TPE Water Sustainability (TPE-WS)

Ailikun

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Chinese Academy of Sciences

GHP workshop, 25 Oct. 2018, Santiago, Chile

TPE and GEWEX

GHP-TPE joint workshop

17-19 Oct 2017, Kathmandu

1. Atmospheric circulation in high-latitude and the Third Pole region
2. Remote sensing and data retrieval for cryosphere
3. Land-surface interaction water resource/cycle in high-latitude and the Third Pole region
4. Climate modelling and future projection for Third Pole
6. Natural hazards and human adaptation in Third Pole

Proposal of New GHP Crosscutting Project:

Third Pole Environment (TPE) Water-Sustainability

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Proposal of New GHP Crosscutting Project:

Third Pole Environment (TPE) Water-Sustainability

Third Pole Environment: Water Sustainability (TPEWS)

GHP Cross-cutting Project Science Plan

Started drafting from Nov. 2017, first manuscript in March 2018, revising process finished June 2018. Totally, 15 TPE scientists contributed to this science plan.

TPE Water Sustainability (TPEWS)
----The Science Plan----

Scientific Questions

1. What are the changes in glaciers, snow and permafrost of the high Asian mountain region in last 50 years?
2. Why are these changes happening and what are the main drivers of these changes in Third Pole region? natural variability or human activities?
3. How are the various drivers affecting the hydrological cycle, natural hazard and ecosystem in the region?
4. Can we predict high-impact hydro-meteorological events and future water cycle changes?

TPE Water Sustainability (TPEWS)
----The Science Plan----

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

TPE Water Sustainability (TPEWS)
----The Science Plan----

Data: Ground Data

1) In situ observational data
   Historical in-situ and current meteorological and hydrological datasets

2) Create a high special 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

TPE Water Sustainability (TPEWS)
----The Science Plan----

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.

TPE Water Sustainability (TPEWS)
----The Science Plan----

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.

TPE Water Sustainability (TPEWS)
----The Science Plan----

Participating Institutes (Chair: Tandong Yao)

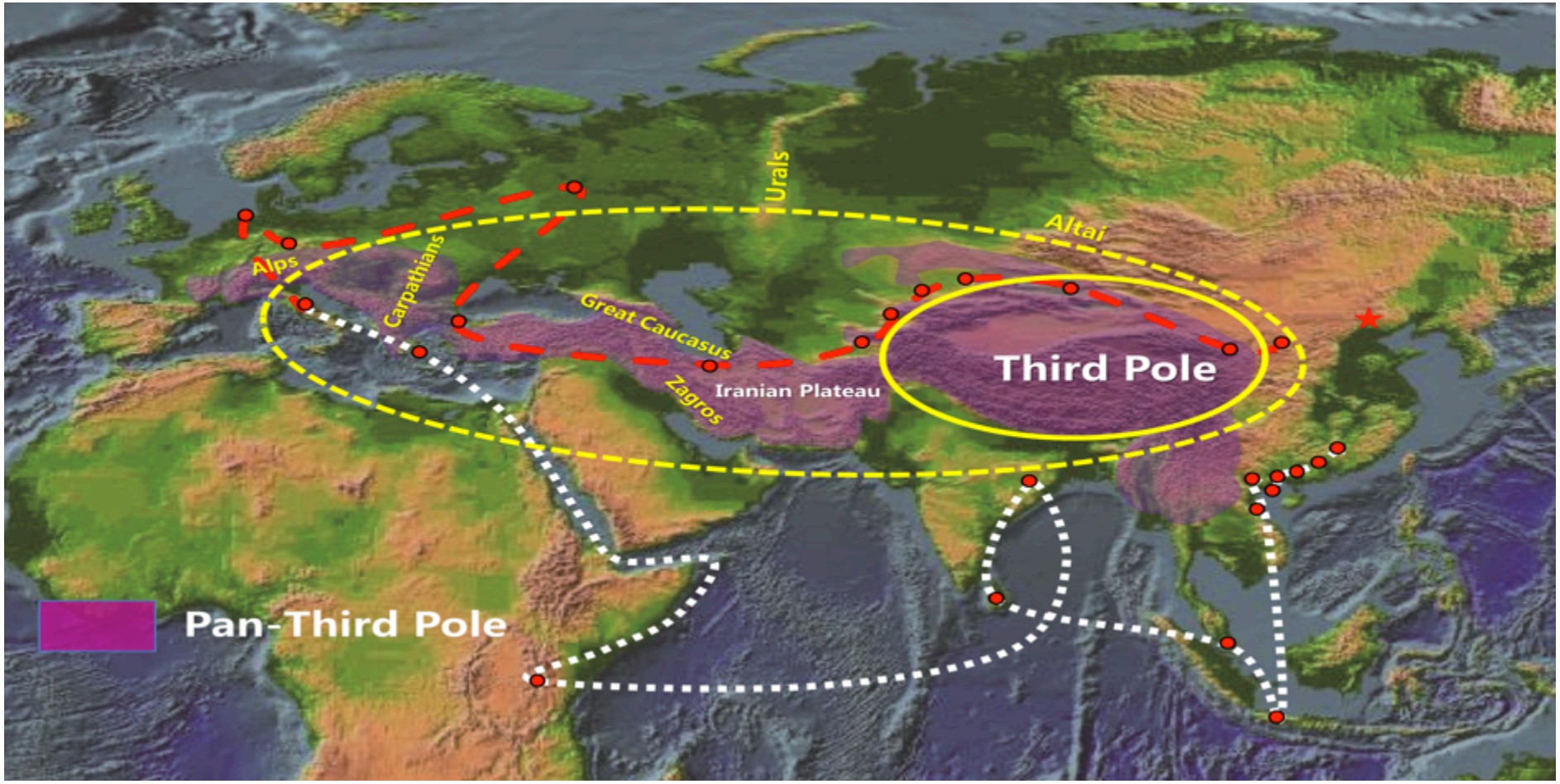
- Institute of Tibetan Plateau Research, CAS
- Institute of Remote Sensing and Digital Earth, CAS
- Institute of Atmospheric Physics, CAS
- Tsinghua University
- Beijing Normal University
- Nanjing University, China
- ITC, University of Twente, the Netherlands
- Tribhuvan University, Nepal
- Nepal Academy of Science and Technology
- Pakistan Space and Upper Atmosphere Research Commission, Pakistan
- The Energy and Resources Institute of India

