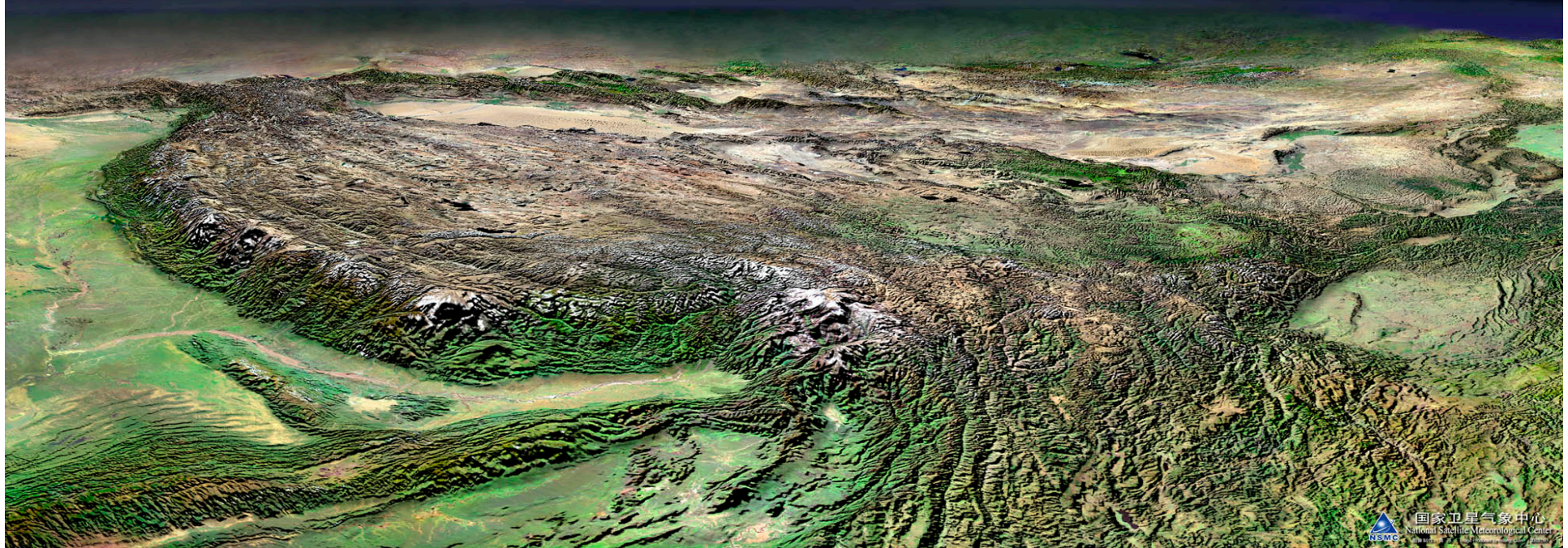


Glacial retreat and its impact on hydrological processes on the Third Pole



Yao Tandong
Institute of Tibetan Plateau Research,
Chinese Academy of Sciences

July 24, 2008

NATURE

THE THIRD POLE

NATURE | Vol 454 | 24 July 2008

CHINA NEWS FEATURE

THE THIRD POLE

Climate change is coming fast and furious to the Tibetan plateau.

NATURE | Vol 454 | 24 July 2008

CHINA NEWS FEATURE



catastrophe," says Ouyang Hua, deputy director of the Institute of Geographical Sciences and Natural Resources Research in Beijing. As permafrost stores one-third of the world's soil carbon, vegetation loss would lead to a huge amount of carbon entering the atmosphere, exacerbating global warming.

Competing forces

With all the changes the Tibetan plateau is undergoing — a warming climate, retreating glaciers, degrading permafrost and alpine ecosystems — what are the implications for the regional and global climate? The first and most important victim could be the Indian monsoon. This strong seasonal wind results from differences in the thermal properties between land and ocean. In summer, the vast land in Asia heats up more than the Indian Ocean, leading to a pressure gradient and the flow of the air and moisture from the ocean. The rise of the Tibetan plateau starting 50 million years ago (see 'Lifting the roof of the world') is thought to have strengthened this effect. As the land surface absorbs more sunlight than the atmosphere, the plateau creates a vast area of surface warmer than the air at that elevation, thereby increasing the land-ocean pressure gradient and intensifying the monsoon.

