Report of the 1st

Third Pole Environment (TPE) Workshop

2009

Beijing, China

Hosted by:

Institute of Tibetan Plateau Research (ITP), CAS

中国科学院青藏高原研究所

Institute of Tibetan Plateau Research, Chinese Academy of Sciences

First Printing: March 2010

Published by:
TPE Program Office
No. 18 Shuangqing Rd., Haidian District
Beijing 100085, P. R. China
www.tpe.ac.cn
Email: tpe@itpcas.ac.cn
Phone: +86-10-62849531

Science Editors: Tandong Yao
Lonnie G. Thompson
Volker Mosbrugger

Technical Editors: Daniel R. Joswiak
Xiaoxin Yang

Copies of this report can be downloaded from the TPE website.
Hardcopies are available from the TPE Program Office.

Reviewed by the TPE Science Committee:

Tandong Yao
Chinese Academy of Sciences
No. 18 Shuangqing Rd., Haidian District
Beijing 100085, China
Email: tdyao@itpcas.ac.cn

Lonnie G. Thompson
Byrd Polar Research Center
The Ohio State University
Columbus, OH 43210, USA
Email: Thompson.3@osu.edu

Volker Mosbrugger
Senckenberg Research Center for Nature Study
Senckenberganlage 25
60325 Frankfurt, Germany
Email: volker.mosbrugger@senckenberg.de

Report of the 1st
Third Pole Environment (TPE) Workshop
Beijing, China
14-16 August 2009

Contents

PREFACE

From August 14-16, an international workshop titled “Third Pole Environment (TPE)” was held with about 70 scientists from 15 countries in and around the Third Pole region, and from several of the major developed countries. The workshop presented the latest progress in the studies of the Third Pole environment, discussed the significance, key science questions, goals and objectives for the future TPE studies, proposed relevant implementation plans, and clarified the management and structure for the TPE. It is anticipated that scientific understanding of the environmental processes and interactions across the Third Pole region will significantly advance with the implementation of the TPE program.

TPE is dedicated to the study of the Third Pole environment. This region is centered on the Tibetan Plateau and concerns the interests of the surrounding countries and regions. 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 changes, and thus is vital for a better understanding of global climate and environment changes and their impacts on and interactions to human activities

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

TPE also offers an open forum to study the Third Pole, and invites involvement from the general academic community. We welcome your suggestions and proposals for pushing forward regional climate and environmental research in the Third Pole.

Tandong Yao
Lonnie G. Thompson
Volker Mosbrugger
TPE Science Committee
March 1, 2010

1. Introduction

Like Antarctica and the Arctic, the Third Pole region is drawing increased attention among the international academic communities. The Third Pole region is home to thousands of glaciers in the tropical/sub-tropical region that exert a direct influence on social and economic development in the surrounding regions such as China, India, Nepal, Tajikistan, Pakistan, Afghanistan, Bhutan, Bangladesh, and Myanmar. It is subjected to influences from multiple climatic systems, complicated geomorphologies and various internal and external geological impacts. The area demonstrates considerable feedbacks to global environmental changes, while at the same time is sensitive to current fluctuations. The result is a region with unique interactions among the atmosphere, cryosphere, hydrosphere, biosphere, and lithosphere. These processes acting at high elevation compose the fundamental basis for the unique geographical unit of the Third Pole.

Considering the importance of the Third Pole, a workshop was held in Beijing to establish initial interest and ideas for a long-term research program, titled “Third Pole Environment (TPE)”. The workshop was sponsored by the Chinese Academy of Sciences (CAS), the National Natural Science Foundation of China, the Ministry of Science and Technology, P.R. China, and hosted by the Institute of Tibetan Plateau Research (ITP), CAS.

A series of observation and monitoring programs in the Third Pole region have been widely implemented, including the Ice Core Program (ICP) which has succeeded in recovering ice cores from eight sites in the Third Pole region, the Himalayas Inter-disciplinary Paleoclimatic Projects (HIPPS), GEWEX Asia Monsoon Experiment on the Tibetan Plateau (GAME/Tibet), Coordinated Enhanced Observing Period (CEOP) Asian-Australian Monsoon Project on the Tibetan Plateau (CAMP/Tibet), the Pyramid Laboratory, Monsoon Asia Integrated Regional Study (MAIRS), Tibetan Plateau-Uplifting, Environmental changes and Ecosystem (TiP), and Climate and Cryospere Programme (CliC). More research programs are being introduced by scientists from

various nations to observe and monitor regional environment and climate in the Third Pole, on both long-term and short-term bases. Yet for a comprehensive understanding of the mechanisms of environmental changes and their impacts on the region, current observational resources need to be integrated, and research goals and approaches need to be updated and identified.

