

Report of Working Group 29 on *Regional Climate Modeling*

The second business meeting of working group (WG 29) on Regional Climate Modeling (RCM) was held in Nanaimo, Canada, on October, 12, 2013 preceding the PICES Annual Meeting. With 17 members and observers in attendance (*WG 29 Endnote 1*), the meeting agenda included an introduction to WG 29 by Co-Chairmen, Drs. Enrique Curchitser and Chan Joo Jang's brief overview to each member nation Regional Climate Modeling (RCM) activity. After short presentations by the RCM working group members, the members discussed some emerging RCM issues, plans and schedule of future activity and preparation of the group's final report. Below are the agenda items (*WG 29 Endnote 2*) and the corresponding discussion of the meeting.

AGENDA ITEM 1

Welcome and self-introductions

1. Pre-meeting social to allow members to interact.
2. Introduction to WG-29 activities by Drs. Jang, Curchitser, and Chang
3. Everyone introduced themselves (including new WG 29 members Drs. Panjun Du (China) and Young Ho Kim (Korea) (attendee sheet was circulated)

AGENDA ITEM 2

WG 29 activities

Dr. Curchitser reviewed WG 29's terms of reference and first meeting in Hiroshima, Japan (2012) after which the group discussed emerging issues arising from that meeting.

Regional Climate Modeling 2nd workshop

Dr. Kyung-II Chang reported on the second Regional Climate Modeling workshop held September 10–12, 2013 in Busan, Korea. Dr. Skip McKinnell has distributed a draft article of the workshop which will be published in the PICES Press newsletter (Vol. 22, No. 1, Winter 2014). The 3-day workshop was attended by more than 40 participants and comprised 9 mesoscale and sub-mesoscale presentations on Day 1, 9 RCM presentations on Day 2, 3 climate variability presentations on Day 3, and 7 posters.

Important discussions:

- At what resolution do models converge?
- How useful are idealized models?
- How important are sub-mesoscale processes for climate?
- What can be learned from 1-way nesting?
- RCM-3 could focus on physical-biological and ocean-atmosphere coupling.

WG 29 proposals for 2014 FUTURE Open Science meeting and 2014 PICES Annual Meeting

WG 29's proposal for a Topic Session on "*Regional climate modeling in the North Pacific*" to be convened by Drs. Curchitser and Jang, was accepted by the OSM SSC and will be held on Day 1 of the FUTURE Open Science Meeting (April 15–18, 2014, Kohala Coast, Hawaii). A proposal for a Topic Session (*WG 29 Endnote 3*) by the same name was submitted by Dr. Jang for PICES-2014 (October 17–26, 2014, Busan, Korea).

AGENDA ITEM 3

Updates on national RCM activities

1. ***Panjun Du (China): Forecasting activities and issues in the East China Sea***

Dr. Du described the modeling activities relating to the East China Sea and the issues relating to forecasting there. In particular he described:

- Storm surge and wave forecasting carried out by six regional divisions,
- Data availability from buoy and coastal observing systems,
- Regional ocean model applications using FVCOM:
 - mari-culture application; tide and sandbar forecasting,
 - Shanghai – saltwater intrusion into Yangtse River in the dry season,
 - Storm surges around Zhou Shan Island – high resolution unstructured grid,
 - Temperature rise in Xiangshan harbour (power stations),
 - Future work and improvements.

2. ***Hiroshi Kuroda (Japan): regional ocean model forecasting and hindcasting around Japan***

Dr. Kuroda described the modeling activities with the FRA implementation of the ROMS model. Specifically he described:

- ½ and 1/10 degree resolution implementations for the western Pacific; some finer 1/50 degree (sub-mesoscale) for Kuroshio and Hokkaido, 3DVar and scale-selective data assimilation – spectral nudging (for spatial scales > 100 km) for large domain model,
- The various models are also being applied for fisheries science.

3. ***Shin-ichi Ito (Japan): Water temperature forecasts for cultured scallops in Mutsu Bay, Japan***

Dr. Ito spoke about water temperature forecasts for cultured scallops in Mutsu Bay.

