

# Third Pole Environment



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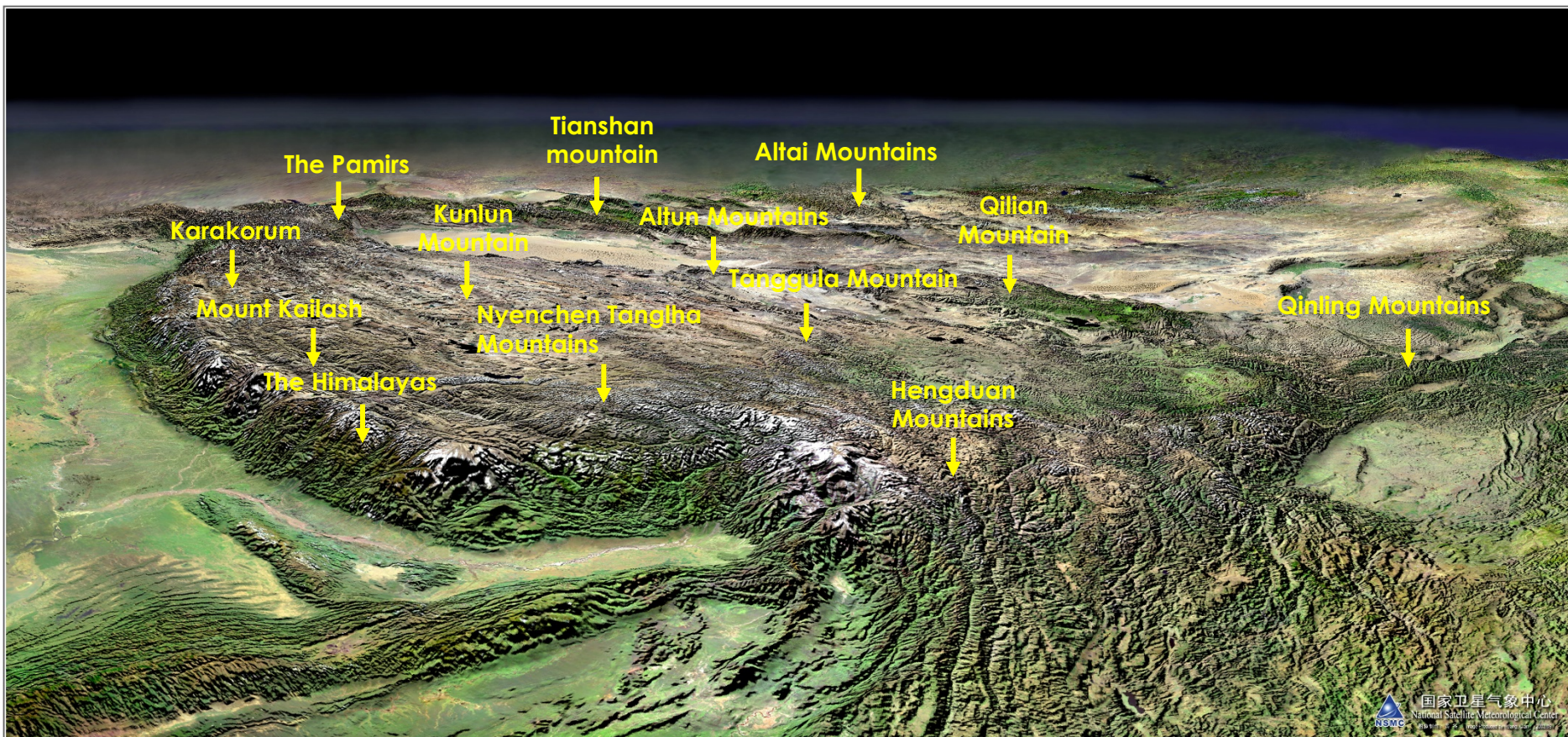


# I. Short Introduction of the TPE



## The Third Pole-Tibetan Plateau and its surroundings

The Third Pole covers nearly 5 million square kilometers. It is the youngest, highest and largest plateau on the Earth. The Third Pole environment is similar to that of North Pole and South Pole. Its changes affect more than 2 billion people in the region.