2. Background

The Third Pole region is centered on the Tibetan Plateau, stretching from the Pamir Plateau and Hindu-Kush in the west to the Hengduan Mountains in the east, and from the Kunlun and Qilian Mountains in the north to the Himalayas in the south. The Third Pole covers over 5,000,000 km^2 in total and with an average elevation surpassing 4000 m. The Third Pole borders more than 10 countries and impacts more than 1.5 billion people that live in the region. Therefore it is important not only for its scientific merits, but also for society in general. The Third Pole region also impacts atmospheric circulation patterns of Eurasia, the Northern Hemisphere and even influences global circulation. At present, the environmental changes in the Third Pole region are characterized by unique changes in the cryosphere, atmosphere, hydrosphere, and biosphere. These changes seriously impact social and economic development in the region, and influence global environmental changes.

The Third Pole bears special significance to environmental changes at local, regional, and global scales. Firstly, it bears a significant impact on the climate system in the northern hemisphere and even the entire earth at various temporal and spatial scales. The region is a key component of Asian monsoon evolution, with direct influence on current climate changes. Desertification on the Tibetan Plateau frequently provides a large amount of sand and dust to the loess plateau and to the northern Pacific. These variations also impact marine biology in the Pacific, and thus influence global climate and biogeochemical cycles as well.

Secondly, cryospheric processes on the Third Pole react sensitively to global changes. Glacial melting and lake level rise show sensitive responses to climate changes; their changes further feedback on climate processes and atmospheric circulation within the Third Pole and at larger scales. Cryospheric processes directly influence the ground hydrological processes in the region. Global warming induces large scale degradation of permafrost in the Third Pole, introducing significant quantities of CH_4 and CO_2 to the atmosphere, thus contributing to the Greenhouse effect.

Thirdly, distribution and function of ecosystems in the Third Pole are fragile to global changes. Under extreme climate conditions, alpine ecosystems typically exist at threshold conditions, and are confronted by possible breakdown due to slight fluctuations in the surrounding environment. Changes in the land cover and associated ecosystem patterns and processes will also affect future species acclimatization and distribution.

Fourthly, human activities in and around the region have exacerbated the degradation of the Third Pole environment. The Third Pole is more and more influenced by anthropogenic input and land degradation. The increasing industrial emissions into the atmosphere combine with different atmospheric circulation systems, such as the general westerlies and monsoon circulation. In particular, black carbon and related POPs have a significant impact on the Third Pole region.

Glacial retreat is one of the most significant landscape changes for the Third Pole. Glaciers in the region are undergoing accelerated retreat, though the extent differs according to location. Dominated by a continental climate, the central region exhibits the least extent of glacial retreat, while the south-eastern region under the influence of a maritime climate exhibits the greatest retreat. Glacial mass balance is crucial for understanding the observed glacial retreat within the Third Pole region. More negative glacial mass balance indicates a rapid loss of ice mass with associated increase in glacial melt water into hydrological systems. Recently, more and more scientists recognize the impact of black carbon on glacial melt. An essential issue is predicting the

extent to which rapid economic development and increased black carbon input will accelerate future glacial melting.

The most significant hydrological hazard on the Third Pole region is the glacial-water-fed lake expansion floods and glacial-terminus lake outburst floods. Due to recent rapid glacial retreat, the lakes fed by glacier melt in the Third Pole region are expanding and in danger of outburst. In general, lakes fed mainly by glacial melting have expanded, while those fed mainly by precipitation have shrunk. Some scientists attribute these variations to rising temperatures, while others attribute them to increasing precipitation and weakening evaporation. Given the close ties of glacier-lake interactions to regional water cycle variability, fluctuation of glacial mass balance has a far-reaching effect not only on the behavior of glaciers and lakes in the Third Pole region, but also on water resources of the populace and social stability in the region. The subsequent significant rise in glacial-water-fed lakes poses potential dangers to people and habitat in the region from expansion and outburst flooding. Glacial retreat induces the expansion of glacial water-fed lakes and increases glacial-water-fed lake expansion floods, which can flood pastures and damage livestock. Glacial-terminus lake outburst floods also intensify with glacial retreat and not only pose a potential geological hazard, but also concern the national interests and diplomatic relations for the countries involved. The Third Pole contains the largest permafrost area in the mid- and low-latitudes. Regional permafrost degradation has important implications for the ecology and environment, as well as for engineering considerations such as the Tibetan Railway.

