Report

Warnaars, Tanya; **Harding, Richard**; **Calow, Roger**; Arnell, Nigel. 2008 *Report on event supported by RCUK Office in China.* RCUK - China office website and other communications, RCUK-China office, 24pp. (UNSPECIFIED) (Unpublished)

Report on Event Supported by RCUK Office in China

Overall Evaluation

This workshop, overall, was a success, it was well organised and was run smoothly. The participants were able to engage in discussions and the schedule and meeting facilities enabled discussions after each speaker. At the end of each session an in-depth discussion was monitored by the chairpersons. The use of dual chair persons and reports encouraged the participants from China and the EU (who has never met before the workshop) to work together.

A key aim of this event was to bring together the climate water communities of China, the UK and EU. Additionally we wished to highlight current and future projects operating in China and to identify funding organisations such as the EU, RCUK. These goals were, on the whole, fulfilled. An interesting outcome was the recognition by the Chinese participants that more dialogue between researchers in the field of climate and hydrology is needed; similarly this issue has only recently been recognised by the UK/EU community.

Value to Research/Training

The participants at this workshop came from a number of different disciplines including; climate science, metrology, water resource, hydrology and agriculture. The input for this group resulted in the identification of a number of research priorities. A summary report of the content of this workshop has been prepared and four future research themes have been identified. This document has been circulated to all 29 presenters at the workshop and their comments on the summary report have been addressed/included. This summary report (attached as Annex E) has been circulated to several organisations active in the area, for example the European Commission, Natural Environment Research Council (UK), DfID[‡]-China Office, FCO[⍋]-China office, RCUK. The outcomes of our workshop have been positively received; however time is needed to know if we can develop further funding opportunities.

Value to inter-institution collaboration

The workshop was a very positive experience, particularly as it was held in Beijing which allowed a sizeable group of UK and European scientist to attend and meet face-to-face with their Chinese colleagues. The discussions during the workshop, which were continued at the conference dinner, made important contributions to building a network of contacts. Most participants had never met prior to the meeting, especially those travelling from outside Beijing; this is a significant benefit of the workshop which was to facilitate discussions and sharing of research ideas. The opportunity to benefit from personal contacts and focused scientific discussions should not be underestimated.

[‡] Department for International Development (UK)
[⍋] Foreign and Commonwealth Office (UK)

Publicity and outreach

A large effort, especially on the part of MAIRS organisers, was made to promote this meeting. For this purpose a number of journalists were invited and an article on the workshop appeared in the paper in two Chinese publication:
Xinhua News Agency:Chinese Version：http://news.xinhuanet.com/newscenter/2008-11/24/content_10406371.htm English Version：http://news.xinhuanet.com/english/2008-11/24/content_10406705.htm
China Science and Technology Daily: http://www.stdaily.com/gb/stdaily/2008-11/27/content_883250.htm (only in Chinese)
Additionally a comment on this workshop appeared in the newsletter of Centre for Ecology and Hydrology, this is an internal newsletter made available to staff of CEH.

As the subject of the workshop was very topical we made every effort to invite a wide audience. Members from the Chinese Ministry of Science and Technology were present as well as the European Union China office; these representatives were in addition to the RCUK members and DfID representative.

The collaboration process

It was very beneficial to hold this workshop in Beijing, particularly for the overseas participant as it gave a greater understanding of the issues facing China as well as providing cultural exposure. The interaction between local and overseas participants was facilitated by being in China as we were able to interact with a wide range of Chinese, from ministerial officials to professors and PhD students. This would not have been the case were the workshop held in the UK. We were privileged that a number of top UK and EU scientists could attend the workshop as this showed our commitment to advancing research in the field of Water and Climate.

RCUK's Performance

The RCUK office was very helpful in providing advice as well as assisting in preparing the invitation list. Organising a workshop of this size is a challenging process especially when located outside the country in the UK. The advice and support given by the RCUK as well as MAIRS were instrumental in making this workshop a success.

The competition and award scheme of RCUK was well structured and easy to follow. Good support and advice was given, in a timely manner, by the RCUK-China office. The NERC representatives in Swindon were also helpful and we exchanged information on the best way to structure the workshop so that all parties benefited as much as possible.

