

Pan-Third Pole Environment and Climate Changes

Baiqing Xu

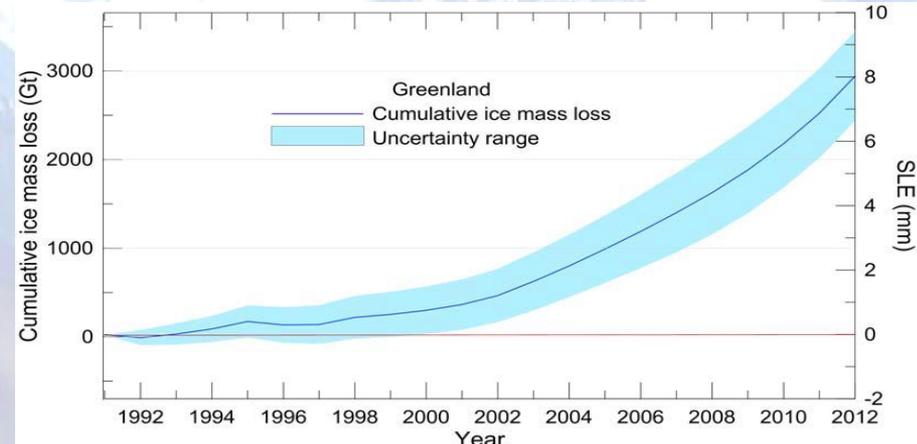
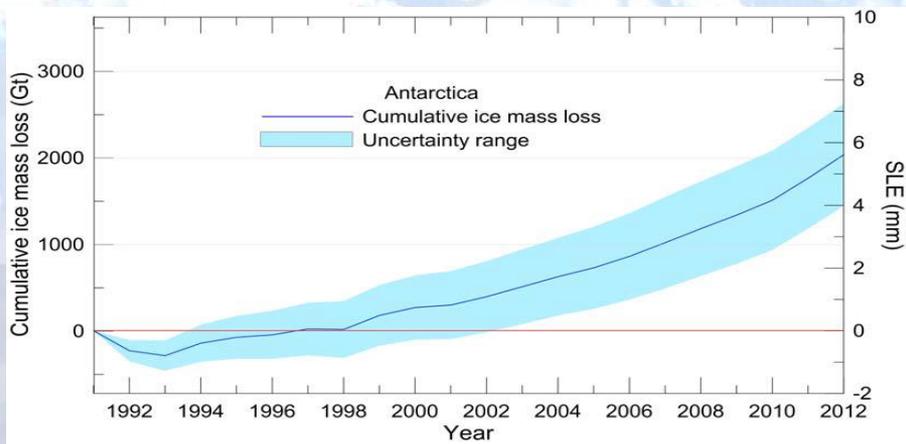
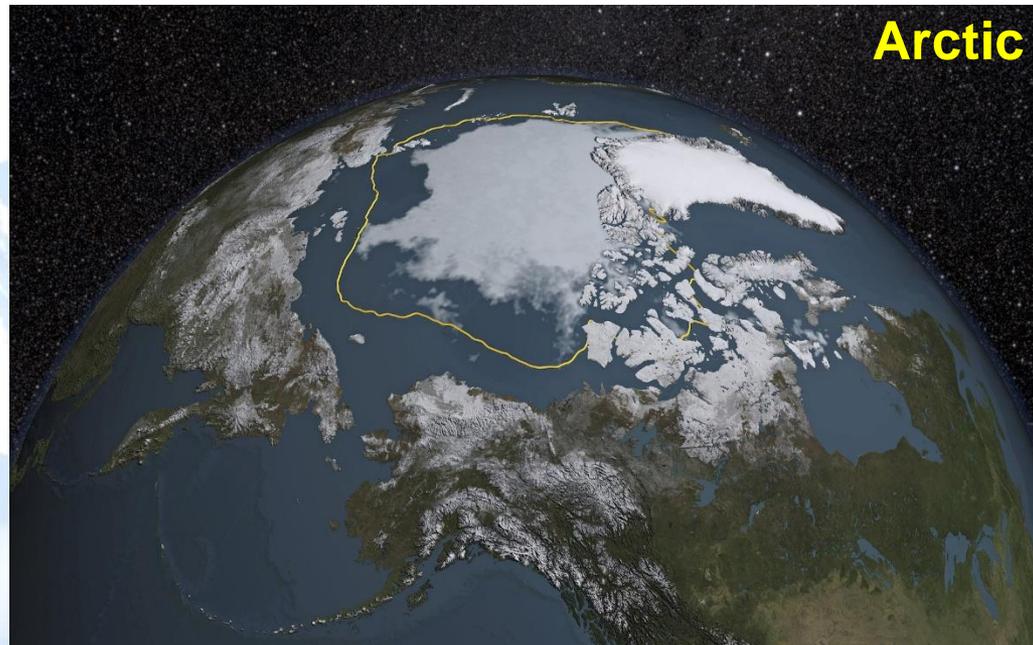
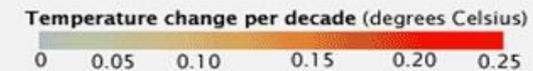
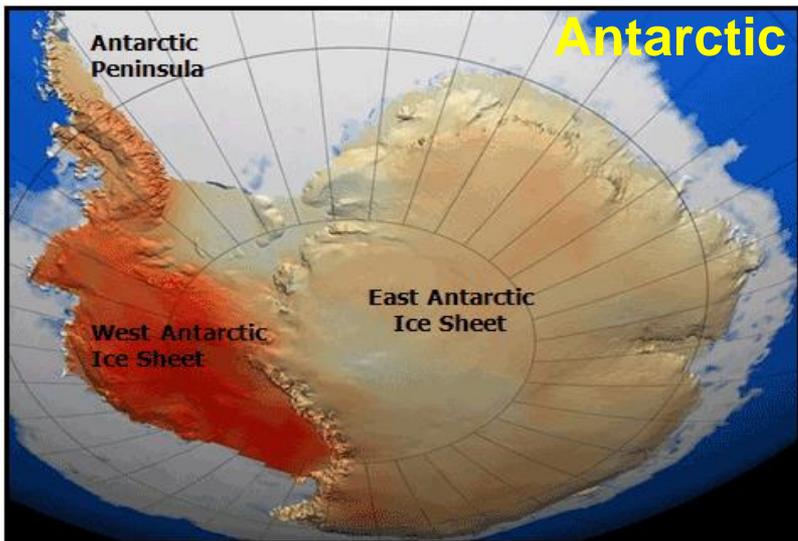
Institute of Tibetan Plateau Research, Chinese Academy of Sciences