Biosphere changes in the Third Pole region are characterized by ecosystem degradation and land cover changes. Although ecosystems in some regions of the Third Pole are improving with increased precipitation, the overall condition is degrading under the combined influence of global warming and increased human activities. With the abrupt environmental changes in the Third Pole region, understanding the causes from a broader perspective is both important and urgent. Current study of environmental changes in the Third Pole region involves two main focuses: observation of existing processes and paleo-environmental archiving. For observation of existing processes,

the monitoring of atmosphere, cryosphere, biosphere, and hydrosphere is crucial. For paleo-environment reconstruction, proxies such as ice cores, lake cores, and tree ring records are essential, as they provide the golden key to understanding past environmental changes.

Influence of the Third Pole on global environmental changes is not only of academic significance, but also of social and economic significance to the countries in the region. Land surface processes on the Tibetan Plateau bear special significance for the environment in the region. As more and more scientists come to realize the importance of environmental changes, and glacial and hydrological processes in the Third Pole region, it is the ideal time to initiate a program titled “Third Pole Environment (TPE)”. It is important to know the current situation concerning the environmental study of the Third Pole. The expeditions in the Third Pole region date back to the 19th century, when explorers were documenting new discoveries. In the 20th century, many large scale expeditions have been conducted across the region. Recently, there are transitions in four main aspects: from general expeditions to station observations, from qualitative to quantitative studies, from analysis to modeling, and from objective to integrating studies.

3. Mission Statement

The Third Pole Environment intends to attract relevant research institutions and academic talents to focus on a theme of ‘water-ice-air-ecosystem-human’ interactions in the Third Pole, 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 enhance human adaptation to the changing environment and help realize human-nature harmony. The mission of TPE is to develop the science and technology for a sustainable development of the Tibetan Plateau and the surrounding regions under global climate changes and growing human impact. The research focus is on the climate and monsoonal change over various time scales and their impact on the land surface-atmosphere interactions.

4. Key Science Topics and Questions

A. Main Science Topics

The workshop participants identified the following scientific topics most pertinent in this respect.

Climate

- Natural climate variability, especially interannual and decadal changes
- Change of monsoon and mid-latitude circulation in the last century
- Interaction between general circulation and TPE
- Extreme events
- Long-term monitoring of climate
- Radiation and energy budget
- Flux of greenhouse gases and other gases such as SO_x
- Atmospheric transport of pollutants to the Third Pole
- Aerosol dynamics in the atmosphere and atmospheric deposition
- Ground-truthing for models and transfer functions
- Regionally differentiated prediction of future climate

Glaciers

- Inventory of glaciers in the Third Pole region
- Response of cryosphere to climate change: impact on environment, ecology and water resources
- Interactions between glaciers and lakes
- Impact of climate change on the hydrology of debris covered glaciers
- Comparison between Antarctica, Arctic and Third Pole ice cores
- Black carbon measurements in glacierized valleys
- Glacial change in terms of forcing parameters: anthropogenic versus natural
- Benchmark glacier monitoring for the World Glacier Monitoring Service

- Development of techniques to investigate small and large glaciers
- Regional ELA modelling

Water

- Inventory of lakes
- Water source of lakes and rivers: its sensitivity to climate change
- Water cycle at a basin scale (different sizes): quantification and prediction
- Measurement of high-elevation precipitation
- Limnology and palaeolimnology: functioning and dynamics of lake ecosystems
- Preparation of a hydroclimatic atlas for the Third Pole region
- Water storage assessment and regional adaptation
- Stable isotopes in water bodies

Ecosystems

- Thermo- and hydrodynamics of permafrost
- Characteristics of the carbon cycle and vegetation on the Third Pole and their impact/feedback on the monsoon
- Biodiversity and carbon assets
- Past and present patterns and processes of changes in the Third Pole biosphere
- Origin and evolution of alpine meadows in the Third Pole
- Extent and nature of human induced changes on Third Pole vegetation

