Introduction of TPE Programme in GEWEX SSG-29

Ailikun

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Institute of Tibetan Plateau Research

Chinese Academy of Sciences

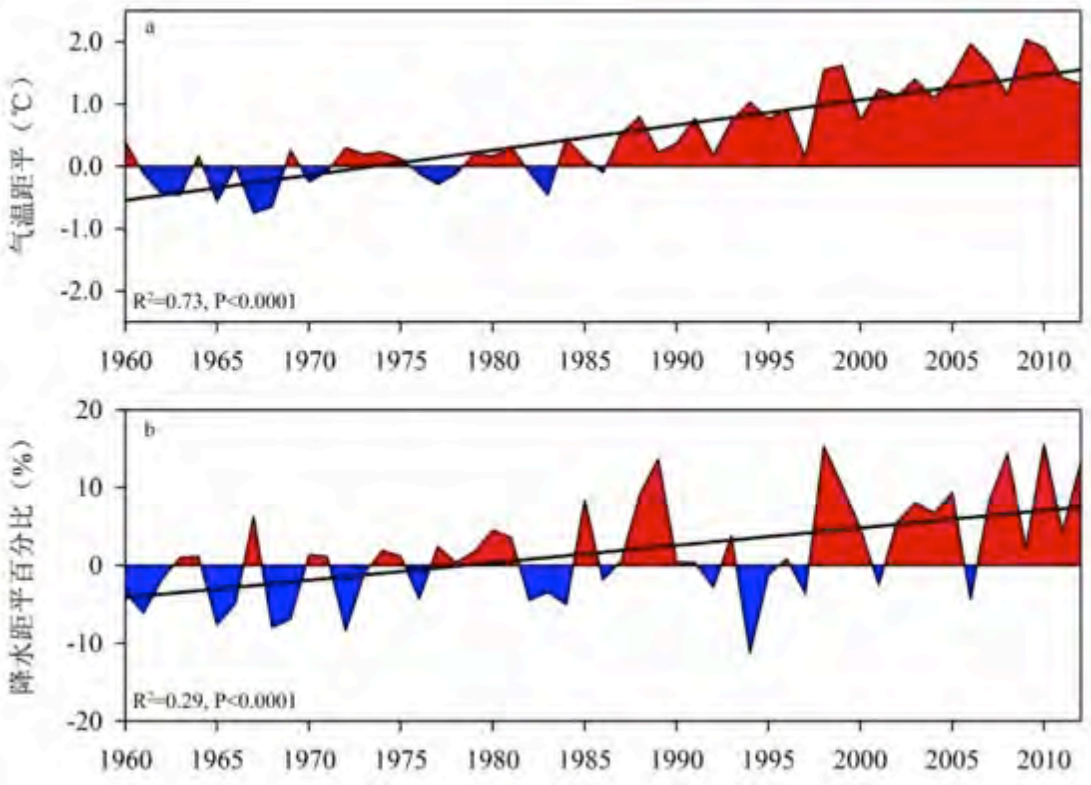
Sanya, China, 6-9 Feb. 2017

The Third Pole region covers 5 million km2 in area with an elevation higher than 4000m by average

