

## **REPORT OF WORKING GROUP 20 ON EVALUATIONS OF CLIMATE CHANGE PROJECTIONS**

The fifth and final meeting of Working Group on *Evaluations of Climate Change Projections* (WG 20) was held from 14:00–17:00 hours, October 24, 2010 in Portland, U.S.A. The Co-Chairman, Dr. Michael Foreman, called the meeting to order and, after introductory formalities, WG 20 member, Dr. Muyin Wang, kindly agreed to act as the rapporteur.

### AGENDA ITEM 3

#### **Review of Working Group Terms of Reference and summary of accomplishments**

Dr. Foreman began the meeting with a recap of the WG 20 Terms of Reference (TORs) and a summary of activities addressing each one (*WG 20 Endnote 3*). It was generally felt that significant progress had been made with the IPCC GCM evaluations (#1), the development of regional climate models (RCMs) (#3), collaboration with other PICES expert groups like CFAME and WG 25 (#2), and convening PICES and international workshops/sessions (#5).

### AGENDA ITEM 4

#### **WG 20 final report**

As WG 20 completed its tenure at this PICES meeting, a primary discussion point was the structure and content of the final report. It was agreed that each of the Working Group member chapters should summarize work accomplished *versus* the Terms of Reference and be 10–20 pages long. With an expectation of contributions from all Working Group members, the following chapter outline was put forward:

1. Acknowledgments, Abbreviations and Acronyms, Executive Summary,
2. Introduction: Background, Terms of Reference, Membership, Outline,
3. Wang, Overland, Bond: GCM downscaling procedures and examples,
4. Di Lorenzo, Miller: regional climate modeling and covariability in North Pacific,
5. Foreman and colleagues: RCM development for BC shelf waters,
6. Christian: GCM carbon cycle development,
7. Curchitser, Hermann: RCM development for the NE Pacific and Bering Sea and two-way coupling of this RCM into the NCAR GCM,
8. Ustinova, Zuenko: evaluation of climatic variability in Far Eastern Seas,
9. Navrotsky: interactions between climate and ecosystems,
10. Yamanaka, Hasumi, and colleagues: ecosystem projections for the Kuorshio/Oyashio system,
11. Jang, Pang, Yeh, Oh and colleagues: GCM projections of changes to mixed layer depth,
12. Qiao, Wang, Wu and colleagues: Chinese contributions,
13. Summary and recommendations.

It was emphasized that the final report is considered “grey literature” and will not be formally reviewed. As such, individual chapters should only give highlights of work that is either planned for publication, or has already been published. For specific PICES formatting requirements authors were referred to [http://www.pices.int/publications/scientific\\_reports](http://www.pices.int/publications/scientific_reports). The PICES Secretariat will technically edit the report and although MS Word files are preferred, other formats are acceptable (*e.g.*, LaTeX equations will be converted to MathType). Tables can either be in Word or Excel (no images of tables) and though the figures can be in any one of the common various formats (*e.g.*, eps, tiff, jpg), they should be good quality and use greyscale if colour is not necessary. Chapters should be sent to Dr. Foreman by December 31, 2010, with earlier submissions preferred.

As PICES Science Board and Governing Council are particularly interested in the recommendations from this Working Group, Dr. Foreman presented four possibilities (WG 20 Endnote 4) that will hopefully be expanded

## WG 20-2010

and extended in the final report. Draft Terms of Reference for a new working group on “North Pacific Climate Variability and Change” that was proposed by Drs. Emanuele Di Lorenzo and Shoshiro Minobe were also presented and discussed along with the four recommendations. Several comments were made asking for clarification of terminology (*e.g.*, conceptual mechanistic model), time scales, and scope, and these were recorded so they could be passed on to Drs. Di Lorenzo and Minobe. Possible membership (*e.g.*, the need to bring in new people) was also discussed.

### AGENDA ITEM 5

#### **Update on FUTURE and its Advisory Panels**

Dr. Hiroaki Saito, Chairman of the FUTURE Advisory Panel on *Climate, Ocean Variability, and Ecosystems* (COVE-AP), gave a brief summary of its meeting on October 22. COVE-AP fully supports the proposed new “climate” working group and is proposing both another new working group on “Ecosystem Responses to Multiple Stressors “ and a workshop on “*Indicators of status and change within North Pacific marine ecosystems: A FUTURE workshop*” to occur just before or after the inter-sessional Science Board meeting in April 2011.

### AGENDA ITEM 6

#### **Other business**

Dr. Anne Hollowed gave a brief summary of recent activities of the joint PICES/ICES WG on *Forecasting Climate Change Impacts on Fish and Shellfish*. Though this Working Group ends in 2011, its high productivity has spawned discussion on how it will continue within each the ICES and PICES frameworks. Regardless of how the Group is re-structured, there will be an ongoing need for IPCC GCM and RCM projections so Dr. Hollowed was supportive of WG 20 recommendations on how that might be done.