Human Dimensions

- Consequences of climate, cryosphere and ecosystem changes on human societies
- Direct anthropogenic impact on Third Pole environment and climate feedbacks
- Indigenous environmental knowledge on both changes and hazards, integration in management concepts
- Payment for ecosystem services from downstream to upstream
- Geohazards and natural hazards: monitoring and early warning systems

- Mining economy and geological prospecting as a factor of pollution and landscape damage in mountain regions

Multicomponent interactions

- Water, climate, ecosystem and human interactions
- Validation of remote sensing products for land processes, water and energy budget studies (see also under Climate)
- Land and atmospheric interactions and its impact on Asian monsoon and climate change
- Integrative data and modelling approaches

Moreover, the participants agreed that it is essential to establish right from the beginning integrating mechanisms such as:

- TPE website
- Annual workshops, rotating in various countries
- Publication of Proceedings and Status/Progress Reports
- Development of a data sharing policy
- Cooperation with universities and research institutions
- Education and outreach programs (e.g. summer schools, field trips)
- Multidisciplinary joint expeditions and experiments
- Establish links to other scientific communities

B. Key Science Questions

Question 1: What environmental and ecological changes have occurred on different time scales in the past, and how are these changes driven?

Question 2: What are the characteristics of water and energy cycles, what are their main components, and what is their relationship to the Indian monsoon and westerlies?

Question 3: How will ecosystems change under global warming, especially at high elevations?

Question 4: What is the status of glaciers on the Third Pole, and how will glacial retreat and mass balance changes affect the water and energy cycle and its components? What are their environmental impacts?

Question 5: What is the impact of anthropogenic output?

Question 6: What is the most appropriate way to adapt to current environmental changes in the Third Pole region?

These key science questions will form the basis for coordinated research studies based on the topics identified by interested research scientists worldwide. Answering these key questions necessitates a multi-disciplinary and multi-national approach from the TPE program.

5. Management and Structure

Based in those countries in and around the Third Pole region, TPE will cooperate with interested scientists worldwide. Collaboration with existing international programs and organizations will be sought to facilitate TPE implementation with multi-national efforts. Management priorities are to launch international expeditions, establish the observational network of research stations, and to hold training schools for young talents based in the universities, institutions, and field stations involved with the TPE program.

The key structure will incorporate a science committee composed of scientists from various nations. The committee will function to propose scientific questions, clarify research objectives, evaluate research approaches, coordinate tasks assigned to

respective nations, and run the TPE office. The TPE office will be responsible for basic program implementation, including the organizational details, international workshops, summer schools for young talents, operation of a TPE website, TPE report, and newsletter correspondence.

Attendees of the 1st TPE workshop nominated the core members of the science committee to include Profs. Tandong Yao, Lonnie Thompson, and Volker Mosbrugger. These TPE leaders will coordinate the nomination of other science committee members, limited to 15 members at the initial stages. The workshop participants also agree to establish the TPE office in Beijing upon finalization of the science committee. Workshops in 2010 and 2011 are planned to be held in Kathmandu (2010) and New Delhi (2011).

The following outline for a TPE management structure evolved from discussions at the 1st TPE Workshop:

1. Program management
    a. Science committee
        i. Develop, promote, and oversee TPE
        ii. Organize workshops and meetings relevant to TPE
        iii. Publish the TPE report
    b. TPE office
        i. Develop a program website to provide relevant information dissemination
        ii. Report regular TPE updates and news
        iii. Support TPE workshops and meetings
        iv. Support a summer school to involve young researchers and cultivate international interest
        v. Edit and circulate the TPE report and relevant materials
2. Data management
    a. Create a centralized TPE data information system

b. Provide guidance and data support with established data sharing policies
c. Establish a TPE digital library
d. Monitoring networks and stations
e. Use the Tibetan Observation and Research Platform (TORP) and other existing stations to extend the network of ground observation stations
f. Extend monitoring of glacial retreat including glacial length, area, volume, and mass balance
g. Increase coverage of monitoring isotopes in precipitation with ground station and ice core data
h. Extend the permafrost monitoring network over the TPE
i. Water and energy cycles
j. Ecosystem monitoring
k. Use ground stations for validation of satellite observations and model outputs
l. Develop intensified projects focused on monsoon and westerly atmospheric processes and interactions
m. Develop a coherent link and standardize observation and interpretation for new and existing stations

6. Implementation Strategies

The following strategies to implement the TPE program were put forth by participants at the 1st TPE Workshop.