Overall this workshop was a positive experience and was a very useful method for providing contact and discussions between Chinese and European partners. The challenge now is to build on this initial contact and work towards greater collaboration. However, this is not possible without appropriating funding and CEH as well as IAP are continuing to work on this.

ANNEXES

Annex A. Event Programme

Workshop Agenda: Climate Change & Global Water Cycle
November 24 -26, 2008, Beijing, China

Monday 24 November 2008

Topic area: Introduce Current China & European Collaboration Projects
Chair persons: Eddy Moors & Xiaotao CHENG
Reporters: Roger Calow & Yangwen Jia

09:30- 10:00 Registration

10:00 - 10:30 Start morning coffee and group photo

10:30 – 10:45 Chris GODWIN: *Welcome talk by RCUK*

10:45 – 11:00 Longchao ZHOU: *Opening remark from MOST Official*

11:00 – 11:15 Ignacio ASENJO RUIZ (EU-China office): *Introductory Talk to EU in China*

11:15 – 11:40 Prof. Congbin Fu: *MAIRS & IAP work*

11:40 – 12:05 Richard HARDING : *European initiatives in Water and Climate Change*

12:05 – 12:30 T. NAKAYAMA: *The Relationship between Droughts in Northern China And Floods in Southern China*

12:30 - 13:30 Lunch

Topic area: Present and Future Water and Land Use (20 minute talks + 5 min. discussion)
Chair persons: Henny van Lanen & Congbin FU
Reporters: Simon Dadson& Yinlong Xu

13:30 – 13:55 Nigel ARNELL: *Climate change and global water resources*

13:55 – 14:20 Yangwen JIA: *Predicting Climate Change Impacts on Water Resources in Weihe River Basin Using GCM and Hydrological Models*

14:20 – 14:45 David WIBERG: *Lands, Demands, and Plans: China's Changing Agricultural Sector and it's Impacts on Land and Water Management, Welfare, and the Environment*.

14:45 – 15:10 Xing CHEN: *Land Use and Regional Climate of China in the Last 300 Years*

15:10 – 15:30 Tea/coffee break

Topic area: Climate and Hydrological Cycle

Chair persons: Nigel Arnell & Yinlong Xu
Reporters: Christel Prudhomme & Guangheng Ni

15:30 – 15:55 Andy WILTSHIRE: *Climate Change: Regional Modelling and Integrated Impacts*

15:55 – 16:20 Kun YANG: *The Change of Hydrological Cycle in the Tibetan Plateau: Modeling and Data Assimilation*

16:20 – 16:45 Eddy MOORS: *Adaptation measures to mitigate climate change and land use change effects on the hydrological cycle*

16:45 – 17:10 Dawen YANG: *Predicting the Regional Hydrological Response to Climate Change in China*

17:10 – 17:30 discussion

18:00-20:30 Reception meeting Dinner

Tuesday 25 November 2008

Topic area: Climate and Hydrological Cycle (cont)

09:00 - 09:25 Wanchang ZHANG: *Research Progress on Coupling XXT Hydrological Model to NOAH LSM being Integrated in GRAPES for Metero-hydrological Studies*

09:25 - 09:50 Simon DADSON: *Estimates of Flood Inundation and Evaporation in the Niger Inland Delta Region using JULES*

09:50 – 10:15 Liliang REN: *Change of Hydrological Cycle within the West Liaohe Basin* under Global Change

10:15 – 10:30 discussion

10:30-11:00 tea/coffee break

Topic area: Regional Trends: Floods and Droughts

Chair persons: Declan Conway & Yangwen Jia
Reporters: Andy Wiltshire & Xing Chen

11:00 - 11:25 Henny van LANEN: *Drought analysis at the regional and the catchment scale*

11:25 - 11:50 Xiaotao CHENG: *Impacts of Climate Change on Flood Management and Drainage Improvement Project and Adaptation Options: Case Study in the Huai River Basin, China*

11:50 – 12:15 Tianjun ZHOU: *East Asian Climate Shift around the Late 1970s*

12:15-12:40 Zhuguo MA: *The Trend of Aridification in China in Last 50 years*

12:40 – 13:40 LUNCH

13:40 – 14:05 Christel PRUDHOMME: *Investigating Links between Large Floods and Weather Types in Europe*

14:05 - 14:30 Xingang DAI: *Climate Change Adaptation and Mitigation in West Inner Mongolia*

