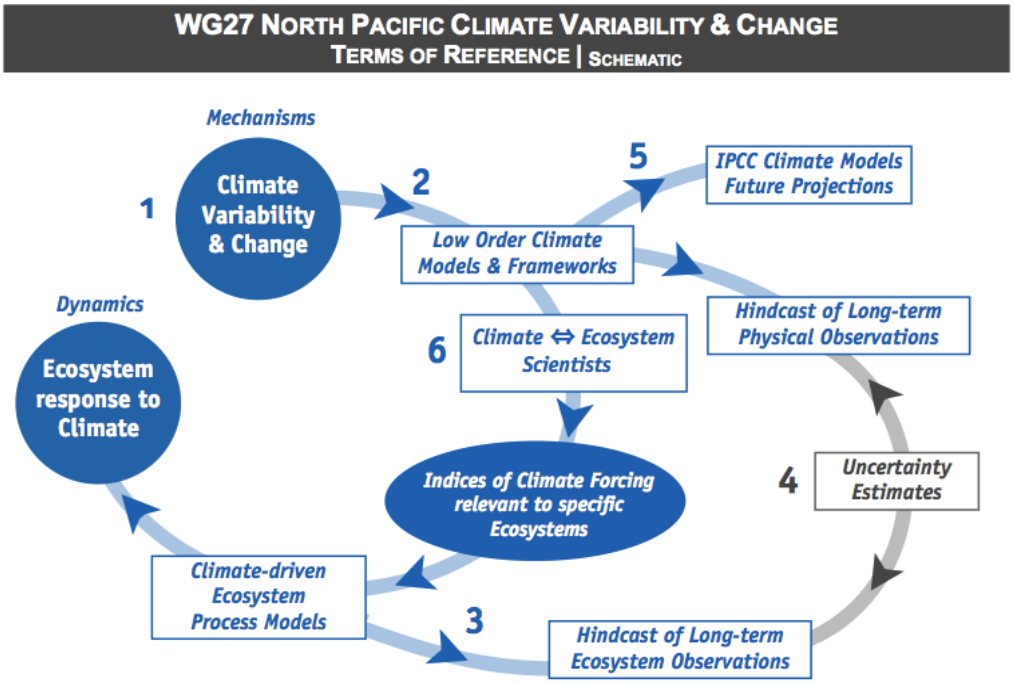
Working Group on *North Pacific Climate Variability and Change*

Despite relatively short time to prepare for the first meeting of Working Group on *North Pacific Climate Variability and Change* (WG 27), WG 27 showed great enthusiasm, with 16 of 19 members attending the meeting at PICES-2011 in Khabarovsk, Russia (*WG27 Endnote 1*). The business meeting agenda (*WG 27 Endnote 2*) began at 9:00 h with participants introducing themselves and briefly summarising their research.

AGENDA ITEM 2
Overall views for the Working Group

As many of the WG members were new to PICES, Co-Chairman, Dr. Michael Foreman, gave a short presentation outlining how such groups are organized within the structure of PICES and their obligations for reporting, meeting, and sponsoring workshops and topic sessions. The benefits of having links to other expert groups in PICES, specifically the proposed initiative on climate change effects on marine ecosystems and the proposed new working group on regional climate modelling, were presented and emphasised.

Co-Chairmen, Drs. Shoshiro Minobe and Emanuele Di Lorenzo, reviewed WG 27 terms of reference (TOR) and Dr. Di Lorenzo presented a schematic summarising the terms of reference and the necessary steps to attain those goals. Dr. Minobe also emphasized how the WG is a good opportunity to increase the value of POC disciplines in PICES, and the value of PICES in the wider physical oceanographic and climate communities.



AGENDA ITEM 3
Presentations on topics relevant to terms of reference

In the main part of the meeting, each participant was given the option of providing a short presentation outlining facets of their research which were relevant to the TOR. All WG members exercised this option and key points of these presentations are summarized in *WG27 Endnote 3*.