# Third Pole Environment (TPE) Program

Launched in 2009 Supported by CAS



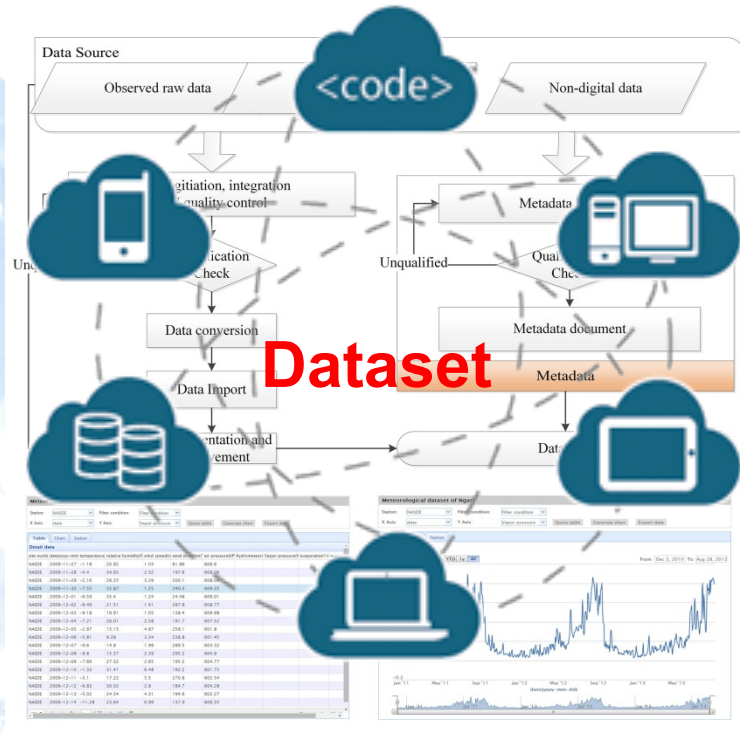
## ➤ **General Goal of TPE:**

The Third Pole Environment (TPE) program aims to attract relevant research institutions and academic talents to focus on a theme of 'water-ice-air-ecosystem-human' interaction in the TPE, to reveal environmental change processes and mechanisms on the Third Pole and their influences and regional responses to global changes, especially monsoon systems, and thus to serve for enhancement of human adaptation to the changing environment and realization of human-nature harmony.

## ➤ **Scientific Goal of TPE:**

To reveal and quantify, from the perspectives of earth system sciences, the interactions among atmosphere, cryosphere, hydrosphere, biosphere and anthroposphere on the Third Pole and their influences on the globe in order to assess the likely future impacts of global change.

# Capacity Building



**Providing data-support resources to solve major environmental problems**



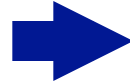
# International cooperation will be based on global networks and groups of collaborators

