Report of the 7th

Third Pole Environment (TPE) Workshop

2017
Kunming,
China

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Report of the 7th

Third Pole Environment (TPE) Workshop

Kunming, China
U.S.A.

July 12, 2017

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Preface

The 7th Third Pole Environment (TPE) Workshop was held in Kunming, China on July 12, 2017. This year marks a new format for the 7th TPE Workshop, held as an open science conference within the Third Pole Science Summit (TPSS), which took place from July 10-12, 2017. On behalf of the TPE Co-Chairs, we wish to thank all the participants and contributors to this 7th TPE Workshop, as well as those who have contributed to TPE research and development over the past eight years.

With the past growth and progress of TPE, the program has expanded in size and scope with participation of scientists, program managers, government leaders, and students. As a reflection of the program growth and international cooperation, the recognized study area of the Third Pole region has also expanded to the Pan-Third Pole Environment (Pan-TPE), a key region for the “Belt and Road Initiative”. This expanded region of interest reflects the regional, hemispherical, and even global influence of the Third Pole region, encompassing the highest mountain ranges on Earth. With the 7th TPE Workshop, we have again succeeded in convening a talented delegation of scientists, program managers, government officials, and students to participate in an open forum to present, discuss and coordinate research efforts in the Third Pole, and now in the expanded Pan-Third Pole region. It is our hope that outcomes from this intensive workshop will continue to shape the course of research and program development of TPE.

The following proceedings summarize the intensive day of presentations and discussions of the 7th TPE Workshop. The full report will be made available on-line and by request for any interested party.

Tandong Yao, Lonnie Thompson, Volker Mosbrugger

TPE Co-Chairs

1. Introduction

The Third Pole region has gained growing attention due to its significant role in global atmospheric circulation and its sensitivity for providing a first indication of climate change, and thus is vital for a better understanding of global climate and environment changes and their impacts on and interactions with human activities.

The TPE program intends to pool international efforts and make use of the multi-national resources for the interdisciplinary study of water-ice-air-ecology-human correlations. A more comprehensive study of these processes and interactions will address the influence of environmental changes on humans, and will provide timely adaptation strategies.

The Third Pole Environment (TPE) program was established in 2009 in response to the demand for heightened scientific coverage of the largely-glaciated region referred to as “Asia’s Water tower.” Since 2009, TPE has hosted seven international workshops, bringing together scientists and stakeholders from all over the world to discuss past, current and planned research initiatives in the Third Pole. The 7th TPE Workshop, held in Kunming, China on July 12, 2017, marks a format for TPE workshops. Based on the discussions of the 6th TPE Workshop, held in Columbus, Ohio, USA, it was decided that the this 7th TPE Workshop would be held as an open science conference within the Third Pole Science Summit (TPSS), which took place from July 10-12, 2017. As the first international conference on Third Pole environment to be held in China, the summit attracted nearly 400 top-level researchers from over 20 countries. The 7th TPE Workshop is of particular significance, as it took place at a time when TPE is expanding its mission to Pan-TPE, a key region for the “Belt and Road Initiative”.

The workshop opened on the morning of July 12, 2017. The scientific sessions began in the morning and continued until mid-day on July 12. After scientific presentations, Profs. Tandong Yao, Lonnie Thompson, and Deliang Chen each delivered a presentation related to Pan-TPE visions. After these three

presentations, participants gathered into six different discussion groups according to their individual interests. The group discussions were summarized during the final afternoon session on July 12. The workshop concluded after final comments and summary by TPE Co-Chair, Prof. Tandong Yao. At the conclusion of the workshop, Prof. Yao indicated that the timing and venue for the 8th TPE Workshop would be discussed further and announced at a later date. The complete 7th TPE Workshop agenda can be found in Appendix 1, and the list of participants can be found in Appendix 2.

2. Scientific Sessions

Session I.