Some climate models show that global warming would lead to a greater increase in the plateau's surface temperature than over the ocean, thus augmenting the monsoon. On the other hand, some models suggest that aerosols that absorb solar radiation, and changes in land use in the region, could weaken the monsoon. "The intensity of

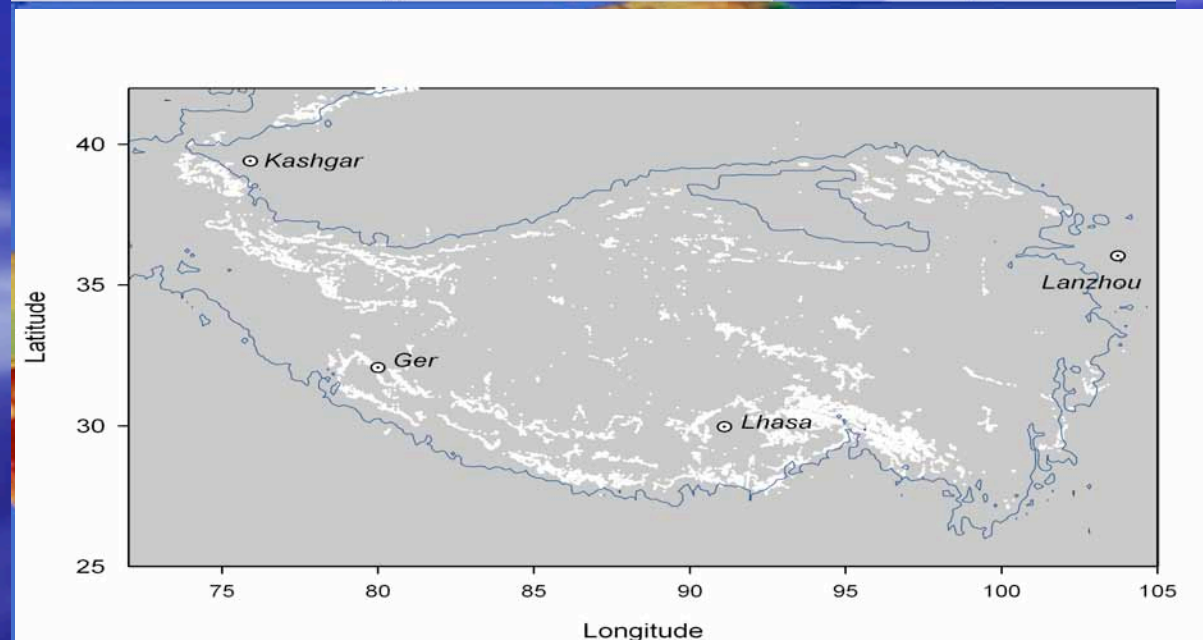
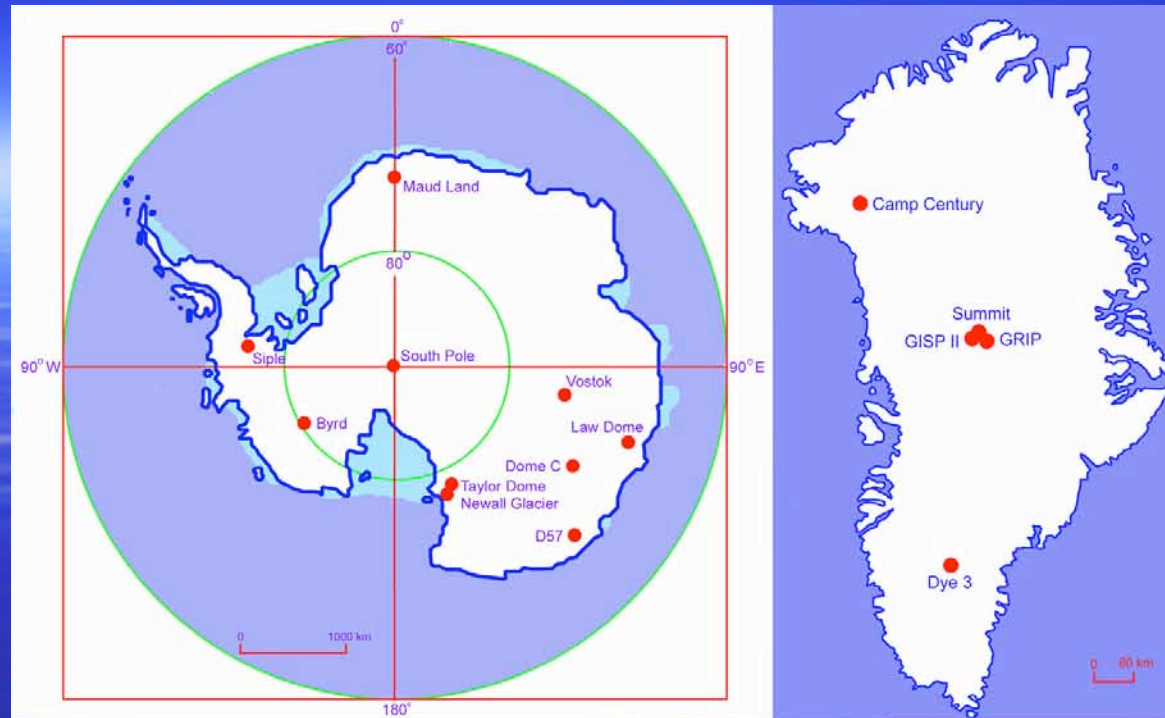
es being carried down to
and Yao Tandong (right)
working on a glacier.