- In 2010 record high temperatures resulted in high scallop mortality,
- Anti-estuary circulation due to anomalous winds was responsible for the mortality,
- A ROMS nested model was implemented down to 1/160 and 1/240 degrees and used to identify conditions that resulted in the anti-estuarine circulation.

4. ***Chan Joo (Korea): RCM development around Korea and CMIP5 analysis***

Dr. Joo discussed the following topics in his presentation:

- Large resource (personnel and computing) requirements are required,
- Coupled atmosphere-ocean model used for NW Pacific; NPZD model for EJS,
- MLD analyses: CanESM2, RCP4.5 so far but more models to come,
- Multi-bias analysis suggests no improvement with CMIP5.

5. ***Young Ho Kim (Korea): climate and regional ocean reanalysis from data assimilation system of KIOST***

- Ensemble optimal interpolation is used for DA (computational demands not as high as other approaches),
- Compared with global climatology, SST in Nino3.4 region, TS cross-sections along 160° and 180°E,
- New open boundary conditions for their model, MOMp1,
- Plan to set up regional ocean forecasting system.

6. ***Jerome Fiechter (USA): Role of Eastern Boundary Current regions in global carbon cycles***

Dr. Fiechter presented results from recent work with a coupled bio-physical regional model for the California Current System. His presentation focused on the model implementation and some early results from that work that included:

- California Current System: ROMS + NEMURO,
- Effect of different horizontal resolutions,
- OCMIP air-sea CO₂ exchange,
- Shelf vs offshore regions,
- More detailed talk on Wednesday (S4),

- Sees daily variability,
- Outgassing in upwelling zone,
- 30km resolution bad, 10km ok, 3km good,
- Map of outgassing vs equilibrium,
- Coastal representation (capes) and bathymetry important,
- Differences in northern and southern CCS for carbon budget,

7. **Dimitry Stepanov (Russia): Numerical study of low frequency variability in JES circulation**

- Ocean model used is INMOM,
- Showed mean circulation at 500m and 1500m; relative vorticity.

8. **Michael Foreman (Canada): Regional ocean climate model projection for the British Columbia continental shelf**

Dr. Foreman discussed the results from two papers that were accepted in Atmosphere-Ocean which focus on regional projections for the British Columbia coast.

9. **Kyung-Il Chang (Korea): WG 29 FUTURE contributions**

- 4 (Julie Hall, Manuel Barange, Phillip Mundy, Hiroaki Saito) out of 6 potential members were in place for the FUTURE Evaluation Team that will meet immediately after the Open Science Meeting to evaluate FUTURE's progress.
- FUTURE products are important, so:
 - How to link WG 29 products to other expert groups?
 - How to identify gaps in FUTURE beyond 2014?
 - In WG 29 final report, need to add summary on how we addressed FUTURE questions.
 - Can we prepare database of future projections (same scenario?):
 - ✓ Perhaps for California Current region (Curchitser), Korea (Jang and/or Chang), Japan (Ito and Kuroda), BC (Foreman)
 - ✓ Need to talk to TCODE (Shevchenko)

The 3rd international symposium on "Effects of climate change on the world's oceans" will take place March 23–27, 2015, in Santos, Brazil. The deadline for symposium theme session and topic suggestions is October 2013. ICES currently has proposed over a dozen topics. Dr. Shoshiro Minobe suggested two topics on:

- impact of climate variability and change on nutrient distributions,
- validation and utilization of earth system models to RCMs.

It was also suggested that a third RCM workshop (RCM3) be held in conjunction with the symposium (jointly with ICES).

AGENDA ITEM 4

WG 29 final report

Dr. Joo presented ideas for a final WG report and along with specific section assignments, will email them to the members. Also discussed was the strategy for data archiving model results that would be available to PICES users:

- What would it entail? Could it be hosted by PICES/TCODE?
- Produce monthly average 3D T, S, velocity, contemporary and future fields? (FUTURE outlooks)
- Do we adopt a unified format and create scripts to facilitate export (would require a lot of work, who?), or do we re-direct users to portals (Japanese, Korean, etc.) for each set of output?
- Important parameters (MLD, nutrients) can come from CMIP5 (Chan Joo Jang, Shoshiro Minobe, Jim Christian already producing), RCM values.