The first scientific session was chaired by Madan Lall Shrestha and included the following five presentations:

Fahu Chen, “Peopling the Tibetan Plateau: advances and perspectives”

Koji Fujita, “Anomalous winter snow amplified earthquake induced disaster of the 2015 Langtang avalanche in Nepal”

Yongkang Xue, “Spring Soil Temperature Anomalies over Tibetan Plateau and Subsequent Downstream late Spring-Summer Droughts/Floods in East Asia”

Adrien Gilbert, “The 2016 gigantic twin glacier collapse in Tibet: towards an improved understanding of large glacier instabilities and their potential links to climate change”

Franco Salerno, “Debris-covered glacier anomaly? Morphological factors controlling changes in the mass balance, surface area, terminus position, and snow line altitude of Himalayan glaciers”

Session II.

The second scientific session was chaired by Fahu Chen and included the following five presentations:

Jiacheng Shi, “Remote Sensing of Energy Distribution Characteristics over Tibet”

Wenjian Zhang, “Global Cryosphere Watch: International mechanism for quality-assured cryosphere observations, products and services”

Peter Van Oevelen, “The WCRP grand challenge on the water for the food baskets of the world: an Asian perspective”

Olaf Lenz, “CAME II (Crossing Climatic Tipping Points – Consequences for Central Asia) – A New German Contribution to TPE”

Mats Eriksson, “New observatories, new data, and new insights on air pollution in the Himalayas”

Session III. Pan-TPE Visions

The third session included the following three presentations related to Pan-TPE:

Tandong Yao, “Briefing: Pan-TPE development”

Lonnie G. Thompson, “TPE: lessons learned”

Deliang Chen, “Future strategy of Pan-TPE”

Session IV. Group Discussions

The fourth session included breakout discussions of six topics. Participants chose their respective group according to their individual interests in the following central themes:

Group 1: Past Environmental Change

Group 2: Westerly-Monsoon Interplay and the Water Cycle

Group 3: Asian Water Tower and Its Impacts

Group 4: Trans-Boundary Water Security and Cooperation

Group 5: Atmosphere-Land-Ecosystem/Ocean Interactions across Time Scales

Group 6: Integrated Assessment, Dissemination, Outreach, Capacity Development and Stake-Holders’ Interaction

Session V. Plenary Discussion

The final workshop session was developed to presenting and discussing the outcomes of the breakout group discussions. The Plenary Discussion is summarized below in Section 3.

Select presentations are also available for download on the TPE website at www.tpe.ac.cn/wkshp7/presentations.

3. Plenary Discussion

The final workshop session was devoted to the presentation of the breakout group discussion outcomes. Presentations from the group discussions are presented below.

3.1. Group 1 – Past Environmental Change

Group 1 was led by Fahu Chen and included the following participants: Hans Linderholm (Rapporteur), Binita Phartiyal, Hema Achyuthan, Lonnie Thompson, Guangjian Wu, Qiang Zhang, Randheer Singh, Yangjian Zhang, Olaf Lenz, Guanghui Dong, Linlin Gao, and Jiajia Su.

Group 1 suggested synthesizing existing paleoclimate proxies, and also suggested comparing proxies with climate models and human history. The Group also notes several timeframes, or time slices, most relevant to the Group, including: 2,000-year records, the Holocene, and the Quaternary and beyond. The Group indicated that there are sediment cores going back to 7.3 Ma.

Some of the key questions discussed by the Group include natural variability, drivers of climate and environmental changes, westerlies-monsoon interactions and variability, and glacier initiation. The Group suggested assessing data coverage and identifying areas with insufficient coverage, or “white spots”, to be sampled. The Group also suggested expanding data availability through the TPE database.

The Group also put for the several suggestions for ongoing projects that may overlap or tie in with the TPE program, including the Fahu project studying early humans and environmental change on the Tibetan Plateau and vegetation history in time slices (Holocene), CAME II, and JETCLIM.

3.2. Group 2 – Westerly-Monsoon Interplay and the Water Cycle

Group 2 was led by Sorooshian Soroosh, and included the following participants: Kun Yang (Rapporteur), D. B. Kattel, Serraj Shrestha, Ali-Munainar, Sunil Acharya , Shuyu Wang, Lochan Devkota, Deepak Aryal, Yanbin Lei, Keqin Duan, and Jing Gao.

