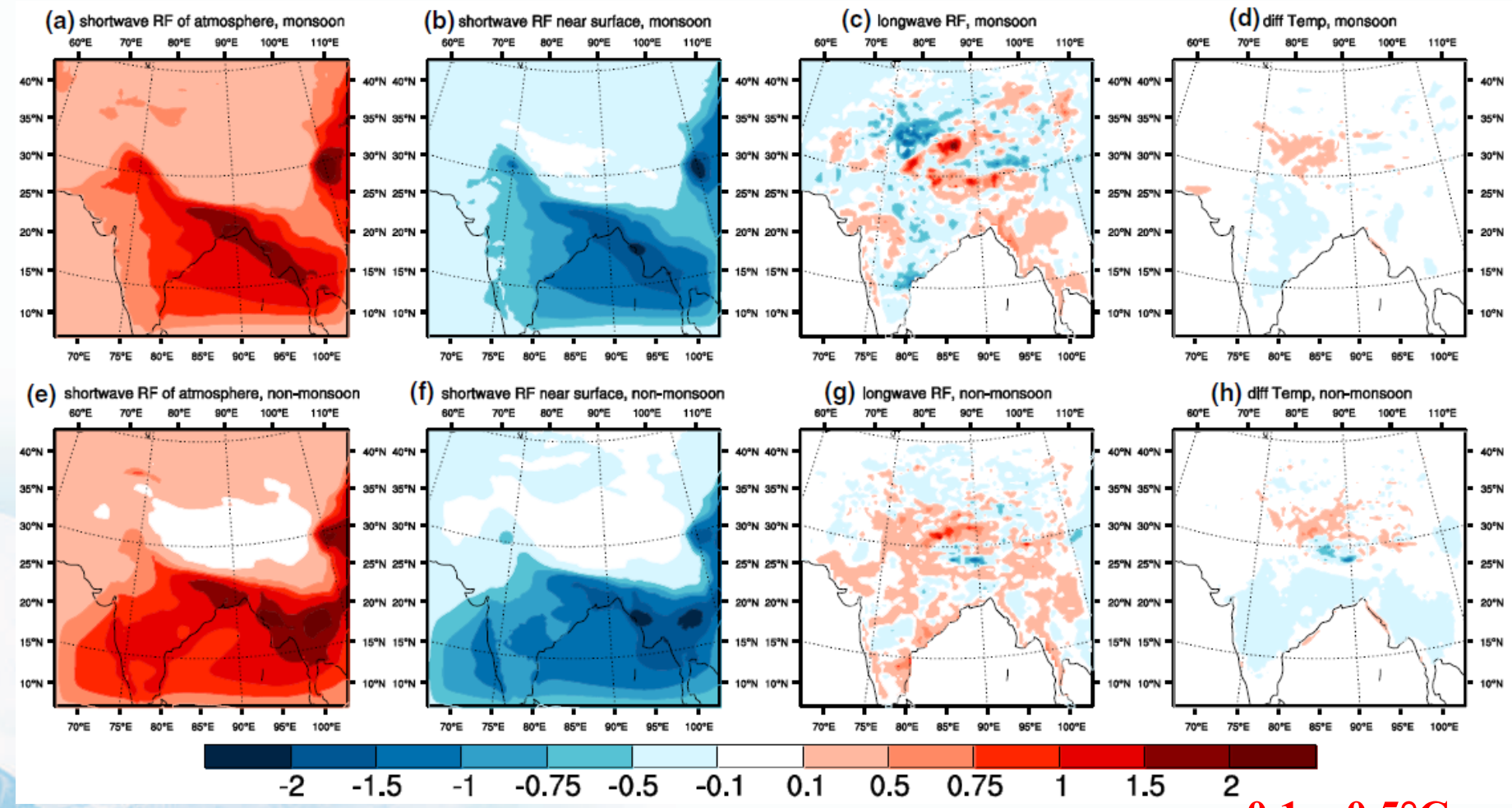
Carbonaceous Aerosols & Climatic Effects

Monsoon

Non-Monsoon



RegCM4.3.5 simulating

0.1 ~ 0.5°C warming!

Ji & Kang et al., 2015

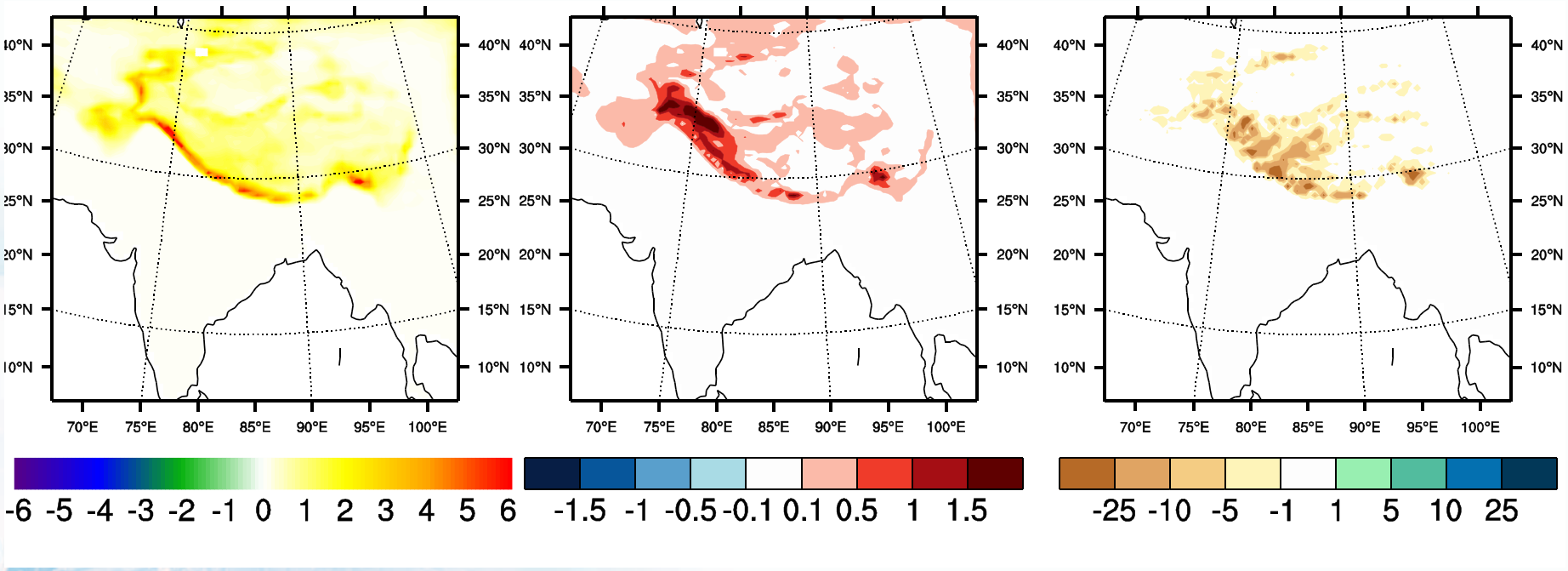
Carbonaceous Aerosols & Climatic Effects