A. To organize joint scientific expeditions through cooperation with neighboring countries such as Nepal, Tajikistan, Pakistan, India and China. Multi-national expedition transects are a priority. Four transects are essential at the initial stage: the *Koshi River Transect* to reveal the relation between Indian monsoon and environmental change; the *Pamir Transect* (China, Tajikistan) to identify the role of westerly circulation systems and environmental changes; the *Kailas Transect* to understand regional ecosystem

responses to climate change; the *Karakorum Transect* from the Karakorum, Pakistan to Kashi, Xinjiang Uyger Autonomous Region to elucidate the relationship between glaciers in the region and environmental variations under current and future climate changes.

B. To set up integration of the observation and research stations with the cooperation of all countries involved. The observational research station can be incorporated with the existing stations, such as the Pyramid station in Nepal and the TORP on the Tibetan Plateau. This will allow the formation of a Third Pole Environment Platform (TPEP) that will enable cross-national field observations with consistent monitoring and data collection guidelines. There is currently an existing platform of 21 stations on the Tibetan Plateau, and the Pyramid station also has a long observational history. However, additional stations in other regions of the Third Pole are needed, including more stations in the Himalayas, Karakoram, and Pamir. Four pairs of comparative stations are proposed at the initial stages: Mutztag Ata-Tajikistan, Mutztag Ata-Karakorum, Qomolangma (north-south-valley), Xixiabangma-Koshi River.

C. To set up a data bank to handle observational data, to form a dedicated TPE database, and to provide the relevant guidance and data support for efficient construction of a secure ecological zone within the TPE region.

D. To construct a TPE website and publish TPE newsletters for timely reporting of the research progress within the project, to incorporate relevant information as it arises during TPE implementation, to help popularize science and encourage increased scientific awareness of the general public.

E. To set up summer schools for talented young researchers, to help cultivate young scientists from nations involved with the TPE program.

F. To cooperate and coordinate with various international programs, organizations and institutions.

G. To become a component of the Scientific Committee on Problems of the Environment (UNESCO/SCOPE) within the International Council for Science (ICSU).

H. To form intensified research areas in the southeastern Tibetan Plateau that will focus on the study of the Indian monsoon, and in the Pamir that will focus on Westerly circulation dynamics.

I. To formulate adaptation strategies and suggest policy actions for the changing Third Pole environment. All countries in and around the Third Pole should benefit from the program and related outreach activities.

7. Collaboration Basis

There is a long history of collaboration in the scientific study of the Third Pole region. For example, the Tibetan Plateau—Uplifting, Environmental changes and Ecosystem (TiP) is a six-year plan for Tibetan Plateau research funded by the German Research Foundation (DFG). Environmental changes and features of ecosystems variability on the Plateau are the core elements of the TiP program. On May 15, 2009, a Sino-German TPE seminar was held in Beijing, with both sides showing enthusiasm in the program with expressed interest in collaboration on relevant scientific issues. Ice Core Program (ICP), initiated on the Tibetan Plateau with collaboration between Prof. Lonnie Thompson of Byrd Polar Research Center, Ohio State University, US, and Prof. Tandong Yao of Institute of Tibetan Plateau Research, Chinese Academy of Sciences, calls attention to modern processes linking ice core climate indices with ice core paleo-climatology through accurate interpretation of past climate and environment changes. ICP has continued since the 1980s, and focuses not only on ice core environmental reconstruction, but also on the current environmental changes and future trends. Research programs studying the water-energy cycle on the Tibetan Plateau and its influence on the Asian monsoon (e.g., CEOP-Tibet related programs), which are

coordinated by Toshio Koike, Tandong Yao and Yaoming Ma, have also created a quality basis for further scientific study. The International Centre for Integrated Mountain Development (ICIMOD), as an international organization focusing on the Third Pole region, is strongly supportive of TPE. Dr. Andreas Schild, Director-General of ICIMOD, has expressed strong interest in and support of the program. Climate and Cryospere Program (CliC), with a special focus on the Tibetan Plateau, alpine environments, and cryosphere observations, is also very interested in the program, as expressed by the Director of CliC office, Dr. Daqing Yang. In addition, the Pyramid Laboratory on the southern slope of Everest will be an excellent contribution to the TPE. The Pyramid Laboratory is a long-term comprehensive observation station led by Gianni Tartari from Italy.