14:30 – 14:45 discussion

Topic area: Implications to Water Resources and Agriculture
Chair persons: David Wiberg & Xingang Dai
Reporters: Tim Wheeler & Tianjun Zhou

14:45 - 15:10 Tim WHEELER: *Water Use by Crops under Climate Change*

15:10– 15:35: Yinlong XU: *Chinese Agriculture under Future Enhanced Constrained Water Resources in North China*

15:35 - 16:00 Declan CONWAY: *Future cereal production in China: The interaction of climate change, water availability and socio-economic scenarios*

16:00 – 16:30 tea/ coffee break

16:30 - 16:55 Roger CALOW: *Coping with climate variability: policy priorities for irrigation management*

16:55 – 17:20 Guanghe NI: *Regional Hydrological Response to Global Climate Change: Some Case Studies in China*

17:20 – 17:45 discussion

<u>Wednesday 26 November 2008</u>

Topic area: Future Collaborative Research
Chair persons: Richard Harding & Liliang REN
Reporters: Tanya Warnaars & Ailikun

09:00 - 10:30 Reports from session reviewers

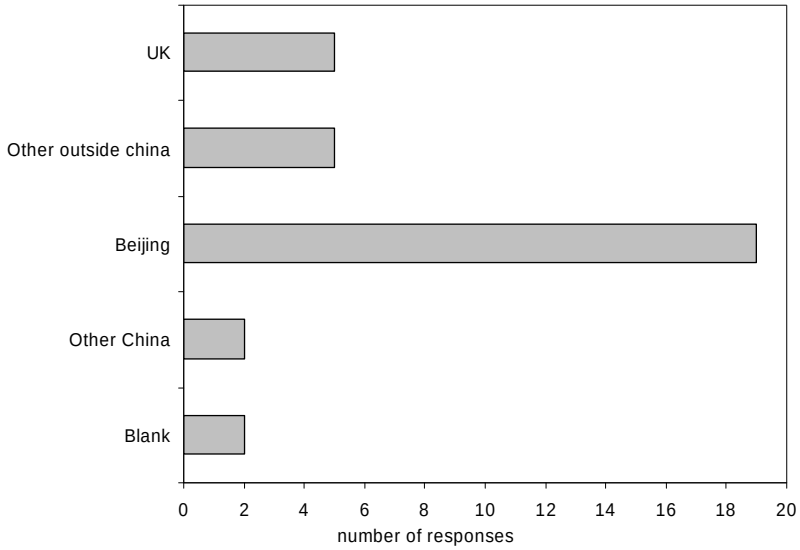
10:30 - 11:00 tea/coffee break and networking

11:00 - 12:00 Discussion of future opportunities

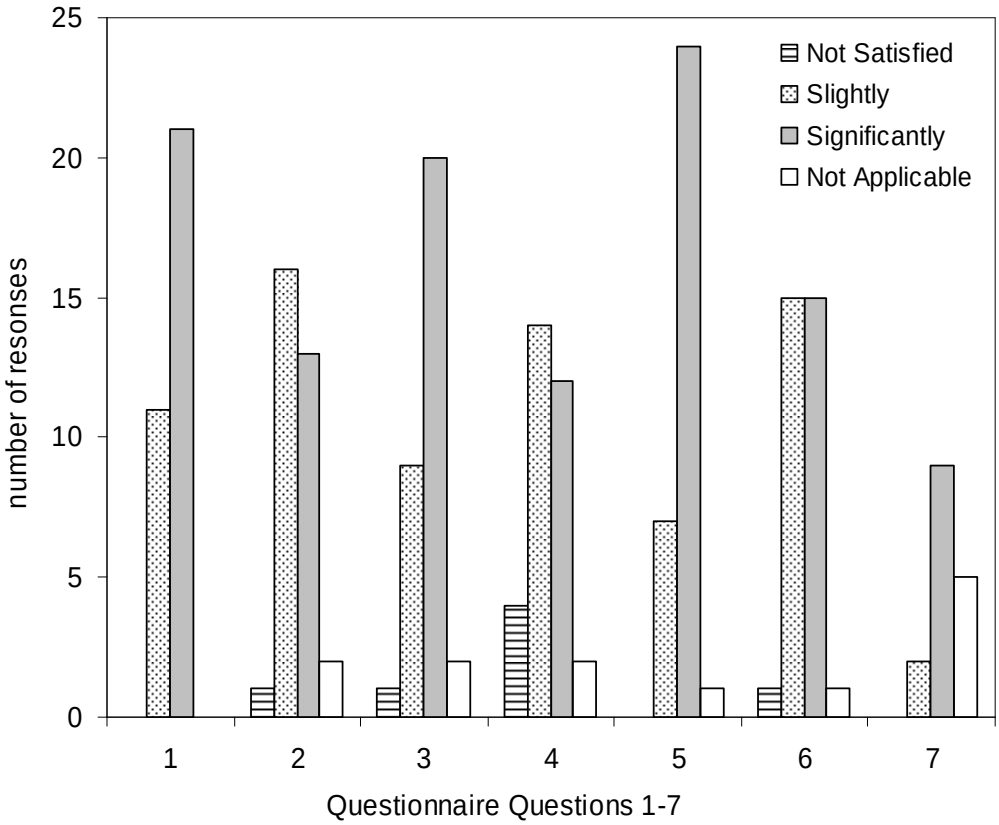
12:00 – 12:30 Closing remarks and end of workshop
(Dr. Richard Harding)