No other business was discussed and the meeting was adjourned at 17:00. Dr. Foreman thanked all members for their contributions over the four-year tenure of the Working Group.

### **WG 20 Endnote 1**

#### **WG 20 participation list**

##### Members

James Christian (Canada)  
Enrique Curshitser (U.S.A.)  
Michael Foreman (Co-Chairman, Canada)  
Arthur Miller (U.S.A.)  
Elena Ustinova (Russia)  
Muyin Wang (U.S.A.)

##### Observers

Teresa A'mar (U.S.A.)  
Kyung-Il Chang (Korea)  
Anne Hollowed (U.S.A.)  
Chan Joo Jang (Korea)  
Dong-Jin Kang (Korea)  
Jung Jin Kim (Korea)  
Yuichiro Kumamoto (Japan)  
Jae Hak Lee (Korea)  
Tim Lee (U.S.A.)  
Hanna Na (Korea)  
Jae-Hyoung Park (Korea)  
Thomas Royer (U.S.A.)  
Toshi Saino (Japan)  
Hiroaki Saito (Japan)  
Sinjae Yoo (Korea)  
Yury Zuenko (Russia)

**WG 20 Endnote 2****WG 20 meeting agenda**

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda and appointment of rapporteur
3. Review of WG Terms of Reference and summary of accomplishments
4. WG 20 final report:
  - a. Organization, contents, formatting
  - b. Chapter assignments and deadlines
  - c. Recommendations for FUTURE
    - i. TOR for a new WG
5. Update on FUTURE and its Advisory Panels (Hiroaki Saito)
6. Other business
7. Adoption of meeting report for presentation at POC committee meeting

**WG 20 Endnote 3****Summary of WG 20 activities versus Terms of Reference**

1. To analyze and evaluate climate change projections for the North Pacific and its marginal seas based on predictions from the latest global and regional models submitted to the Inter-governmental Panel on Climate Change (IPCC) for their 4<sup>th</sup> assessment report.
  - Several Wang/Overland/Bond papers published evaluating global climate models (GCMs) and their projections in North Pacific and Arctic,
  - Di Lorenzo, Miller and colleagues: conducted NPGO analyses of IPCC model results,
  - Hasumi and colleagues continued analyses and improvements to Japanese GCM (MIROC),
  - Yamanaka and colleagues continued analyses of ecosystem models coupled to Japanese GCM,
  - Qiao and colleagues studied GCM improvements by addition of surface waves,
  - Ustinova and colleagues evaluated climate variability in Far Eastern seas,
  - Jang and colleagues studied GCM projected mixed layer depth changes in North Pacific,
  - Foreman and colleagues evaluated GCM winds off BC.
2. To facilitate analyses of climate effects on marine ecosystems and ecosystem feedbacks to climate by, for example computing an ensemble of the IPCC model projections for the North Pacific and making these projections available to other PICES groups such as CFAME.
  - Worked with CFAME,
    - Conducted joint workshops at PICES Annual Meetings, and April 2008 workshop in Hawaii,
    - Contributed to the final report and co-authored publication,
  - Working with WG25 – joint PICES/ICES WG-FCCIFS,
    - Foreman, Yamanaka are WG 25 members,
    - Co-convened Theme Session on “*Downscaling variables from global models*” in which WG 20 members participated in, at the International Symposium on “*Climate change effects on fish and fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*”, April 2010 in Sendai, Japan,
    - Manuscripts were submitted to ICES Journal of Marine Science
  - Yamanaka and colleagues continued development and analyses of an ecosystem model coupled to Japanese GCM
3. To facilitate the development of higher-resolution regional ocean and coupled atmosphere–ocean models that are forced by, and take their boundary conditions from, IPCC global or regional models.
  - RCMs developed, or under development, for:
    - California shelf (Auad, Miller, Di Lorenzo),
    - NE Pacific and Bering Sea – fully coupled to NCAR GCM (Curchitser *et al.*),