The Group identified several issues regarding capacity building as it relates to westerly-monsoon interplay and the water cycle. The first point discussed by the Group was data issues, and they specifically addressed the points of data sharing, developing high resolution climate reanalysis data, and data uncertainties such as Periann-CDR, GPCP. The second capacity building issue discussed was modeling and data assimilation development. The Group indicated the need to address basic processes understanding, for example with complex terrain-related hydrological and momentum exchange, lake-air interaction, and land-air interactions. The Group also put forth the question of how to improve regional climate modeling, and stressed the need for satellite data assimilation (e.g. snow cover and GRACE and microwave).

The following five scientific issues were discussed by the Past Environmental Change group:

- Where is the transitional zone between monsoon and westerlies? Transition variability (when, where, how), particularly at decadal scale? What is the role of global change in the variability?
- Why the change in precipitation is inverse between South TP and North TP, and why Indian monsoon intensity is not highly correlated with precipitation in South TP? What (NAO, HCI) determines these spatial patterns?

- Impacting processes of monsoon and westerly on the water cycle to be clarified through stable isotopes? How to use isotope to improve understanding transport processes of westerly and monsoon as well as the impact of big events (like El Nino)?
- Where water vapor over TP comes from at decadal and annual scales? What is the role of the internal water cycle?
- Do monsoon and westerly change coherently or inversely? How they determine lake/glacier variability?

The group also discussed the possible contributions of the above scientific issues, and the contributions of past environmental change in general. The group indicated one important contribution is to high-elevation water cycle process understanding and modeling. A second contribution put forth by the group is to enhance the understanding of the future of glaciers in the Third Pole, as it relates to precipitation and temperature change at decadal or longer time scales.

3.3. Group 3 – Asian Water Tower and Its Impacts

Group 3 was led by A. Stroeven, and included Lan Cuo (Rapporteur), Koji Fujita, Lei Wang, Fan Zhang, Ninglian Wang, Madan Shrestha, Tinghai Ou, Islam Tarekul, Zubair Ahmad Sofi, Sunil Subba, Suhaib Farhan, and Franco Saleno.

The following includes the summary of the Asian Water Tower and It's Impacts discussion group, as presented by the group:

Scientific Topics:

Components of cryosphere water resources in the Asia Water Tower:

1. Precipitation
2. Glacier and seasonal snow
3. Frozen soil
4. Streamflow
5. Lake

Commonly Asked questions related to these components:

1. Precipitation scarcity at high elevation
2. Glacier change
3. Snow change
4. Frozen soil degradation
5. Precipitation change
6. Their impacts on streamflow both at seasonal and yearly time scales
7. Drought/flood

Some other issues:

1. Tipping points?
2. Human perspectives? Anthropocene?
3. Weather/climate circulation systems vs. water resources change?
4. Water cycle?
5. How to collaborate with WMO/WCRP?
6. Debris covered glacier vs. non-debris covered glacier?

Methodology: execute the research

In-situ observation, satellite observation, modeling?

Products:

1. Improved gridded precipitation dataset

   Pan-TPE and the Silk Road, expanded area as discussed by Prof. Yao. TPE: 5 million square km, 4000 m above sea level, 2 billion people affected

   Pritchard, 2017 Nature
   Desertification, IPCC AR6 will include it.

   Aral Sea shrank from 68,000 km2 to 3,000 km2 since 1960.

   Water, Ecosystem and anthropogenic activity as major topics.

   Need to demonstrate both social and economic relevance while maintaining its scientific goal.

Atmosphere-water-ice-ecosystem-human interaction in high mountain regions, from observations and research to services, policy and society.

The following notes were presented by Group 3, and include specific points discussed by the group participants.

Importance of Pan-TPE:

Prof. Madan: flood influence, in the case of Himalaya in Nepal, disappearance in high regions, also in the low hills, but it is due to human activity. Not in high elevation areas.

High elevation areas, what has been done in the high elevation, good idea to document the status of water sources in the high mountains. Different kinds of observations and ranges are possible.

1. The status of high mountain water resources,
2. Water balance in area not affected by human activities.

Glacier expansion and less retreat in the Karakorum region, there are few field observations in this area. Measurement of precipitation, at high PMD 25 stations below 2,000 m elevation. Measurements at 2,000-4,000 m elevations have started, 350 mm in the high elevation, But need 1,500-2,000 mm per year to sustain glaciers. With regard to Pan-TPE, the Karakoram region offers opportunities for a mass-balance program and precipitation observations at high elevations. Debris cover may also be an issue, but precipitation is the main issue.