TPE Water Sustainability (TPEWS)
----The Science Plan----

International Partners

- INARCH: mountain hydrological cycle obervation and modeling
- Post-MAHASRI: mountain precipitation and monsoon
- CORDEX: high resolution regional model for Third Pole (~10KM)
- WMO: cryosphere monitoring and regional coordination
- UNEP: assessment report for Third Pole

CAS Strategic Priority A Program: Pan-Third Pole Environment Study for a Green Silk Road (2018-2023, PI: Tandong Yao)



TPE
THIRD POLE ENVIRONMENT

Pan-TPE
PAN THIRD POLE ENVIRONMENT

Objectives of CAS Pan-TPE Program

- To illuminate Water Tower of Asia change and its impacts on the Silk Road associated with climate change and earth system interactions
- To reveal water-ecosystem coupling mechanism and to project future environmental consequences along the Silk Road under different climate scenarios
- To propose new models of green growth for the regions

Pan-TPE

Themes

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

Questions

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?

Tasks

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

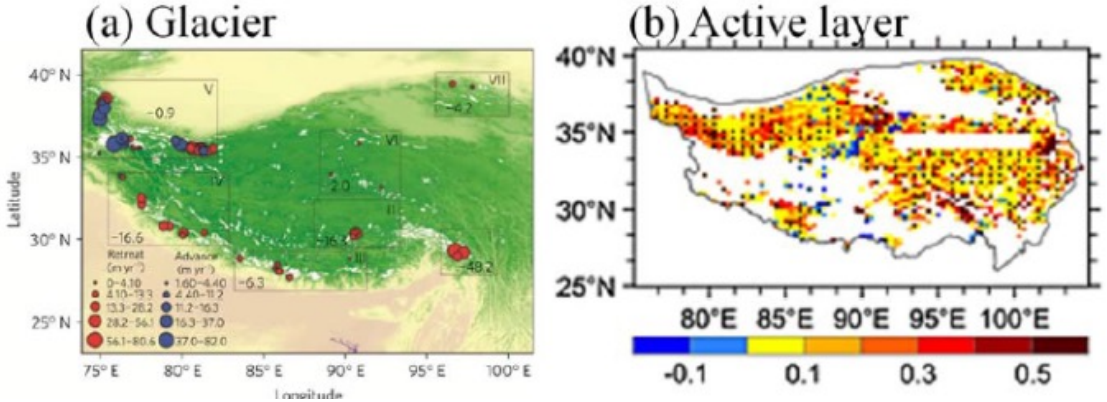
Integrated Environmental Assessment for sustainable Development