Scientists from the neighboring countries have also worked in the Third Pole region for many years, and have expressed interest in the TPE program. Among them are Prof. Baldev Arora, director of the Wadia Institute of Hamalayan Geology, Prof. Lochan Devkota from Tribhuvan University, Nepal, and Dr. Rahmatullah Jilani from Space and Upper Atmosphere Research Committee, Pakistan.

8. Conclusions

The first TPE workshop concluded on August 16, 2009 with all participants encouraged by the expressed interest and motivation of those who attended. The goals of the workshop were successfully achieved through the sharing of academic research, the discussion of priority scientific topics within the Third Pole, and significant dialog regarding the planning and future directions of the TPE program. Detailed transcripts of workshop dialogs and individual session discussions are available through the TPE office.

With the TPE project initiated, the following lead Science Committee members were nominated: Tandong Yao (Chair), Lonnie G. Thompson (Co-chair), and Volker

Mosbrugger (Co-chair). Their responsibilities are to coordinate and nominate other members of the Science Committee. To support regional activities, workshops, web development, and research dissemination, a TPE program office was established in Beijing with the support of the Chinese Academy of Sciences (CAS).

The breadth of scientific and environmental questions opened for discussion highlighted the uniqueness of the TPE program as a total environmental study of the past, ongoing, and future environmental changes affecting the Third Pole region and its inhabitants. To continue the development and progress of the TPE program, a second workshop is planned to take place in 2010. Participants agreed that the second TPE workshop should be hosted in Kathmandu, Nepal, with a target timeframe of October, 2010.

Appendix 1 – Workshop Program

1st Third Pole Environment (TPE) Workshop

August 14-16, 2009, Beijing, China

2009/8/14 Registration

2009/8/15	**Presentations**
8:30-9:50/10:00	***Chaired by*** Yao, Tandong and Tartari, Gianni
Yao, Tandong	Welcome, and introduction of the TPE program
Mosbrugger, Volker	Third Pole environment-monsoon dynamics and geoecosystem
Yang, Daqing	Climate and Cryosphere (CliC) Project Update
Greenwood, Gregory	Elements of Integrated Environmental Research on the Third Pole of the Planet
Ouyang, Hua	Third Pole: regional cooperation
9:50/10:00-10:20,	Coffee Break (including group photo)
10:20-12:20	***Chaired by*** Deng, Wei and Su, Zhongbo (Bob)
Koike, Toshio	Quantitative Approaches to the Atmosphere-Land Interaction in the Tibetan Plateau
Tartari, Gianni	The contribution of CEOP-HE to the study the Third Pole surrounding areas: Himalaya and Karakorum
Ma, Yaoming	Ongoing research initiative on the land-atmospheric interaction over the Tibetan Plateau
Su, Zhongbo (Bob)	Some recent progresses in understanding land-atmosphere interactions on the Tibetan plateau - satellite observations and modeling
Ueno, Kenichi	Mountain weather modification in the Tibet/Himalayas
Jilani, Rahmatullah	Monitoring glaciers in Pakistan
—*Lunch*—	
13:30 – 15:30	***Chaired by*** Ma,Yaoming and Gleixner, Gerd
Luo, Yong	Environment Evolution over the Tibetan Plateau and Its Impact on Asian Atmospheric Circulations
Devkota, Lochan P.	Climate Change Scenario over Koshi Basin
Hasnain, Syed I.	Impact of Climate Change on Himalayan Glaciers: Carbon Dioxide and Non-Carbon Dioxide Climate Forcing Agents
Xie, Hongjie	MODIS and ICESat-based snow cover and glacier changes across three rivers headstream region of Tibetan Plateau
Arora, Baldev R.	Active monitoring of Himalayan glaciers with special reference to climate change
Nakawo, Masayoshi	Water circulation from the Qilian Mountains for the last 2000 years-a consequence of our history