Effects of BC-snow radiative feedback

RF
1-6 W/m²

Increasing Tem.
0.1-1.5°C

Snow melt
10-25 mm

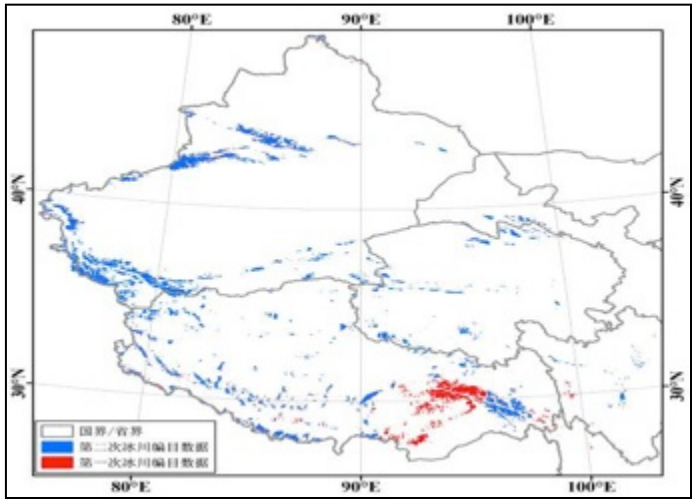


RegCM4.3.5 + SNICAR

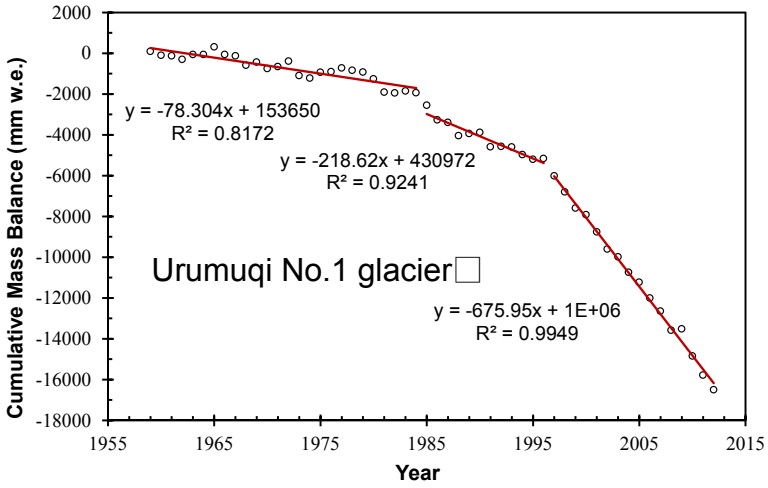
Ji et al., 2016. ACCR

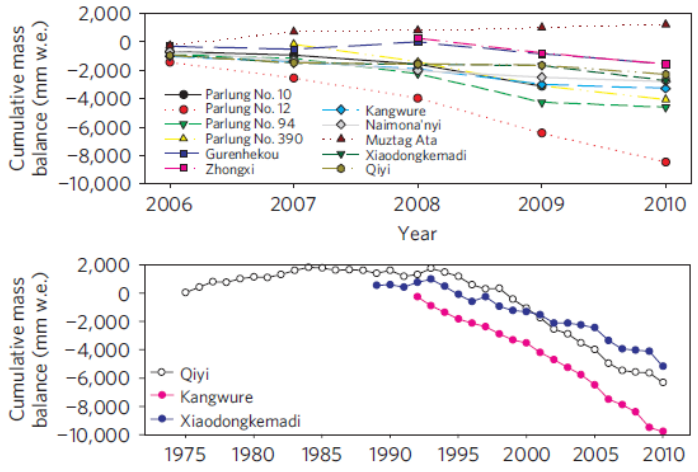
Impacts of atmospheric pollutants on glacier melt

Glacier area of 51800 km^2 with a reduction rate of 18.1% during the last 50 years