Far-reaching impacts and feedbacks from Third Pole to Poles

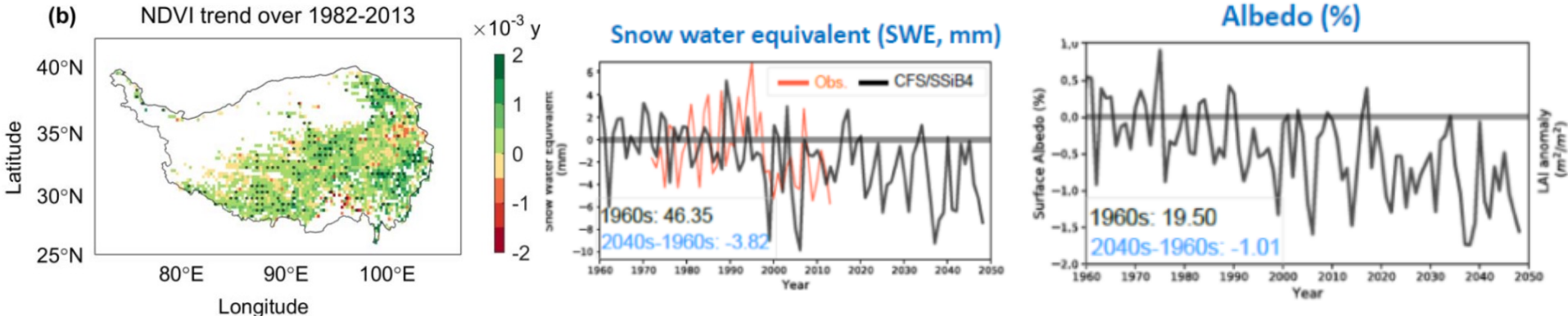
TPE Session in GEWEX OSC
6-11 May of 2018,
Canmore, Canada

This session further presented the latest scientific achievements with focus on

1). Glacier, snow dynamics and local/regional hydrological cycle in the Third Pole Region

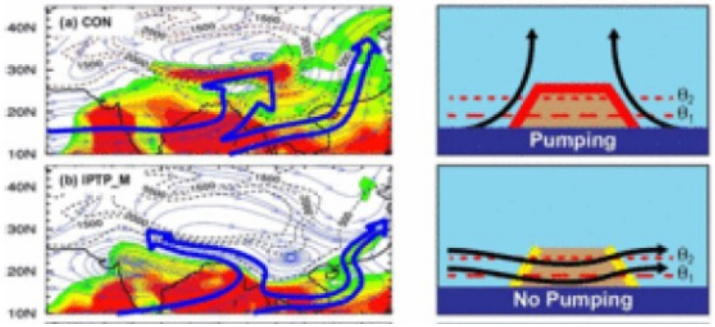


2) Land surface characteristics, parameterizations and its application in regional climate modeling over the highlands of the Third Pole



This session further presented the latest scientific achievements with focus on

3) Global and Regional Earth system (multi-sphere) modeling for the Third Pole Region and TPE processes impact on the adjacent regions at different scales



4) Ground/satellite observations and data assimilation for the highlands of the Third Pole Region.