Islamabad, Pakistan, 26 February - 2 March 2018





Two Polar Regions

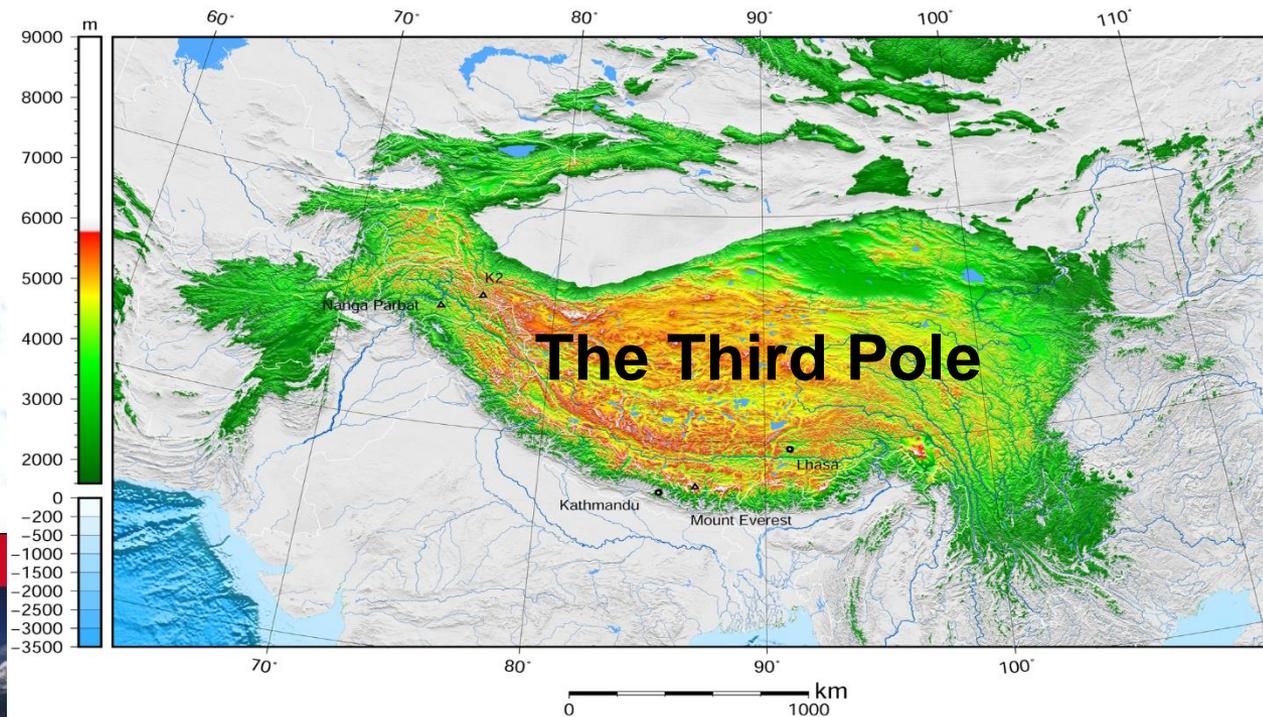




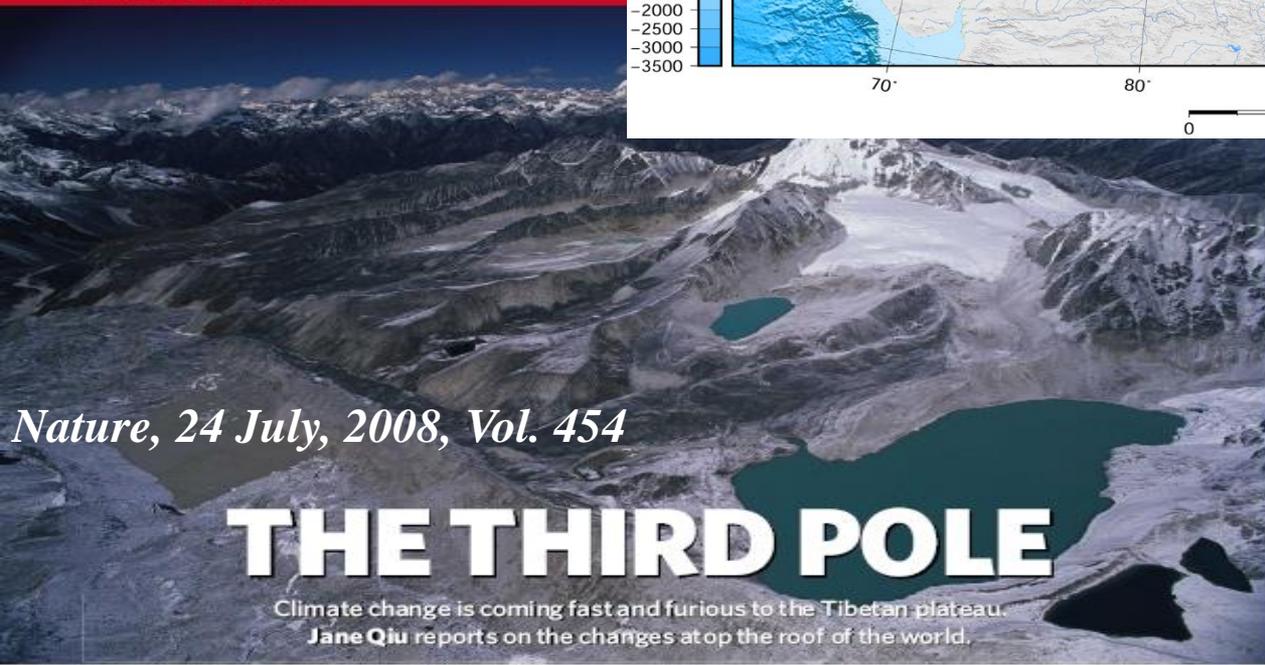
The Third Pole



After the North and South Poles, the Third Pole refers to the unique high mountain region centered on the Tibetan Plateau



NATURE Vol. 454 (24 July 2008)



Total area of over 5 million km² and averaged altitude of 4 km

THE THIRD POLE

Climate change is coming fast and furious to the Tibetan plateau.
Jane Qiu reports on the changes atop the roof of the world.



Third Pole Environment (TPE) Program

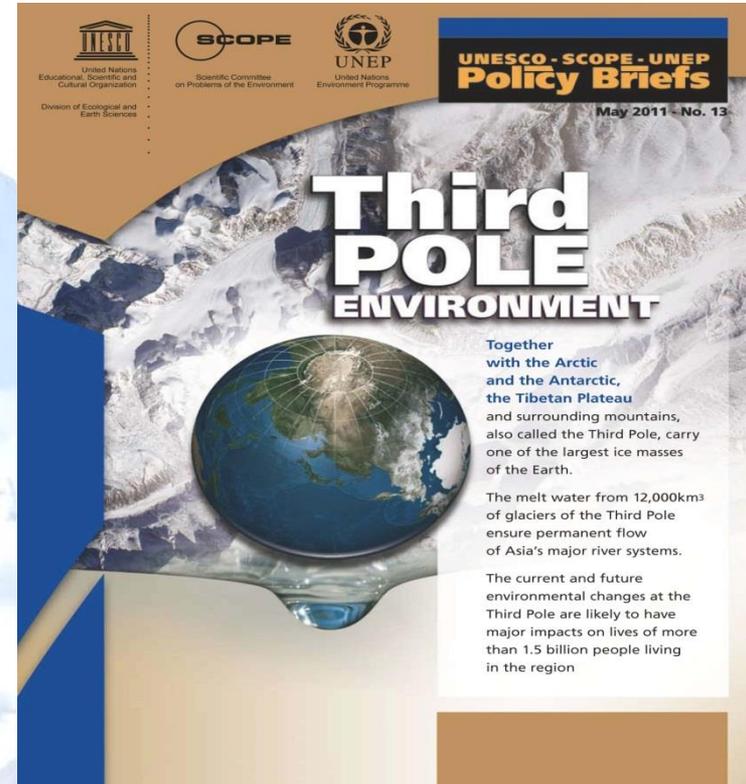


TPE program started in 2009

TPE Chair: Tandong Yao (Academician, CAS)

TPE Co-chair: Lonnie Thompson (Academician NAS and CAS)

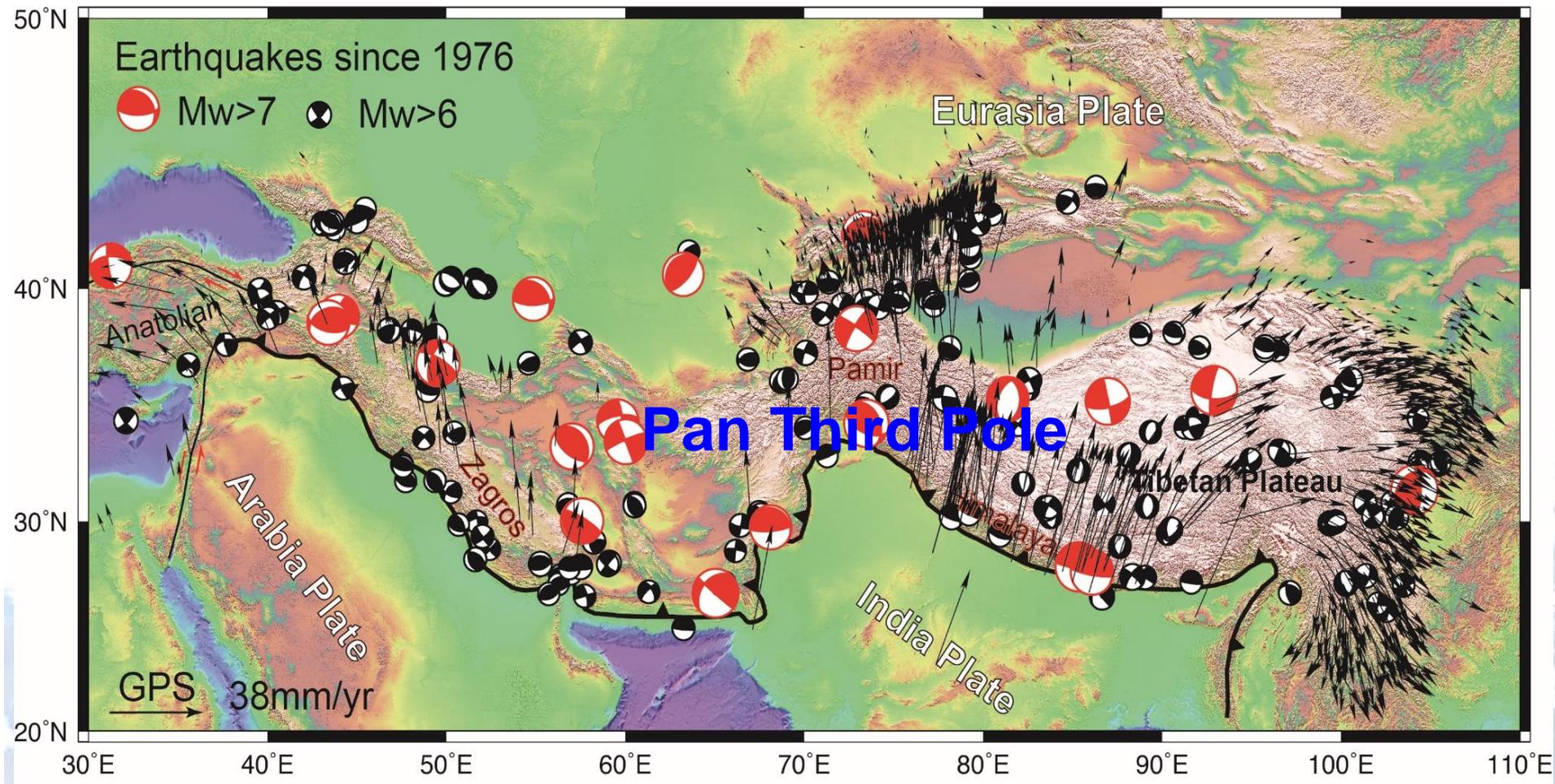
Volker Mosbrugger (Academician, Germany)