Liu et al.,2015.JG

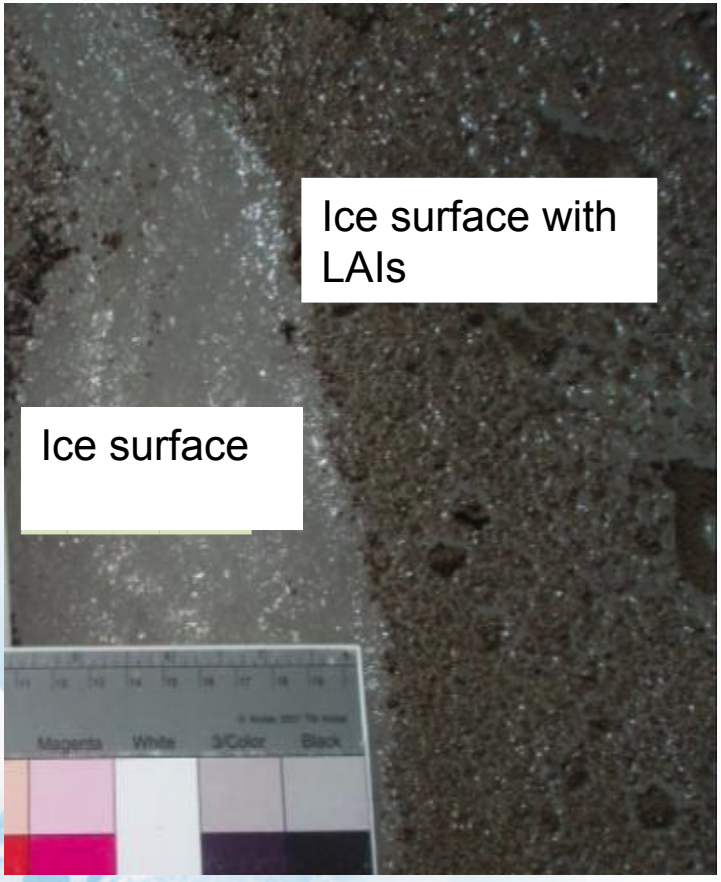


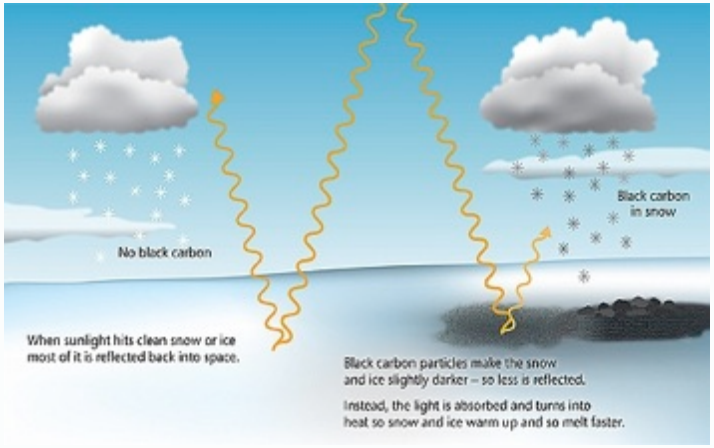


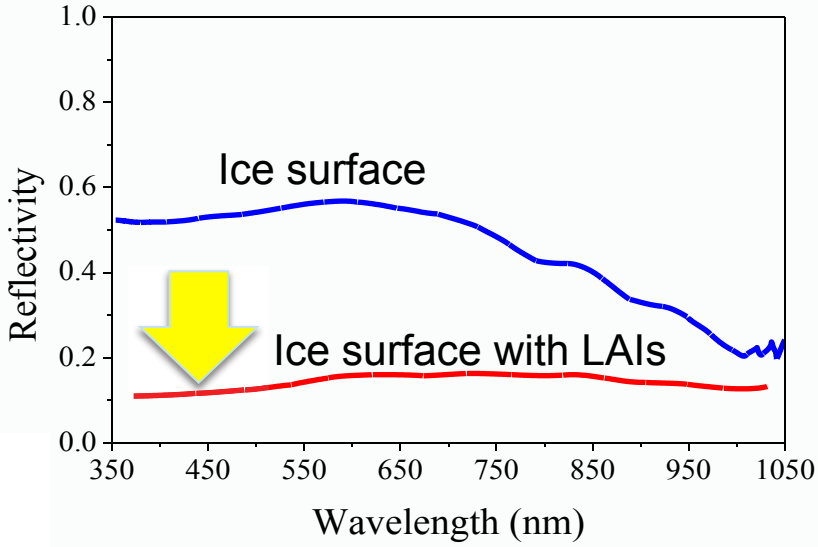
Deficit mass balance causing glacier shrinking

Yao et al.,2011. NCC

Impacts of atmospheric pollutants on glacier melt

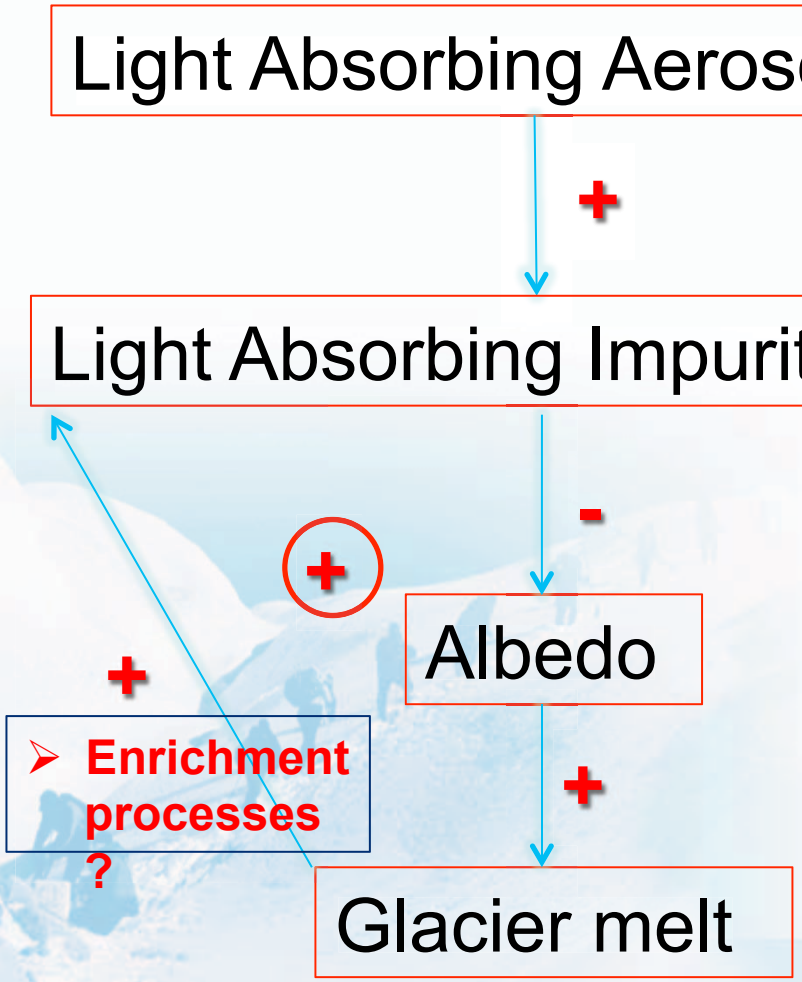






$$Q_0 = S\downarrow(1-\alpha) + L\downarrow - L\uparrow + Q_H + Q_L + Q_R$$

Impacts of atmospheric pollutants on glacier melt



- Spatial and temporal loadings?
- Sources?

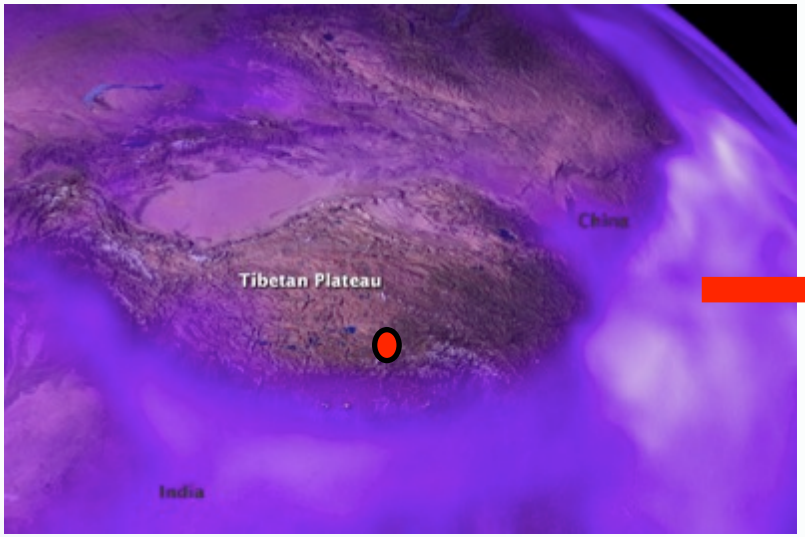
- Depositional/removal processes?

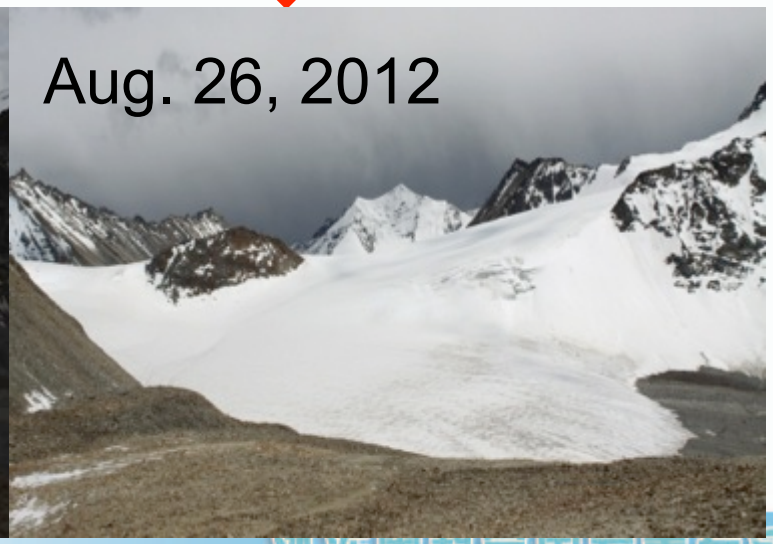
- Dust and BC (or organics)?
- Spatial and temporal Changes?

