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Project report

Report of the 1st WCRP GC Sea Level Science Steering Team Meeting

19 – 20 March, 2015 Utrecht, the Netherlands

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ACTION ITEMS:

***ACTION**: Ask WCRP Director to send letters from WCRP to GC members (Detlef).*

***ACTION**: Initiate SL White Paper to summarize the scientific status of the topic (co-chairs).*

***ACTION**: Revises its text with the new structure (all).*

***ACTION**: Cleans up a newer version of Science Plan, with version number (Detlef).*

***ACTION**: Write letter about the 2016 SL conference to WCRP and IOC for support (Detlef).*

***ACTION**: Draft plan of SL summer school 2015, including schedule and topic (Detlef).*

1. Welcome and charge to the meeting

The local organizer, Roderik van de Wal from the University of Utrecht, the Netherlands, welcomed all participants to the meeting. There were 17 participants to the meeting. Mark Tamisiea from NOC, UK attended all the sessions via skype. Ayako Abe-Ouchi from University of Tokyo, Japan tried but failed in joining the meeting at the last minute.

The meeting convener, the lead of the GC Sea Level Science Steering Team, also the co-chair of CLIVAR SSG, Detlef Stammer, thanked the host by the University of Utrecht and local organizer Roderik van de Wal. Since it was the first time for this steering team to meet, Detlef asked every participant to make self-introduction to others. Then Detlef gave a brief introduction of the WCRP and its "Grand Challenge" (GC): the "Regional Sea Level Change and Coastal Impacts" (SL) is one of the six WCRP GCs. WCRP will grant each GC 20k CHF per year to support its activity, and WCRP doesn't have enough money to support all the SL meetings. The WCRP GC SL is now led by CLIVAR as a Research Foci of CLIVAR. The webpage of SL is now under construction within clivar.org and its content will be maintained by the CLIVAR project office in future. It will appear in WCRP website via a link to CLIVAR's webpage. Lei Han from CLIVAR project office (ICPO) is now the staff person of SL.

Detlef also explained the overarching goal of this WCRP GC, which is to establish a quantitative understanding of the natural and anthropogenic mechanisms of regional to local sea level variability; to promote advances in observing systems required for an integrated SL monitoring; and to foster the development of SL predictions and projections that are of increasing benefit for coastal zone management. The goal of the two days' meeting was to review the draft science plan, the reports from the working packages (WP) of the GC team, and to plan the SL conference in 2016.

2. Structure and scope of the SL steering team

The GC SL steering team will be organized with three co-chairs and five working packages. The three co-chairs are Detlef Stammer (Germany), Robert Nicholls (UK), and Roderik van de Wal (The Netherlands). The five working packages are:

WP 1) An integrated approach to historic sea level estimates (paleo time scale)
WP 2) Quantifying the contribution of land ice to near-future sea level rise
WP 3) Contemporary regional sea level variability and change
WP 4) Predictability of regional sea level
WP 5) Sea level science for coastal zone management

The participants had a discussion on the scope of this GC research theme, and agreed on some concepts in the GC. For example, "Regional" refers to coastal zone, while "Local" refers to coastal city. The scope of SL related research is quite broad, and the team cannot cover all aspects. So the scope of the team is mainly focused on the scientific issues rather than on engineering or infrastructure. By working in the GC SL team, the participants are supposed to get credit at home from WCRP in an appropriate way.

***ACTION**: Ask WCRP Director to send letters from WCRP to GC members (Detlef).*

It is worth paying attention to that the IGBP is doing the same observation on SL as well. It is also

involved in the framework of Future Earth as well as the WCRP GC SL. IGBP is run by ICSU, while WCRP has three parents, WMO, IOC and ICSU.