## CAS Overseas Centers

## TPE global networks





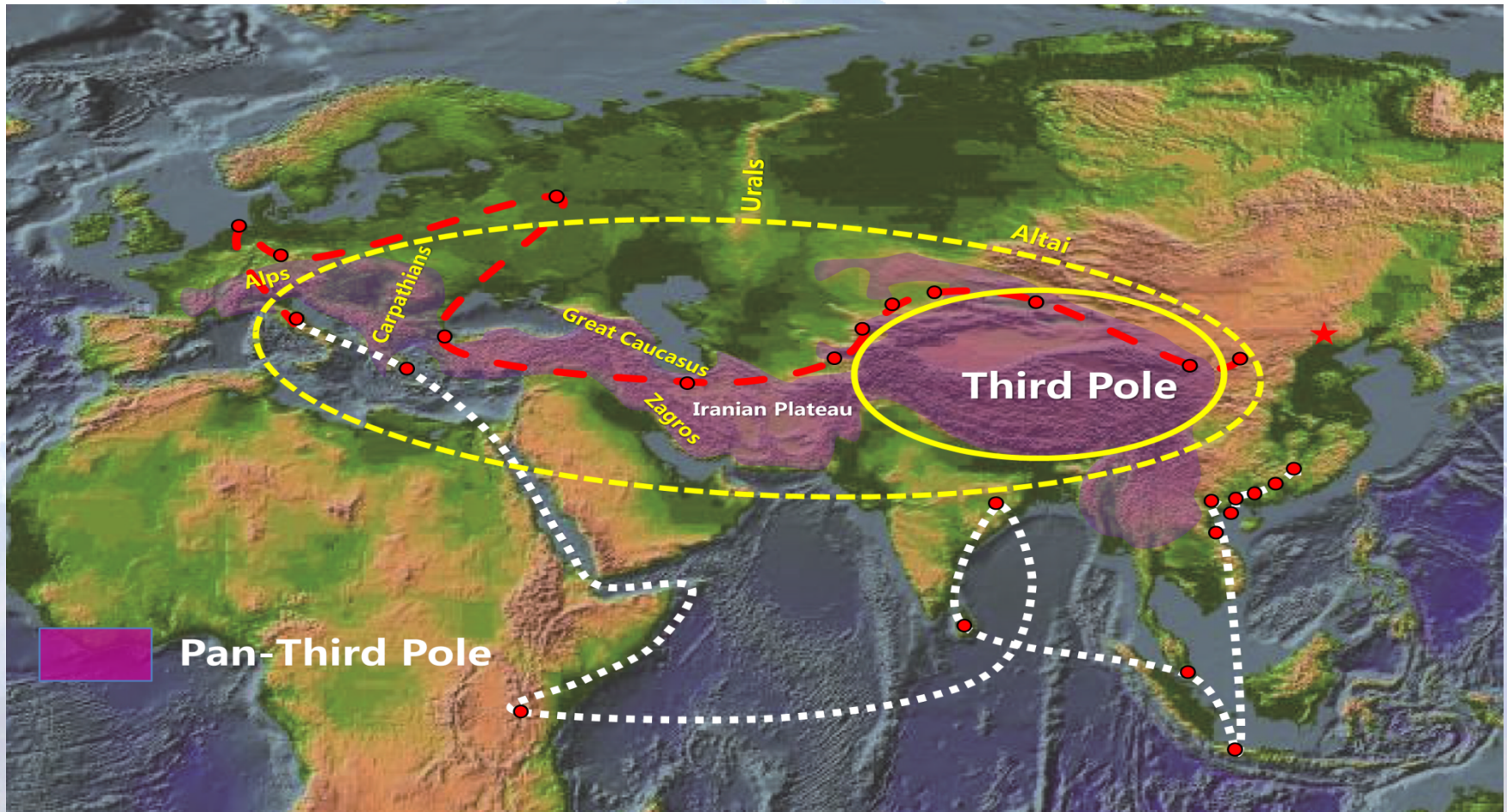


**Pan-TPE: A new CAS Strategic A Program called “Pan Third Pole Environment Study for a Green Silk Road”(2018-2023)**

**It is a new frontier for the Third Pole Environment Program, Earth system science research related to water, ecosystem and human activities.**

# The Pan Third Pole

Expanded westward from the Third Pole, the Pan-Third Pole region covers 20 million km<sup>2</sup>, encompassing the Tibetan Plateau, Pamir, Hindu Kush, Iran Plateau, the Caucasians, the Carpathians, etc. It is home to over 3 billion people.





# Integrated solution under the earth system science framework by interdisciplinary approach



# Pan-TPE

## Themes(2)

## Questions (5)

## Tasks (8)

The uncertainties of Pan Third Pole environment as influenced by westerly-monsoon interaction

The right response strategy of society to the Pan Third Pole environmental changes

What is the role of westerly-monsoon interaction in water resource change?

What are the impacts of climate change on ecosystem and biodiversity and their feedbacks?

How to prevent environmental risks and hazards through technology innovation?

How to balance human activities and environment resilience?

How to tackle environmental challenges facing social development?

Geological and paleo-environmental evolution

Westerly-monsoon interaction and change of Water Tower of Asia as well as their impacts