ide," he says. He estimates
mbined effect of black car-
eenhouse gases may be suf-
count for a warming trend of
decade in the Himalayas, roughly
en observed so far.
lack carbon settles on Himalayan
darkens the snow and ice so that
o more heat and become warmer.

danger far exceeded by long-term issues with



**Three largest
ice masses on
the earth
including
Antarctica
region, Arctic
region and
Third Pole
region**



Glacier distribution on the Third Pole

There are more than 100,000 km² of glacier on the Third Pole, including about 50,000 km² on the Tibetan Plateau. The other glaciers are, respectively, in the Himalayas, Karakorum and Hindukushi.

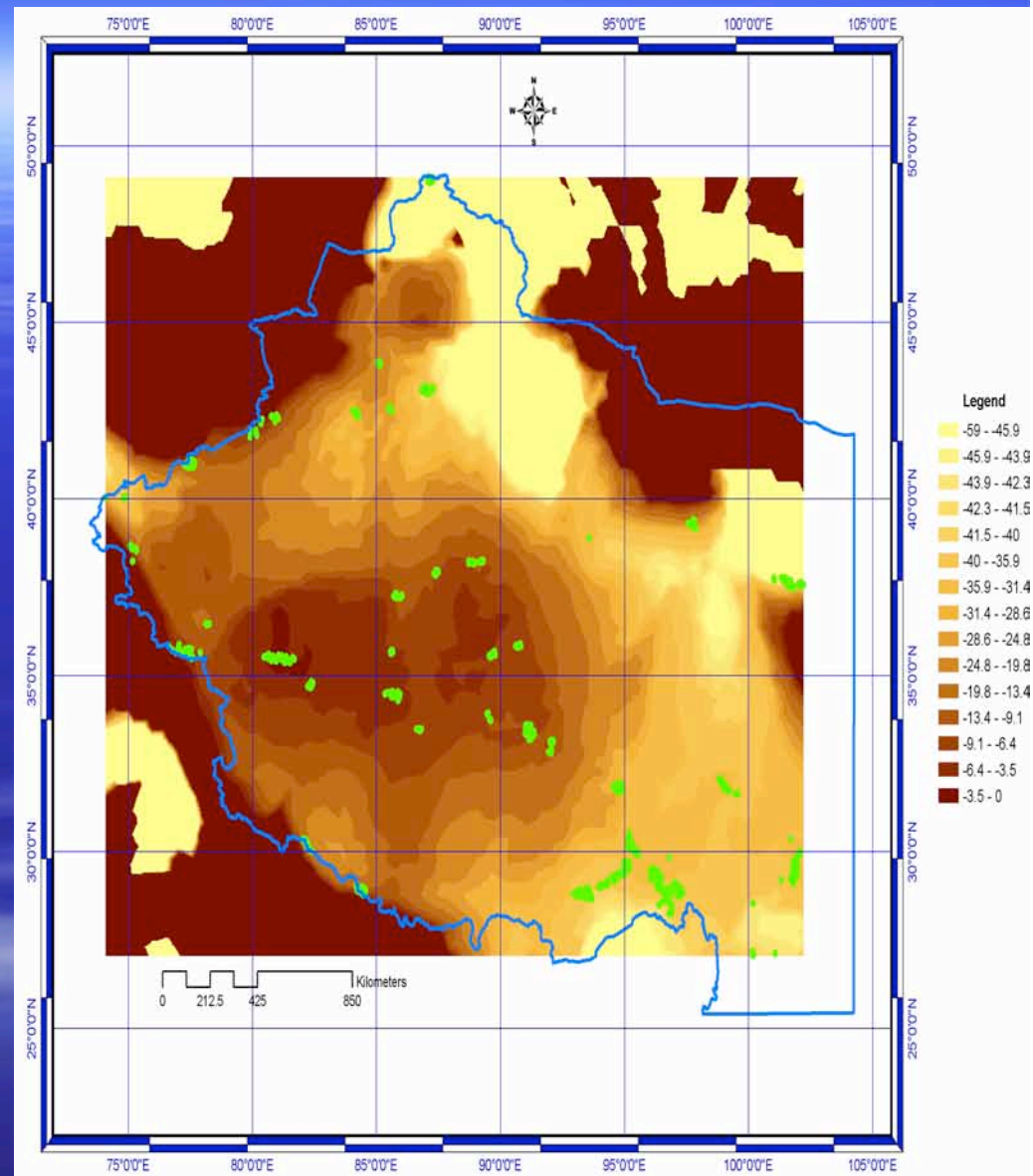
**Glaciers on the Third Pole are
extensively retreating**