## WG 20-2010

- BC shelf (Foreman *et al.*),
  - Washington-Oregon shelf (Bond, Hermann, Curchitser),
  - Kuroshio region (Kurogi, Hasumi, Tanaka),
  - Curchitser participated in RCM workshop in September,
  - Japanese have 0.25° resolution GCM.
4. To facilitate the development of local and regional data sets (*e.g.*, SST, river flow, sea ice cover) incorporating information from climate model projections as well as observations and historical re-analyses.
    - Augmenting a data set of buoy wind measurements off the BC coast by filling gaps over the last decade with values from a NASA archive and analysing 50-year time series for trends in magnitude or timing,
    - Argo float data freely available (Freeland has given several summaries at POC meetings),
    - See recommendation #3.
  5. To ensure effective two-way communication with CLIVAR.
    - CLIVAR representatives gave presentations at WG 20 business meetings or co-sponsored workshops at several PICES Annual Meetings,
    - A close relationship has been maintained with ESSAS (Wang, Curchitser).
  6. To convene workshops/sessions to evaluate and compare results.
    - Conducted annual workshops at all PICES meetings,
      - 3 jointly with CFAME,
    - Participated in the CFAME inter-sessional workshop on “*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*” in Honolulu, April 2008,
    - Co-convened a Theme Session on “*Climate model projections*” at the International Symposium on “*Effects of climate change in the World’s oceans*”, May 2008 in Gijón, Spain,
    - Co-convened a Theme Session on “*Downscaling variables from global models*” at the International Symposium on “*Climate change Effects on Fish and Fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*”, April 2010 in Sendai, Japan.
  7. To publish a final report summarizing results.
    - Proceeding.

## WG 20 Endnote 4

### Draft recommendations for the final report

1. Continue evaluating IPCC GCM (and RCM) results.
  - a. James Overland, Muyin Wang, Chan Joo Jang (and others?) plan evaluations of new AR5 outputs when they are available (winter 2010–11?);
  - b. WG 25 (joint PICES/ICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish*) will be interested in these forecasts;
  - c. The RCM community is hoping to have a chapter in AR5;
  - d. Besides continuing Japanese GCM/ecosystem model studies (Yamanaka and colleagues), several North Pacific RCMs are under development that are being, or could be, coupled to ecosystem models (*e.g.*, Curchitser, Hermann, Rose *et al.*);
  - e. This activity may not warrant a new Working Group but the work should be part of COVE-AP and/or SOFE-AP.

2. Continue analyses of North Pacific inter-annual to inter-decadal variability. This would be an extension of the PICES-2009 workshop on “*Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales*” (W8) convened by Emanuele Di Lorenzo and Shoshiro Minobe.
  - A new working group, under POC and with COVE-AP’s support, has been proposed (*WG 20 Endnote 5* has the draft Terms of Reference);
  - IPCC-AR5 will include decadal predictions. Unlike GCM predictions that should only be evaluated statistically, these decadal predictions should be directly comparable with subsequent observations. An analysis of these predictions could be part of SOFE.
3. Establish live-access servers or ftp sites to archive and provide easy access to results from RCMs, analogous to the PCMDI archive for IPCC GCM results.
  - This would address WG 20 TOR #4, something that was not adequately accomplished during the tenure of the Working Group;
  - It would also provide fisheries scientists (*e.g.*, WG-FCCIFS) with climate change variables on much finer spatial scales than can be resolved with the GCMs.
  - This could be a possible activity for the COVE or SOFE Advisory Panels and TCODE.
4. Provide and regularly update lists of links to GCM/RCM sites like NARCCAP (North American regional climate model results, <http://www.narccap.ucar.edu/>) and to relevant publications like the “Guide to Best Practices on the Use of Climate Models” (Overland *et al.*).

#### WG 20 Endnote 5

##### Proposal for a new Working Group on “North Pacific Climate Variability and Change”

#### Motivation

The need to develop essential mechanistic understandings of North Pacific climate variability and change that can better guide the formulation of process-based hypotheses underlying the links between ecosystem dynamics and physical climate.

#### Draft Terms of Reference

1. Develop conceptual mechanistic models or frameworks of North Pacific climate variability and change that can be readily used by ecosystem scientists to explore hypotheses of the links between ecosystem dynamics and physical climate.
2. Summarize the current understanding of mechanisms of Pacific climate variability, and evaluate the strengths of the underlying hypotheses with supporting evidence.
3. Coordinate, in conjunction with ecosystem scientists, the development and implementation of process-based models to hindcast the variability of available long-term biological time series.
4. Provide improved metrics to test the dynamics of the IPCC models.
5. Understand and fill the gaps between what the physical models can currently produce and what ecosystem scientists suggest are important physical forcing factors required for predicting species and ecosystem responses to climate change.
6. Maintain linkages with, and summarize the results from National and International programs/projects such as CLIVAR, IMBER, US CAMEO, ESSAS, Japanese Hot Spot in the Climate System, POMAL, CREAMS EAST-I, POBEX, and others.
7. Convene workshops and sessions to evaluate and compare results.
8. Publish a final report summarizing results.

**Suggested Co-Chairmen:** E. Di Lorenzo (U.S.A.), S. Minobe (Japan), M. Foreman (Canada)