Ecosystem and biodiversity change and their response to climate change

Impact and regulations of anthropogenic activities

Environmental risks and mountain hazards

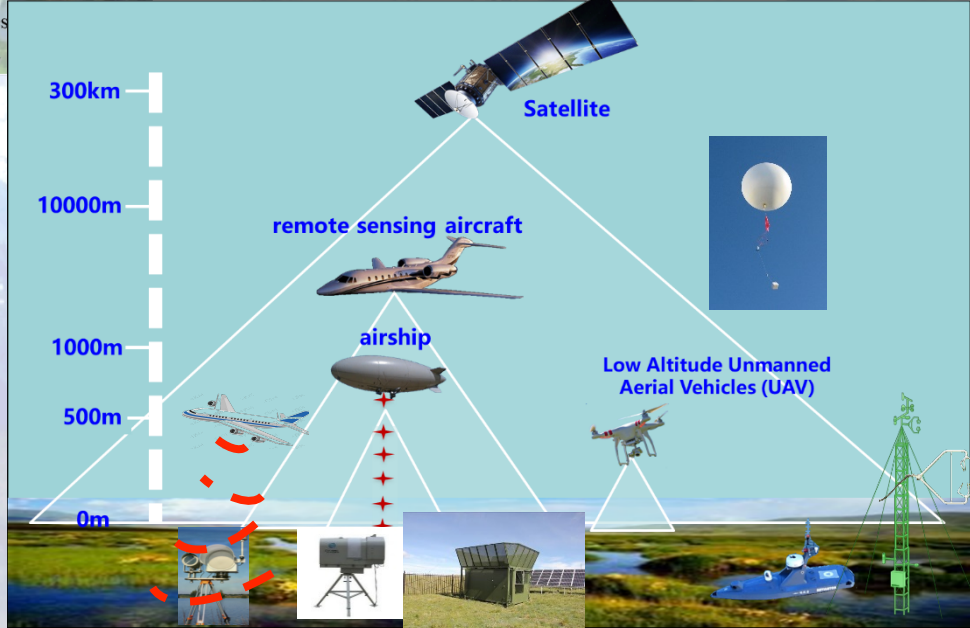
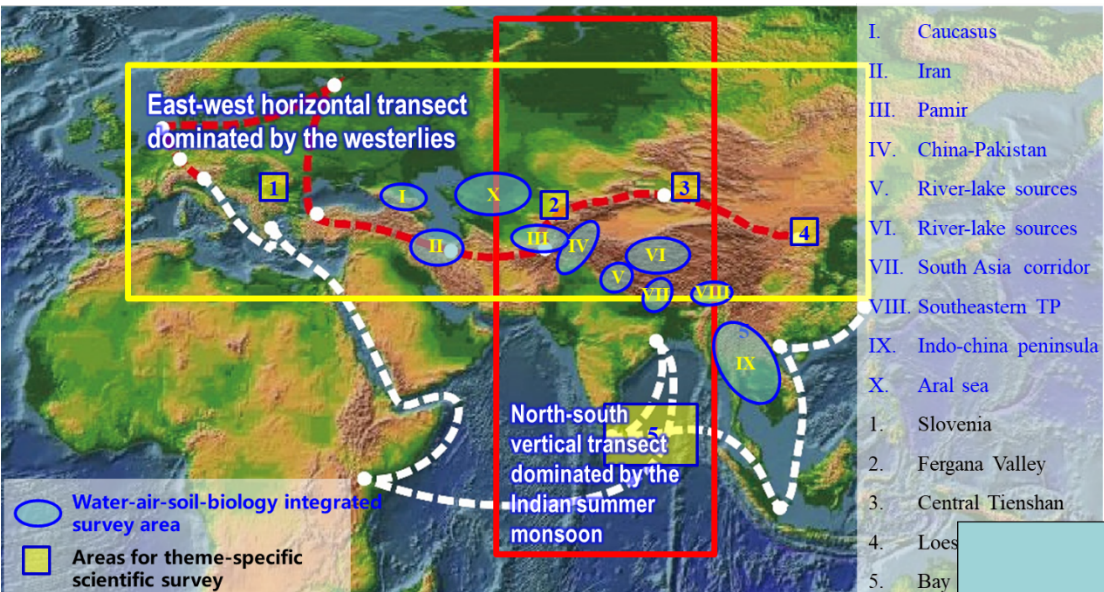
Mitigation and adaptation for environmental resilience based on in-situ observation

Integrated Environmental Assessment for sustainable Development

Far-reaching impacts and feedbacks from Third Pole to Poles



# Comprehensive ground/space observing networks on vertical and horizontal transects over Pan-Third Pole region



## **II. TPE and GEWEX**

## **Research Priorities:**

- 1. Water-energy exchanges and transport over the Third Pole region based on observation (in situ and satellite)**
- 2. Mechanisms and changes in hydrological cycle over the Third Pole region**
- 3. Regional/global modeling focusing on Third Pole, especially improving modeling capacity and providing high resolution model products for the region**
- 4. Data assimilation and prediction of high-impact hydro-meteorological events and future changes in hydrological cycle and water-energy exchanges**

## **Data: Ground Data :**

### **1) In situ observational data**

Historical in-situ and current meteorological and hydrological datasets

2) Create a high spatial and temporal (daily and sub-daily) resolution data for the modeling community.