AGENDA ITEM 3
Discussion for specific plans and schedule

The meeting then revisited the TOR, and for each of the first six, a list of members interested in directing some of their research in that direction was made. These lists are included along with the TOR (*WG27 Endnote 4*). Following this discussion, action items for each of the TOR were also developed and are listed in *WG27 Endnote 5*.

Dr. Di Lorenzo suggested that the working group have its own webpage and presented a prototype (*WG27 Endnote 6*) with several sub-links designed to facilitate communication among the group, to the PICES community, and to the general public. The plan is to have this webpage housed at the Georgia Institute of Technology, where there are fast servers, and to have a link on the PICES webpage.

No other business was discussed and the meeting was adjourned at about 17:45 h. Dr. Minobe thanked all participants for their presentations, discussion, and commitment to conducting research directed at specific terms of reference.

WG 27 Endnote 1

WG 27 participation list

Members

Soon-Il An (Korea)
Steven Bograd (USA)
Enrique Curchitser (USA)
Shoshiro Minobe (Co-Chairman, Japan)
Emanuele Di Lorenzo (Co-Chairman, USA)
Michael Foreman (Canada)
Shin-ichi Ito (Japan)
Chan Joo Jang (Korea)
Xiaopei Lin (China)
Guimei Liu (China)
Takashi Mochizuki (Japan)
Tatyana Pavlova (Russia)
Bunmei Taguchi (Japan)
Elena Ustinova (Russia)
Sang-Wook Yeh (Korea)
Yury Zuenko (Russia)

Observers

Robin Brown (Canada)
Kyung-Il Chang (Korea)
Anne Hollowed (USA)
Dosoo Jang (Korea)
Suam Kim (Korea)
Mi Hye Lee (Korea)
Vyacheslav Lobanov (Russia)
Olga Trusenlova (Russia)

WG 27 Endnote 2

WG 27 meeting agenda

1. Welcome and self-introduction
2. Overall views for this working group (Foreman, Di Lorenzo, Minobe)
3. Short presentations for topics relevant to TORs from each member (10 min)
4. Discussion for specific plans and schedule

WG 27 Endnote 3

Summary of members' research areas and interest

1. Soon-Il An:

- The forcing of the PDO (diagram) is made up of Kelvin Waves, ENSO → AL connection and also SSH thermocline variations in the KOE.
- AR-1 model to reconstruct PDO using all components shows KOE, ENSO ocean and atmospheric teleconnections are important.
- Use AR-1 model to diagnose IPCC models. Controlled mostly by North Pacific modes and weak connection to ENSO.
- PMIP models to understand if PDO and ENSO coupling in a changing climate is modulated in time → when ENSO is weaker and teleconnection pattern may have changed PDO is still strong and driven by AL.
- Explore these dynamics in CMIP5 and paleoclimate simulations.
- Question: feedback from KOE → AL → PDO?

2. Chan Joo Jang:

- MLD depth in IPCC models → improved better metrics for IPCC models. MLD depth shows strong dipole change over the KOE region. Stronger wind stress between 30–40°N drives MLD change → SST and Qnet.
- IPCC model have strong biases in the mean, shallower North of KOE and deeper south of the KOE. Future changes in MLD pattern similar to bias.
- MLD projected changes are strong in the KOE but also show a pattern in the return eastern boundary current (shallowing).
- MLD variance also changes.
- Question: how important is MLD depth and variance for ecosystem processes?
- Question: is KOE position related to changes in MLD depth?

3. Sang-Wook Yeh:

- Warm pool SST impacts on North Pacific climate variability and change == teleconnection from tropics to extra-tropics and mean trend of warm pool → mean NPGO like changes in North Pacific. 2nd mode warm pool mode captures trend and connected to NPGO.
- Warm pool trend shift Aleutian Low → mean NPGO-like pattern in the extra-tropical SST (cartoon diagram). Evidence that the NPGO amplitude is increased.
- Question: Does NPGO force changes in North Pacific atmospheric circulation and teleconnection with ENSO?