WG 29-2013

AGENDA ITEM 5

WG 29 term extension

The last item proposed by the Co-Chairs and discussed by the group was whether to request a one-year extension to the Working Group. The main reason for the extension is to be able to participate in the upcoming PICES/ICES/IOC symposium in Brazil, where a session on regional modeling was proposed. With the group's agreement, the Co-Chairs agreed to present the request in the POC Committee meeting.



WG 29 meeting participants (left to right): Hiroshi Kuroda, Arthur Miller, Emanuele Di Lorenzo, Shin-ichi Ito, Young Ho Kim, Xingrong Chen, Panjun Du, Angelica Peña, Enrique Curchitser, Elena Ustinova, Kyung-II Chang, Dmitry Stepanov, Chan Joo Jang, Michael Foreman, Hal Batchelder, and Jerome Fiechter.

WG 29 Endnote 1

WG 29 participation list

Members

Chan Joo Jang (Korea, Co-Chairman)
Enrique Curchitser (USA, Co-Chairman)
Dmitry V. Stepanov (Russia)
Jerome Fiechter (USA)
Shin-ichi Ito (Japan)
Hiroshi Kuroda (Japan)
Kyung-II Chang (Korea)
Elena Ustinova (Russia)
Angelica Peña (Canada)
James Christian (Canada)
Michael Foreman (Canada)
Young Ho Kim (Korea)
Panjun Du (China)

Observers

Harold (Hal) Batchelder (USA)
Xingrong Chen (China)
Emanuele Di Lorenzo (USA)
Arthur Miller (USA)

WG 29 Endnote 2**WG 29 meeting agenda**

1. Welcome and self-introductions including introduction of new WG 29 members (Drs. Panjun Du (China) and Young Ho Kim (Korea)) (Co-chairs)
2. Introduction to WG 29 activity (Jang, Curchitser, Chang)
 - a. Brief introduction of WG 29 including Terms of Reference (Jang)
 - b. Review of the first meeting of WG-29 in Hiroshima, Japan (Curchitser)
 - c. Report on the Regional Climate Modeling 2nd workshop in Busan, Korea (Chang)
 - d. Report on WG29 workshop proposals for 2014 Open Science meeting and for 2014 PICES Annual Meeting (Jang)
3. Short update by each member of their nation RCM activity (WG 29 members)
4. Discussion on preparation and timeline of WG 29 final report, and specific plans and schedule (Co-Chairs)
5. WG 29 term extension

WG 29 Endnote 3

**Proposal for a 1-day Topic Session on
 “Regional climate modeling in the North Pacific” at PICES-2014**

Regional climate models are a key scientific tool for understanding climate change at regional to local scale, which is highly relevant to considerations for many socio-economic impacts. Despite the apparent limitations associated with errors in forcing fields and uncertainties in downscaling techniques, regional climate models continue to provide critical information for regional climate change by filling the gap between projections by global climate models and demand for developing adaptation and mitigation strategies at highly resolved scales. This session calls for papers addressing the recent efforts for regional climate modeling such as developing novel approaches for dynamic downscaling, comparison between regional and global climate model results, detection and evaluation of regional climate changes in the North Pacific Ocean simulated by regional and global climate models, assessment of their uncertainty, and coupling of regional climate models with other Earth system model components such as biogeochemical and ecological models. The session aims to assemble and share existing expertise in recent efforts to regional climate models by providing a platform to discuss their limitations and reliability.

Sponsoring Committees/Program: POC/TCODE/FUTURE

Convenors: ChanJoo Jang (Korea), Enrique Curchitser (USA), Michael Foreman (Canada), Kyung-II Chang (Korea), Shin-ichi Ito (Japan), Angelica Peña (Canada), Hyodae Seo (USA)