TPE workshop in Gothenburg
24-26 Sep 2018

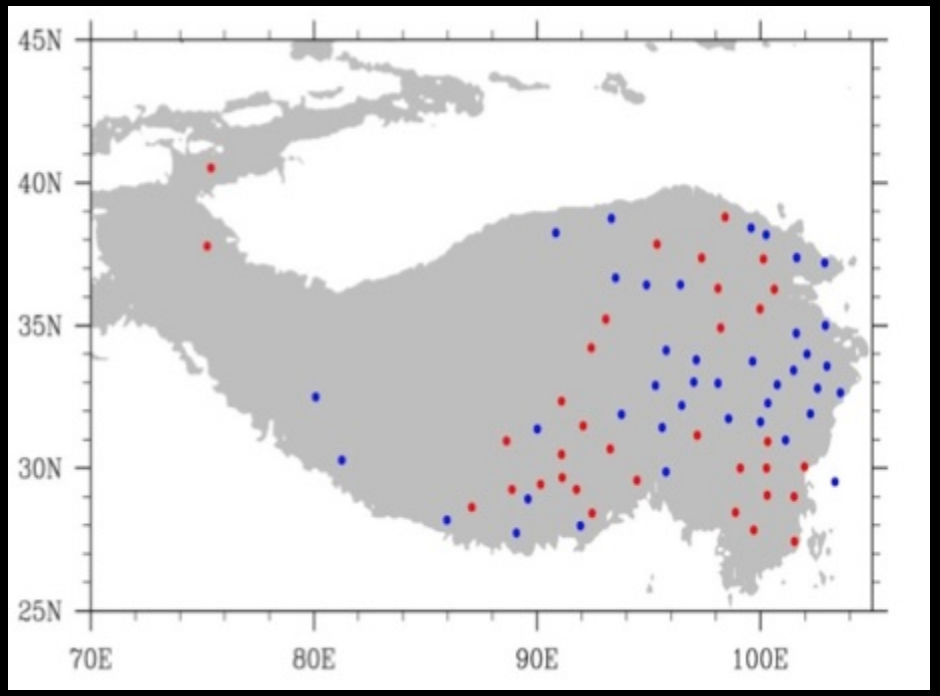
Some hot questions

- How changes in large-scale circulations influence the climate, hydrology and ecosystem in the TPE?
- Water balance at Plateau-scale?
- Where water vapor over TP comes from at decadal and annual scales?

CMA Ground Meteor observation in China（2422 stations）

212 climate reference stations (194 WMO), 633 base stations, 120 upper air stations (87 WMO)

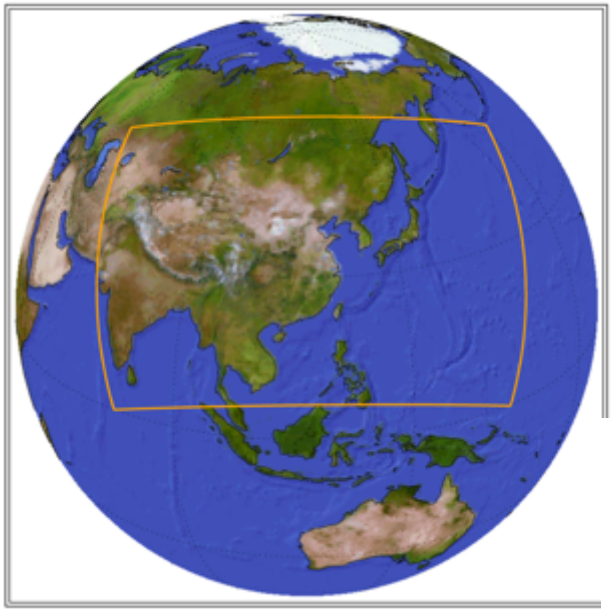
Scarceness of observations over the TP（from GX. WU）



73 stations available after quality check in TP

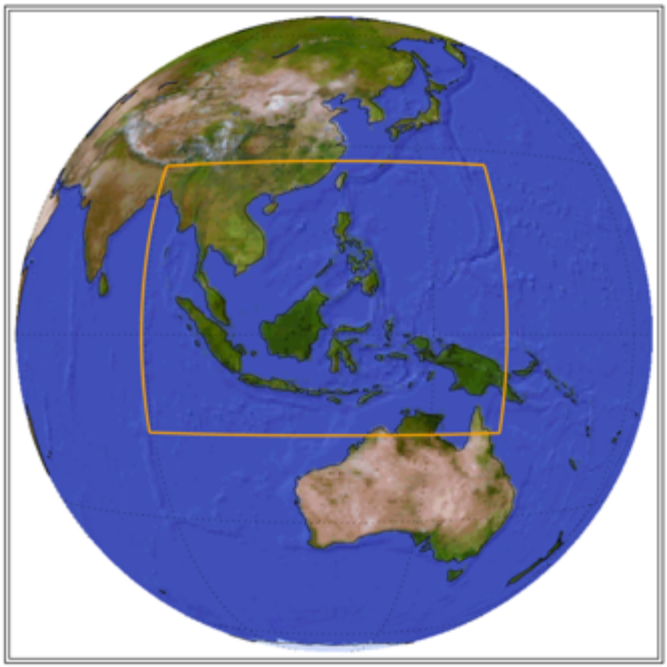
WCRP CORDEX Domains in Asia

South Asia



East Asia

SEA Asia



Discussion on Observation

- To improve precipitation simulation in high resolution model, need the support of ground truth. Find out how many stations needed and where to deploy station.
- High elevation precipitation is still not clear
- Snow-to-Precipitation rate, Snow data correction
- Cold region remote sensing is needed, particularly for solid precipitation
- Chemical tracers and stable isotope are very helpful in quantifying hydrological processes

Discussion on Observation

- ERA and satellite data are not so trustable over Third Pole.
- Developing high resolution climate reanalysis for TPE (around 10KM)
- Establish Precipitation observing network in individual climate regions
- Data sharing for TPE group
- Coordinate observations between other mountainous regions and TPE

Future Activity

WMO High Mountain Summit
25-27 April 2019, Geneva

- TPE session
- Joint session?
- Side events