The Third Pole Provides Water Resources for About 2 Billion People

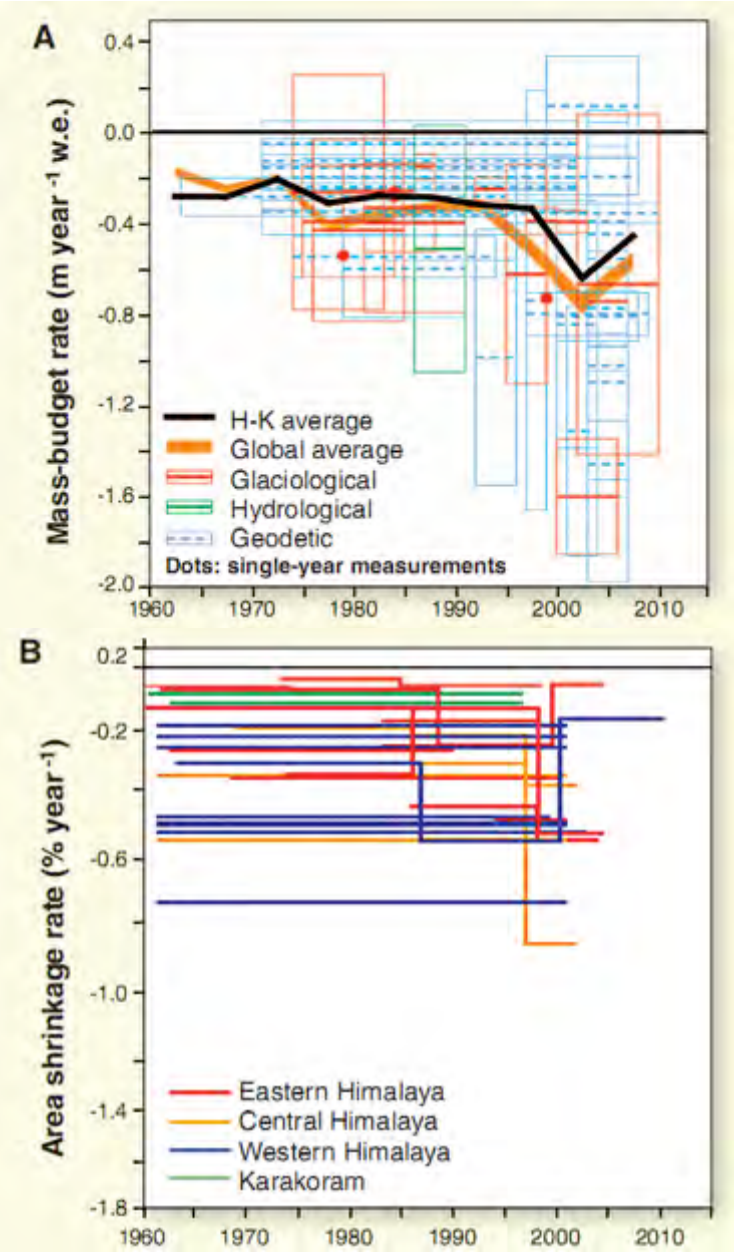
Climate is warming more rapidly

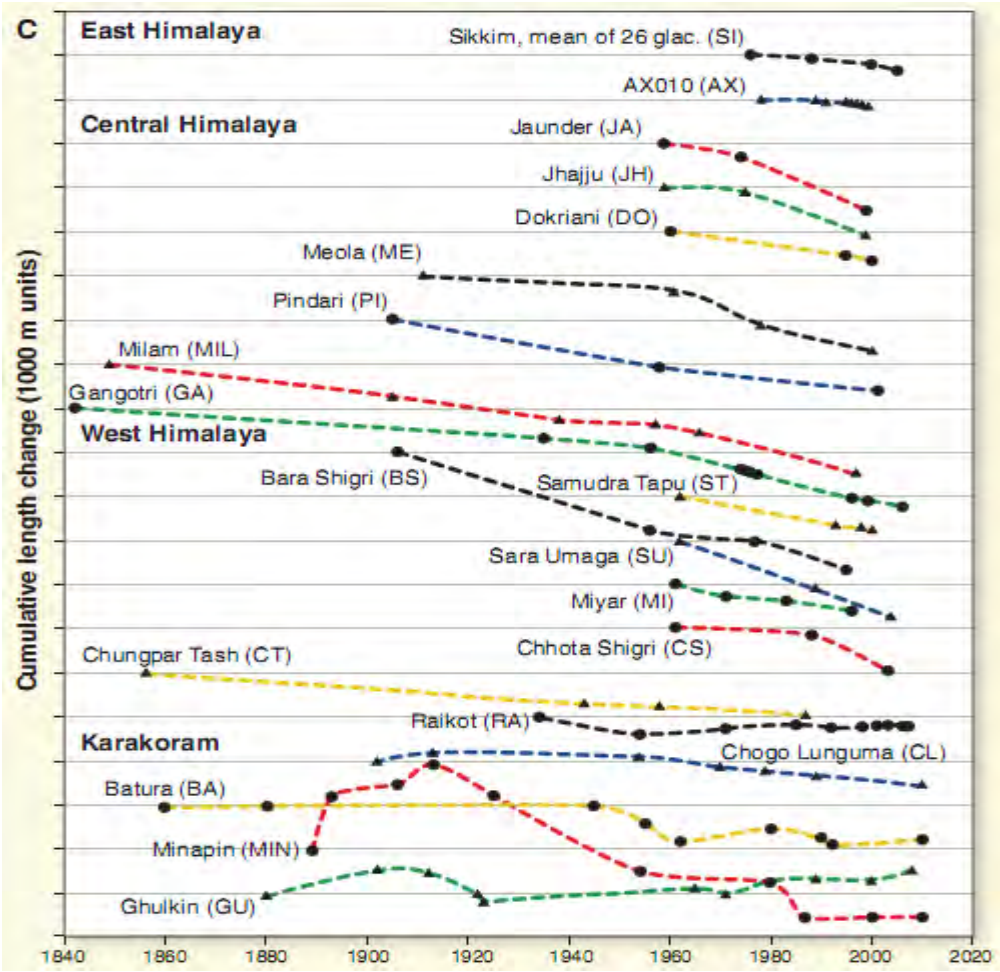
Warming with 0.3-0.4℃/10a from 1960 to 2012



Time series of T anomaly and P anomaly (%) in Tibetan Plateau of China from 1960 to 2012.