1. Lack of good mass balance, capture the glaciers with different sensitivity to climate change,
2. Karakoram precipitation accuracy.

Mats Eriksson, with ICIMOD: More attention on cryosphere, importance of melting glacier, disentangle of glacier, snow contribution needs to continue. Society is also an important consideration. The human dimension may depend on the region, for example snow/glacier is more important in Karakoram, but perhaps not in Nepal.

1. Disentangle streamflow components, e.g., glacier, snow etc.

Prof. Ninglian Wang: With global warming, how the water cycle links to water availability and application of water in different regions. How much water comes from the high mountains, and how much is needed in the downstream.
1. Sensitivity of water supply and availability in future climate.

Prof. Koji Fujita: Precipitation data over 10-year time periods is not enough, accessing remote sensing data will help. Many models are applied. Observation of glaciers has increased over the past 10 years, especially with the activities of ITP, TPE, and ICIMOD. Important points related to data sharing, remote sensing, observation, Pan-TPE, and pushing to merge observational data. ICIMOD has a satellite data portal on their website. Similar mass balance data portal would be useful, question of whom to report mass balance data reported to.

Information is available but not comprehensive, so Pan-TPE can be a common platform of the data and analysis. WMO compare observations data with consistency. At a minimum, a list of the data and associated information can be provided so people will know where to go to look for the data. Data intercomparison, and minimize the data issue are important points. A hazard dataset, including drought and flood, and data set sharing are also important.
1. Data sharing, mass balance intercomparisons

Prof. Franco Salerno: Need to stress data quality information, often mention data quantity. Difficulty accessing remote sites. Disentangle water contribution, improve the basic understanding. Need to consider all aspects of the water balance, including glaciers, lakes, and hazards. Can coordinate studies, it is easy to study a lake then to go to the nearby glacier. Use availability of water, including integration of water from all aspects, quality and quantity of the watershed.

Prof. Fan Zhang: Important issues include chemical transport and hazards. Sediments reflects the changes in land cover, and sediment can impact the downstream regions, especially related to hydropower and coastal areas.

1. Water quality in addition to quantity.
2. Focus on lakes which are an integrated part of water balance components in a watershed.

Student comment: Need to understand global warming history, to help our present and future life. What can we do and learn from history?

1. How do we address the concerns of the new generation scientists?

Prof. Ou: Regarding water vapor transfer, need a generation of high resolution reanalysis data. Is it possible to include all the meteorological variables? Under the Pan-TPE project, can have a concentrated effort to help the generation of reanalysis data. Meteorological data to use may be obtained as part of Pan-TPE. The generation process is already started.

1. Increase the number of observation-based meteorological data in Pan-TPE area to evaluate model outputs.

Prof. Wang Lei:

1. Prediction of future disasters, more accurate forcing data, integrate all the data through the international collaboration.
2. Thickness of the active layer of permafrost change and its effects on vegetation, etc.
3. Water resources from glaciers will reach a tipping point; what will be the effects on water resources?
4. Sources of water vapor (monsoon, westerlies and Tibetan Plateau) affects precipitation, total water storage, glacier, lake.

ICIMOD representative: Anthropocene perspective: big lakes, Aral Sea disappears, human made disaster. Iran Ulma Lake may face the same fate, many blame the climate change in order to protect human interests. Policy makers need to promote honest results. Flood on the southern side of Himalaya, human induced due to poor governance, management. Downstream impact of poor infrastructure, water integrity, misuse, impact, mitigation, rules and transparency information.

1. In the conversion of science to policy, we need to be honest; both nature and people can be the cause of problems.

2. Prevent miss-management and poor governance of water infrastructure in upstream and downstream contexts.

Summary of the discussion Group 3: Asia Water Tower and Its Impacts.