Annex B. Participant feedback statistics/comments

The RCUK workshop questionnaire was distributed to all and a total of 33 paper copies were returned. The statistic and comments recorded below are based on the 33 completed questionnaires. The majority (57%) of the completed questionnaires were from persons located in Beijing.



On the RCUK questionnaire there were a total of 7 questions and participants were asked to place a tick by the column that was most applicable:



In general the workshop participants were significantly satisfied with the workshop with a total of 55% of all responses being in the 'Significant' column. However, most participants were only slightly satisfied by question 2* (50%) and 4† (44%). This response is probably a reflection of the need for communication between the different communities inside and outside of China.

Most participants provided personal comments and expressed a desire for further information about collaborative work and funding opportunities. It might be helpful to have a follow up meeting or correspondence in a years time between the community that was united during this workshop event. The RCUK is mentioned as having a key role in facilitating the dialogue between the UK and Chinese research communities, because communication is currently lacking.

A sample of the written responses are included here, including the ones written in Chinese.

Research Councils UK (RCUK) Office in China Questionnaire – Workshop

Optional (Filling this in will help us to understand your needs and to facilitate UK/China collaboration) 可选填（回答此问题可帮助我们及时了解您的需要并做出相应的回应来促进中英科研合作）
How would you like to follow-up your Workshop activity? How can RCUK China Office help? 您将如何开展研讨会后续工作？您希望英国研究理事会中国办事处如何协助开展这些工作？ [illegible]

For participants from outside of China: 外方参会人员请填写：	☐UK 英国 ☐ Other (please specify)其他请注明
For Chinese participants: 中方参会人员请填写：	City of residence 居住城市： ☑ Beijing 北京 ☐ Shanghai 上海 ☐ Other (please specify)其他请注明

Thanks for filling in this questionnaire. Please hand it back to your event organiser.
非常感谢您的协助，请将问卷交至活动组织方。

* Question 2: To increase your access to international resources and/or facilities
† Question 4: To meet objectives you could not have achieved through other schemes

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How would you like to follow-up your Workshop activity? How can RCUK China Office help? 您将如何开展研讨会后续工作？您希望英国研究理事会中国办事处如何协助开展这些工作？ 尽快落实研究经费及研究问题（中英双方感兴趣的），尤其是气候变化与水的问题。

For participants from outside of China: 外方参会人员请填写：	☐UK 英国 ☐ Other (please specify)其他请注明
For Chinese participants: 中方参会人员请填写：	City of residence 居住城市： ☑ Beijing 北京 ☐ Shanghai 上海 ☐ Other (please specify)其他请注明

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How would you like to follow-up your Workshop activity? How can RCUK China Office help? 您将如何开展研讨会后续工作？您希望英国研究理事会中国办事处如何协助开展这些工作？ 希望两边就某一方面问题，共同开展研究和共同申请经费

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For Chinese participants: 中方参会人员请填写：	City of residence 居住城市： ☑ Beijing 北京 ☐ Shanghai 上海 ☐ Other (please specify)其他请注明