Glacier melt in the Himalayas

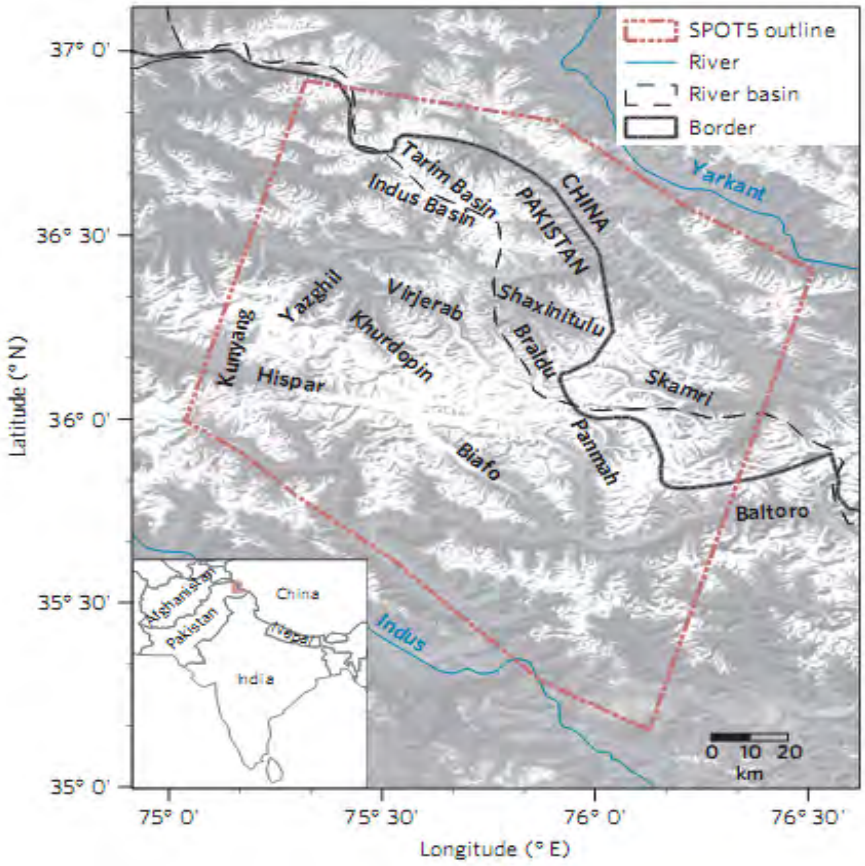


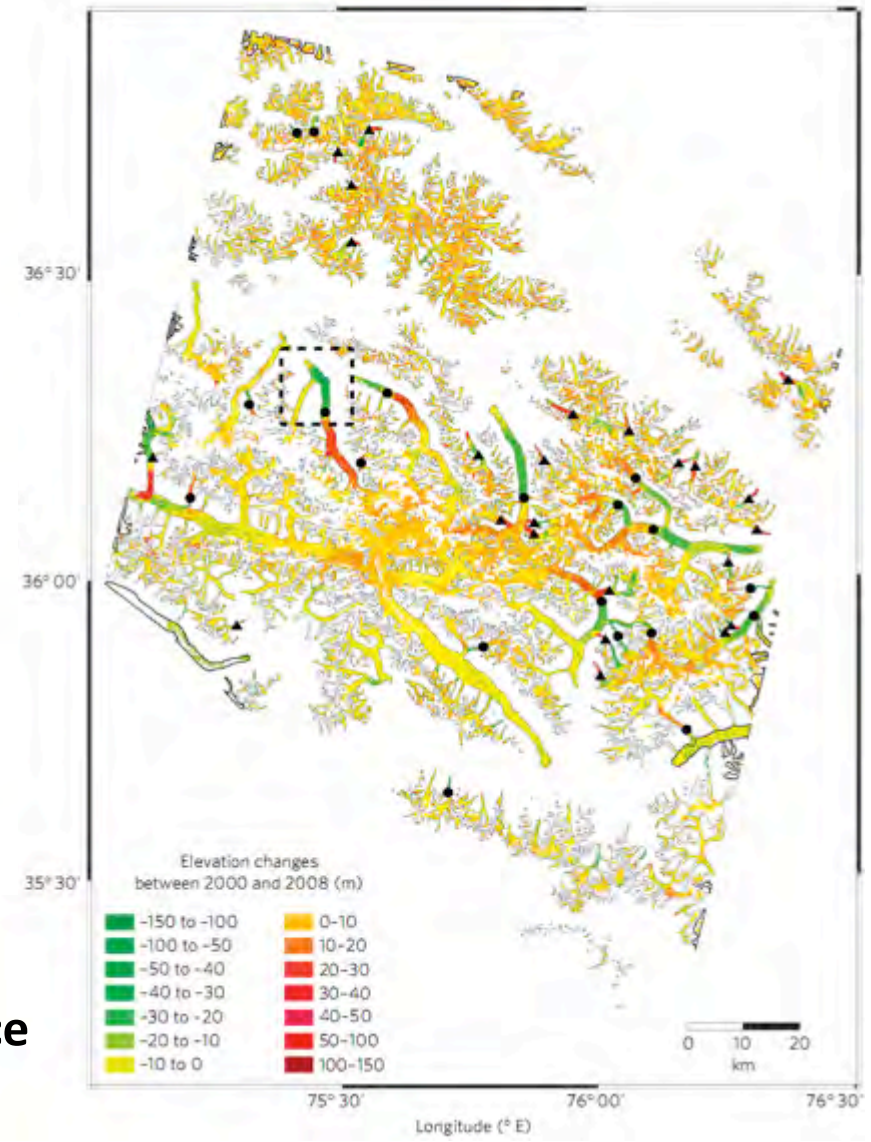


Intensive glacier melt in Himalayas

Bolch et al. Science(2012)

Glacier melt in the Pamir/Karakoram



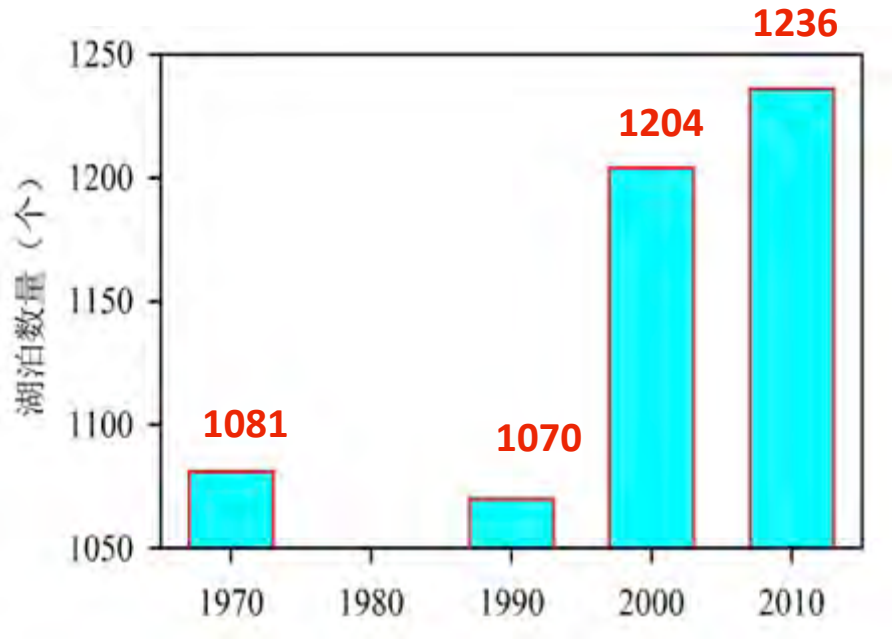


Comparison between SRTM（2000）and SPOT5（2008) reveal positive mass balance in Karakoram (0.11±0.22 m yr^{-1})

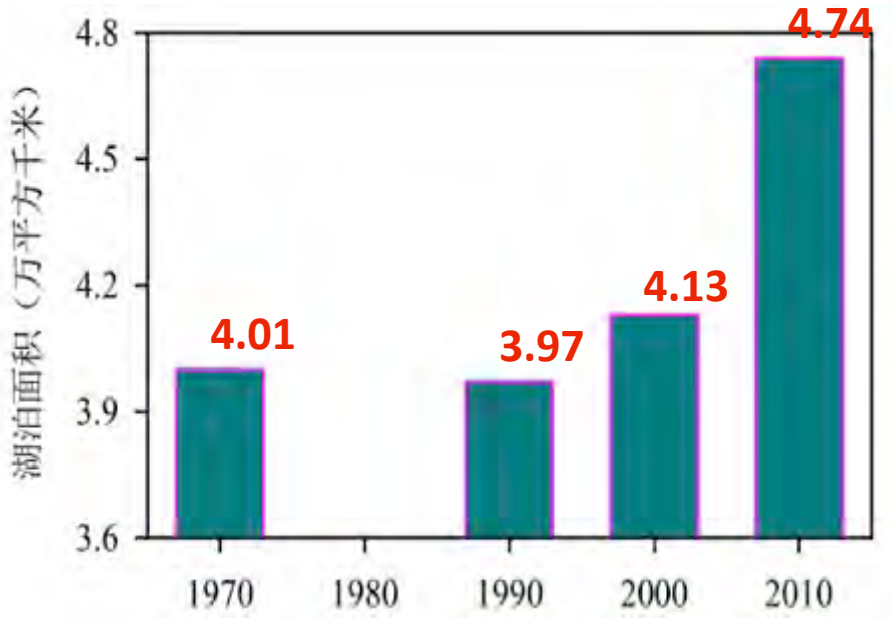
Gardelle et al.. Nature Geoscience(2012)