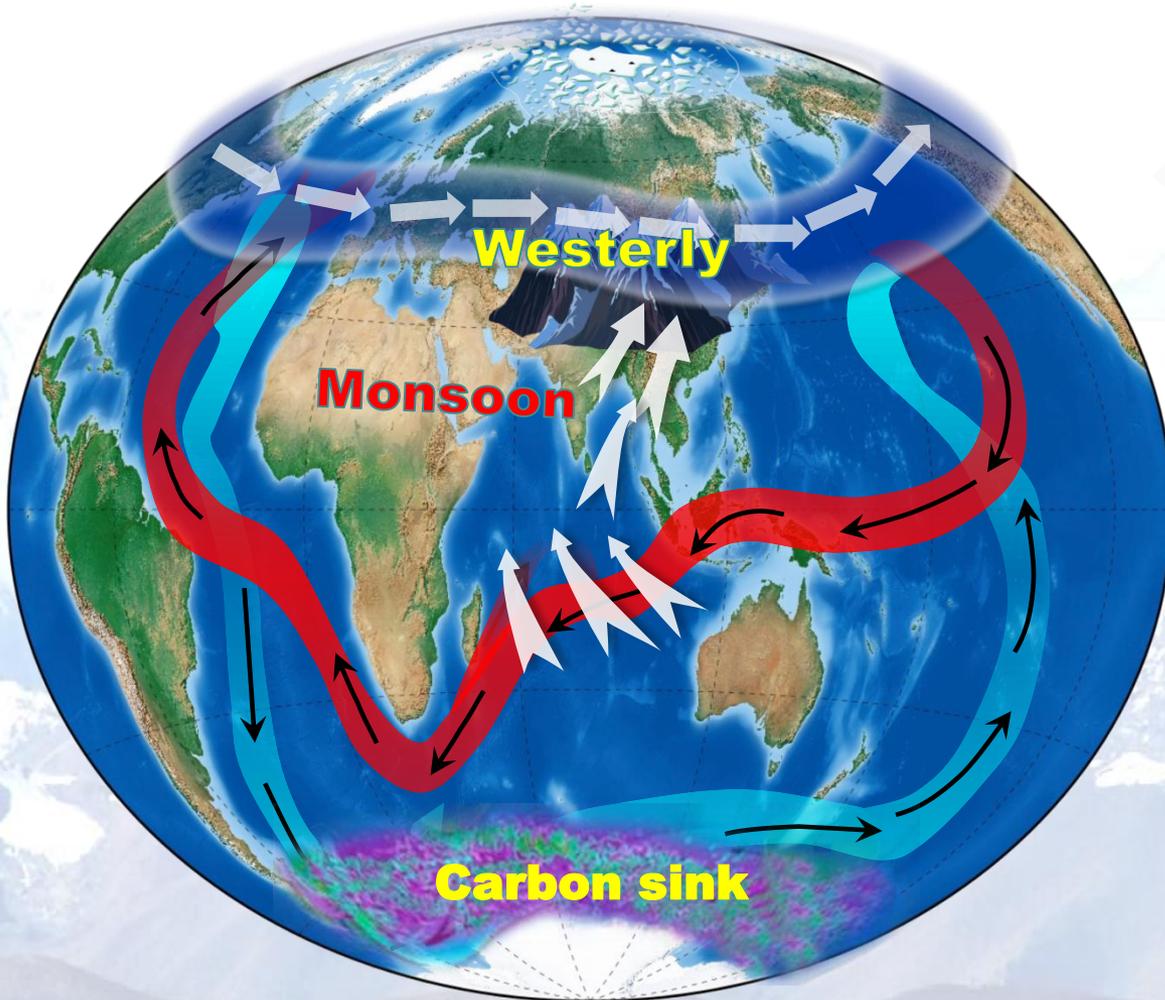
TPE entered UNESCO-UNEP-SCOPE flagship program in 2011



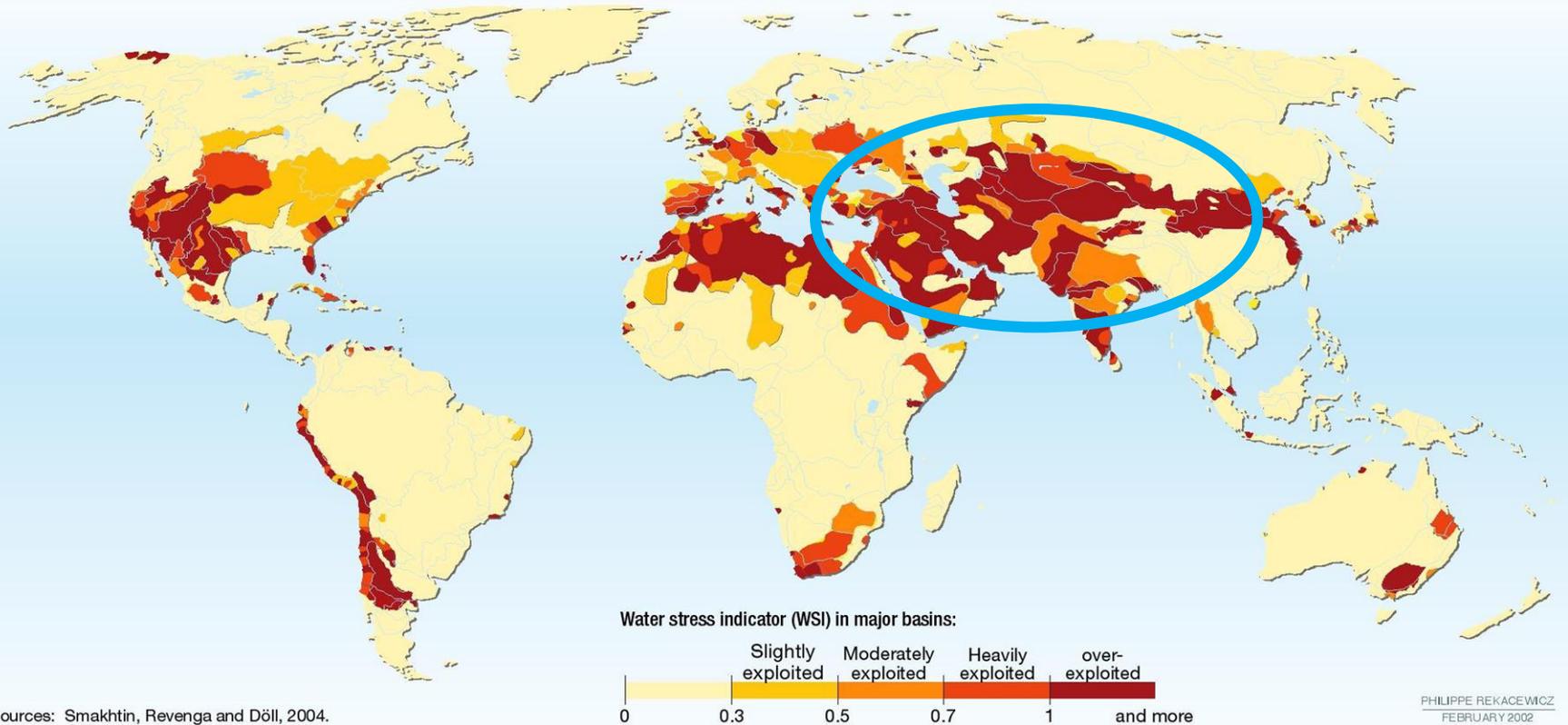
Pan Third Pole



With a total area of over 20 million km², as one of the world's most densely populated areas (more than 3 billion people living in the Pan Third Pole region).



Pan-TP region is facing the most severe water stress in the world

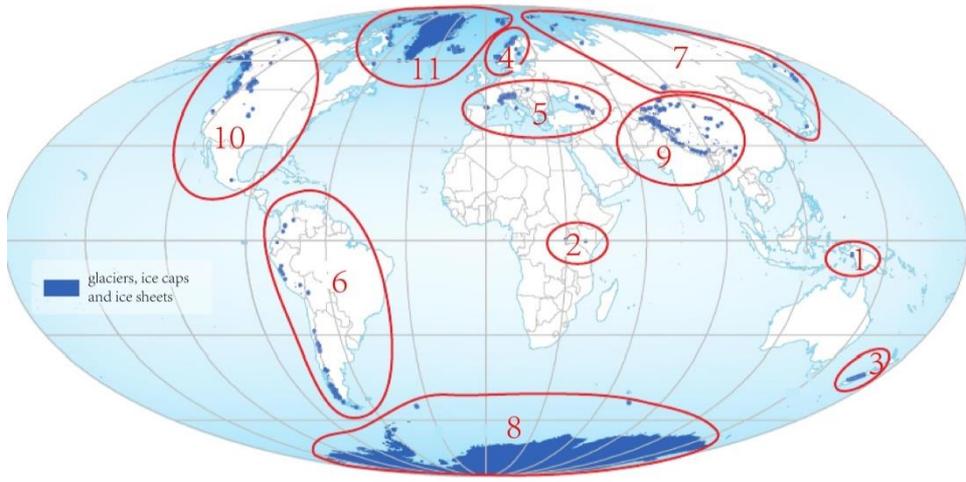


Sources: Smakhtin, Revenga and Döll, 2004.

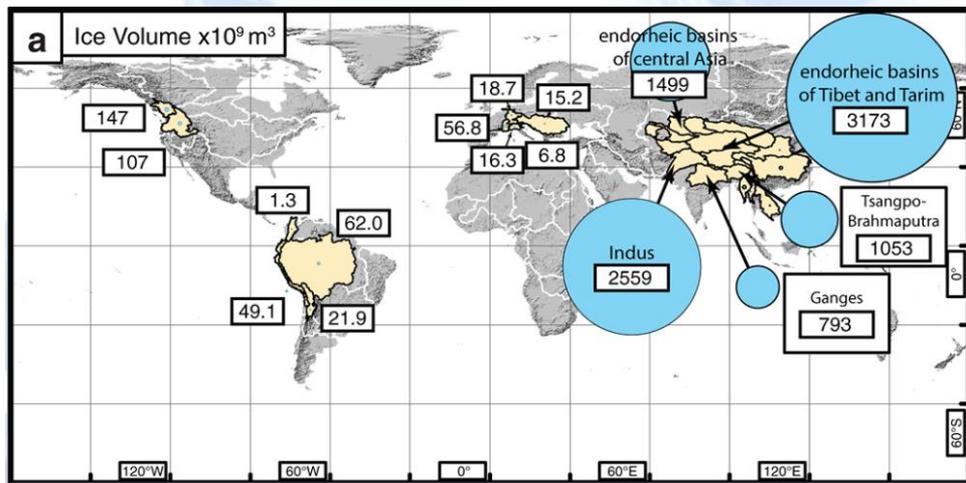
PHILIPPE REKACEWICZ
FEBRUARY 2002

The shortage of water resource heavily limits the economic development, the exploitation of cross-border water resource often evokes serious conflicts, as it covers trans-border rivers.