3) Soil T and M, vegetation, snow, glacier, for land-atmosphere interactions and energy and water cycle processes

4) Social and social-economic data



## Data: Satellite Data

- ✓ Hydrological cycle elements derived from remote sensing observations at different scale, especially at watershed scale, including precipitation, snow cover area (SCA), soil moisture (SM), radiation, evapotranspiration (ET), runoff, lake volume and groundwater.

## **Data: Modeling Output**

To understand the intricate bondage between atmospheric processes and the hydrological aspects, it is important to develop robust high resolution regional models.

## Participating Institutes (Chair: Tandong Yao, Yaoming Ma)

1. **Institute of Tibetan Plateau Research, CAS**
2. Institute of Remote Sensing and Digital Earth, CAS
3. Institute of Atmospheric Physics, CAS
4. Northwest Institute of Eco-Environment and Resources, CAS
5. Tsinghua University
6. Beijing Normal University
7. Nanjing University, China
8. ITC, University of Twente, the Netherlands
9. Tribhuvan University, Nepal
10. Nepal Academy of Science and Technology
11. Pakistan Space and Upper Atmosphere Research Commission, Pakistan
12. The Energy and Resources Institute of India

## Scientific activities in 2019:

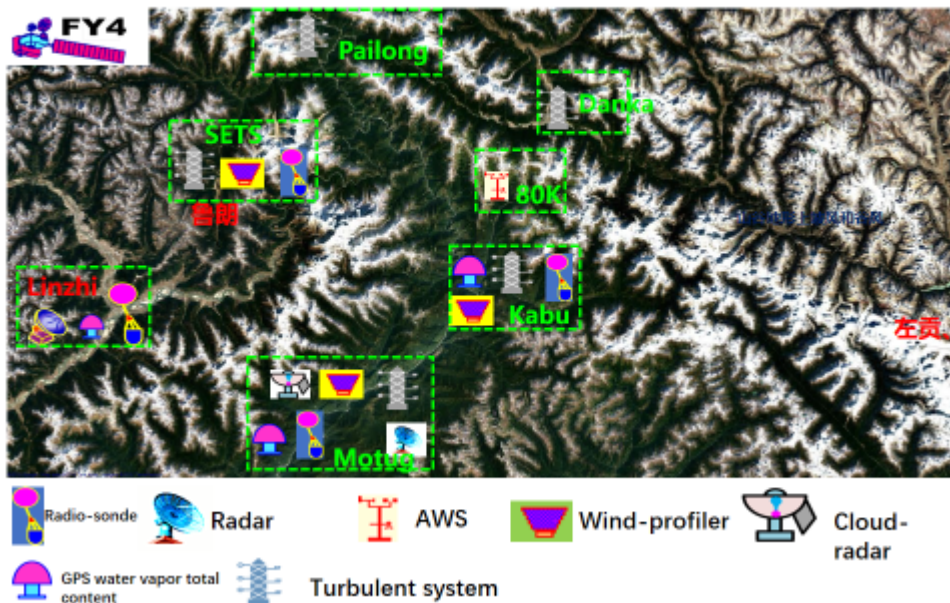
- 1) Three Intensive Observational Periods (IOP) of comprehensive ground/space observation from horizontal transects over the Third Pole region;





## Scientific activities in 2019:

- 2) The researchers from Prof. Yaoming MA's group set up the observation network along the Yarlung Zangbo Grand Canyon, known as the world's deepest canyon, which was confirmed as the largest water vapor transmission channel in the Qinghai-Tibet Plateau by Chinese Academy of Sciences (CAS) in 1981.