Increasing lakes in Tibetan Plateau of China in last 40 years

Changes of lake number

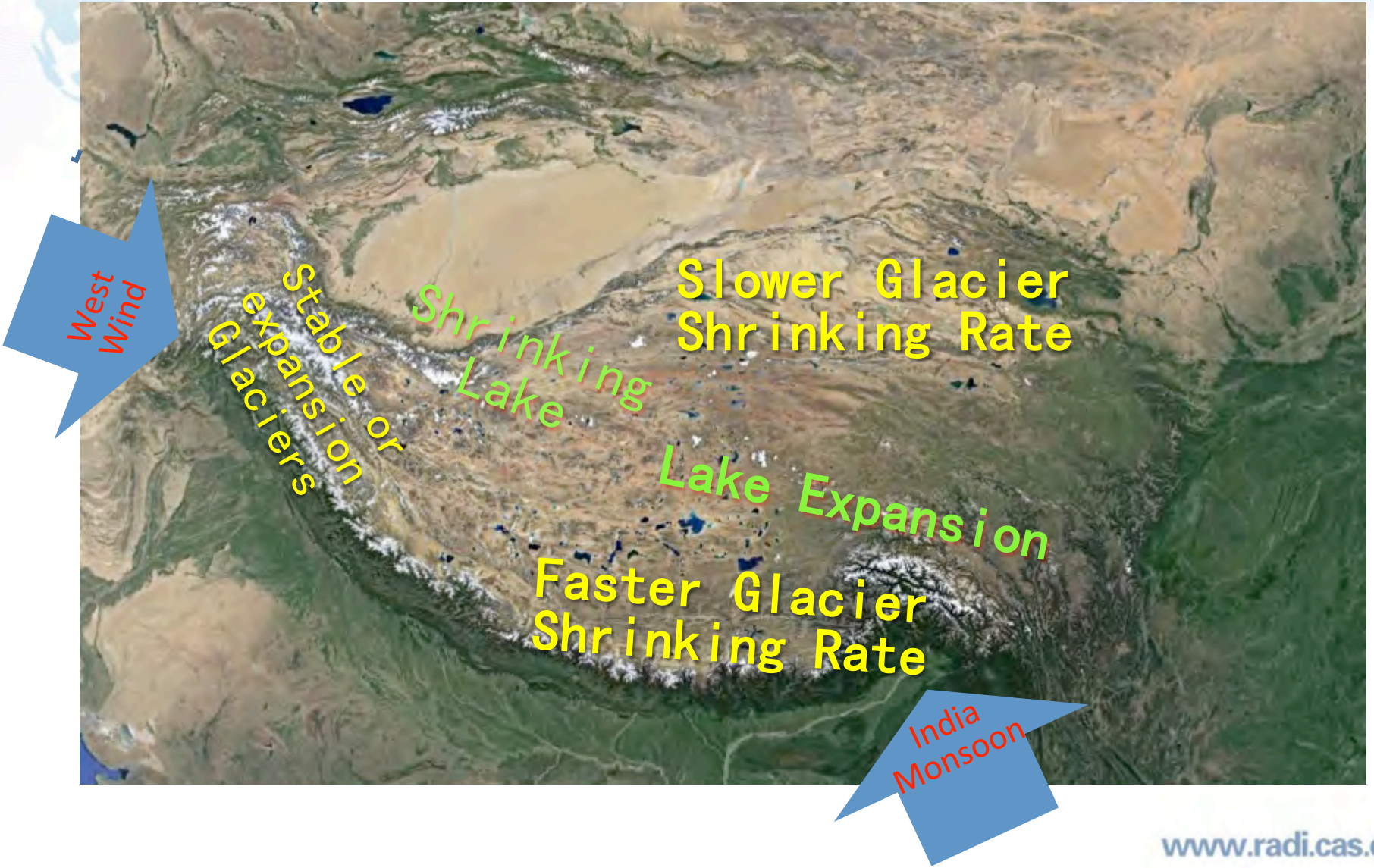


Changes of lake area (10,000 KM^2)



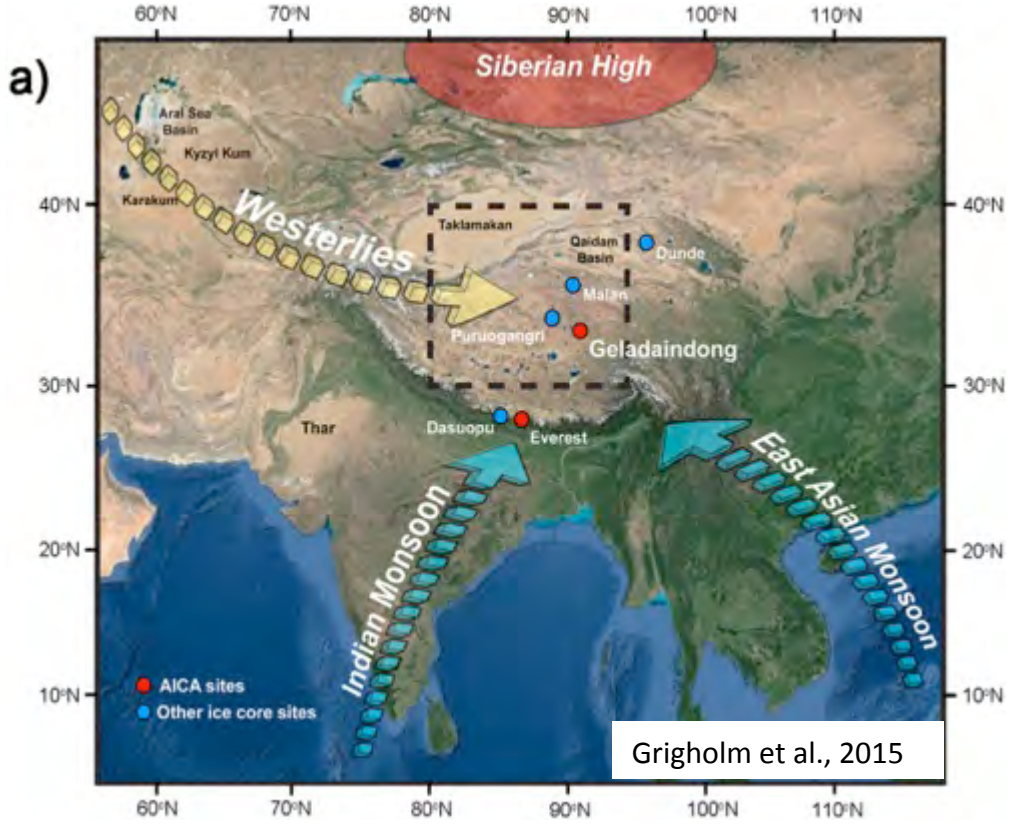
Only calculating the Lakes with area > 1 km^2

Current Understanding of glacier and lake changes （Quote from JianCheng Shi）



TPE in regional and global context

Interaction between Asian monsoon and mid-latitude westerlies



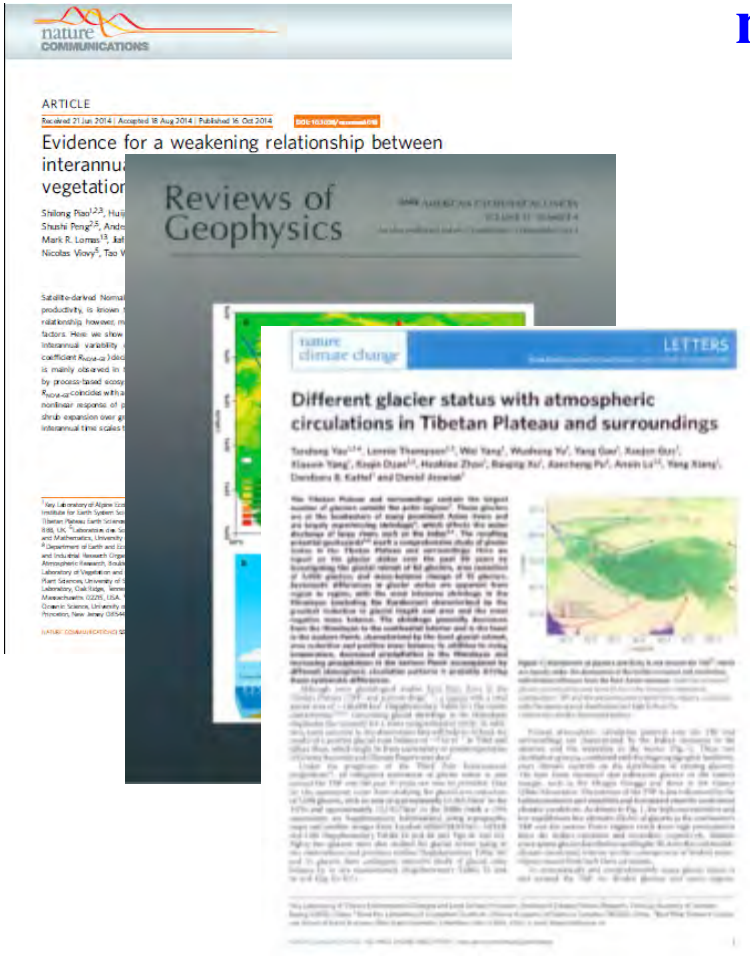
Grigholm et al., 2015

Most atmospheric teleconnection patterns are related to Third Pole

Figure quote from Deliang Chen

How does Third Pole impact on and respond to interaction of westerlies and monsoon?