Surface Areas of Glaciers

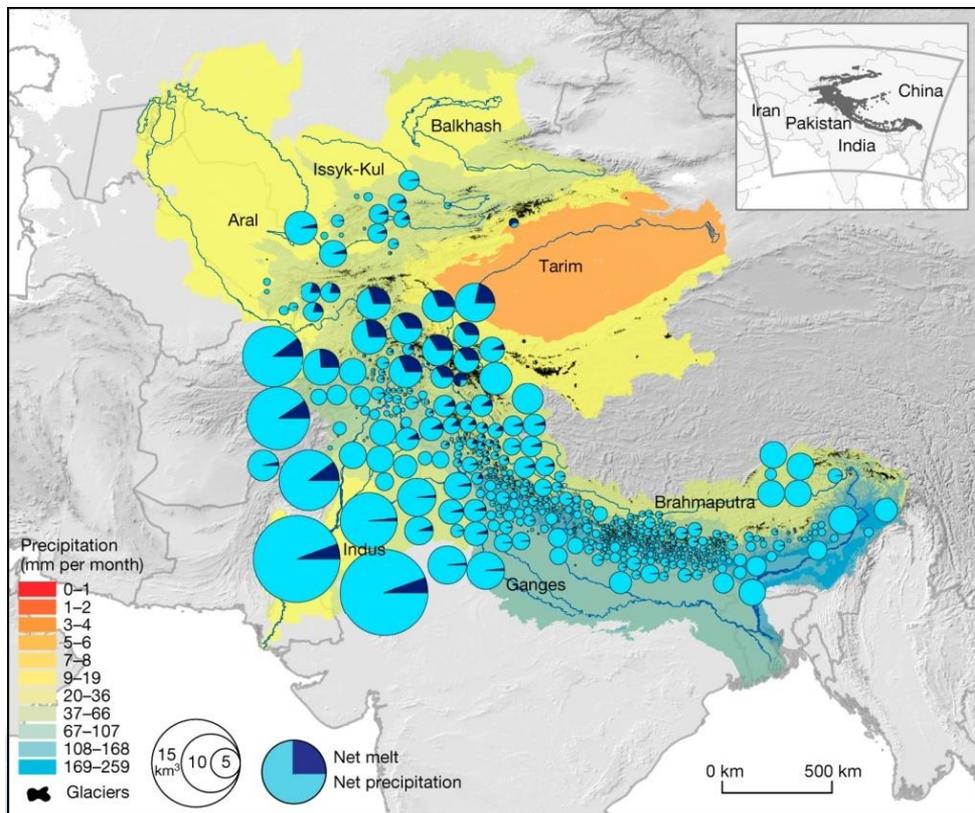


Zemp et al., 2008

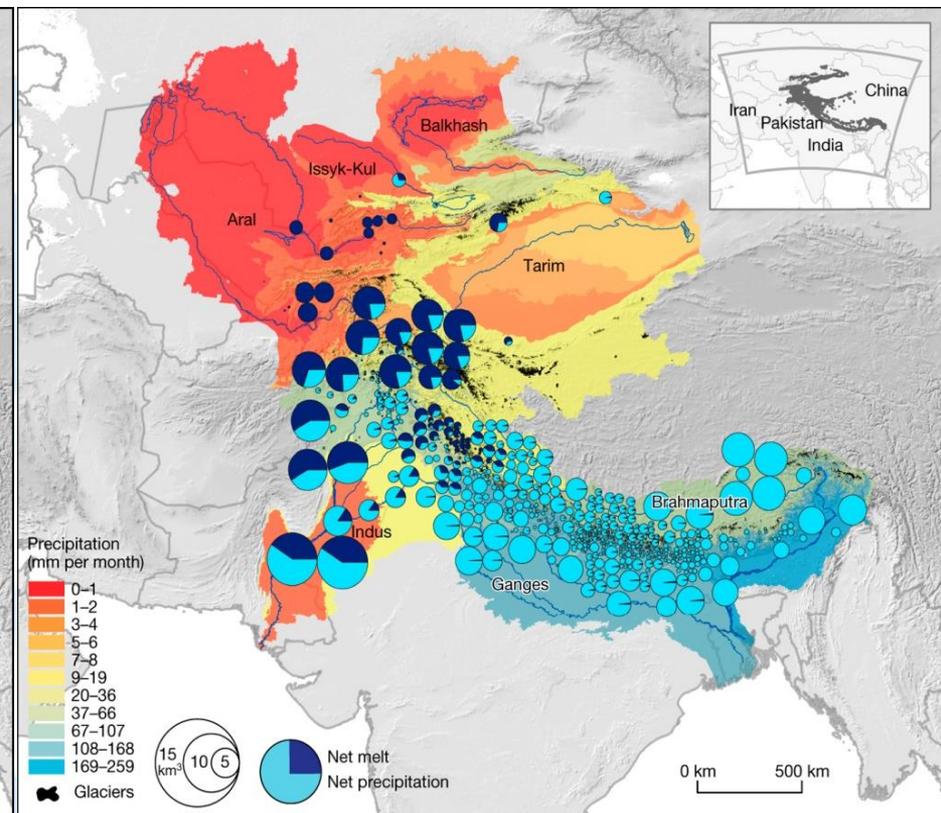


M. Huss et al., 2017

Region	Area, km ²
Total in Europe	17,290
Total in Siberia	3,500
High mountain(HM) Asia	
Tien Shan	15,470
Dzhungaria	1,000
Tarbagatay	17
Pamir	12,260
Qilian Shan	1,930
Altun	266
Kunlun Shan	12,260
Karakoram	16,600
Qiantang Plateau	1,802
Tanggula	2,260
Gandishi	1,615
Niaingentanglha	7,536
Hengduan	1,618
Himalaya	33,050
Hindukush	3,200
Hinduradsh	2,700
Total in HM Asia	116,180
Middle East(Near East)	
East Caucasus(Caspian Sea basin)	781.7
Maliy Caucasus	3.8
Turkey	24
Iran	20
Total in Middle East	830
Total in Asia	120,680



Precipitation and glacial melt inputs in an average year



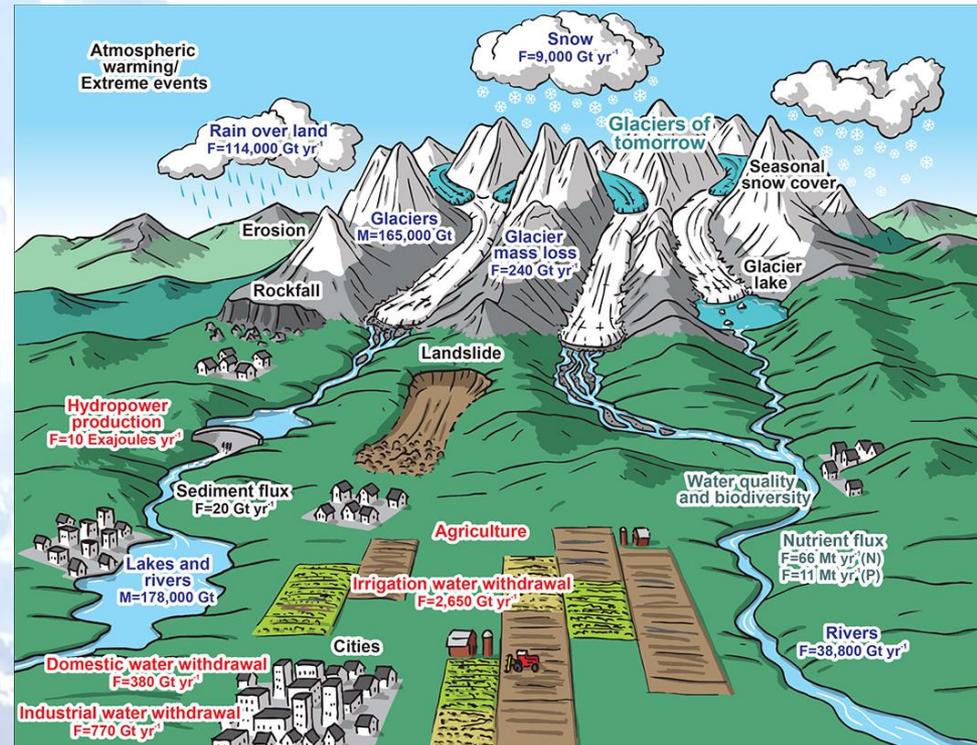
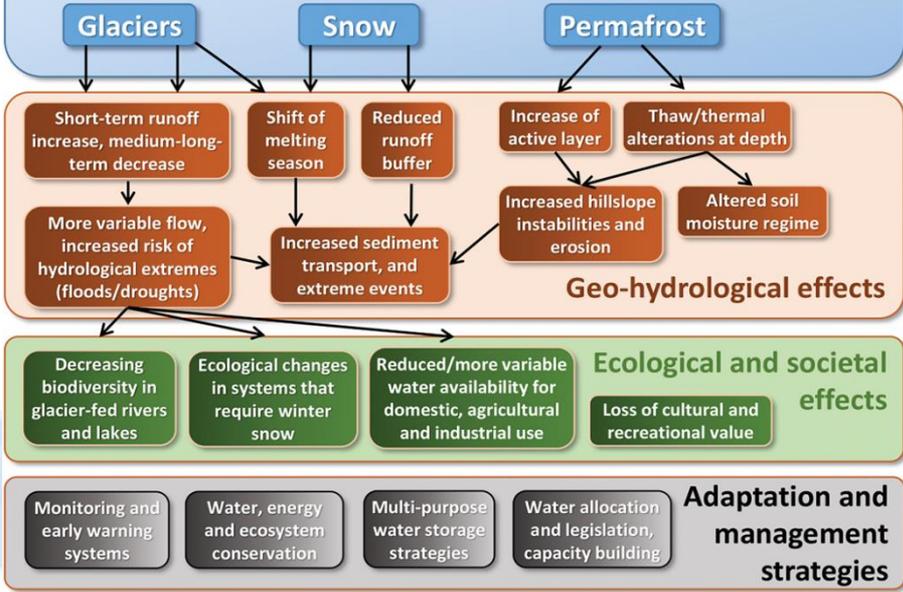
Precipitation and glacial melt inputs in a drought year