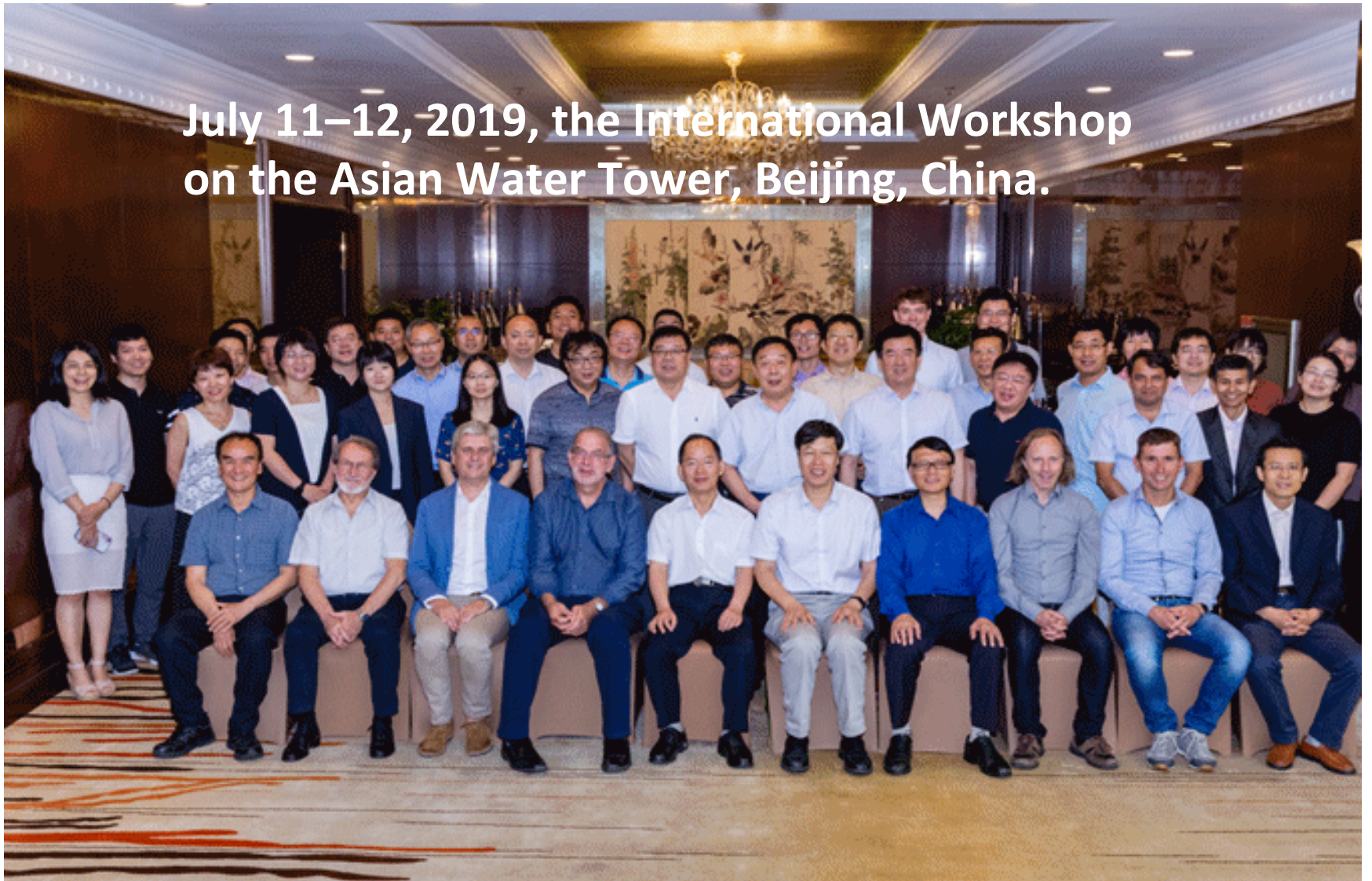


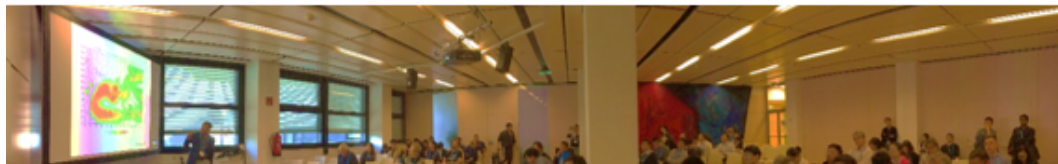
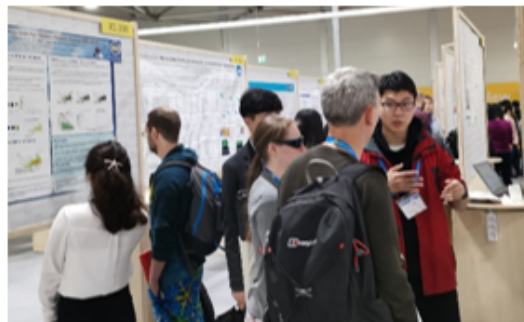
## Workshops and meetings held in the past one year