The environment of the Third Pole is now a hot topic worldwide



The recent announcement of the 2015 Research Frontiers by Thomson Reuters indicates that *The relationship among glacier, water resources and climatic changes on the Third pole* is a leading frontier of earth science. The top 20 papers were cited 1651 times, and the 4 distinguished papers were cited more than 1200 times

Volker Mosbrugger

Lonnie G. Thompson

Tandong Yao

United Nations
Educational, Scientific and
Cultural Organization

Division of Ecological and
Earth Sciences

SCOPE

Scientific Committee
on Problems of the Environment

UNEP

United Nations
Environment Programme

UNESCO - SCOPE - UNEP
Policy Briefs

May 2011 - No. 13

Third POLE ENVIRONMENT

TPE program were highlighted in Nature and Science

TIBET'S PRIMEVAL ICE

The quest for the world's oldest ice could yield a Rosetta Stone for how Asia responds to a changing climate

THE THIRD POLE

NEWS IN FOCUS

Measuring the meltdown

Glaciologists to target third pole

Double threat for Tibet

'Third Pole' Glacier Research Gets A Boost From China

The Economist

The climate of Tibet

Pole-land

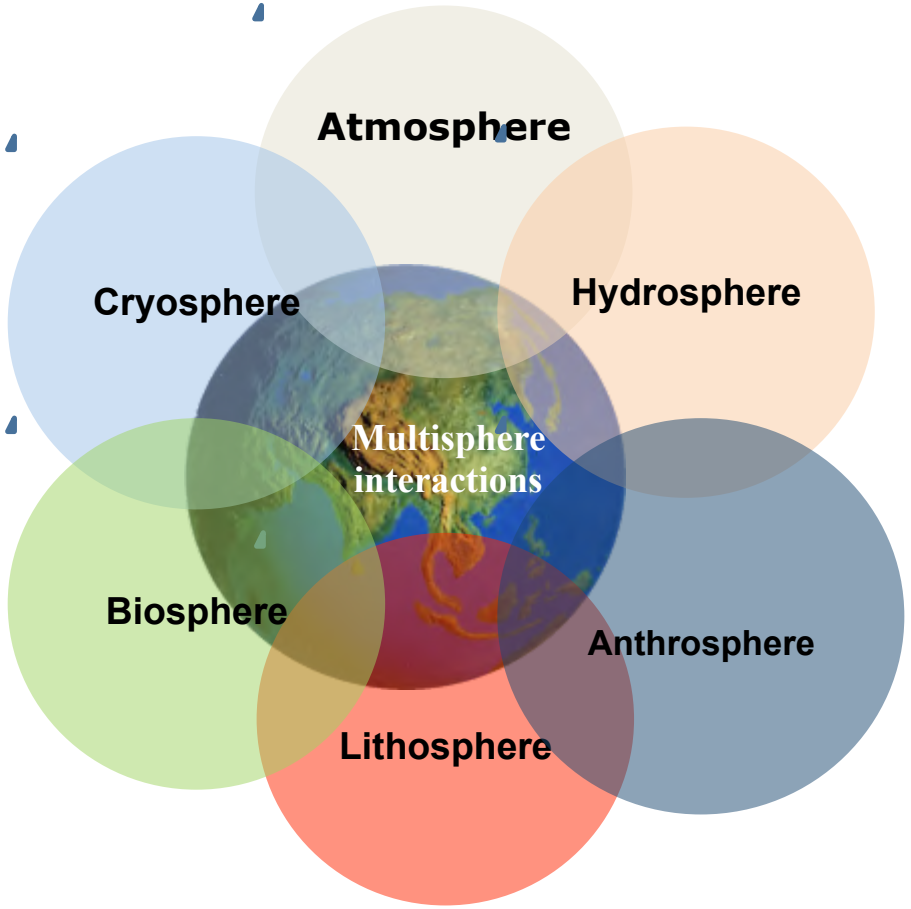
The world's third-largest area of ice is about to undergo a systematic investigation

The Objectives of TPE (2011)

Water in the Third Pole is proposed to be the most important objective, Third Pole Environment (TPE) programme focuses on clarifying the cryospheric melt dominant processes and consequences, and proposing scientific advices to mitigate or adapt to hazardous consequences. TPE provides an important platform to enhance the research collaborations regionally and globally. (TPE Science Plan 2011)

TPE
THIRD POLE ENVIRONMENT

The Objectives of TPE (2016)



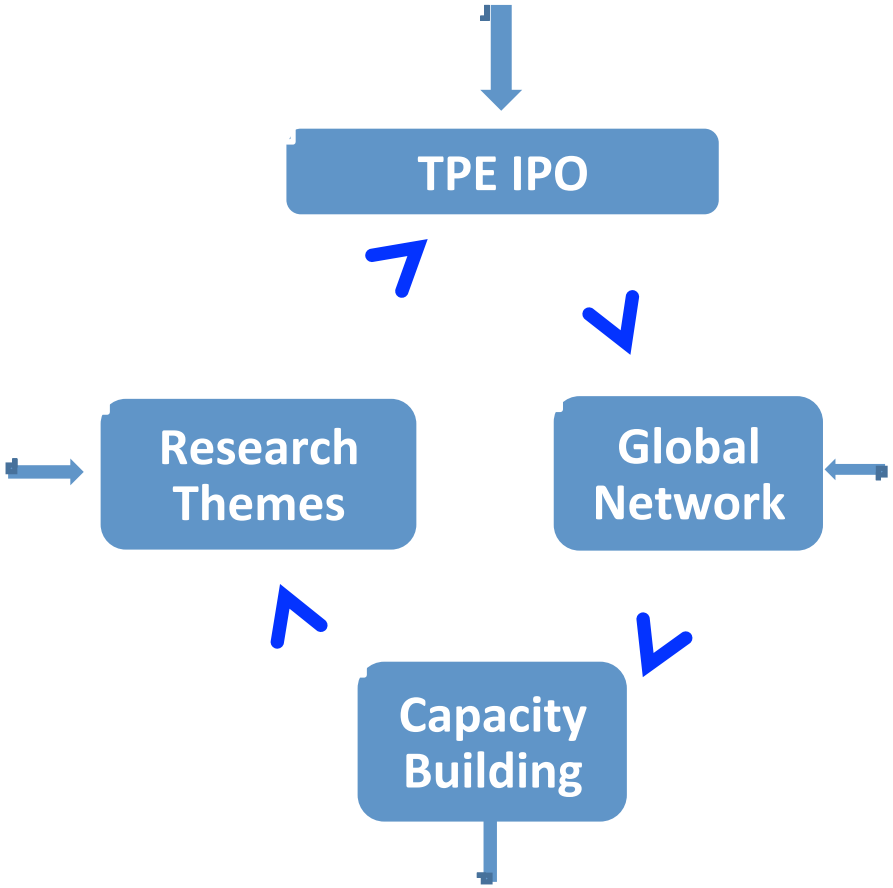
- ✓TPE programme is to obtain a system understanding of the evolution of third pole and of its impact on the dynamics of the earth system: past - present - future.
- ✓TPE programme focuses on the understanding the mechanism of multisphere interaction in the Third Pole and its surrounding regions.