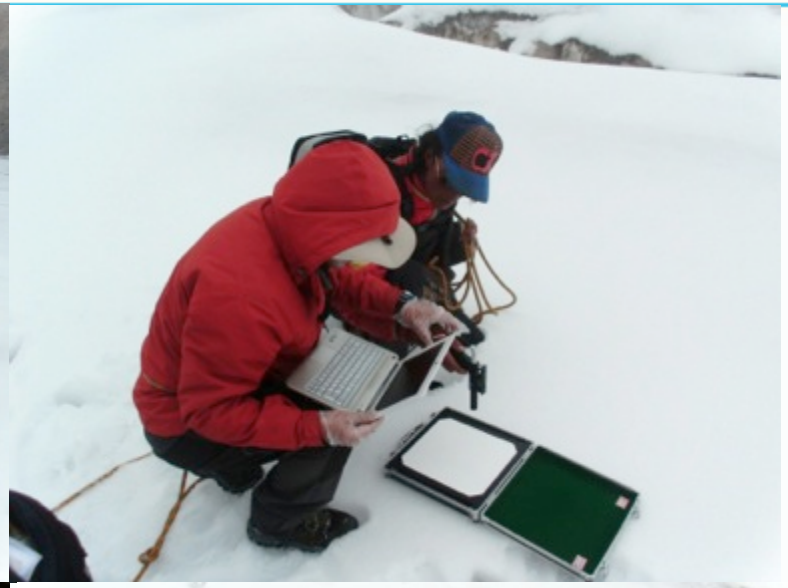
- Calculating and Modeling (SNICAR)?
- Other parameters (density, size ……)

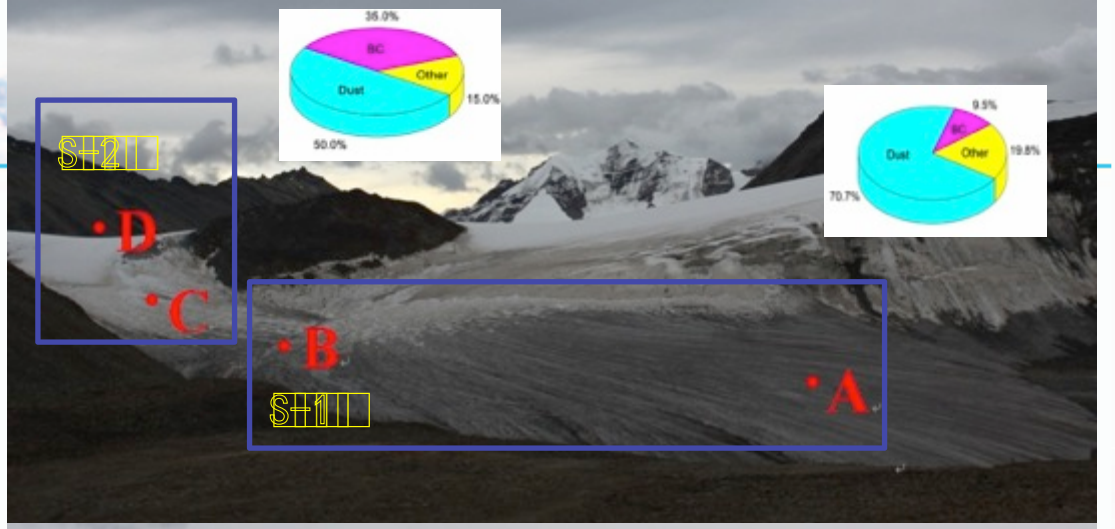
- Glacier energy and mass balance model?

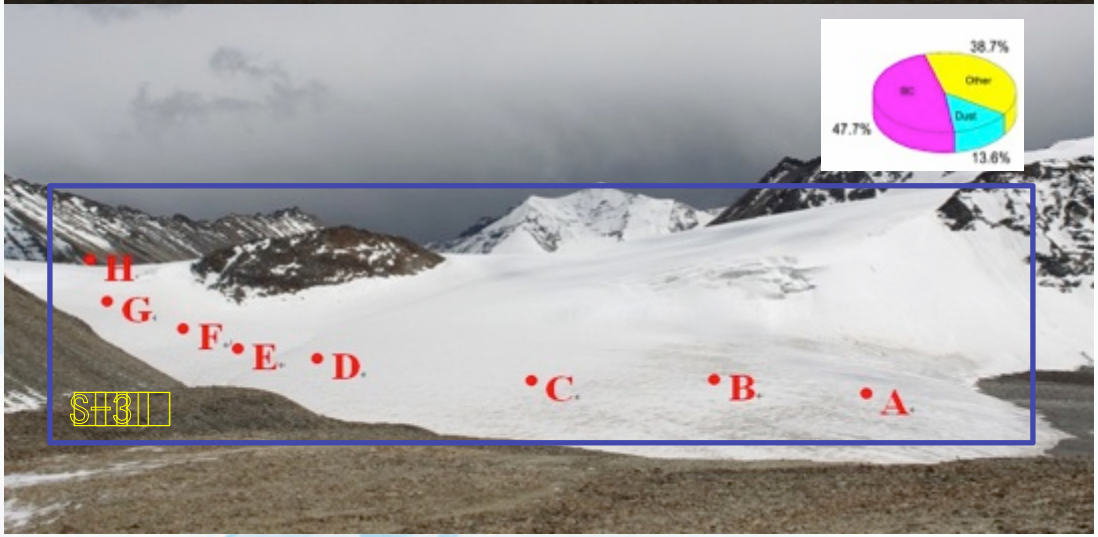
Role of BC, Dust and Others in Glacier Melt