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How would you like to follow-up your Workshop activity? How can RCUK China Office help? 您将如何开展研讨会后续工作？您希望英国研究理事会中国办事处如何协助开展这些工作？ 简会报道相关专家的科研工作，让更多读者，尤其是中国方面的相关专家了解缓和"气候变化"和"水循环"的科研工作。 希望英国研究理事会能继续通知媒体一些相关活动，并提供资料。

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How would you like to follow-up your Workshop activity? How can RCUK China Office help? 您将如何开展研讨会后续工作？您希望英国研究理事会中国办事处如何协助开展这些工作？ • Set up collaboration research projects, including short exchange visits to the UK & China, and easier access to data How can RCUK helps? In helping funding such research projects, e.g. through phD research grants co-supervised in the UK & in China.

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How would you like to follow-up your Workshop activity? How can RCUK China Office help? 您将如何开展研讨会后续工作？您希望英国研究理事会中国办事处如何协助开展这些工作？ I really get much information in this workshop, and I will try to contact some participants after the meeting. The purpose I will do so is to look for cooperation in the research area of climate change and regional response. I hope RCUK China Office can send me news and useful information.

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Annex C. List of participants showing

Title	Forename	Surname	Status	Affiliation	email
Dr		AILIKUN	Researcher	Monsoon Asia Integrated Regional Study (IAP)	aili@mairs-essp.org
Prof	Nigel	ARNELL	Professor	Reading University	n.w.arnell@reading.ac.uk
Ms	Jing	CAI	manager	RCUK-China office	Jing.cai@recul.cn
Mr.	Roger	CALOW	Researcher	British Geological Survey and Overseas Development Institute	rcal@bgs.ac.uk
Prof.	Zhansheng	CHE	Professor	Chinese Acadamy of Science	zhancs2006@gmail.com
Dr.	Xing	CHEN	Professor	Nanjing University	xchen@nju.edu.cn
Prof.	Xiaotao	CHENG	Professor	China Institute of Water Resources and Hydropower Research (IWHR)	chengxt@iwhr.com
Dr.	Declan	CONWAY	Researcher/Teacher	Tyndall Centre for Climate Change Research & DFID	D.Conway@uea.ac.uk
Dr.	Simon	DADSON	Researcher	CEH	SJDAD@ceh.ac.uk
Dr.	Xingang	DAI	Professor	IAP/CAS	daixg@tea.ac.cn
Dr.	Yingjie	FAN	Resercher	China National Science Foundation	fanyj@nsfc.gov.cn
Prof.	Congbin	FU	Professor	IAP/CAS	fcb@tea.ac.cn
Mr.	Chris	GODWIN	Manager	RCUK- China	chris.godwin@rcuk.cn
Dr	Richard	HARDING	Researcher	CEH	rjh@ceh.ac.uk
Dr.	Anli	HUANG	Scientist	Tsinghua University	julian@greebkeaoforuard.com
Dr.	Yangwen	JIA	Professor	China Institute of Water Resources and Hydropower Research	jiayw@iwhr.com
Dr	Henny	VAN LANEN	Resercher/Teacher	Wageningen University (Netherlands)	Henny.vanLanen@wur.nl
Dr.	Shan	LI	Researcher	IAP/CAS	lishan@tea.ac.cn
Dr.	Shan	LI	Researcher	IAP/CAS	lizhen@tea.ac.cn
Dr.	Chunzhen	LIU	Researcher	China Water Information Center,	liucz@mwr.gov.cn
Dr.	Ruijuan	LIU	Researcher	IAP/ CAS	liurj@tea.ac.cn
Dr.	Yonghe	LIU	Researcher	IAP/ CAS	Liuyh@tea.ac.ck
Prof	Eduardus	MOORS	Researcher	Wageningen University	Eddy.Moors@wur.nl
Dr.	Tadanobu	NAKAYAMA	Researcher	National Institute for Environmental Studies (NIES)	nakat@nies.go.jp
Dr.	Guangheng	NI	Researcher	Tsinghua University	ghni@tsinghua.edu.cn
Dr.	Xiaorui	NIU	Researcher	IAP/CAS	niuxr@tea.ac.cn
Dr	Christel	PRUDHOMME	Researcher	CEH	chrp@ceh.ac.uk
Dr.	Cheng	QIAN	Researcher	IAP/ CAS	qianch@tea.ac.cn
Dr.	Liliang	REN	Professor	Hehai University	rll@hhu.edu.cn