Climate Change Impacts and Process Linkages Within the Mountain Cryosphere

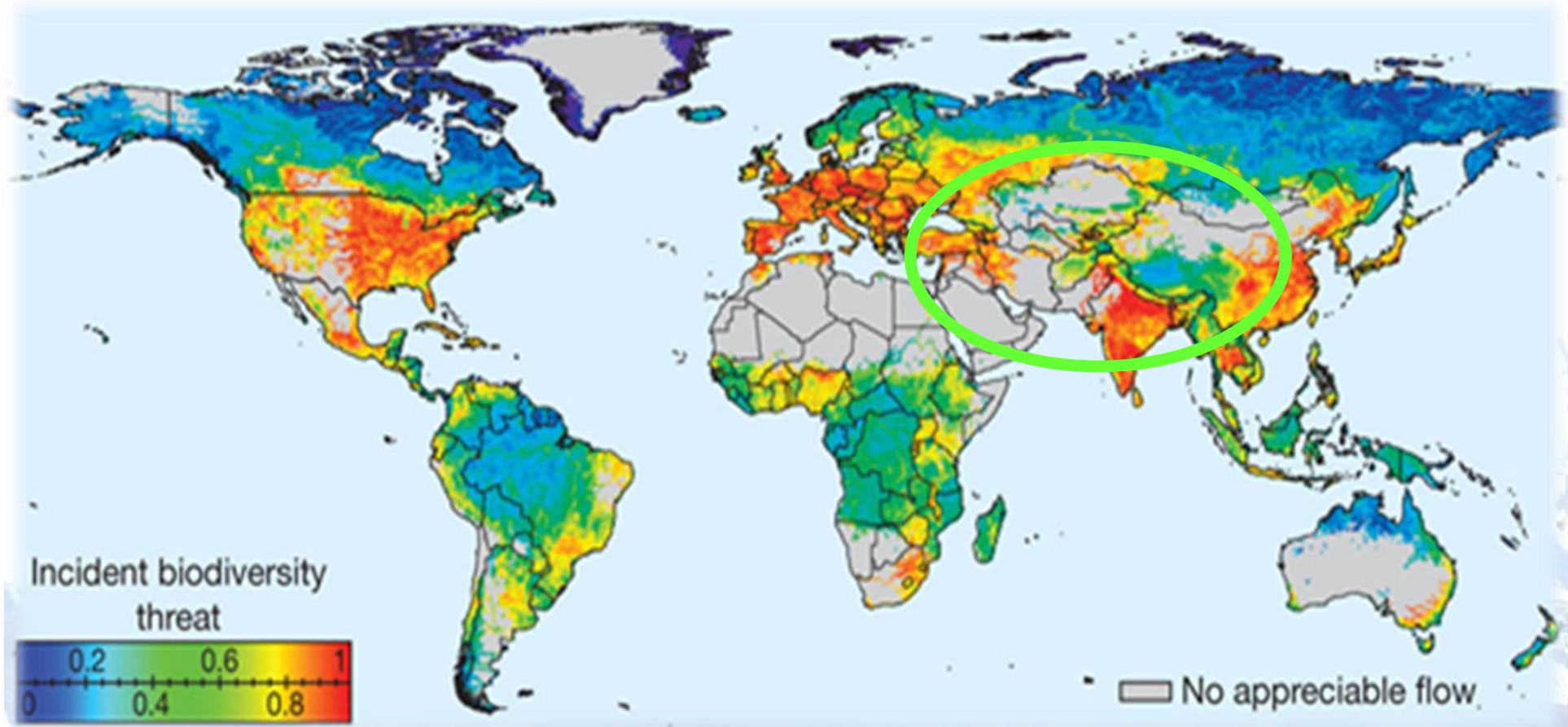
Mass Fluxes Related to the Cryosphere and Mountain Hydrology

Impacts of climate change on cryospheric processes

- Shift of all components to higher altitudes and latitudes
- Decreasing area, volume and duration of snow and ice
- Less inter-seasonal water storage capacity



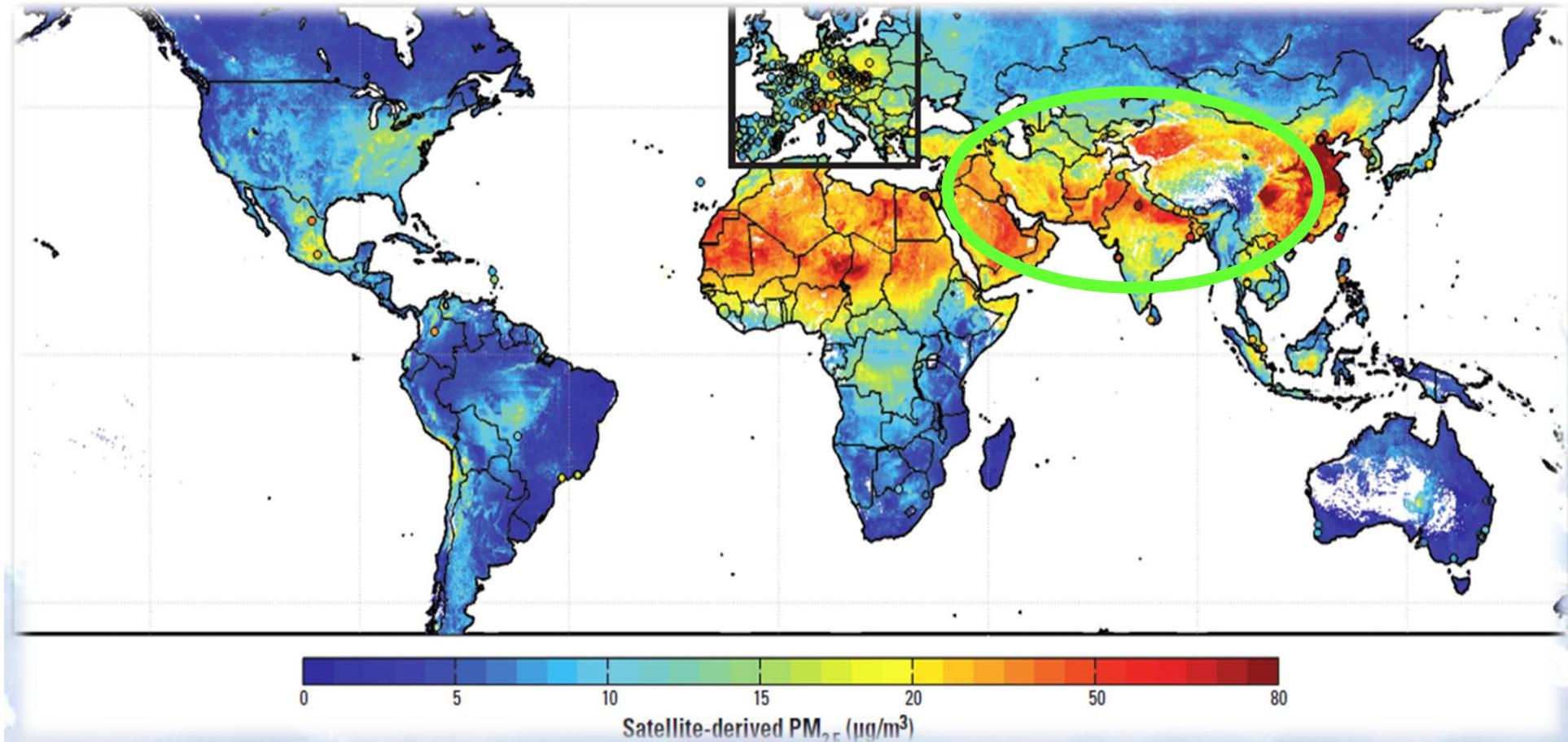
Pan-TP is also facing most serious eco-system degradation in the world



Vörösmarty et al. Nature, 2010

Under the impact of human activities and global change, the biodiversity in the Pan-TP confronts grave threats.