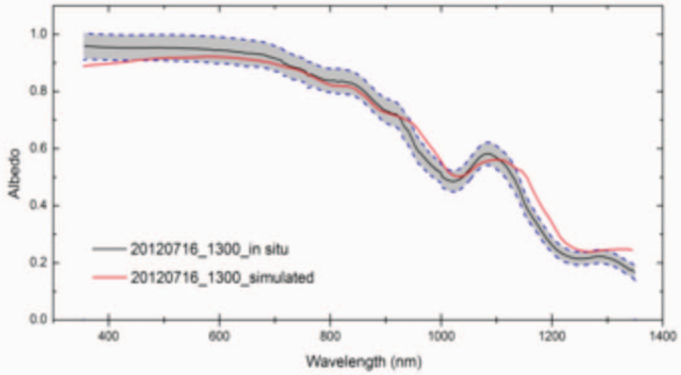


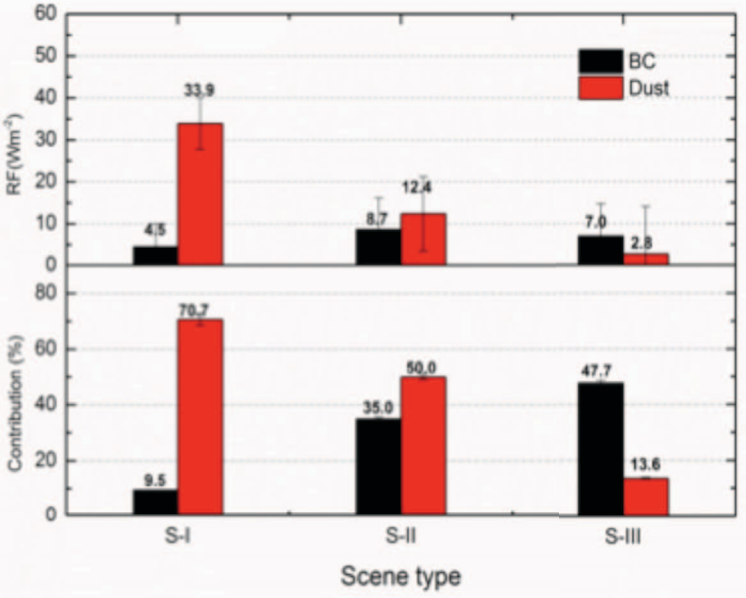






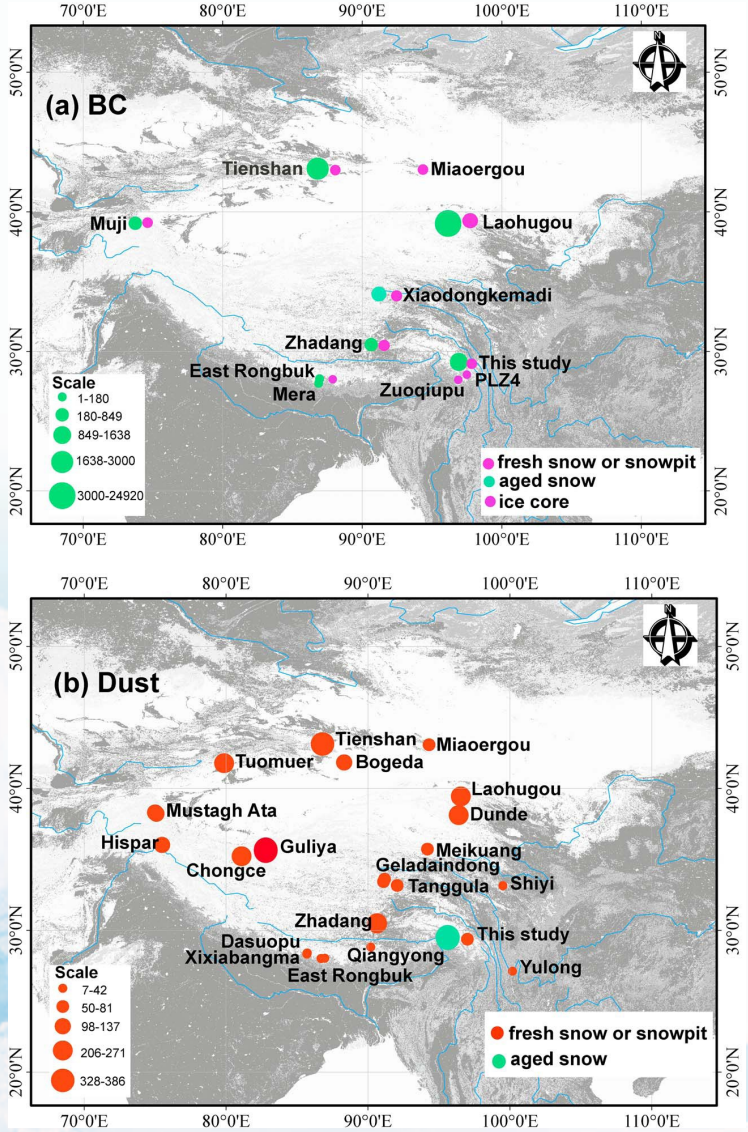






Qu et al., 2015. ACP

Spatial distributions - Glacier



(a) BC and (b) dust distributions on the Tibetan Plateau and its surroundings.

For snowpit/fresh snow:
Comparable to that from Himalayas
Lower than that fro Tienshan and North Tibetan Plateau

Aged snow data:
Lower than that from Tienshan and Qilian Mountain

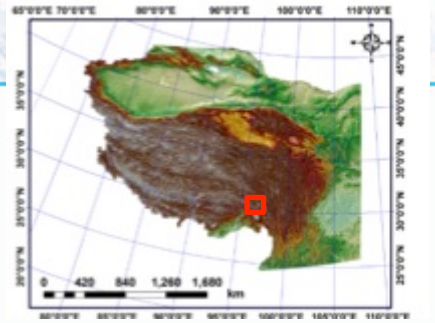
Affected by Transportation Sources

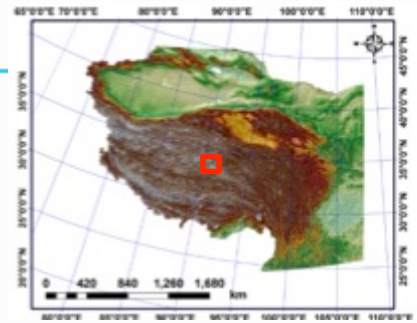
(Zhang Y et al., 2016; 2017a)