**Retreating glaciers reaches 80—95% of the
total glaciers**



Ata Glacier

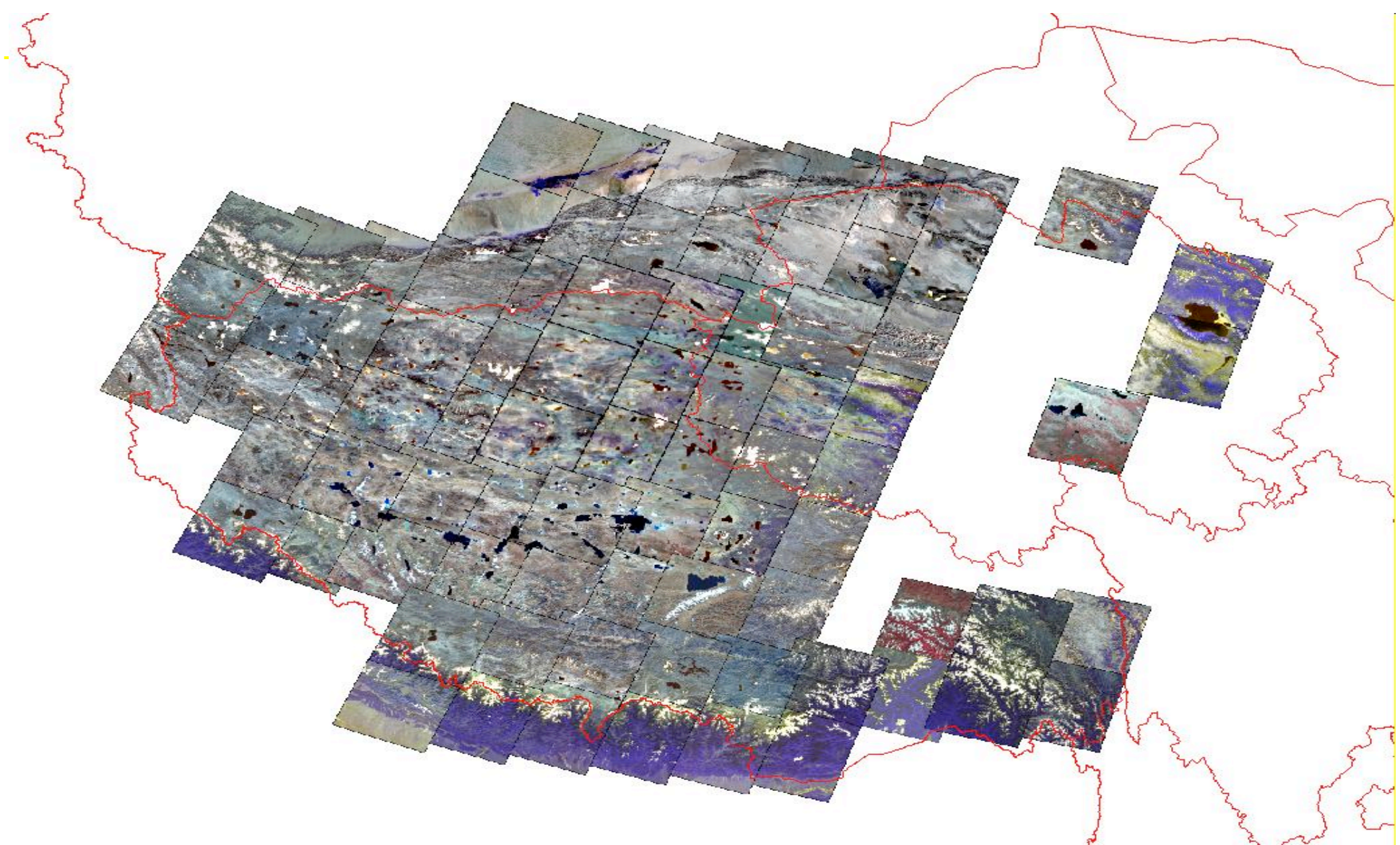
- Amplitude of glacial retreat in the marginal regions is larger than those inside the interior regions
- Glacial area retreated by 7% in the 40a before 2000, and by 5% in the past 10a
- Glacial retreat in the past 10a is accelerating.