In applying the scientific achievements of SL research in the engineering, there are some problems in the communications between scientists and engineers or policy makers. For example, the engineers are still using the 1980s or 1990s' very rough data in the coastal infrastructure planning. To the scientists, the SL issue is a problem of probability, while the engineers prefer "one number", and the tail of the probability distribution function (PDF) only. It is a question about communication. For the scientists, they need to hear all the questions from the engineers, and are open to their criticisms. While for the engineers, they should not ask for one number, which is not scientific.

To support the research of GC SL, more funding opportunities are to be sought or stimulated. One mentioned is the EU calls for Horizon2020. Other funding resources for each WP are to be explored.

3. Review of the WP work plans and implementations

Members from all the five WPs gave presentations on the work plan of respective WP, to be reviewed by the team.

WP 1: An integrated approach to paleo time scale sea level estimates

Natalya Gomez gave a presentation on the WP 1 theme "An integrated approach to paleo time scale sea level estimates" and introduced the research with the coupled ice sheet-sea level modeling. Questions and suggestions out of this WP include:

- How can we collect data and make them more useful?
- Stimulate dialog between models and data people;
- Initiate a model intercomparison of the ice sheet models;
- Initiate connection to ice sheet modeling community to bring them together.

WP 2: Quantifying the contribution of land ice to near-future sea level rise

Tony Payne and David Holland gave the presentations on WP 2 theme "Quantifying the contribution of land ice to near-future sea level rise", respectively. Tony pointed out that the ice sheet model is mainly CliC targeted activity, and talked about the ISMIP6 and other CliC activities such as GlacierMIP. There will be a session on SL and ice sheets in COP21 conference in Paris. About the funding resources, Tony mentioned NASA sea level science team and EU. David Holland reported the CliC targeted activity status in his presentation, and talked about MISOMIO, which is the combination of MISMIP and ISMIP. The member candidates for this WP are suggested to be made up of two oceanographers, one sociologist and one link to CliC. Questions and suggestions out of this WP include:

- A new title is needed for this WP;
- Solicit funding for ISMIP6;
- Conduct comparison of 3D, 2D ocean in coupled ocean/ice setups;
- Develop parameterization of full 3D ocean processes.

WP 3: Contemporary regional sea level variability, change and extremes

Rui Ponte, Catia Domingues, Kevin Horsburgh gave presentation respectively on the WP3: "Contemporary regional sea level variability, change and extremes". This WP is to study the

predictability of sea level due to the climate variability. Rui Ponte talked about the causal reasons of global, regional, local sea level change, which may include non-linear effects (eddies), internal variability such as ENSO, IOP, AMO, NAO and so on. He stated the necessity to find out the climate variability on SL and address the model shortcomings. Catia showed an example in the data intercomparison experiments that the differences in the mapping of upper-ocean heat content in 2008 by different agencies with the same data were surprisingly large. She stated that an integrated observing system was quite necessary. Kevin Horsburgh, also the chair of the JCOMM ETWCH forecasting system, introduced the JCOMM activity relevant to WCRP GC extremes. During the discussion, David Holland and Robert Nicholls proposed the topic of this WP is too broad. The WP member agreed to narrow the scope, not trying to do everything, but to find the gap and push it. Questions and suggestions out of this WP include:

- Quantify internal variability;
- Diagnose the mechanisms of climate variability of SL;
- Assess realism of the goals;
- Investigate possible dependencies of the variability;

WP 4: Predictability of regional sea level

Jonathan Gregory gave a presentation on WP 4 theme “Predictability of regional sea level”, co-worked with Jianjun Yin. He stated the predictability was limited by the mode uncertainty, heat uptake uncertainty, and geographical variation. Large spread existed in the predictions among different models. Wind stress and heat flux had significant effect on SL. He also suggested to unify the terminology in SL, for example, to use one chapter in the white paper of SL to define good terminology and clarify the definitions. Jonathan also mentioned about need of the member recruitment of this WP. Detlef replied the enrolling of WP 4 could be endorsed by OMDP or SSG of CLIVAR. Questions and suggestions out of this WP include:

- Define climate feedback parameters in ocean models;
- Where should the freshwater input from the melting ice sheets put into climate models?
- What is the temperature of ice melt water getting into the water?
- Is the irreversibility of Greenland ice sheet still an open question?
- Projection for anthropogenic intervention in terrestrial hydrology;
- Investigate ocean response to climate change in models.