Key Scientific Questions of TPE (2016)

- ✓What are the key earth system processes and their interactions among multi-spheres in TPE and its surrounding region?
- ✓What are the impacts of global environment change to Third Pole environment? And what are the feedbacks?
- ✓ How to protect and safeguard the livelihood local people, and how to support government/people approaching to the UN SDGs?

TPE SSC

Co-chairs: T. Yao, L. Thompson, V. Mosbrugger



Glacier/permafrost/snow dynamics and water resources

Multi-sphere (ice-land-air-water-human) interactions

Paleo-climate

Mountain hazards and risk assessment

Mountain air pollution and human health

Land use/cover changes（LULCC） and ecosystem

Adaptation strategies for mountain sustainability

Regional and Education Centers

（China, Nepal, Sri Lanka, Burma, Center Asia）

Global Offices

（Beijing, Kathmandu, Islamabad US, Germany）

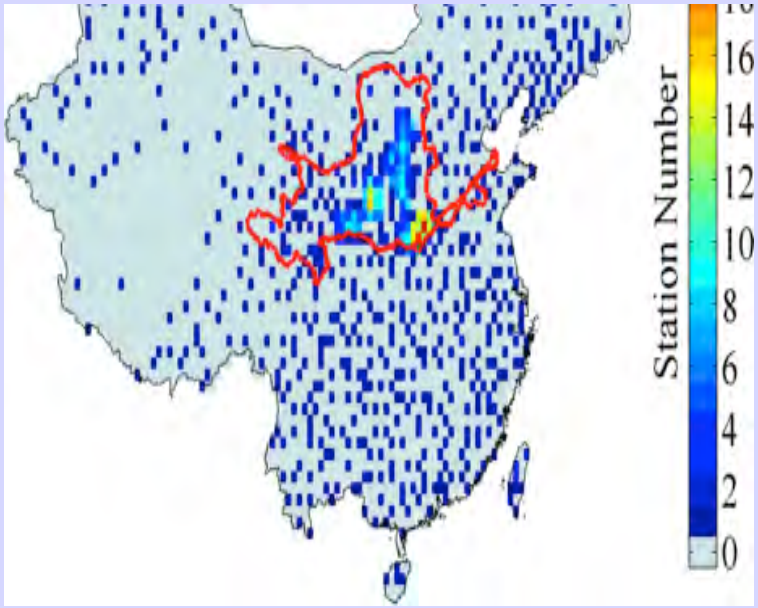
Master/PhD courses

Young Scientists Trainings

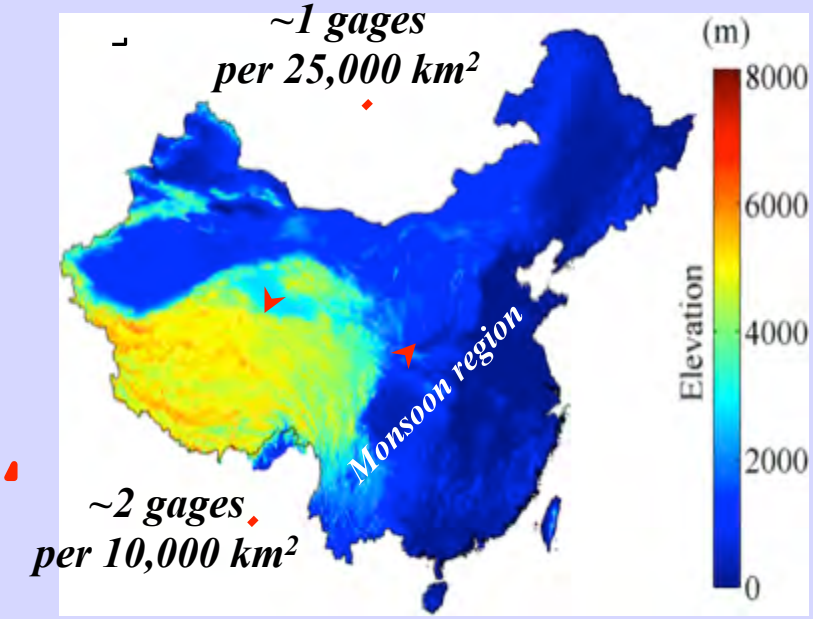
TPE Data Center

Structure of TPE programme

Lack of ground observation in Tibetan Plateau (quote from Soroosh PERSIANN-CDR)