Title	Forename	Surname	Status	Affiliation	email
Mr	Ignacio Asenjo	RUIZ	Manager	EU-China Office	Ignacio.ASENJO@ec.europa.eu
Dr	Jing	WANG	Professor	China Institute of Water Resources and Hydropower research	Wangjing8585@126.com
Dr.	Shuyu	WANG	Researcher	IAP/ CAS	wsy@tea.ac.cn
Dr.	Yi	WANG	Researcher	IAP/ CAS	wangyi@tea.ac.cn
Ms.	Dongyao	WANG	manager	Bureau International Cooperation (CAS)	dywang@cashg.ac.cn
Dr	Tanya	WARNAARS	Manager/ Researcher	CEH	twarnaars@ceh.ac.uk
Prof.	Timothy	WHEELER	Professor	Reading University	t.r.wheeler@rdg.ac.uk
Dr.	David	WIBERG	Researcher	IIASA	wiberg@iiasa.ac.at
Dr	Andrew	WILTSHIRE	Researcher	Met Office Hadley Centre	andy.wiltshire@metoffice.gov.uk
Dr.	Yunfei	WU	Researcher	IAP/ CAS	wuyf@tea.ac.cn
Dr.	Zhenghui	XIE	Researcher	IAP/ CAS	zxie@mail.iap.ac.cn
Dr.	Baoliang	XU	Researcher	IAP/ CAS	xubl@tea.ac.cn
Dr.	Yinlong	XU	Professor	Chinese Academy of Agricultural Sciences	xuyl@ami.ac.cn
Prof.	Zongxue	XU	Professor	Beijing Normal University	zxxu@bnu.edu.cn
Prof.	Dawen	YANG	Professor	Tsinghua University	yangdw@tsinghua.edu.cn
Dr.	Kun	YANG	Professor	Institute of Tibetan Plateau Research, Chinese Academy of Sciences	yangk@itpcas.ac.cn
Ms.	Ying	YANG	Programe officer	MAIRS/ IAP/ CAS	yangying@mairs-essp.org
Dr.	Huiling	YUAN	Researcher	NOAA/ ESRL	Huiling.yuan@noaa.gov
Dr.	Wanchang	ZHANG	Professor	IAP/CAS	zhangwch@tea.ac.cn
Dr.	Longchao	ZHOU	Researcher	MOST	zhoulc@most.gov.cn
Dr.	Tianjun	ZHOU	Professor	IAP/CAS	zhoutj@lasg.iap.ac.cn

Journalist:

Zheng YU Xinhua New Agency	**ZIfan DONG** Science and Technology Daily of China
Aihua WANG Xinhua New Agency	**Rupeng CAI** China New Weekly
Daqing LI Science and Technology Daily of China	**Peng Li** China Financial and Economical News

Annex D. Photo album

Group Photo of all participant (taken on first day)

Preparing for the start of the workshop Day 1

Richard Harding Welcoming all to the Workshop

Richard Harding giving his presentation of the WATCH project and ties to RCUK

Attendees on the first day listening to talks

Questions by Dr. Wanchang ZANG from CAS

Dr. Declan Conway asking questions

Prof Chunzhen LIU (China Water Information Centre) with questions

Presentation by Dr. Henny van Lanen (Wageningen University)

Presentation by Wanchang ZHANG (IAP/ CAS)

Presentation by Dr. Liliang REN (Hehai University)

Prof. Nigel Arnell summarising the session on Climate and Hydrological Cycle

Annex E. Summary and Future Research

Workshop Summary Report: Water and Climate Change Workshop

24-26 November 2008, Beijing China

Background

The Global Water Cycle is an integral part of the Earth System. The workshop focused on large scale hydrological models and their use for projecting future changes to the water cycle. Such models can assist in identifying regions that are particularly vulnerable to future changes and can represent hydrological processes that control the propagation of extreme events, such as droughts and floods. An important challenge to modelling is how models can be validated using specific river basins. This workshop explored scientific questions relating to the modelling of climate and hydrological processes across the interface of climatology and hydrology.