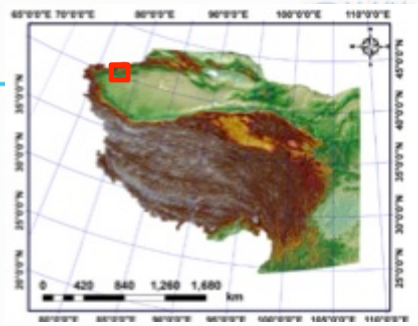
SE Tibetan Plateau

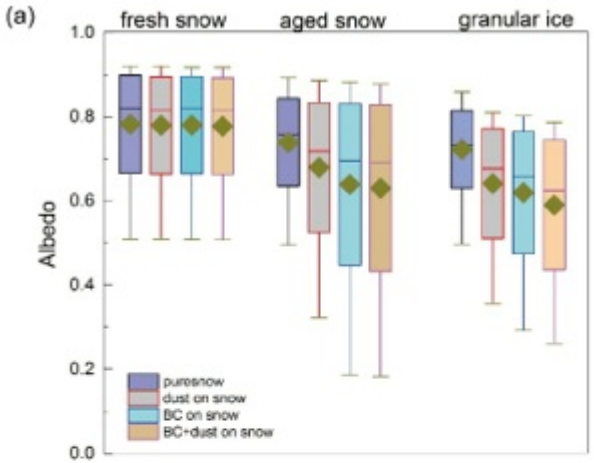
Central Tibetan Plateau

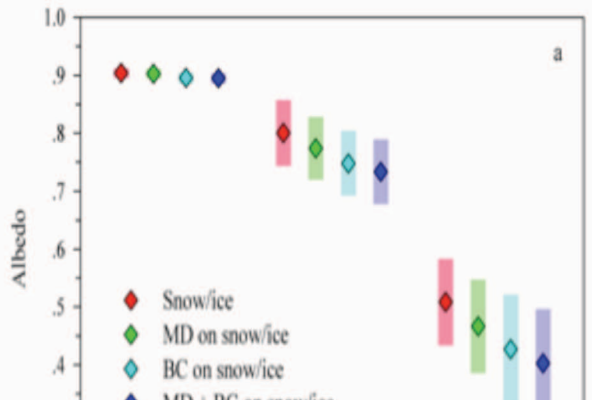
Western Tianshan

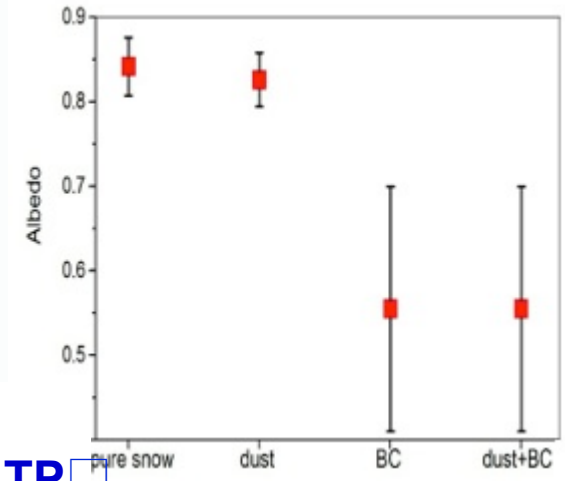




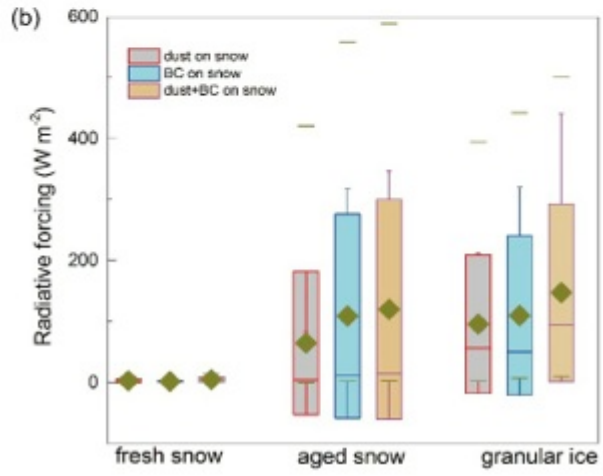


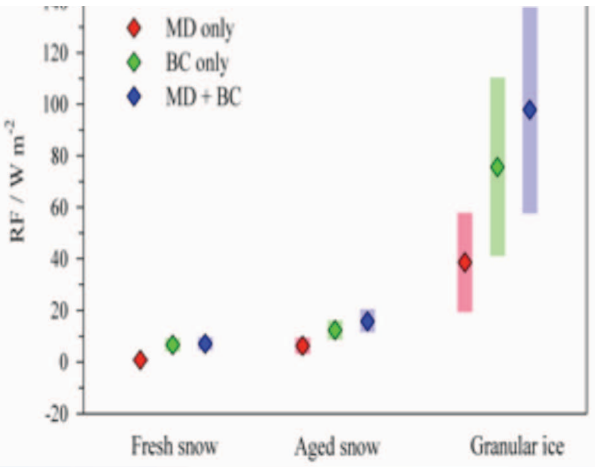