4. Bunmei Taguchi:

- Decadal variability in the KOE (2007 study) showing shift and intensification (speed) of mode. 2nd mode important for sardines. Large-scale waves are important but it is the frontal scale dynamics that ultimately downscale the signal.
- Frontal scale dynamics impact the large-scale circulation with a possibility of dual way interactions.
- Frankignoul *et al*. 2011, *Yeh et al.* 2011.

- Atmospheric patterns are driven by SST frontal structures but there is still debate on what is the actual pattern of the response.

5. Enrique Curchister
- Regional coupled models, improving biases in eastern boundary current, nesting regional models in climate models. Feedback from regional scale to basin-scale climate variability
- Coupled model of ocean and fish to be used to explore how the regional expression of climate impacts ecosystem variables and develop process model to capture how climate signals impact ecosystem variables the essential connecting dynamics.
- SODA output for North Pacific 5 days output (.25 resolution).

6. Steven Bograd
- Long-term variability in the California Current, phenology, climate change effects on top predator. Developing hypotheses to link physical forcing to ecosystem variability and develop climate-driven ecosystem models.
- Understanding long-term trends in nutrients and oxygen that are coherent → hypothesis developed about ventilation rates. Testing this hypothesis could be an important activity.
- Biogeochemical emphasis.
- Trends and decadal changes in the spring transition connected to 2nd mode → large-scale climate.
- Niches of animals inferred from tagging shows a connection to ocean properties.
- large-scale climate affects these properties → empirical model to connect to habitat.

7. Michael Foreman:
- TOR number 4. Long-term timeseries of winds off BC coast 50 year.
- CUI dynamics along the entire North American coast (timing and strength and its relation to climate) use Foreman data with CCS data.
- Increase wind variability trend.
- Gillet 2003 trends in SLP.

8. Patrick Cummins (presented by M. Foreman)
- Timeseries of SST and salinity at lighthouses.
- SST connected to PDO.
- Salinity local signal still to be explained.

9. Shoshiro Minobe
- TOR number 4: estimating uncertainties in the decadal signals using an AR-1 model.
- 2000s phase reversal to weakened Aleutian low and positive phase of PDO occurred for sure.

10. Xiaopei Lin:
- Western Pacific Current impact on climate change.
- Warming trend related to ocean advection, on the other hand latent heat flux is cooling.
- Mechanism driving this trend remain unclear.
- Dipole mode related to the KOE mode.
- Regional air-sea coupled model (WRF + ROMS) covering most of Asia and western Pacific.
- Question about the validity of SST data in the Yellow Seas.

11. Shin-Ichi Ito
- Pacific saury projections using Nemuro fish forced by IPCC model outputs.

12. Elena Ustinova
- Climate variability and change in far eastern seas and adjacent areas.

13. Guimei Liu
- Regional ocean, biological, and carbon coupled model for the South China Sea.
- 30-yr integration of a 0.125-degree OGCM over the North Pacific.

14. Yury Zuenko
- Finding adequate indices to connect physical variability to ecosystem measure in the Japanese sea.
- Arctic Oscillation (AO) seems very relevant but not ENSO (although lag relationship has not been explored).

15. Tatiana Pavlova
- Analysis of AOGCMs in the Arctic region. Multi-mode ensembles analysis.

16. Takashi Mochizuki
- Decadal projection with MIROC show some skill in predicting the PDO, defined as 0–400 m averaged water temperature EOF1, for several years.
- They perform assimilation to initialize the decadal state and then ensemble runs are performed to asses the skill of prediction.

17. Emanuele Di Lorenzo
- PODX: Pacific Ocean Decadal/Climate Change Study: Di Lorenzo, Schneider, Vimont, Newman, Cobb.
- AR4/AR5 climate model simulations and paleo data.
- How do AR4 model capture these pacific decadal modes?
- Furtado *et al*. 2011.
- AR4 models (Ensemble mean): looks good for AL/PDO, but NPO is good SST2 is bad.
- Also, bad for ENSL→AL, CPW (shifted west) →NPO, NPGO→CPW.