Meeting discussions

China has the world's fastest growing research community, and initial speakers focused on the current China and European collaboration projects. The different funding options currently available from both RCUK and EU were described. Although Chinese partners are able to apply directly to the EU proposal calls, to date only a small number of Chinese partners are involved. However co-funding initiatives are ongoing. Conversely the China-US partnerships are stronger than the China-EU links.

Two cross-cutting projects were introduced: the MAIRS[1] and WATCH[2] projects. MAIRS focuses on the coupled human and environment system in the monsoon Asia region and WATCH is a global project investigating the impact of climate change on the global water cycle. A key point in both projects is the issue of uncertainty and how this is interpreted and conveyed to policy makers in their decision making.

Of the 669 cities in China 110 are seriously short of water. China is affected by a monsoon climate with uneven distribution of precipitation in space and time. Droughts (north, e.g. Yellow River Basin) and floods (south, e.g. Yangtze River Basin) occur regularly. Since the late 1970s-early 1980s the pattern of the East Asian monsoon has changed, with wetter conditions in the south and drier conditions in the north of China. Recognising the difference between hydrological and agricultural droughts is necessary as each type is represented in the models by different indicators and sectors (stakeholders). The tropical ocean warming is one mechanism for the weakening tendency of global land monsoon rainfall in the past 50 years. Recent spring drought of southern China is partly dominated by upper tropospheric cooling, which is significantly related to the NAO[3]. Furthermore the use of weather patterns was presented as a process for evaluating duration of flood events. There is no consensus among the climate models as to the sign of rainfall trends in the monsoon region in the future.

[1] Monsoon Asia Integrated Regional Study (www.mairs-essp.org), led by Institute of Atmospheric Physics, Beijing
[2] WATer and global CHange (www.eu-watch.org), led by Centre for Ecology and Hydrology, UK
[3] North Atlantic Oscillation

Strong seasonal changes in surface energy budget have also been observed. In the Tibetan plateau, for example, there is strong evidence of glacial retreat. The Tibetan climate has huge influence on the river flow of large rivers of China (e.g. Yellow and Yangtze rivers), as well as the Asian monsoon climate itself. Over the past 30 years, the glacier area on Qinghai-Tibetan Plateau decreased with a rate of 147km^2/annum, mainly due to increased temperature (an increase of 0.9^{o}C over 30 years). Melting glaciers under warmer climates are producing a water volume that is almost equal to the amount of annual runoff of the Yellow River, thereby increasing the frequency of glacier lake outburst floods.

Evaporation demand (as measured by evaporation pans) has generally decreased across China in recent decades. This is almost certainly linked to solar dimming as a result of increased concentration of aerosols. River flows are, however, generally decreasing, most probably as a result of increasing abstraction from rivers and groundwater.

The development of combined flood and drought management systems needs urgently to be enhanced, including both structural and non-structural measures. Under the present conditions it is hard to make a quantitative analysis of the impacts of climate change in the future, especially for extreme events. In particular deciding whether changes are driven by changes in climate (specifically temperature and precipitation), by changes in land use (lakes, vegetation cover) or land use practices and water management (irrigation, urbanisation and increased domestic and industrial water demand). In order to cope with the adverse impacts of climate change, self-adaptive capacities should be enhanced in coping with the floods and droughts that may increase in severity and frequency in the future.

The discussion on water and land use highlighted the increasing demand made on the water resources in China. Not only are changing land use practices, such as increased livestock numbers for meat production, increasing the demand for water but changes in the frequency of floods and droughts are impacting on production. Variation in natural water systems is mainly influenced by temperature and precipitation, whereas for managed water systems their variation is also influenced by human activities. Industrial and domestic water use is projected to rise; while irrigation demand is expected to fall as the government attempts to shift water from agricultural to municipal users. Observations of trends in land use and river flow regimes have identified the importance of feedbacks in the water cycle, whether the changes are driven by climate change or land use practices and water management.

Climate change is one among many important factors determining risks to crop, animal and human health e.g., land degradation, water/air pollution. There is a need to communicate uncertainty more effectively, including a move beyond presenting averages of ensembles. We need to focus on interactions between these factors and climate change, especially considering Northern China currently suffers severe water stress and Southern China severe floods. Climate change and land use should be regarded as complementary, not as separate issues.