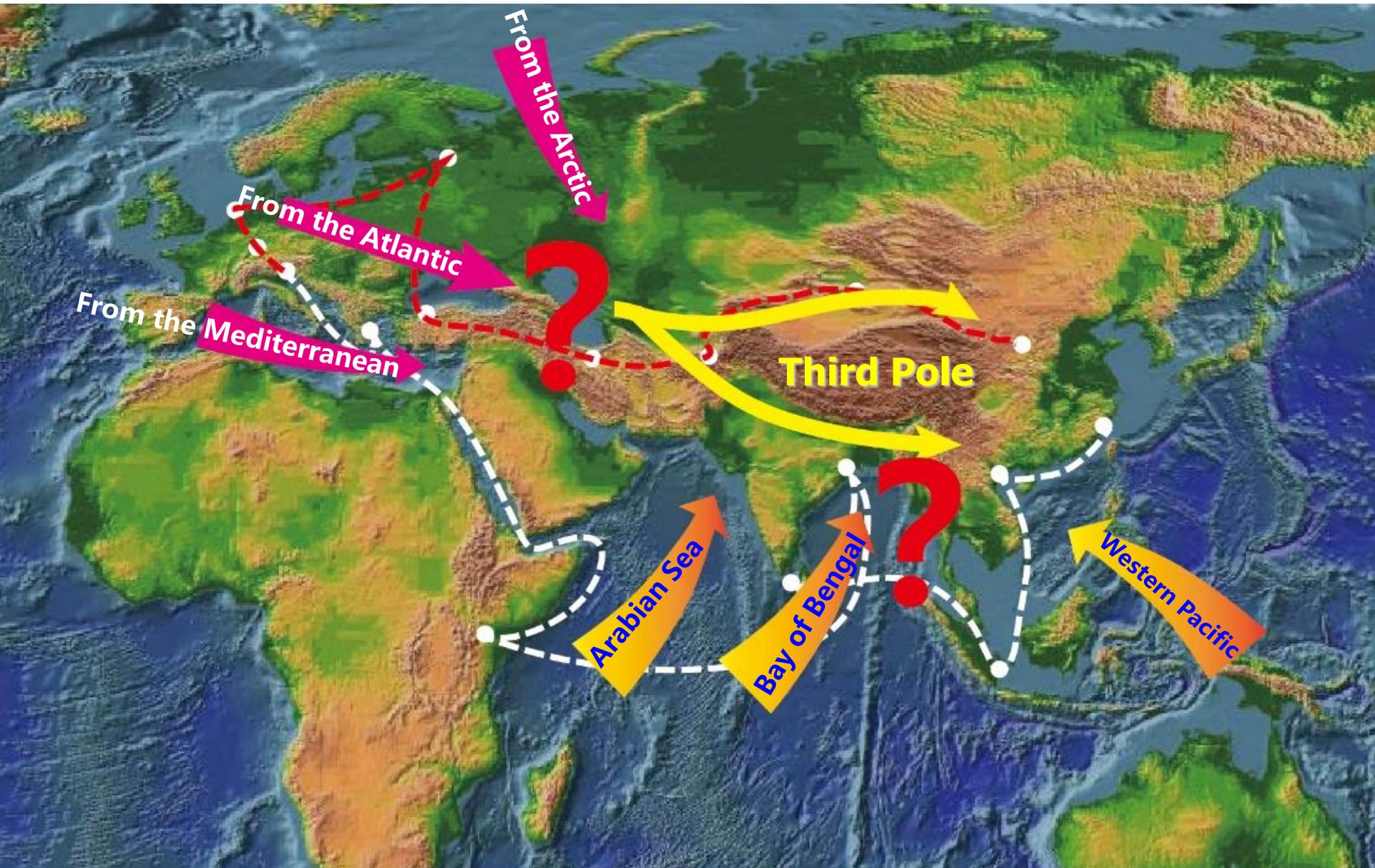
Regional disasters heavily affect human living environment in Pan-TP



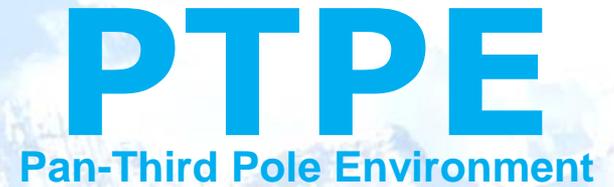
Donkelaar et al., 2010, EHP

Air pollution, water hazards, glacial lake outburst, glacial surges, and landslides, etc.

Scientists increasingly recognize the importance of Asian Monsoon and westerlies influence on Earth System in Pan-TP region.