Spatial pattern of glacial retreat

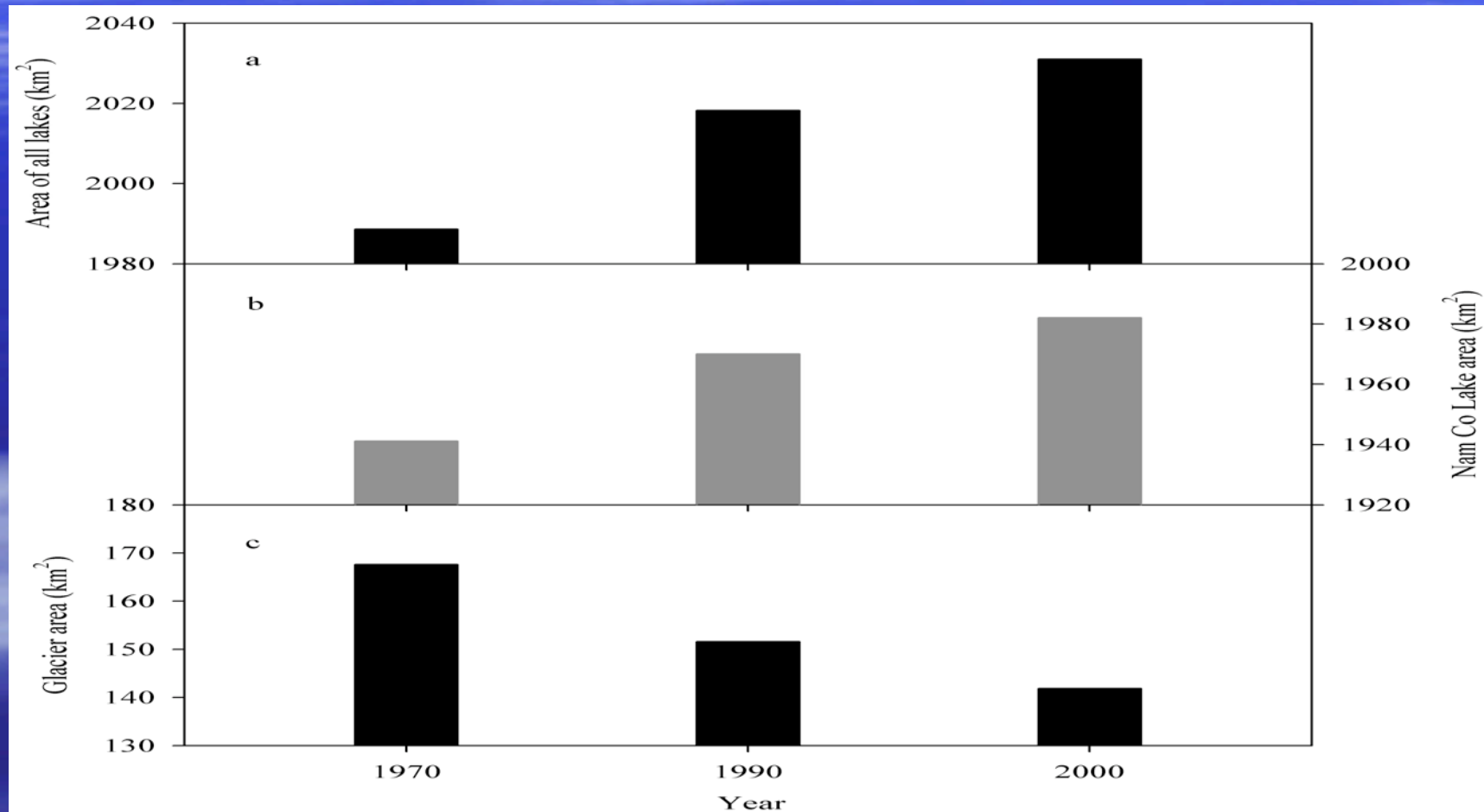
Major impact

**Glacial Lake Expansion Flood (GLEF) and
Glacial Lake Outburst Flood (GLOF)
induced by glacial retreat is a severe social
problem on the Third Pole region.**



Only on the Tibetan Plateau, there are more than 1000 lakes, most are supplied by glacial melting water; there are more than 3000 glacial terminus lakes which are directly at glacial terminus