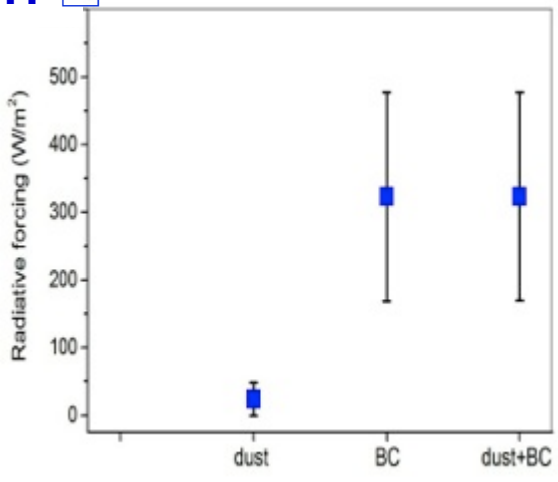


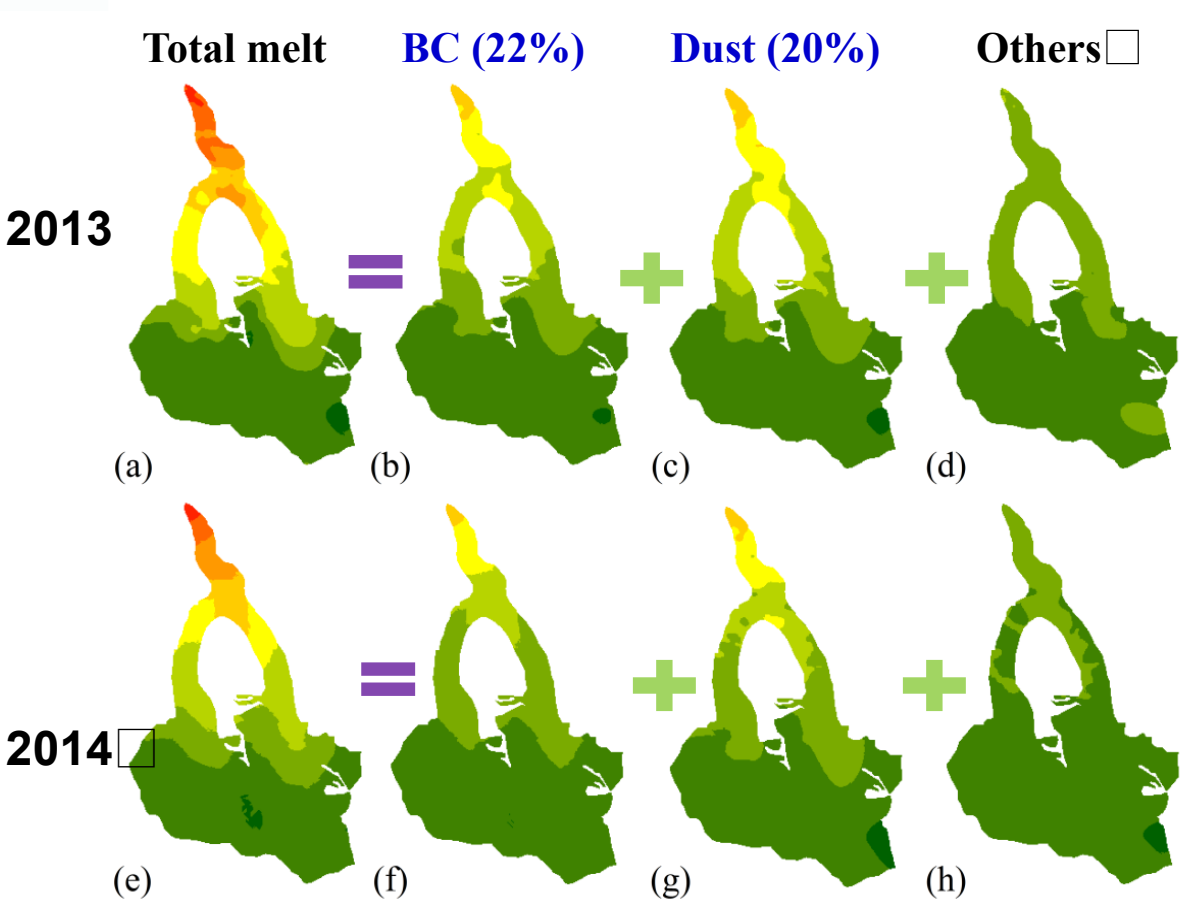


- **BC > dust**
- **W Tianshan > SE TP > C TP**







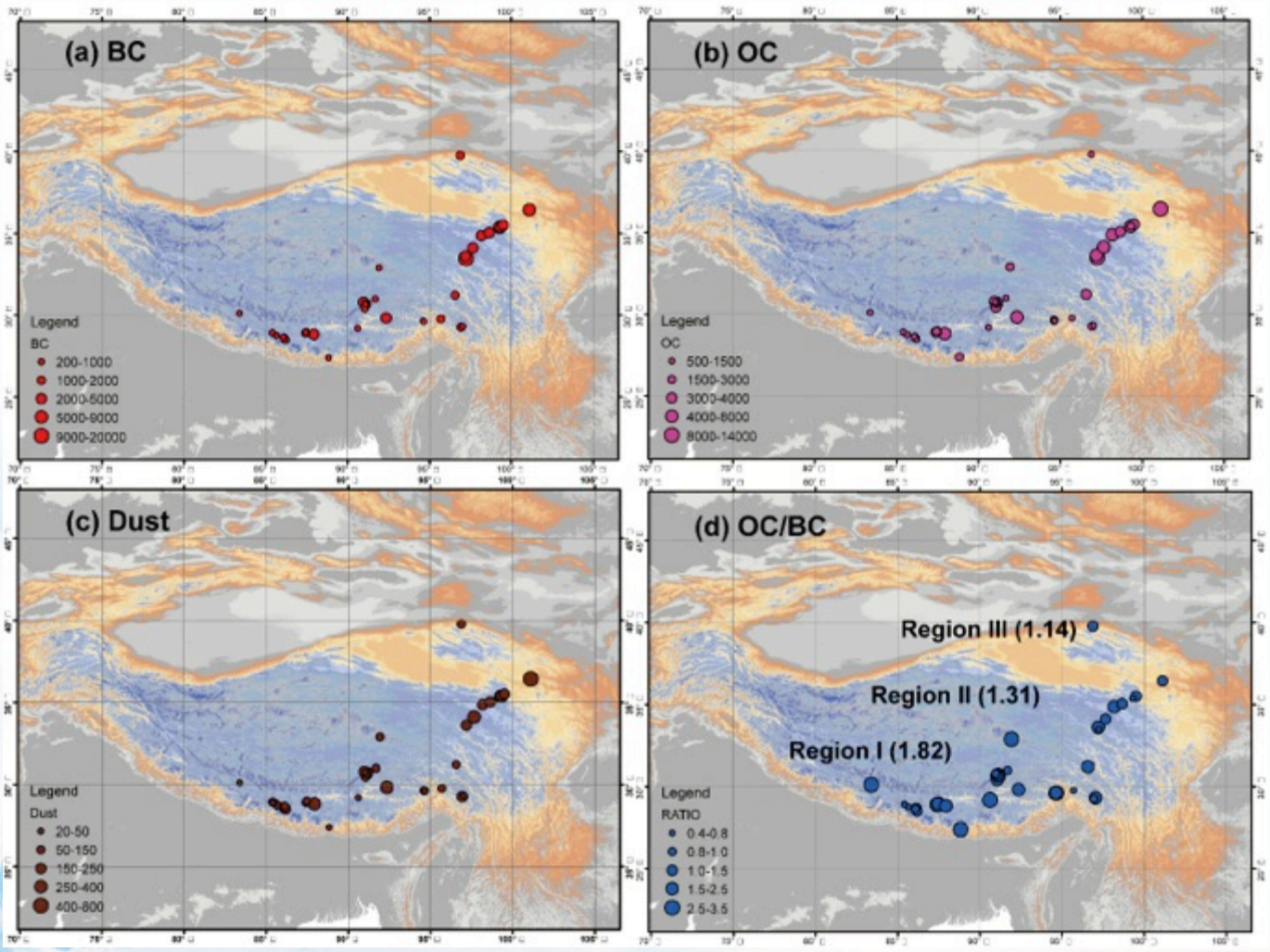


Glacier ablation (mm)

- -250 - 0
- 0 - 250
- 250 - 500
- 500 - 750
- 750 - 1,000
- 1,000 - 1,250
- 1,250 - 1,500
- 1,500 - 1,750
- 1,750 - 2,000