- January, 2019, International Workshop on Cryosphere and Water Cycle Observation-Modeling Integration over Third Pole, Beijing, China.
- TPE session held in the EGU General Assembly 2019, April 7-12, 2019, Vienna, Austria.
- TPE session held in AOGS 16th Annual Meeting, 28 July - 2 August 2019, Singapore
- July 11–12, 2019, the International Workshop on the Asian Water Tower, Beijing, China. This event gathered about 40 participants, among which were both international and Chinese scholars and students.
- October 11-12, 2019, GEWEX GHP meeting, Sydney, Australia.
- The World Meteorological Organization convened a High Mountain Summit (HMS) on 29–31 October, 2019 in Geneva, Switzerland, with Third Pole Environment (TPE) being one of its six partners.
- 9<sup>th</sup> TPE synthesis workshop, November 28-29, 2019, Frankfurt, Germany.
- TPE session in AGU fall meeting. December 9-15, 2019, San Francisco.



July 11–12, 2019, the International Workshop  
on the Asian Water Tower, Beijing, China.









*Participants of the 2019 GHP Meeting at The ARC Centre of Excellence for Climate Extremes (CLEX), Sydney, Australia (left to right)*

Back row: Craig Ferguson, Peter van Oevelen, Jason Evans, Ulrich Looser, Tory Terao, Joan Cuxart, Fernande Vervoort, Andeas Prein.

Front Row: Ali Nazemi, Jan Polcher, Eleanor Blyth, Li Jia, Vidya Samadi, Francina Dominquez, Mónica Lakatos, Yaoming Ma, Warren Helgason.



Prof. YAO Tandong, Co-Chair of the Third Pole Environment was invited to give a keynote speech on the High Mountain Summit (HMS) on 29–31 October, 2019 in Geneva, Switzerland, convened by WMO





9<sup>th</sup> TPE synthesis workshop, November 28-29, 2019, Frankfurt, Germany.



TPE session in 2019 AGU fall meeting, December 9-15, 2019, San Francisco, U.S.A.