ACTION*: Write supporting letters to CMIP6 for FAFMIP and ICEMIP6 (Detlef).*

WP 5: Sea level science for coastal zone management

Robert Nicholls, together with Kathy McInnes and A.S. Unnikrishnan, presented a talk on the WP 5 theme “Sea level science for coastal zone management”. Coastal area is a small portion on the earth, but the population concentrates mostly in this area, so SL issue did have significant impact on human beings. Robert stated that the definition of coastal zone area depends on the slope, the coastline is also hard to define. In the discussion of tsunami or storm surge induced SL change, the team agreed that the weather timescale phenomena were not issues our group would deal with, but the SL change may alter the climatology that could change the intensity of the storm surge. The importance of two-way dialogue between the scientists and coastal zone management were also stated. The team agreed that we do not provide solution to the coastal zone management, but estimate the very likely range. David Holland suggested that we could select several regions, like some developing areas and New York to provide SL

information. Serious land subsidence in large coastal cities were reported, such as in Tianjin, Shanghai, Guangzhou of China. The team also discussed the way to include Extremes into the GC. A possible way is to put it into WP 5. Questions and suggestions out of this WP include:

- DEM of areas below 10m for the global coastal line (including islands);
- What information is required to inform coastal zone management and climate mitigation?
- Definition of climate extremes;
- Look backward the historical impacts and adaptation;
- Short term events: what we know and where do we need research?
- Notes on extremes observing system;
- Information required for good adaptation;
- Document: Usage of sea level information for coastal communities

Based on the discussions on the five WPs, each WP was asked to revise its text with the new structure as follows:

1) Title
2) Leads
3) Supporting leads
4) Challenges
5) Approach
6) Deliverables
7) Next Steps
8) Linkages

In the new structure, a new section “next step” was added, and three sections “Challenges”, “Approach” and “Linkages” were asked to be further revised and expanded.

Detlef proposed the writing of a White Paper on SL, to summarize the scientific status of the topic. The White Paper is planned to be initiated by the co-chairs on what is required for sea level research, what the challenges are and what is required to solve them. The next step is to write a book on SL by compiling all the white papers. This book is supposed to be an educational textbook, and also used to inform the other communities.

***ACTION**: Initiate SL White Paper to summarize the scientific status of the topic (co-chairs).*

***ACTION**: Revises its text with the new structure (all).*

***ACTION**: Cleans up a newer version of Science Plan, with version number (Detlef).*

4. Planning of the SL science conference and summer school

An important SL meeting “Workshop on Understanding Sea-level Rise and Variability” hosted by the IOC of UNESCO was held in Paris June 6-9, 2006. The workshop was organized by WCRP to bring together all relevant scientific expertise with a view towards identifying the uncertainties associated with

past and future sea-level rise and variability, as well as the research and observational activities needed for narrowing these uncertainties. There were 163 scientists from 29 countries attending that workshop.

As the ten years' anniversary of the Paris workshop, WCRP GC SL steering team is planning an SL conference in 2016. Some details of the conference organizing was discussed in the meeting.

This conference is expected to bring 500-600 participants. The co-chairs of GC SL steering team serve as the chairs of the conference. The Scientific Steering Committee include GC SL steering team plus John Church and Philip Woodworth joined as the advisors. The conference is planned to be organized with only plenary sessions, no parallel sessions. The length of the meeting is five days. There will be about 20 invited speakers and ECS presenting in the meeting. It is also mentioned that if the year 2016 is a little rush to arrange such a large-scale meeting, 2017 will also be an option.