Points of interests discussed by group members:

1. The status of high mountain water resources.
2. Water balance in areas not affected by human activities.
3. Lack of good mass balance, capture the glaciers with different sensitivity to climate change.
4. Karakoram precipitation accuracy.
5. Disentangle streamflow components, e.g., glacier, snow etc.
6. Sensitivity of water supply and availability in future climate.
7. Data sharing, mass balance intercomparisons.
8. Water quality in addition to quantity.
9. Focus on lakes which are an integrated part of water balance components in a watershed.
10. How do we address the concerns of the new generation scientists?
11. Increase the number of observation-based meteorological data in the Pan-TPE area to evaluate model outputs.
12. Predict the future disasters, more accurate forcing data, integrate all the data through the international collaboration.
13. Thickness of the active layer of permafrost change and its effects on vegetation, etc.
14. Water resources from glaciers will reach a tipping point; what will be the effects on water resources?
15. Sources of water vapor (monsoon, westerlies and Tibetan Plateau) affects precipitation, total water storage, glacier, lake.
16. In the conversion of science to policy, we need to be honest; both nature and people can be the cause to problems.
17. Prevent miss-management and poor governance of water infrastructure in upstream and downstream contexts.
18. Sediment transport issues related to water quality, disaster, infrastructure.

3.4. Group 4 – Trans-Boundary Water Security and Cooperation

The fourth discussion group was led by Jeff Dozier, and included Fengge Su (Rapporteur), Anil Kulkarni, Ramesh Pant, Faizan-ur-Rehman Qaiser, Narendra Raj Khanal, Dibit Aryal, Zahid Imran, Jagirani DoDo, Nitesh Knadka, Tarekul Islam, and Nasir Ahmed.

The group discussed several transboundary examples in the Asian Third Pole, including the following:

- Indus
  - Headwaters in Tibet, Afghanistan (Kabul R), India (Sutlej R)
  - Main stem in Pakistan
  - Drainage area 1.165 M km^2
- Ganges
  - Headwaters in Tibet, Nepal, Sikkim
  - Main stem in India, flows into Bangladesh where it joins the Brahmaputra
  - Drainage area 1.08 M km^2
- Brahmaputra
  - Headwaters in Tibet (Yarlang Tsangpo) & Bhutan (Manas R)
  - Flows into India and through Bangladesh where it joins the Ganges
  - Drainage area 0.71 M km^2
- Mekong
  - 7 countries involved, generally a successful example of integrated management of whole basin

The group also presented a summary of the main issues that were discussed, including:

- Sharing of data and information
  - Hydrometerological data
  - Sediment transport from upstream (can last longer than the flood)
  - Glacial lake outbursts and other upstream disasters
    - Trade-off between mitigation and early warning
  - Internal access to data is not uniform, e.g. India
- Integrated management system for whole basin, not country by country
  - Current situation lacks consistent international cooperation
  - Need precipitation/melt data for upstream parts of the basin
  - Need upstream management of water quality
  - Establish early warning systems for whole basin
  - Better country-by-country management of agricultural use
- Establish hydro-diplomacy among the young scientists, to work against the hydro-hegemony

3.5. Group 5 – Atmosphere-Land-Ecosystem-Ocean Interactions across Time Scales

Group 5 was led by Tianjun Zhou, and included the following participants: Michael Ek (Rapporteur), Yongkang Xue, Jagdosh Dotel, Laurent Li, Nita Dyola, Minghuai Wang, Nirajan Luintel, Yanhong Gao, Rongxiang Tian, and Sayeed Ahmed Choudhury.

The Atmosphere-Land-Ecosystem-Ocean Interactions across Time Scales group began by presenting the participant discussions of the following four questions or themes:

- **Which time scales should we focus?** Sub-seasonal to seasonal, to decadal, but also include medium-range (NWP time scales). Diurnal cycle is especially important for convection/precipitation, and boundary-layer evolution.

- **What kind of data and products should be used/developed?** Field campaigns, satellite data, data assimilation (related to modeling), surface data, lake measurements, including sustainable measurements. A list of key variables for use in meteorology, hydrology, ecology, etc. should be developed, as well as a regional re-analysis data set over the Third Pole (and east Asia), similar to the North American Regional Reanalysis. Also need more winter observations. Data products need a standard format for quality control and a central data control. Suggest utilizing “superstations” to develop data sets for model evaluations and improvements, e.g. GEWEX/GLASS global set of land (flux) data sets.

- **What kind of tools should we develop?** Global and regional models, convection-resolving, variable resolution models, land-surface including lakes, glaciers, etc. Data assimilation (or “merging”) systems. Downscaling and “elevation adjustment” tools. How to make in situ observations consistent with model output, and with satellite measurements? Model intercomparisions, from fully-coupled to stand alone models, e.g. land-hydrology. “Metrics of coupling”, applied to fully-coupled models as well as Single Column Models to assess physics.