# Selected publication in 2019:

1. Liu, L.\* , Ma Yaoming\* , M.Menenti, W.Ma, 2019, Evaluation of WRF modeling in relation to different land surface schemes and initial and boundary conditions: a snow event simulation over the Tibetan Plateau, *Journal of Geophysical Research: Atmospheres*,124, 209-226, doi: [10.1029/2018JD029208](https://doi.org/10.1029/2018JD029208).
2. Wang, B. \* , Ma Yaoming\* , Y.Wang, Z.Su\* , W.Ma, 2019, Significant differences exist in lakeatmosphere interactions and the evaporation rates of high-elevation small and large lakes, *Journal of Hydrology*, 573, 220-234, doi: [10.1016/j.jhydrol.2019.03.066](https://doi.org/10.1016/j.jhydrol.2019.03.066).
3. Zhong, L.\* , Ma Yaoming\* , Y.Xue, S.Piao, 2019, Climate Change Trends and Impacts on Vegetation Greening over the Tibetan Plateau, *Journal of Geophysical Research: Atmospheres*, 124, 7540–7552, doi: [10.1029/2019JD030481](https://doi.org/10.1029/2019JD030481).
4. Subba, S., Ma Yaoming\* , W. Ma, 2019, Spatial and temporal analysis of precipitation extremities of Eastern Nepal in the last two decades (1997–2016). *Journal of Geophysical Research: Atmospheres*, 124, 7523–7539, doi: [10.1029/2019JD030639](https://doi.org/10.1029/2019JD030639).
5. Acharya1,R.H., M.Sigdel1\* , Ma Yaoming\* , B.Wang, 2019, Diurnal and seasonal variation of heat fluxes over an agricultural field in southeastern Nepal, *Theoretical and Applied Climatology*, 137:2949–2960, doi:10.1007/s00704-019-02790-3.
6. Wang, Y., Z.Ding\* , Ma Yaoming\* , 2019, Spatial and temporal analysis of changes in temperature extremes in the non-monsoon region of China from 1961 to 2016, *Theoretical and Applied Climatology*, 137:2697–2713, doi:10.1007/s00704-019-02767-2.
7. Zhong, L. , Ma Yaoming, Hu, Z., Fu, Y., Hu, Y., Wang, X., Cheng, M., and Ge, N., 2019, Estimation of hourly land surface heat fluxes over the Tibetan Plateau by the combined use of geostationary and polar-orbiting satellites, *Atmospheric Chemistry and Physics*, 19, 5529-5541, doi: [10.5194/acp-19-5529-2019](https://doi.org/10.5194/acp-19-5529-2019).
8. Wang, B., Ma Yaoming, W. Ma, Z. Su, and X. Dong, 2019, Evaluation of ten methods for estimating evaporation in a small high-elevation lake on the Tibetan Plateau, *Theoretical and Applied Climatology*, 136: 1033-1045, doi: [10.1007/s00704-018-2539-9](https://doi.org/10.1007/s00704-018-2539-9).
9. Jia, D., J.Wen, Ma Yaoming, J.Zhou,J.Chen,R.Liu,X.Wang,T.Zhang,X.Lai, Z. Wang, 2019, A study of the characteristics of energy flux and its relationship with the summer monsoon over alpine wetlands in the source region of the Yellow River, *Meteorology and Atmospheric Physics*, 131, 195-210, doi:10.1007/s00703-017-0563-4.
10. Han, Y. , W. Ma\* , Ma Yaoming, C.Sun, 2019, Variations of surface heat fluxes over the Tibetan Plateaubefore and after the onset of the South Asian summer monsoon during 1979–2016. *Journal of Meteorological Research*, 33(3), 491–500, doi: [10.1007/s13351-019-8616-x](https://doi.org/10.1007/s13351-019-8616-x).
11. Chen, X\*., Z.Su, Ma Yaoming , M. Elizabeth, Optimization of a remote sensing energy balance method over different canopy applied at global scale, *Agricultural and Forest Meteorology*, 179,107633, doi: [10.1016/j.agrformet.2019.107633](https://doi.org/10.1016/j.agrformet.2019.107633).
12. Xie, Z\*., Z.Hu, Ma Yaoming , G.Sun, L.Gu,S.Liu, Y.Wang, H.Zheng, W. Ma\* , 2019, Modeling blowing snow over the Tibetan Plateau with the Community Land Model: Method and preliminary evaluation, *Journal of Geophysical Research: Atmospheres*, 124. doi : [10.1029/2019JD030684](https://doi.org/10.1029/2019JD030684).
13. Joshi, B., Ma Yaoming\* , W.Ma, M.Sigdel, B.Wang, S.Subba, 2019, Seasonal and Diurnal Variations of Carbon Dioxide and Energy Fluxes over Three Land Cover Types of Nepal, *Theoretical and Applied Climatology*, doi:10.1007/s00704-019-02986-7.
14. Latif, Y. , Ma Yaoming , Y. Muhammad, S.Muhammad, A.W.Muhammad, 2019, Spatial analysis of temperature time

## Planned new scientific activities in the coming one year:

1. Two fieldwork in spring/fall 2020 to Paiku Co on the southern Tibetan Plateau to install various measurement devices and collect field data, including an automatic weather station, pressure transducers for lake level changes and time lapse cameras.
2. A comprehensive field observation to land-atmospheric interaction in October 2020 in the Monsoon-dominance transect (four stations: Kathmandu, Mt. Qomolangma, Namco, Linzhi) and Westerlies-dominance transect (four stations: Ali, Tutuohe, Dunhuang and Pingliang) over the Pan-third pole region
3. A comprehensive field investigation to glaciers and glacial lakes in November 2020 to the south-eastern Tibetan Plateau.

## Planned workshops or meetings in the coming one year:

- TPE International workshop Nepal, April, 2020, Kathmandu, Nepal.
- TPE session in EGU General Assembly 2020, May 1-3, 2020, Vienna, Austria.
- TPE session in AOGS 17th Annual Meeting, 28 Jun - 4 Jul 2020, Hongcheon, Korea.
- Kickoff meeting of TPE Water Sustainability (TPEWS) one of GEWEX RHP in August, Xigelila, China.
- TPE session in AGU fall meeting, December, 2020, San Francisco, U.S.A.