—*Afternoon Break* —

15:50-18:10	***Chaired by*** Zhang, Renhe and Jilani, Rahmatullah
Menenti ,Massimo	A prototype observing and modeling system of the water balance of the Qinghai - Tibet Plateau
Tian, Lide	Stable isotopes in the hydrocycle on the Tibetan Plateau-reviews and perspectives
Hashmi, Danial	Influence of climate change on upper Indus Basin Rivers
Hu, Pinghua	The Pilot Research on geo-surface processes and adaptation to climate change in Himalayan region-introduction
Shi, Jiancheng	Remote sensing of surface properties over Tibet region
Shao, Xuemei	Past climate change on the Tibetan Plateau revealed from tree rings
Xu, Baiqing	Environmental change during the Late Holocene in Southern Tibet revealed by sediment from a pro-glacial lake
Chudok	Above ground biomass estimation in the north Tibetan Plateau, China using MODIS imagery

— *Dinner Break* —

2009/8/16	**Discussions**
8:30-10:00	***Chaired by*** Greenwood, Gregory and Mosbrugger, Volker Scientific questions in TPE studies

— *Coffee Break* —

10:20-11:50	***Chaired by*** Menenti, Massimo and Koike, Toshio Implementation plans in TPE studies

—*Lunch*—

14:00-15:30	***Chaired by*** Yang, Daqing and Ouyang, Hua Organization in TPE studies

— *Afternoon Break* —

15:50-17:20	***Chaired by*** Yao, Tandong and Hasnain, Syed Workshop conclusion and future planning

—*Banquet with traditional Tibetan performances*—

Finale

Appendix 2 – List of Participants

Attendee	Country	Institute/Organization/Government	Email
Bai, Ling	China	Department of Sciences, Tibet University	xzdxbl@yahoo.com.cn
Chdok	China	Tibetan Bureau of Meteorology	chu_d22@yahoo.com
Chen, Tuo	China	Cold and Arid Regions Environmental Engineering and Research Institute	chentuo@lzb.ac.cn
Deng, Wei	China	Institute of Mountain Hazards and Environment, CAS	dengwei@imde.ac.cn
Ding, Lin	China	Institute of Tibetan Plateau Research, CAS	dinglin@mail.igcas.ac.cn
Duan, Keqin	China	Cold and Arid Regions Environmental Engineering and Research Institute	kqduan@ns.lzb.ac.cn
He, Yuanqing	China	Cold and Arid Regions Environmental Engineering and Research Institute	yqhe@lzb.ac.cn
Hou, Shugui	China	Cold and Arid Regions Environmental Engineering and Research Institute	shugui@lzb.ac.cn
Hu, Pinghua	China	Institute of Mountain Hazards and Environment, CAS	chinasec@icimod.org
Kang, Shichang	China	Institute of Tibetan Plateau Research, CAS	shichang.kang@itpcas.ac.cn
Liu, Fengjing	China	Sierra Nevada Research Institute, University of California	fliu@UCMERCED.edu
Liu, Jingshi	China	Institute of Tibetan Plateau Research, CAS	jsliu@itpcas.ac.cn
Liu, Shiyin	China	Cold and Arid Regions Environmental Engineering and Research Institute	liusy@lzb.ac.cn
Liu, Yimin	China	Institute of Atmospheric Physics, CAS	lym@lasg.iap.ac.cn
Ma, Yaoming	China	Institute of Tibetan Plateau Research, CAS	ymma@itpcas.ac.cn
Ouyang, Hua	China	ICIMOD	houyang@icimod.org
Shao, Xuemei	China	Institute of Geographic Sciences and Natural Resources Research, CAS	shaoxm@igsnrr.ac.cn
Tian, Lide	China	Institute of Tibetan Plateau Research, CAS	ldt@itpcas.ac.cn
Xu, Baiqing	China	Institute of Tibetan Plateau Research, CAS	baiqing@itpcas.ac.cn
Yang, Kun	China	Institute of Tibetan Plateau Research, CAS	yangk@itpcas.ac.cn
Yang, Meixue	China	Cold and Arid Regions Environmental Engineering and Research Institute	mxyang@ns.lzb.ac.cn