EA Rain Gauge Distribution



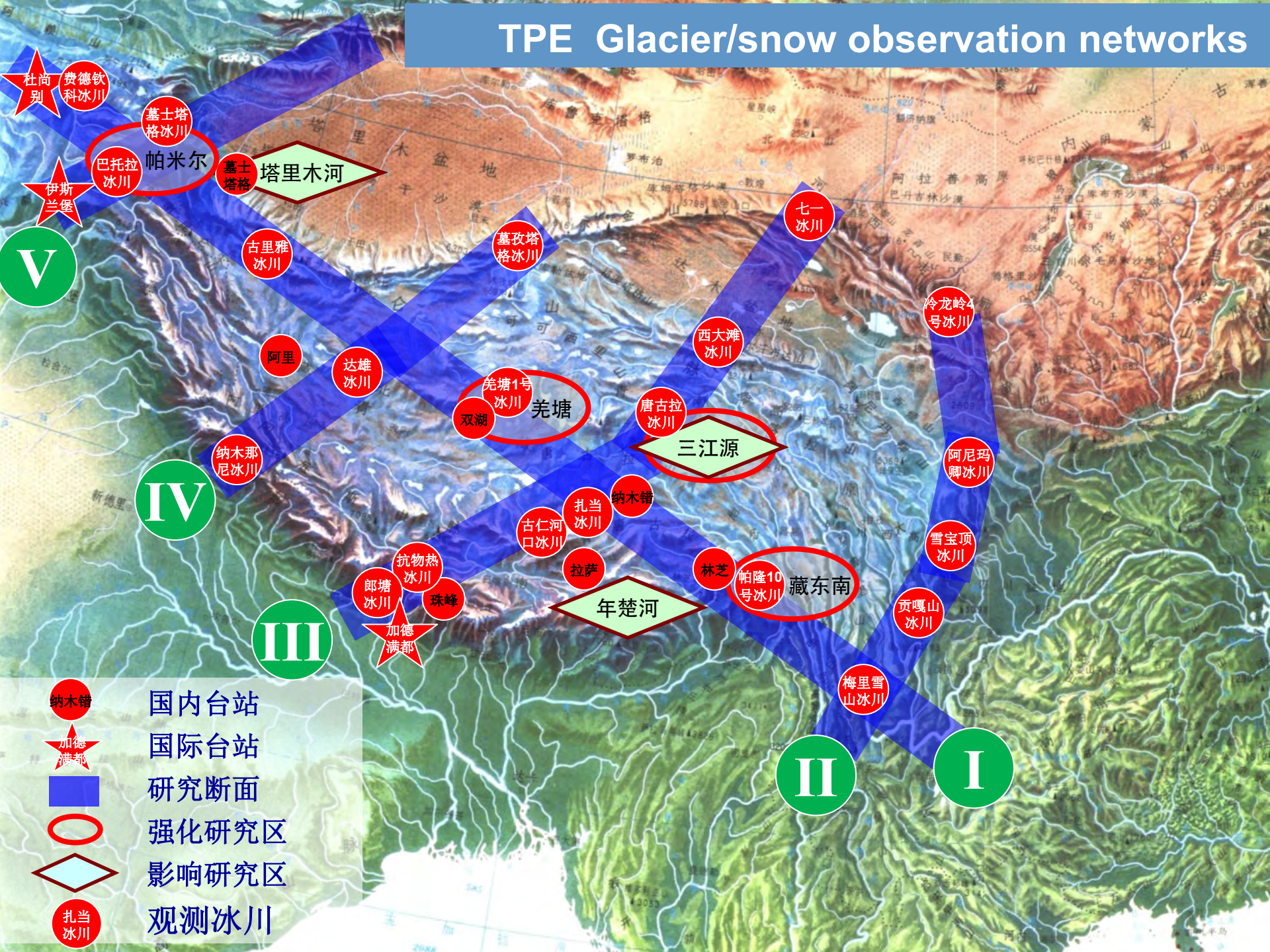
Elevation Map

Dr. Chiyuan Miao - BNU

Gauge data: *daily precipitation over East Asia (EA) (Xie et al., 2007)*

- *More than 2200 ground-based stations across China*
- *0.5˚ resolution*
- *Period 1983-2006*

PERSIANN-CDR: *up scaled into the same resolution as EA (0.5º)*


TPE Glacier/snow observation networks
杜尚别
费德钦科冰川
墓士塔格冰川
巴托拉冰川
帕米尔
墓士塔格
塔里木河
伊斯兰堡
V
古里雅冰川
墓孜塔格冰川
七一冰川
冷龙岭4号冰川
西大滩冰川
阿里
达雄冰川
羌塘1号冰川
双湖
羌塘
唐古拉冰川
三江源
阿尼玛卿冰川
纳木那尼冰川
IV
扎当冰川
纳木错
古仁河口冰川
雪宝顶冰川
抗物热冰川
郎塘冰川
珠峰
拉萨
林芝
帕隆10号冰川
藏东南
加德满都
年楚河
贡嘎山冰川
III
梅里雪山冰川
II
I
纳木错
国内台站
加德满都
国际台站
研究断面
强化研究区
影响研究区
扎当冰川
观测冰川

Flagship Station Monitoring Network

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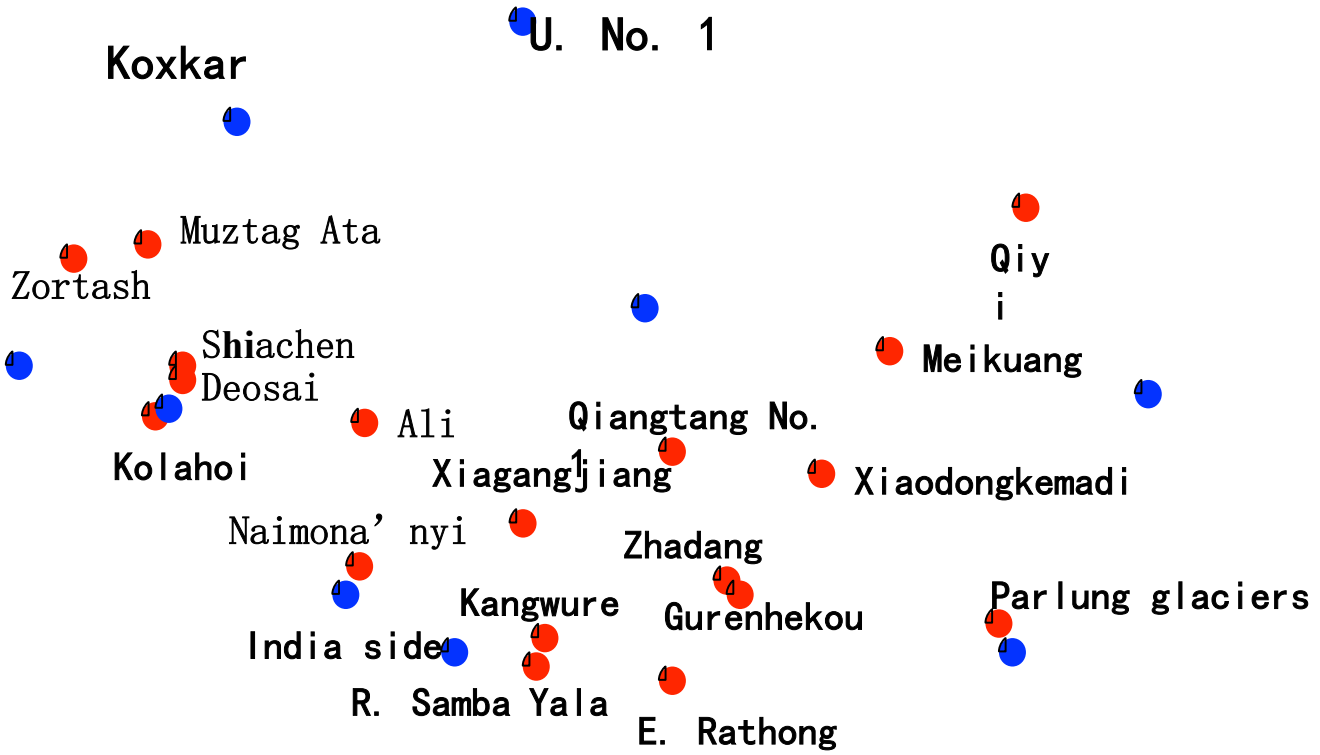