The potential venue include New York, Singapore, Boston, Hong Kong, Guangzhou, and Tokyo. Detlef Stammer will write a letter about the conference vision and statement to WCRP and IOC for support, will also clarify with IOC the connection to United Nations headquarters if the venue is selected in New York.

***ACTION**: Write letter about the 2016 SL conference to WCRP and IOC for support (Detlef).*

The summer school issue was also discussed in the meeting. Summer school on SL will be planned every two years to train young scientists. The next one will be in this year. Considering the SL is too broad while summer school need to be specific, one topic one time will be adopted for the summer school to narrow the topic. The expected number of student is 40. Detlef stammer will check with EGU about summer school issue. Opportunities to cooperate with AGU and ESA were also clarified.

***ACTION**: Draft plan of SL summer school 2015, including schedule and topic.*

Appendix A: Agenda

19th and 20th of March, 2015.
Beginning: 10:00, Thursday, March 19, 2015
Ending: 16:00, Friday, March 20, 2015

Major objectives of the meeting:

1) Discussing and finalizing the science in and implementation of work packages
2) Start the planning for the Sea Level Conference 2016 (with a second planned a few years later, e.g., 2021).

Day 1: March 19, 2015
Meeting room: Groeneman Building B1.09

10:00 **Opening of the meeting, goals of the meeting, logistics, etc**

- Summary of Status of the GC and Work ahead of us
- Review of science plan for last adjustments

Discussion of each WP with respect to work plan, implementation, membership of WG, schedule, etc.

11:00 WP 1: **An integrated approach to paleo time scale sea level estimates**
Discussion leads: Natalya Gomez, Roderik van de Wal, Mark Tamisiea

14:00 WP 2: **Quantifying the contribution of land ice to near-future sea level rise**
Discussion leads: Tony Payne, David Holland, Roderik van de Wal, Ayako Abe-Ouchi

16:00 WP 3: Contemporary regional sea level variability, change and extremes
Discussion leads: Rui Ponte, Catia Domingues, Benoit Meyssignac, Kevin Horsburgh, Detlef Stammer

18:00 Adjourn for the day

Day 2: March 20, 2015
Meeting room: Langeveld Building E1.24

8:30 WP 4: Predictability of regional sea level
Discussion leads: Jonathan Gregory, Jianjun Yin, Tony Payne, Detlef Stammer

11:00 WP 5: Sea level science for coastal zone management
Discussion leads: Robert Nicholls, Goneri Le Cozannet, S. Unnikrishnan, Kathy McInnes, Kevin Horsburgh, Pietro Teatini

13:00 Sealevel Conference 2016
Discussion leads: Detlef Stammer.

14:00 **Any Other business:**
Discussion leads: Detlef Stammer

- Interactions between WPs
- General Activities
- Review national programs

16:00 Adjourn and transportation to airport

Appendix B: List of participants:

Name	Affiliation, Country	
Detlef Stammer	CEN, Germany	GC Lead, Co-chair
Roderik van de Wal	U. Utrecht, The Netherlands	Co-chair
Robert Nicholls	U. Southampton, UK	Co-chair
Kevin Horsburgh	NOC, UK	member
Natalya Gomez	Harvard, USA	member
Mark Tamisiea	NOC, UK	member
Tony Payne	U. Bristol, UK	member
David Holland	Courant, USA	member
Rui Ponte	AER, USA	member
Catia Domingues	U. Tasmania, Australia	member
Benoit Meyssignac	LEGOS, France	member
Jianjun Yin	U. Arizona, USA	member
Jonathan Gregory	U. Reading, UK	member
A.S. Unnikrishnan	NIO, India	member
Gonéri Le Cozannet	BRGM, France	member
Kathy McInnes	CSIRO, AU	member
Pietro Teatini	U. Padova, Italy	member
Lei Han	FIO, China	ICPO