Yang, Yongping	China	Kunming Institute of Botany/ Institute of Tibetan Plateau Research, CAS	yangyp@mail.kib.ac.cn
Yao, Tandong	China	Institute of Tibetan Plateau Research, CAS	tdyao@itpcas.ac.cn
Ye, Baisheng	China	Cold and Arid Regions Environmental Engineering and Research Institute	yebs@lzb.ac.cn
Yi, Chaolu	China	Institute of Tibetan Plateau Research, CAS	clyi@itpcas.ac.cn
Zhang, Renhe	China	Chinese Academy of Meteorological Sciences	renhe@rays.cma.gov.cn
Zhang, Yili	China	Institute of Geographic Sciences and Natural Resources Research, CAS	zhangyl@igsnrr.ac.cn
Zhang, Yinsheng	China	Institute of Tibetan Plateau Research, CAS	yszhang@itpcas.ac.cn
Zhao, Lin	China	Cold and Arid Regions Environmental Engineering and Research Institute	linzhao@lzb.ac.cn
Gleixner, Gerd	Germany	Max-Planck Institute of Biogeochemistry	ggleix@bgc-jena.mpg.de
Mosbrugger, Volker	Germany	Senckenberg Research Center for Nature Study	volker.mosbrugger@senckenberg.de
Roesler, Wolfgang A.	Germany	Tuebingen University	wolfgang.roesler@uni-tuebingen.de
Arora, Baldev R.	India	Wadia Institute of Himalayan Geology	wihg@sancharnet.in;arorabr@wihg.res.in
Hasnain, Syed I.	India	The Energy and Resources Institute (TERI), New Delhi; Glacier and Climate Change Commission, Govt. of Sikkim	hasnainsyed09@gmail.com
Tayal, Shresth	India	Jawaharlal Nehru University, New Delhi	t.shresth@gmail.com
Tartari ,Gianni	Italy	Water Research Institute of the Italian National Research Council (CNR-IRSA)	tartari@irsa.cnr.it
Koike, Toshio	Japan	Department of Civil Engineering, School of Engineering, The University of Tokyo	tkoike@hydra.t.u-tokyo.ac.jp
Nakawo, Masayoshi	Japan	National Institutes for the Humanities	nakawo@chikyu.ac.jp
Ueno, Kenichi	Japan	Graduate School of Life and Environmental sciences, University of Tsukuba	kenueno@sakura.cc.tsukuba.ac.jp
Devkota, Lochan P.	Nepal	Central Department of Hydrology and Meteorology, Tribhuvan University	devkotalp@hotmail.com
Mool, Pradeep	Nepal	Water and Hazards (Ice and Water), ICIMOD	pmool@icimod.org
Shrestha, Basanta	Nepal	Mountain Environmental Natural Resources Information Systems, ICIMOD	bshrestha@icimod.org

Menenti ,Massimo	Netherlands	Department of Earth Observation Systems, Delft University of Technology, the Netherlands; Agricultral and Forest research Institute of the Italian National Research Council (CNR- ISAFoM)	M.Menenti@tudelft.nl
Su,Zhongbo (Bob)	Netherlands	Department of Water Resource, International Institute for Geo-Information Science and Earth Observation (ITC)	b-su@itc.nl
Jia, Li	Netherlands	Alterra Green World Research,Wageningen University and Research Centre Wagenigen	Li.Jia@wur.nl
Yang, Daqing	Norway	Norwegian Polar Institute	daqing@npolar.no
Hashmi, Danial	Pakistan	Water and Power Development Authority (WPDA), Pakistan	daniyal_hashmey@yahoo.com
Jilani, Rahmatullah	Pakistan	Space Applications, SUPARCO	rahmatullahjilani@hotmail.com
Greenwood, Gregory	Switzerland	Lausanne University； Mountain Research Initiative	green@giub.unibe.ch
Fayziev,Radjabovich Abdulkhak	Tajikstan	Institute of Geology, Tajikistan	faiziev38@mail.ru
Minaev,Evgenevich Vladislav	Tajikstan	Institute of Geology, Tajikistan	v_minaev@mail.ru
Liang, Shunlin	US	University of Maryland, college park	sliang@geog.umd.edu
Lu, Lixin	US	Department of Atmospheric Sciences, Colorado Sate University	lixin@atmos.colostate.edu
Shi, Jiancheng	US	University of California, Santa Barbara	jiancheng.shi@bren.ic.ucsb.edu
Xie, Hongjie	US	Department of Geological Sciences, University of Texas at San Antonio	Hongjie.Xie@utsa.edu
Hewitt, Keneth	Canada	Geography and Environmental Studies, Cold Regions Research Centre (WLU)	khewitt@wlu.ca