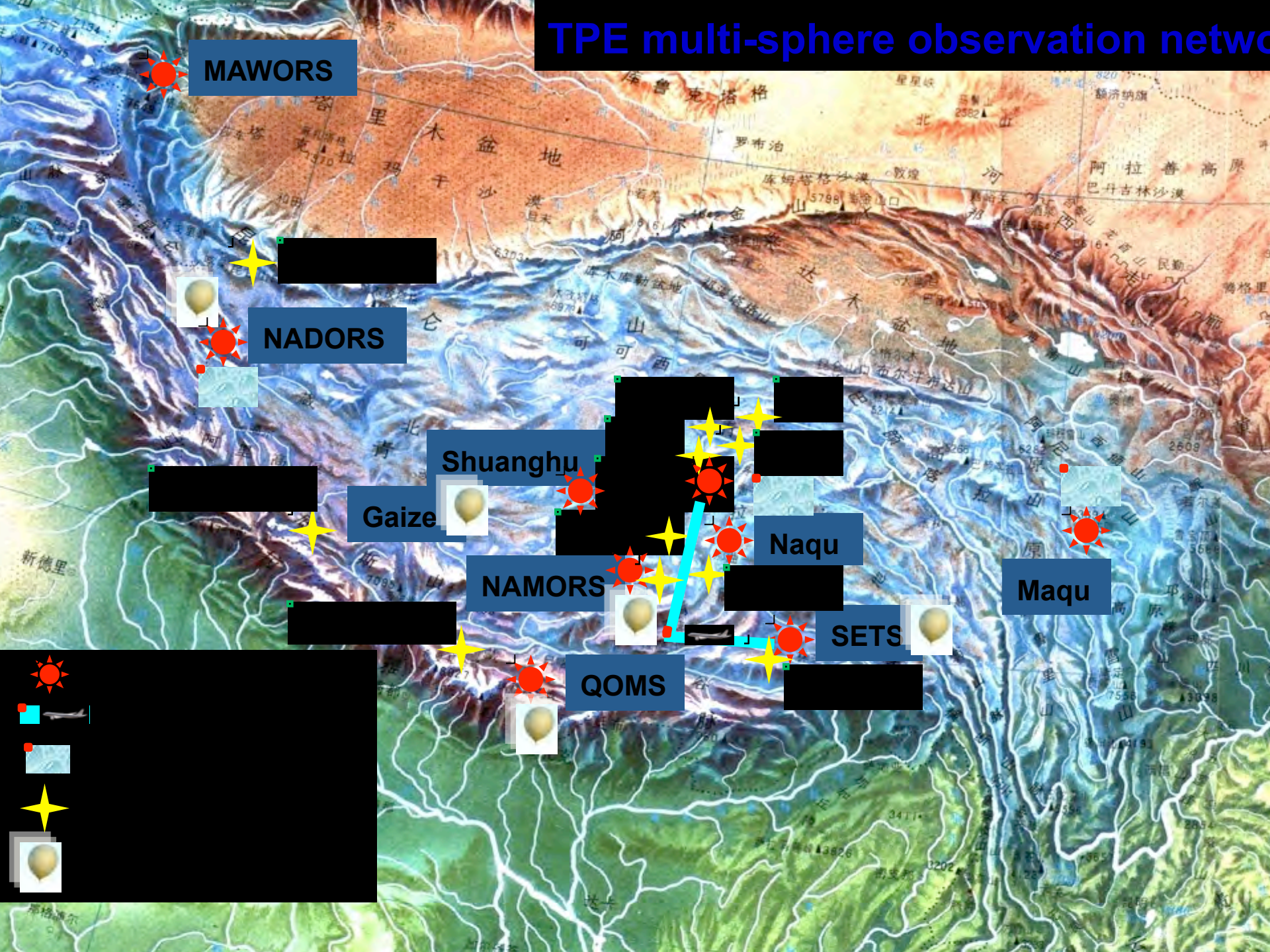
TPE multi-sphere observation netwo
MAWORS
NADORS
Shuanghu
Gaize
NAMORS
Naqu
Maqu
SETS
QOMS

Efforts to built up datasets for TPE region

http://en.tpedatabase.cn/

1. Glaciers changes in the Tibetan Plateau and surroundings(70s-00s): Tandong YAO (ITPCAS)
2. Tibetan Plateau observatory of plateau scale soil moisture and soil temperature (Tibet-in-situ): Bob SU, University of Twente
3. Blended soil moisture data product over Tibetan Plateau: Yijian Zeng, University of Twente
4. Soil moisture and Temperature monitoring network in the Central Tibetan Plateau (CTP-SMTMN): Kun YANG (ITPCAS)
5. Precipitation Database in Tibetan Plateau: Kun YANG (ITPCAS)
6. A 50-years daily surface solar radiation dataset over 716 China meteorological stations: Kun YANG (ITPCAS)

TPE Global Network

Research and Education Centers

TPE Offices

- Beijing Office: HQ for coordination, research and training
- Kathmandu Center: Observation and training
- US Office: Glacier dynamics and Paleo-climate
- German Office: Ecosystem and human adaptation
- Islamabad Office: Observation and training

TPE Annual Workshops (2009-)

- The 4th Third Pole Environment (TPE) Workshop
- April 1-3, 2013, Dehradun, India

- 6th TPE Workshop
- 16-18 May, 2016, Columbus, Ohio, USA

Other TPE Workshops

International Workshop on Indian Monsoon and Earth System

Kathmandu, Nepal 2016.03.28-2016.03.29

International Workshop on Land Surface Multi-spheres Processes of Tibetan Plateau

Xining, Qinghai, China 2016.8.8-2016.8.10

TPE sessions in AGU and EGU

Education and Training

- To train young talents from the Third Pole region, including China, India, Nepal, Tajikistan, Pakistan, Afghanistan, Bhutan, Bangladesh, and Myanmar
- To help build multi-nation teams for long-term cross-border scientific expeditions and observation
- To estanblish unified scientific concept within these teams via science and technology transfer

TPE organizes joint scientific expeditions through cooperation with neighbor countries as Nepal, Tajikistan, Pakistan, India and China, to promote joint observation and research.

TPE-UNESCO
Joint publications

Assessment of Climate and Water Changes Under Global Warming over the Tibetan Plateau

THIRD POLE ENVIRONMENT

November 2016

CAS Key Project: Coordinated Observation and Research inTPE and surrounding regions (2016-2020, USD 6.5 million)

1. Integrated Observation system
2. Interaction between monsoon and westerlies
3. Glacier/snow dynamics and water resources
4. Multi-sphere (ice-land-air-water) interaction and hydrological cycle
5. LULCC and ecosystem services

- Institute of Tibetan Plateau Research/CAS
- Institute of Remote sensing and Digital Earth/CAS
- Peking University
- Lanzhou University
- South China Sea Institute of Oceanology/CAS
- Xinjiang institute of ecology and geography/CAS
- Northwest Institute of Eco-environment and research/CAS
- TU/Nepal
- Ohio State University
- ICIMOD
- NASA
- Research Institute and Nature Museum, Germany
- University of Gothenburg, Sweden

Third Pole Science Summit
—TPE-CSTP-HKT Joint Conference

10-12 July, 2017
Kunming, China

http://tpss2017.tpe.ac.cn

Third Pole Science Summit
—TPE-CSTP-HKT Joint Conference

Sessions:

1) Lithosphere Geodynamics and Continent-continent Collision of the Third Pole
2) Geological Evolution and Mineral Resource Development on the Third Pole
3) Uplift of the Third Pole and its Impact
4) Environmental Changes on the Third Pole and Global Change
5) **Integrated Observations and Modeling of Atmospheric and Land-surface on the Third Pole**
6) **Cryosphere dynamics and Water Cycle on the Third Pole**
7) Biodiversity and Ecosystem on the Third Pole
8) Hazards and Environmental Risks on the Third Pole
9) Natural Resource Management and Regional Sustainability on the Third Pole