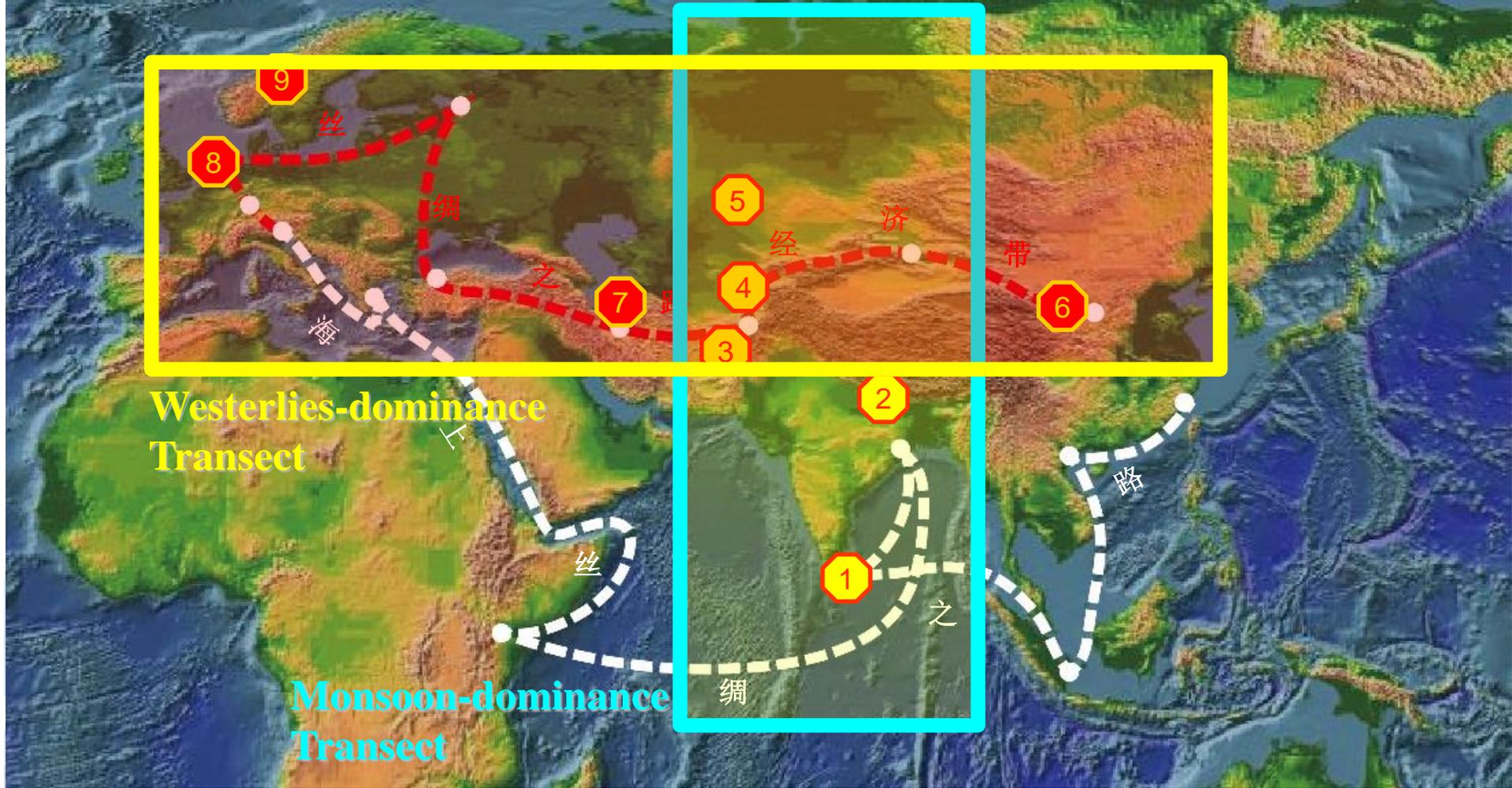


From TPE to PTPE

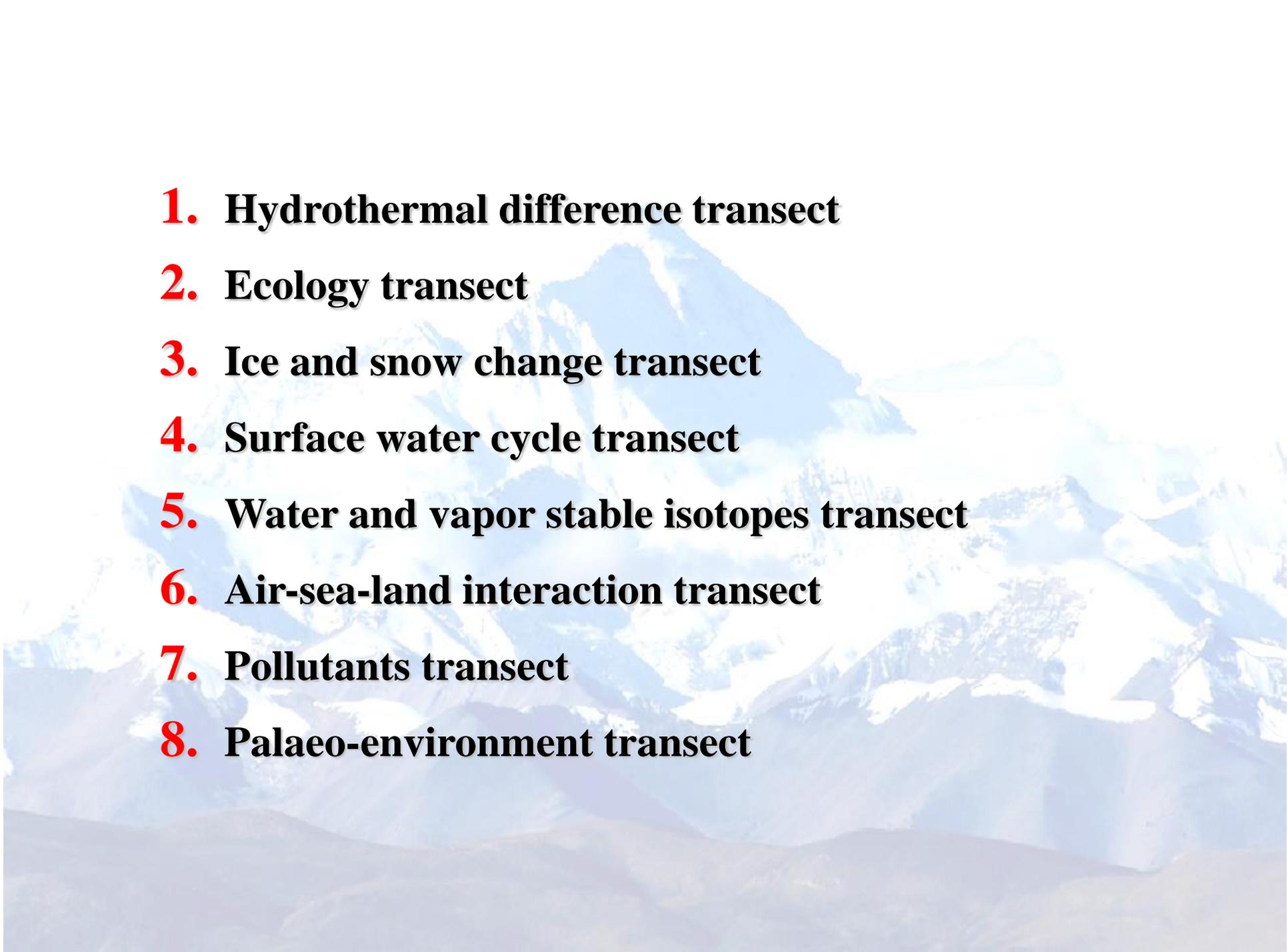


Focus on: Water-Ecosystem-Human activities

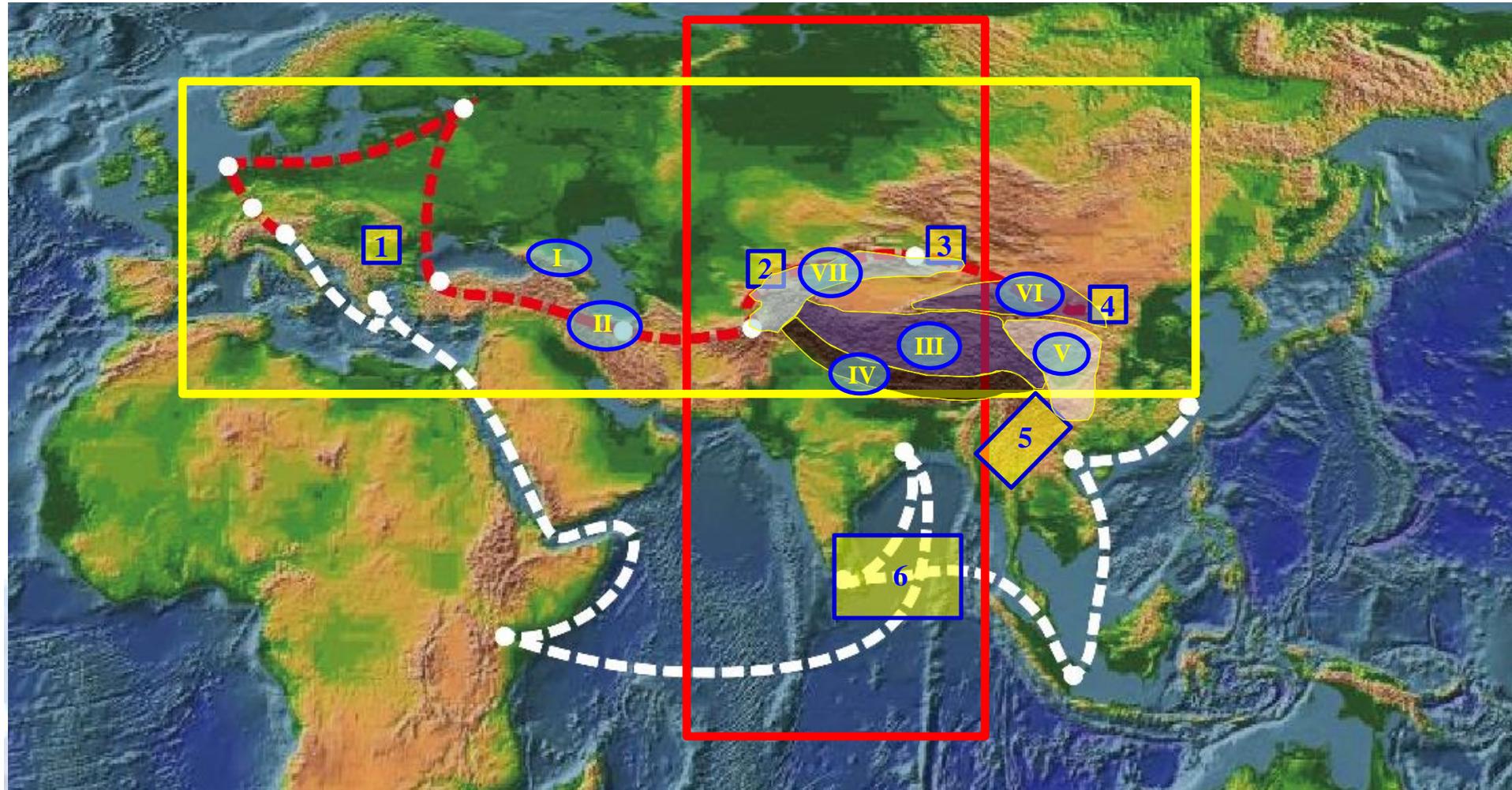
Implementation plan



- 1 Sri Lanka
- 2 Kathmandu
- 3 Pakistan
- 4 Tajikistan
- 5 Kazakhstan
- 6 Lanzhou
- 7 Iran
- 8 Germany
- 9 Sweden

- 
- 1. Hydrothermal difference transect**
 - 2. Ecology transect**
 - 3. Ice and snow change transect**
 - 4. Surface water cycle transect**
 - 5. Water and vapor stable isotopes transect**
 - 6. Air-sea-land interaction transect**
 - 7. Pollutants transect**
 - 8. Palaeo-environment transect**