- **Collaboration/cooperation** between agencies/institutes/academics, e.g. CMA and CAS, and other international groups and programs (e.g. universities, WMO), Meteorological centers and climate research groups.

The Group also discussed potential future research and collaborations within seven areas, and included some of the specific points put forth by group participants.

1. Land & atmosphere interaction & climate prediction

   Prof. Yongkang Xue indicated that initialized May LST in the TP leads to better simulation of EA precipitation in June. Development of LSM and field campaigns was also noted as an area for future research and collaboration.

2. Decadal variability

   Prof. Kun Yang noted the expansion of TP lakes since 1995, and asked for suggestions on improving the current understanding of potential causes. Prof. Lonnie Thompson noted the potential use of TP ice core data, SST, monsoon and 20th century drought data for characterizing decadal variability in the Third Pole region.

3. Warming, wetting and greening of the TP

   Further collaboration is needed to understand if the Third Pole is experiencing continual warming, or are there any periods of slow-down or a hiatus. The group also identified the need for additional research and collaboration to identify warming and wetting trends, as well as wetting and greening trends over the Third Pole and relationships to ocean variability.

   The group highlighted recent research results related to warming, wetting and greening of the TP, including the following:

   Zhang et al., Recent changes in the moisture source of precipitation over the Tibetan Plateau. JC 2017

   Zhang, W., T. Zhou, and L. Zhang (2017), Wetting and greening Tibetan Plateau in early summer in recent decades, J. Geophys. Res. Atmos., 122, 5808–5822

Xiang, B. and B. Wang, 2013, Mechanisms for the advanced Asian summer monsoon onset since the mid-to-late 1990s, J. Climate.

4. Past millennial changes: proxy, modeling, understanding
   A lot of potential for research collaborations related to past millennial climate changes in the Third Pole region based on proxy data, in addition to model and proxy data comparisons. Need to improve understanding of data and models.

5. Westerly and monsoon interaction across time scales
   The group pointed out the recent paper *Li et al. 2016 Review of Geophysics*, and also emphasized the current distribution of observational stations for westerly and monsoon meteorological data, and also suggested collaborating with the China Meteorological Administration (CMA), which has extensive homogenized daily rain-gauge data.

6. Integrated process-level models, cast studies

7. Links between weather and “climate” time scales.

3.6. Group 6 – Integrated Assessment, Dissemination, Outreach, Capacity Development and Stake-holders’ Interaction

Comments and Actions Suggested:

Assessment (1)

- Assessment should be targeted, integrated, useful, and specific.
- Assessment should be cross-disciplinary, cross- project, and cross-institutional.
- Satisfy the requirements of needed communities.
- Data issue: particularly socioeconomic data: definition, scale, and bias correction.

- Learn from other programs, such as Arctic assessment and etc.

Assessment (2)

- PAN-TPE is a comprehensive concept, not only natural science, but also for human welfare, benefit of societies and Earth's future.
- Use UN SDGs as a framework, localization and customization SDGs targets and indicators.
- Use integrated model to support integrated assessment.

Dissemination and capacity building

- Dissemination should be targeted mainly outside of the scientific community.
- Dissemination to general public is a much harder one.
- Can use social media and popularized journals.
- Capacity building should be carried out in different levels.
- Attractive stories to reach out to different communities.
- Focus can be placed on developing countries.

Stake-holders' Interaction

- Identification of stakeholders is very important: governments at different levels can be key players.
- Meeting should not only be scientific conferences, but also ones with relevant stakeholders (mayors, natives, low level-high level), e.g., ICIMOD meeting is good example.

4. Workshop Conclusions

Nearly 400 scientists from over 20 countries attended the 7th TPE Workshop in Kunming, China. The gathering of scientists from around the world highlights the growth in international cooperation inspired by TPE.