Namuco lake





Lagu Glacial Lake

1980

1990

2000

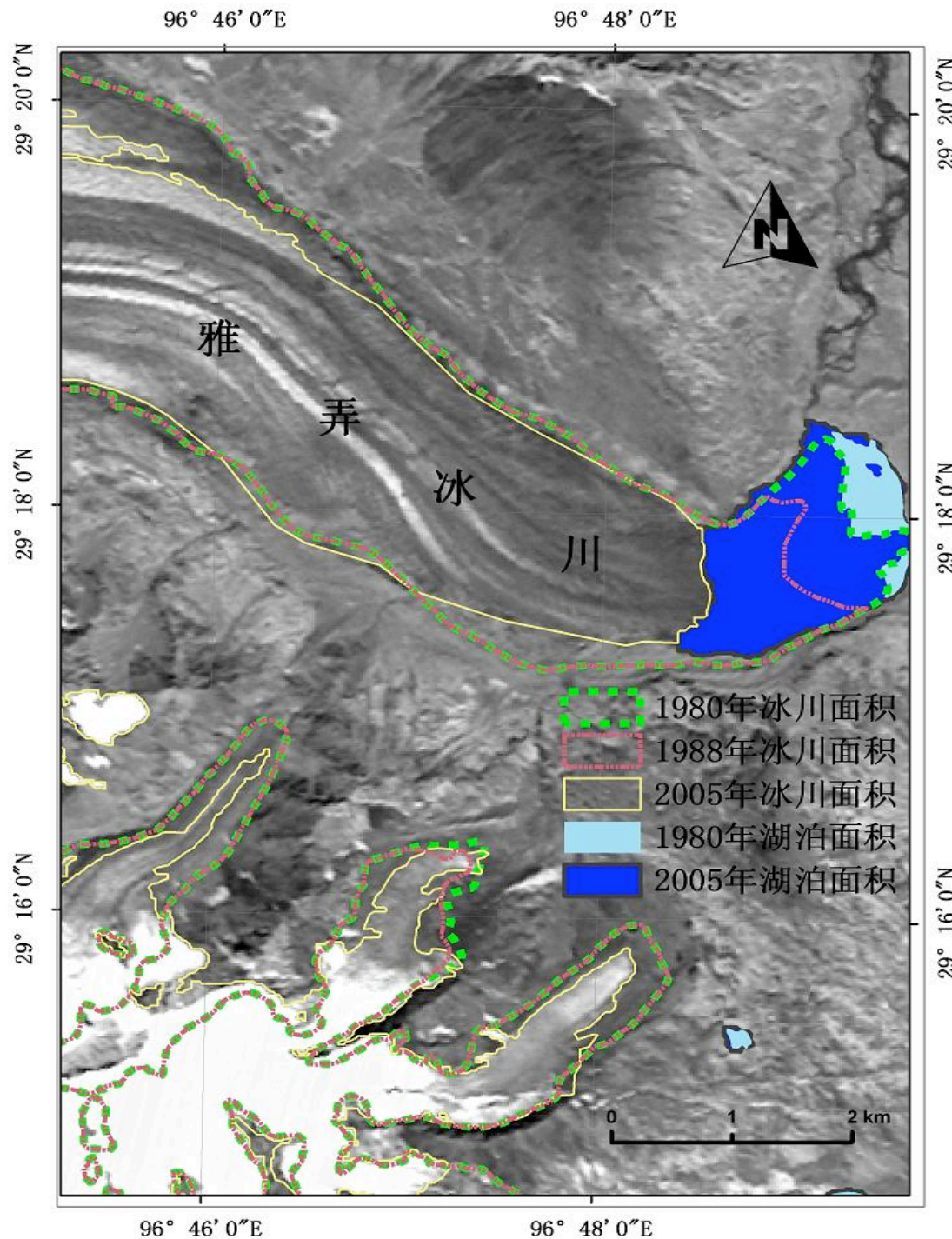
Changes of Lagu Glacier

0.42km²

0.71km²

2.22km²

相同比例尺



From 2000 to
2005, the area of
the glacial lake
increased from
2.22 km² to 2.55
km², about 15% in
5 years



2006.5.4

1970

4.3km²

1990

0.71km²

2000

1.6km²

Variations of Dongguanla Co



**Tibetan Plateau Environmental Changes
and adaptation (TECA)**

**Tibetan Plateau Observation and
Research Platform (TORP)**

**The Third Pole Environment (TPE)—
workshop, August 16-18, 2009, Lhasa**

**Fifth International Conference on Tibetan
Plateau, August 11-14, 2009, Beijing**

A photograph of a skier standing on a snowy mountain peak. The skier is wearing dark gear and is positioned on the right side of the frame, looking out over a vast, snow-covered landscape. The sun is shining brightly in the upper center of the image, creating a lens flare effect. The sky is a deep blue, and the ground is covered in white snow with some tracks visible. The text "Thanks for your attention!" is overlaid in large, bold, yellow letters across the center of the image.

**Thanks for
your
attention!**