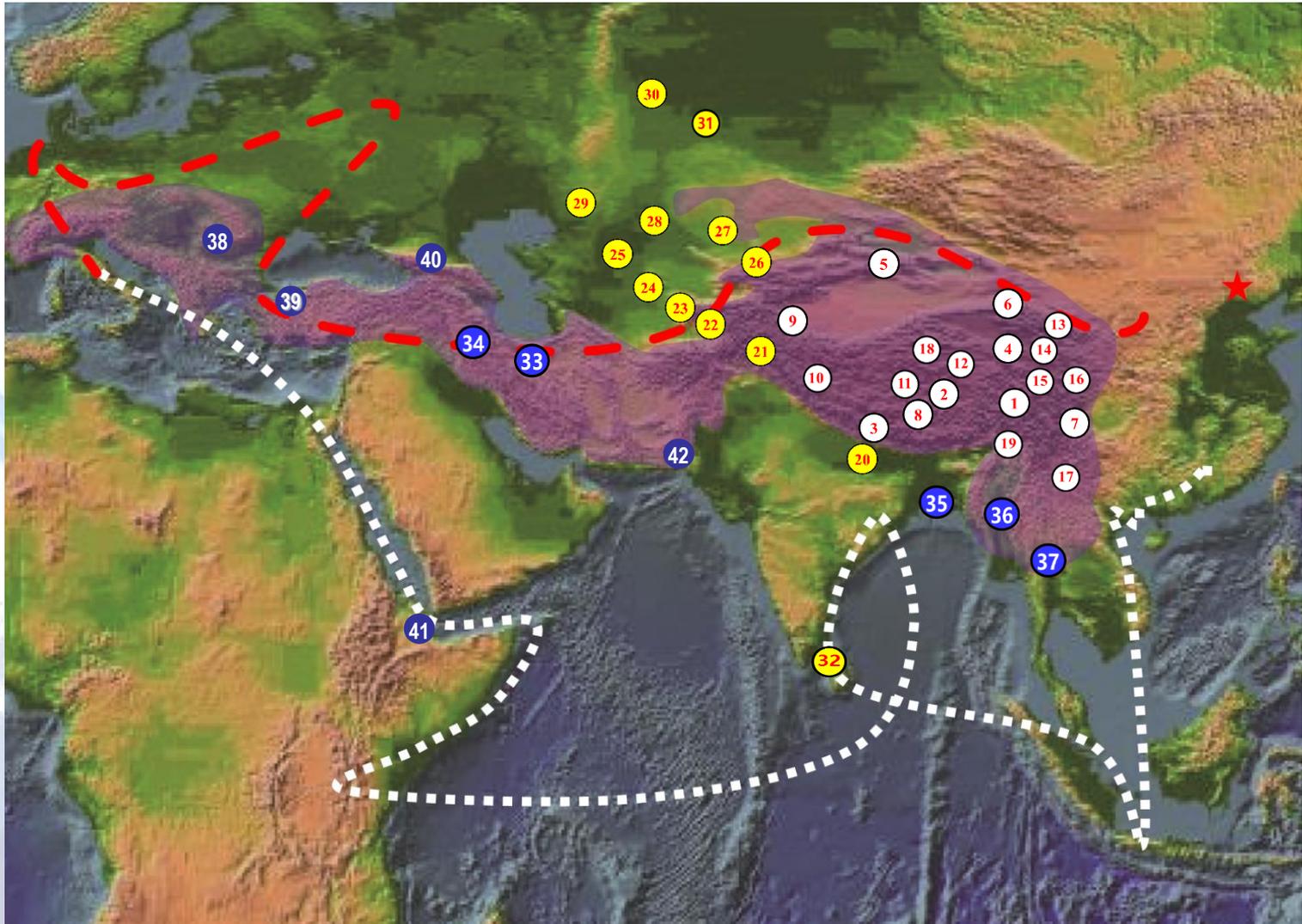
Scientific Expeditions



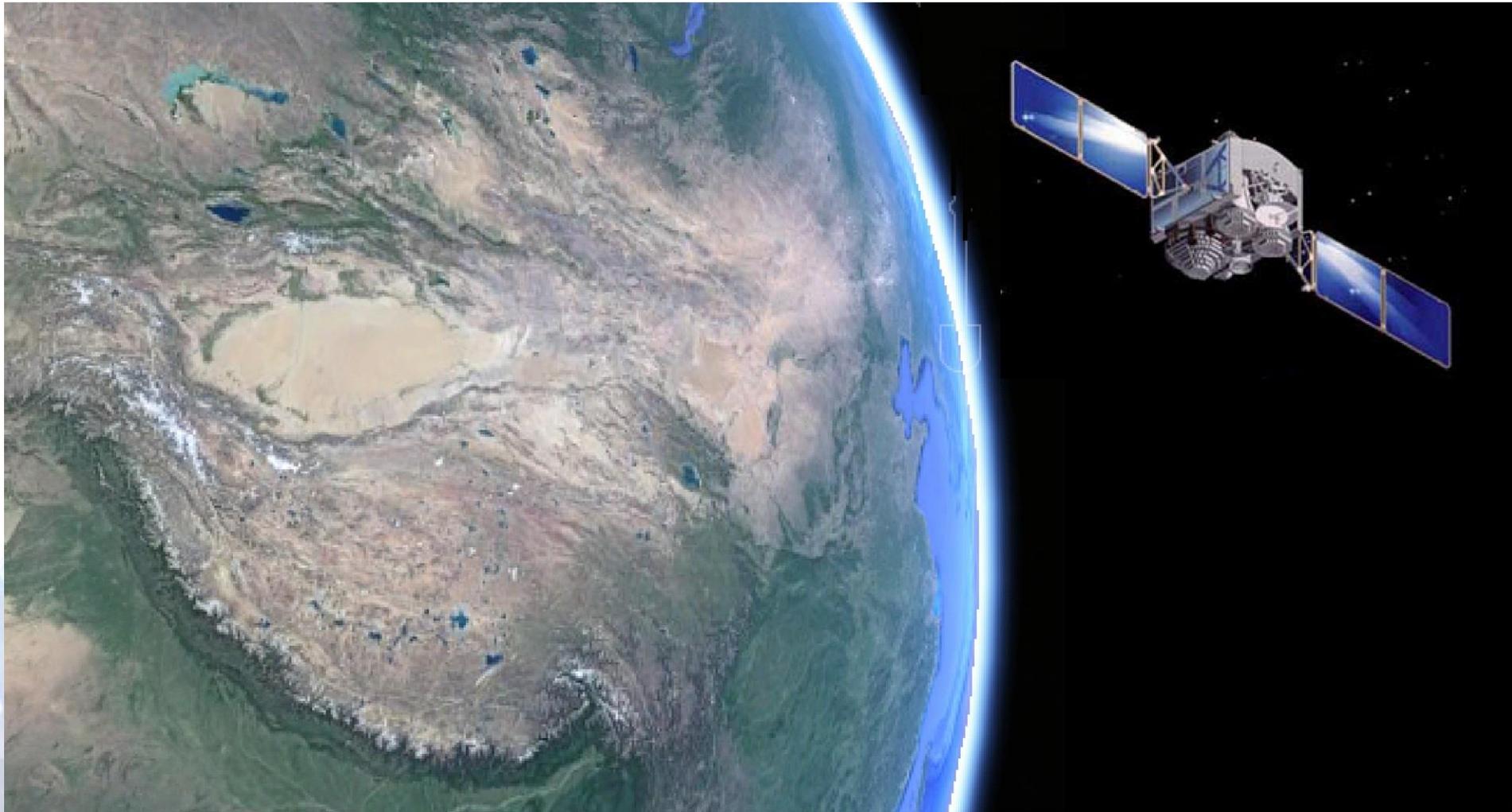
○ Comprehensive expedition (7)

□ Subject expedition (6)

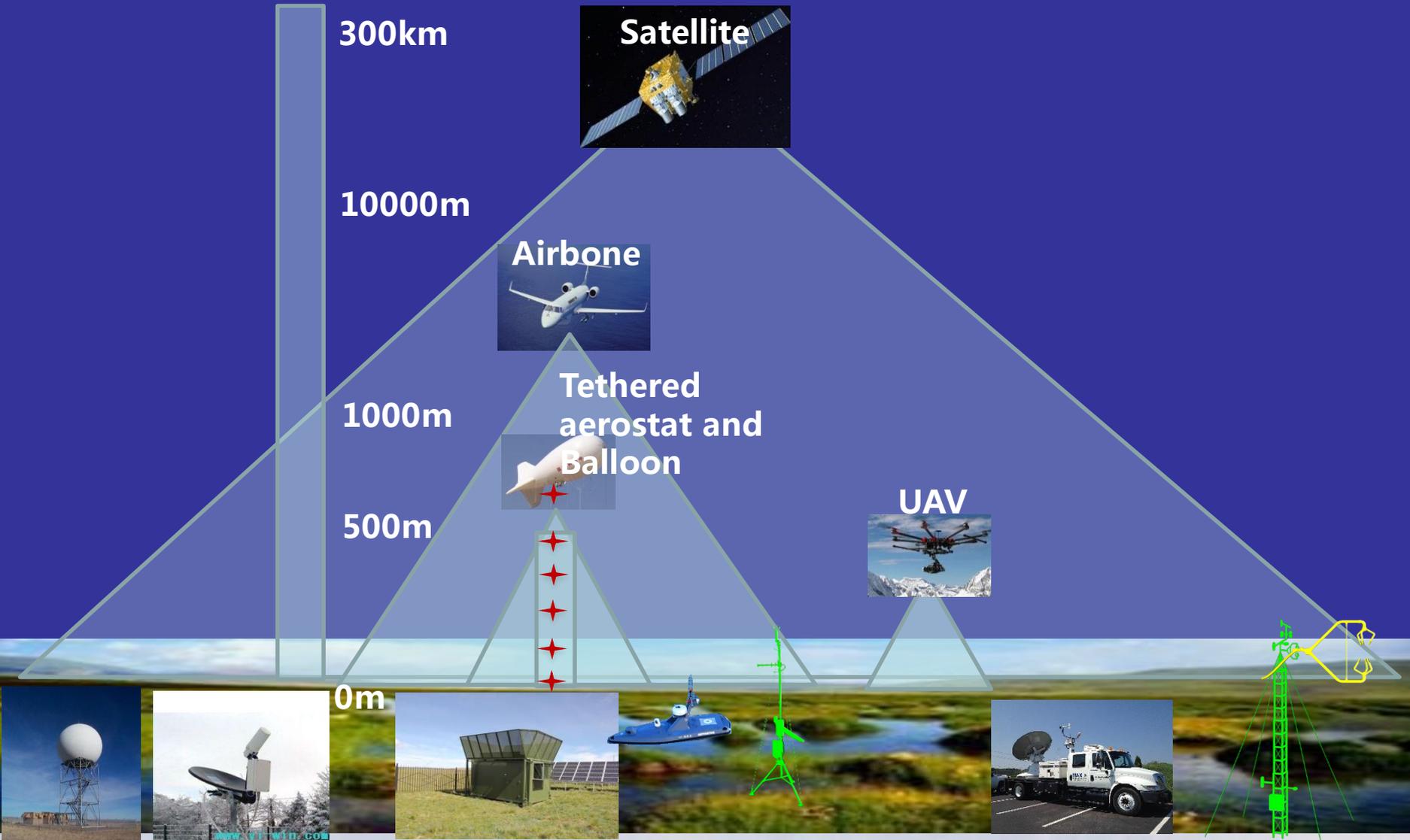
Ground-base Observation Network



Third Pole Environment Satellite



Integrated Observations



Scientific goals

- ❑ To study the spatial and temporal variation of Asian Monsoon under global warming and the environmental responses of the Pan Third Pole region
- ❑ To reveal the impact of Asian Monsoon and westerlies on water resources and ecological system resources, and to clarify occurrence of environmental disasters
- ❑ To propose regionally coordinated plan to study Asian Monsoon, westerlies and Earth System over Pan Third Pole region

Scientific Research

Scientific
Questions

1

Interactions between Indian Monsoon and Westerlies and their impacts

2

Climate change impacts on water resources

3

Climate change impacts on ecosystems

4

Environment assessment

Scientific Research

Research Contents

Interactions between Monsoon and Westerlies and their impacts on PTP

- Identify the influences by Westerlies and Indian Summer Monsoon in PTP
- Abrupt influences and feedback to Westerlies and Indian Summer Monsoon in PTP
- Moisture sources and transporting paths
- Air-sea-land thermodynamic process and simulation

Regional water cycling and sustainability of water resources

- Impacts of Climate change and human activities on water cycle
- Cryosphere change and water resources
- Water formation and change in the headwaters of some typical rivers
- Regional water recourses and evaluations

Eco-system processes and Ecological security

- Reconstruction of evolution of vegetation and climate
- The stability of terrestrial ecosystems under extreme environmental conditions
- Regional assessment of ecological vulnerability under global change

Environmental risks and disasters in PTP

- Environmental pollution and its risk assessment
- Effect of dust Storms and environmental effects
- Extreme weather events and risk assessment
- Risk assessment s of typical of mountain hazards and their response

Education & Training

**Graduate
students**

**Young
Scientists
Training
Program**

**Online Class
For M.Sc. and
Ph.D. students**

**Summer
School for
Undergraduate
students**

Talents training for countries in PTP

Scientific Think Tank

Pool of top scientists of the world studying on TPE

Linkage with related international organizations

Partner with related international projects

**Environment
Assessment**

- **Water resource**
- **Water related hazards**
- **Environmental pollution and earth system process**
- **.....**

Organization and Cooperation

CRE networks

TPE networks



Promote the scientific research, Educational Training, Capacity Building and environmental assessment in PTP countries



Thank you!