The group discussions were summarized during the final afternoon session on July 12, and the workshop concluded after final comments and summary by TPE Co-Chair, Prof. Tandong Yao. One of the over-arching conclusions of the 7th TPE Workshop is the expansion of the Third Pole region to encompass the Pan-Third Pole Environment (Pan-TPE). The Pan-TPE region expands the Third Pole in all directions, but the east-west directions are the major ones. This geographically expanded region encompasses over 20 million km^2 and will further encourage international cooperation of scientific research in the Pan-TPE, and reflects the regional, hemispherical, and even global influence of the Third Pole region. In addition, Pan-TPE not only encompasses the high mountain regions, but also low elevation deserts, as the high mountain and low desert regions are closely related, as well as Central Asian great lakes region. Another workshop conclusion is the increasingly acknowledged human aspects of climate and environmental change in the Pan-TPE region. The multidisciplinary approach of TPE is conducive to exchange and collaboration, and will help tackle environmental issues with the goal of better risk management for Pan-TPE. The 7th TPE Workshop also emphasized the need for additional field campaigns to provide better data coverage in the vast Pan-TPE region, and the transect approach to field expeditions already employed by TPE was discussed further, with additional Pan-TPE field work planning and discussion by workshop participants.

At the conclusion of the workshop, Prof. Yao indicated that the timing and venue for the 8th TPE Workshop would be discussed further and announced at a later date. The complete 7th TPE Workshop agenda can be found in Appendix 1, and the list of participants can be found in Appendix 2.

Appendix 1. Agenda

7th TPE workshop
(Kunming, July 12, 2017)

Morning:	**8:30-11:55 Presentation,** ***Lecture Hall, 3rd Floor, Conference Building***	
Session 1	***Chair: Madan Lall Shrestha***	***Title***
8:30-8:50	Fahu Chen	Peopling the Tibetan Plateau: advance and perspectives
8:50-9:10	Koji Fujita	Anomalous winter snow amplified earthquake induced disaster of the 2015 Langtang avalanche in Nepal
9:10-9:30	Yongkang Xue	Spring Soil Temperature Anomalies over Tibetan Plateau and Subsequent Downstream Late Spring-Summer Droughts/Floods in East Asia
9:30-9:50	Adrien Gilbert	The 2016 gigantic twin glacier collapses in Tibet: towards an improved understanding of large glacier instabilities and their potential links to climate change
9:50-10:10	Franco Salerno	Debris-covered glacier anomaly? Morphological factors controlling changes in the mass balance, surface area, terminus position, and snow line altitude of Himalayan glaciers
10:10-10:30	Coffee Break	
Session 2	***Chair: Fahu Chen***	***Title***
10:30-10:50	Jiancheng Shi	Remote Sensing of Energy Distribution Characteristics over Tibet
10:50-11:10	Wenjian Zhang	Global Cryosphere Watch: international mechanism for quality-assured cryosphere observations, products and services
11:10-11:25	Peter Van Oevelen	The WCRP grand challenge on the water for the food baskets of the world: an Asian perspective
11:25-11:40	Olaf Lenz	CAME II (Crossing Climatic Tipping Points – Consequences for Central Asia) – A New German Contribution to TPE
11:40-11:55	Mats Eriksson	New observatories, new data, and new insights on air pollution in the Himalayas
Afternoon: 14:00-17:00 TPE discussion session		
Session 3	***Pan-TPE visions***	
14:00-14:10	Tandong Yao	Briefing Pan-TPE development
14:10-14:20	Lonnie G. Thompson	TPE: lessons learned
14:20-14:30	Deliang Chen	Future strategy of Pan-TPE
Session 4	***Proceed to Various Rooms for Group discussions***	
14:30-15:50	**Group 1:** Past Environmental Change (***Leader:*** Fahu Chen; ***Rapporteur:*** Hans Linderholm) **Venue:** ***Room 3448, Yuantong Building*** **Group 2:** Westerly-Monsoon Interplay and water cycle (***Leader:*** Sorooshian Soroosh; ***Rapporteur:*** Kun Yang) **Venue:** ***Room 3449, Yuantong Building***	