The main focus of the workshop was on the topic of climate and the hydrological cycle. Recently China has invested strongly in data collection for model calibration

establishing an important resource. The rainfall production in RCMs and GCMs[4], as well as soil moisture representation, are both areas in need of improvement. Due to the high level of aerosols in Asia (due to industrial emission as well as dust-storms), the use of scenarios incorporating aerosol emission in China could improve the representation of current temperature trends.

Agriculture places a large strain on water resources due to it high consumption, particularly in regions with variability in rainfall as well as changing food requirements. In China 40% of agricultural land is irrigated, in addition up to 200,000 hectare of cultivated area is threatened by drought, increasing the need for maintaining water security. Water management will be key to future agricultural productivity and the land-climate system. There is scope for reducing evaporation from irrigated areas but increases in irrigation efficiency may be accompanied by reductions in groundwater recharge and down stream flows. Local knowledge should not be overlooked as a source of large scale information. Integrated assessments on water resources and agriculture are needed alongside large scale hydrological and climatological studies. These need to include groundwater in view of its importance as a source of supply in northern China, its future role in buffering climate variability and uncertainties about the impact future climate change on recharge, storage and availability.

Identifying Future Research Priorities:

There is a clearly identified need to bring the water and climate communities together, since at present they work at different scales, use different models and techniques and there is limited mutual understanding. Additionally there is a need to integrate land use and agricultural processes and to link biophysical modelling with the socio-economic understanding.

Key needs:

- Better and consistent methodologies to down-scale climate model data and large scale hydrological models to catchment scales to increase knowledge on the hydrological regime and its extremes (drought and floods)
- Methods to upscale local catchment scale knowledge and upscale and generalise catchment scale adaptation studies to the regional scale.
- Better understanding of calibration issues
  - How to generalise catchment level parameters to the regional scale?
  - How to link to physical characteristics (soil type, topography, geology etc).
- Better understanding of irrigation/groundwater interactions.
  - Need better groundwater representation at the regional (and global) scales.
  - Improved estimates of evaporation and soil water at regional scales – Earth Observation (EO) methodologies may help here.
- Better attribution of observed trends in river flow (runoff) and evaporation across China – is it climate change, impact of rising CO_2 on evaporation, solar dimming (aerosol emission), land use change or other anthropogenic interactions?

[4] Regional Climate Models & Global Climate Models

- Better assessment of the risks associated with drought, water scarcity and need for capacity building and knowledge transfer

There is a need for an integrated modelling framework to better link climate, hydrological and agricultural models with social and economic analyses.

Four themes were recognised by the assembled Chinese and European partners, each with a common focus on combining scientific advances with policy relevance. All have the potential to develop Chinese and European research capacity on science-policy links:

1) Changes over the past and next three decades

Climate, hydrological extremes and water resources over China have changed substantially in the last three decades and we expect increasing changes in the next three. Decadal variability and trends are an important time scale of direct relevance to adaptation planning. We need to understand past variability (attribution of past trends), the institutional responses to these changes and likelihood and impact of possible future changes.

2) Effects of changes in the EASM (East Asian Summer Monsoon)

The East Asian Summer Monsoon has changed in the past few decades, although the causes are uncertain. The response of the EASM to increasing greenhouse gasses is uncertain (with no consensus in sign of rainfall change across the models). The questions this topic would address are:

- What are causes of past changes in the EASM?
- How might it change in the future?
- What would be the consequences of change (e.g. on the hydrological regime and its extremes)?

3) Risks to food and water security

- How vulnerable are Chinese food and water security to climate change (and other pressures) also considering change in drought through the 21st century?
- Take a vulnerability based approach – what changes would be problematic
- Seek to estimate risk, under defined conditions ('risk' as a product of hazard and vulnerability)
- Capacity building – support for cross-disciplinary approaches to risk assessment and vulnerability mapping?)

4) Himalayan-Tibetan Plateau glacial melt

The Himalayan glaciers are already melting. It is clear this will continue as the region warms, however the precipitation changes will be as important as those of temperature and there will be feedbacks, especially between the snow/ice covered areas and the atmosphere. There will be multiple anthropogenic drivers to change in the Himalayan region, including GHG increases, land use change and the impact of aerosols. We need to understand (attribute) past changes, estimate how these changes will progress in the future and assess the possible impacts on the hydrological regime of the down stream river systems and water resources.