WG 27 Endnote 4

Terms of reference: Members' involvement

1. Summarize the current understanding of mechanisms of Pacific climate variability and change, and evaluate the strengths of the underlying hypotheses with supporting evidence.
   (*Members involved: Di Lorenzo, Taguchi, Ustinova, Minobe*)
2. Develop conceptual frameworks and low-order models of North Pacific climate variability and change, which can be used by climate researchers to investigate the mechanisms of those variations and by ecosystem scientists to explore hypotheses linking ecosystem dynamics and physical climate.
   (*Members involved: Xiaopei Lin, Soon Il, Sang-Wook, Di Lorenzo, Minobe*)
3. In conjunction with ecosystem scientists, coordinate the development and implementation of process-based models, which include important processes in simple forms, to hindcast the variability of available long-term biological time series.
   (*Members involved: Foreman, Guimei, Bograd, Ito, (Hollowed), Di Lorenzo, Curchister*)
4. Develop a method to identify and provide uncertainty estimates of decadal variability in recent historical climate and ecosystem time series.
   (*Member involved: Minobe)*
5. Provide improved metrics to test the mechanisms of climate variability and change in IPCC models, and in coordination with other PICES working groups and FUTURE Advisory Panels, assist in evaluating those models and providing regional climate forecasts over the North Pacific.
   (*Members involved: Di Lorenzo, Yeh, Jang, Guimei, Pavlova, Bograd, Mochizuki*)
6. Understand and fill the gaps between what physical models can currently produce and what ecosystem scientists suggest are the important physical forcing factors required for predicting

species and ecosystem responses to climate variability and change.
(*Members involved: Foreman, Guimei, Bograd, Ito, (Hollowed), Di Lorenzo, Curchister*)

7. 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.
(*Most members are heavily involved in these organizations)*
8. Convene workshops and sessions to evaluate and compare results and maintain an awareness of state-of-the-art advances outside the PICES community.
9. Publish a final report summarizing results.

WG 27 Endnote 5

Action items for 2011–2012

TOR 1 and 2: TOR 2 Dr. Minobe will produce a simple mathematical framework or simple model to capture and quantify the known mechanisms of Pacific climate variability with Dr. Di Lorenzo and Foreman by the end of 2011. This review will be submitted in January 2012 to the other members for discussion. Dr. Di Lorenzo will also implement a Linear Inverse Model (LIM) for quantifying and testing the dynamics of the links between the different modes of Pacific climate variability.

TOR 3: Drs. Minobe and Di Lorenzo will lead an effort to update and expand the Hare and Mantua (2000) ecosystem dataset and re-interpret the results in light of the recent advances in our understanding of Pacific climate variability. We will also attempt to include other ecosystem data from Drs. S. Chiba, S. Bograd and J. Keister.

TOR 4: Dr. Minobe will continue to develop methods for estimating uncertainties in the physical indices. Methodologies for ecosystem uncertainties will be address at a later stage when the first process models become available.

TOR 5: Drs. Di Lorenzo and An are currently publishing papers that use metrics from low-order climate models to evaluate the IPCC models. Other members are also conducting research that falls under this TOR. We plan to review all these findings at the next meeting together with results from research activities of other non-members.

TOR 6: We will begin by establishing a connection with new P/ICES initiative on climate change effects on marine ecosystems as well as reviewing PICES Scientific Report No. 34 (Forecasting Climate Impacts on Future Production of Commercially Exploited Fish and Shellfish, A.B. Hollowed, R.J. Bramish, T.A. Oakey and M.J. Schirripa (Eds.), 2008) which provides a comprehensive review of several hypotheses of how ecosystem variables are linked to physical parameters.

WG 27 Endnote 6

Website development

The WG 27 webpage includes motivation, terms of references, member list, and links to video presentation for proposal of the working group (April 2011) and to the FUTURE project, which is the current central project of PICES.