Li et al., 2016, TC

Spatial distributions – Snow Cover

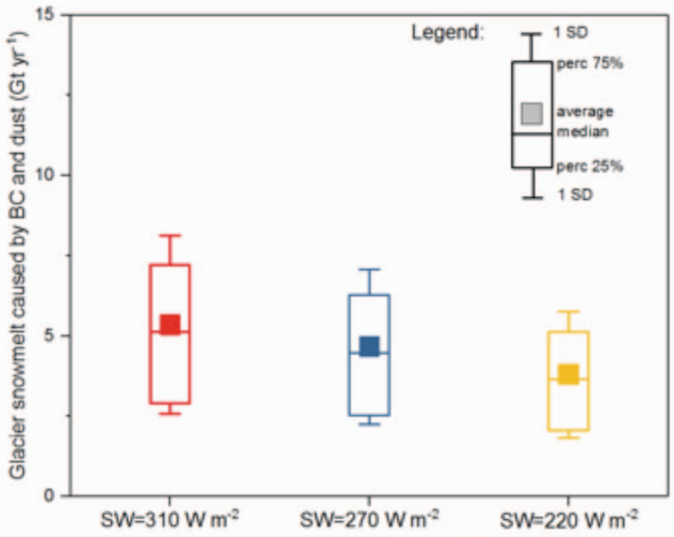


North > South

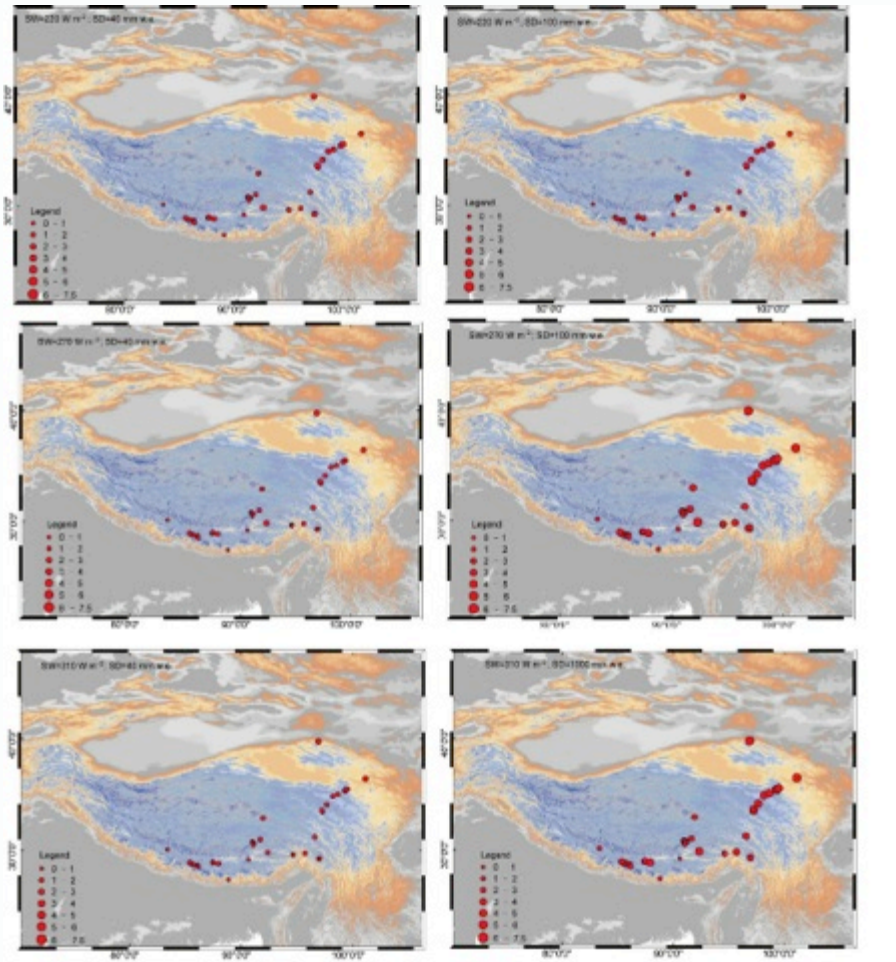
- ✓ Different snow types
- ✓ BC or dust sources
- ✓ Transportation

(Zhang Y et al., 2017b)

Contributions of LAIs snow cover duration



- ✓ [illegible]
- ✓ [illegible]



- ✓ [illegible]

(Zhang et al., 2017b)

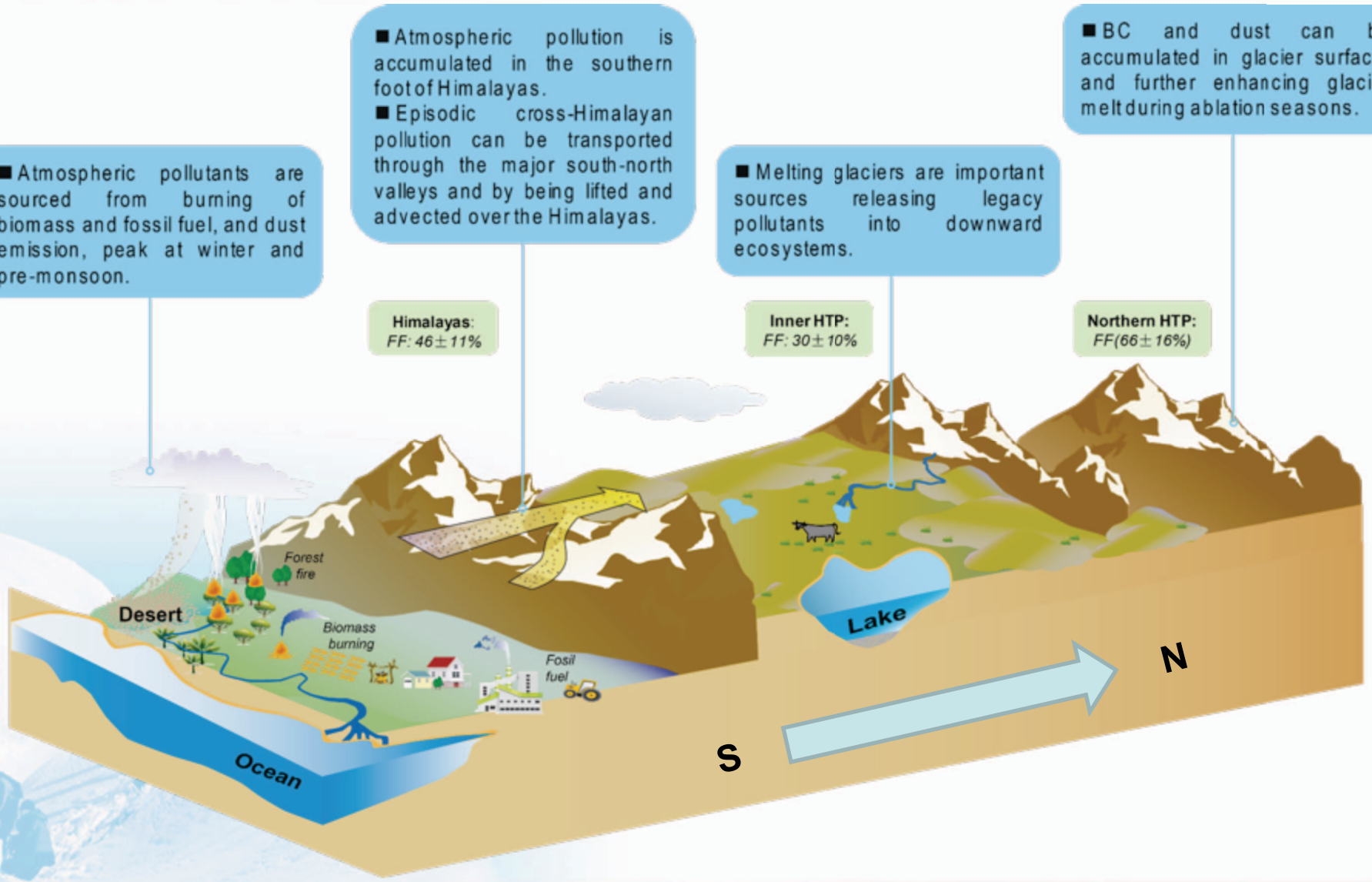
Summary of Major Research Achievements

■ Atmospheric pollutants are sourced from burning of biomass and fossil fuel, and dust emission, peak at winter and pre-monsoon.

■ Atmospheric pollution is accumulated in the southern foot of Himalayas.
■ Episodic cross-Himalayan pollution can be transported through the major south-north valleys and by being lifted and advected over the Himalayas.

■ Melting glaciers are important sources releasing legacy pollutants into downward ecosystems.

■ BC and dust can be accumulated in glacier surface, and further enhancing glacier melt during ablation seasons.



Atmospheric Pollution and Cryospheric Change
A Global Perspective

Kang & Zhang et al., In Preparation

Thank you!

Rongbuk Glacier, Mt. Everest

(http://www.weather.com.cn/climate/qhbhyw/12/1570550.shtml?p=3)