	Group 3: Asian Water Tower and its impacts (***Leader:*** A. Stroeven; ***Rapporteur:*** Lan Cuo) **Venue:** ***Room 3450, Yuantong Building*** **Group 4:** Trans-boundary water security and cooperation (***Leader:*** Jeff Dozier; ***Rapporteur:*** Fengge Su) **Venue:** ***Lecture Hall, 3rd Floor, Conference Building*** **Group 5:** Atmosphere-land-atmospherer interaction (***Leader:*** Tianjun Zhou; ***Rapporteur:*** Michael Ek) **Venue:** ***Lecture Hall, 3rd Floor, Conference Building*** **Group 6:** Integrated assessment, dissemination, outreach and stake-holders' interaction (***Leader:*** Peter van Oevelen; ***Rapporteur:*** Xin Li) **Venue:** ***Room 3411, Yuantong Building***
15:50-16:00	Coffee Break
Session 5	**Plenary discussion,** ***the Lecture Hall, 3rd Floor, Conference Building***
16:00-16:50	Presentation of the breakout group discussion outcomes (5 minutes each) (***Chair: Deliang Chen***)
Finale	

Appendix 2. List of Participants

No.	Name	Country	Affiliation
1	Erwin Appel	Germany	University Tuebingen
2	Tobias Bolch	Switzerland	University of Zurich
3	William Boos	USA	Yale University
4	Raymond Bradley	USA	University of Massachusetts
5	Achim Brauning	Germany	University Erlangen
6	Deliang Chen	Sweden	University of Gothenburg
7	Peter Clift	USA	Louisiana State University
8	Emily Collier	Netherlands	Utrecht University
9	Gerhard Daut	Germany	Jena University
10	Lochan Devkota	Nepal	Tribhuvan University
11	Elisabeth Dietze	Germany	Helmholtz Centre Potsdam
12	Lin Ding	China	ITPCAS
13	Todd Ehlers	Germany	University Tübingen
14	Klaus Fraedrich	Germany	Max-Planck-Institute for Meteorology
15	Koji Fujita	Japan	University of Nagoya
16	Gerd Gleixner	Germany	MPI Jena
17	Rajeev Goyal	Nepal	ICIMOD
18	Hans Graf	England	University of Cambridge
19	Gregory Greenwood	Switzerland	Mountain Research Initiative
20	Walter Immerzeel	Netherlands	Utrecht University
21	Daniel Joswiak	China	ITPCAS
22	Andreas Kääb	Norway	University of Oslo

23	Farshed Karimov.	Tajikistan	Institute of Geology, Academy of Sciences of the Republic of Tajikistan
24	Oliver Korup	Germany	University of Potsdam
25	Aljoscha Kress	Germany	Senckenberg Gesellschaftfür Naturforschung, Frankfurt
26	Frank Lehmkuhl	Germany	RWTH Aachen University
27	Eryuan Liang	China	ITPCAS
28	Yongqin Liu	China	ITPCAS
29	Yaoming Ma	China	ITPCAS
30	Volker Mosbrugger	Germany	Senckenberg Gesellschaft für Naturforschung, Frankfurt
31	H.C. Nainwal	India	HNB Garhwal University
32	Stefano Parolai	Germany	Helmholtz Centre Potsdam
33	Francesca Pelliciotti	Switzerland	ETH
34	Said Rahman	Pakistan	SUPARCO
35	Wolfgang Roesler	Germany	University of Tuebingen
36	Sybille Roller	Germany	SenckenbergGesellschaftfürNaturforschung, Frankfurt
37	Franco Salerno	Italy	The Water Research Institute, CNR
38	Dieter Scherer	Germany	FU Berlin
39	Bernd Schurr	Germany	German Research Centre for Geosciences Helmholtz Centre Potsdam
40	Bob Spicer	UK	The Open University
41	Volkhard Spiess	Germany	University of Bremen
42	Bob Su	Netherlands	ITC, University of Twente
43	Fengge Su	China	ITPCAS
44	Gianni Tartari	Italy	The Water Research Institute, CNR
45	Shresth Tayal	India	TERI

46	Lonnie Thompson	USA	The Ohio State University
47	Anna Wegner	Germany	Alfred Wegener Institute
48	Guangjian Wu	China	ITPCAS
49	Baiqing Xu	China	ITPCAS
50	Kun Yang	China	ITPCAS
51	Xiaoxin Yang	China	ITPCAS
53	Tandong Yao	China	ITPCAS
54	Fan Zhang	China	ITPCAS
55	Liping Zhu	China	IPTCAS

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