

## FUTURE OSM Session on “Regional climate modeling in the North Pacific”

*by Enrique Curchitser and Chan Joo Jang*

A one-day session exploring regional climate modeling in the North Pacific was convened on April 15, 2014, at the FUTURE Open Science Meeting (on the Big Island of Hawaii) to report progress made towards the goals of FUTURE science program. The session was an opportunity for members of the PICES Working Group on *Regional Climate Modeling* (WG 29) to summarize their activities and develop links to other FUTURE efforts.

The topic of regional climate models has generated interest in the PICES community since it recognizes the need to both explore the implications of the global IPCC-class models for PICES member countries and assess state-of-the-science techniques for downscaling global models. Regional downscaling—effectively running models with higher spatial resolution in target areas—of global models is a means of representing climate on time and space scales more appropriate for socio-economic and coastal ocean studies. WG 29 has been focusing on ocean processes and the implications to marine ecosystems.

The session was co-convened by Drs. Enrique Curchitser (Rutgers University, USA) and Chan Joo Chang (KIOST, Korea) and had three invited speakers, Drs. Michael Foreman (Institute of Ocean Sciences, Canada), Arthur Miller (Scripps Institution of Oceanography, USA) and Takashi Mochizuki (JAMSTEC, Japan) and a total of 11 contributed papers. In the first invited presentation, given at the plenary session, Dr. Foreman described new techniques for downscaling climate projections for coastal, coupled physical–biological studies. The technique relies on bias correction of winds from global-scale future projections based on seasonal historical patterns. He demonstrated an application of this technique to the coast of British Columbia where both wind magnitude and direction are crucial to determining the patterns of coastal circulation.

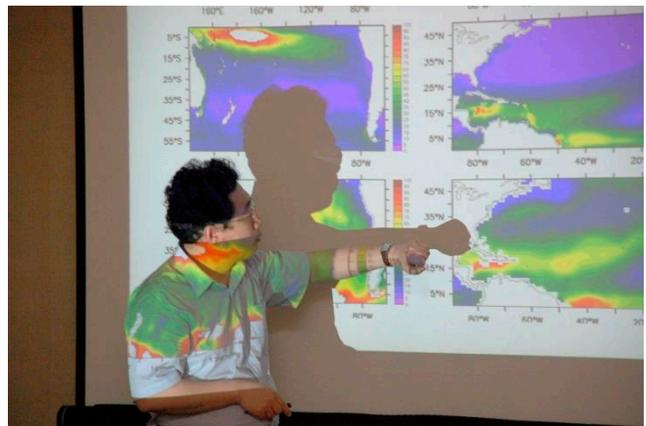


Co-Convenor, Dr. Chan Joo Jang (KIOST, Korea), introducing the list of presentations for the theme session.

Dr. Miller presented results from a coupled ocean–atmosphere regional model of the Kuroshio Extension region, which is characterized by energetic oceanic eddies and fronts. He explored mechanisms for air–sea coupling of high-resolution components and highlighted the important role of the ocean in forcing the atmosphere on regional scales.

Dr. Mochizuki discussed the role of internal model variability to future projections using global models, in particular for the coming decades. He concluded that accurate initial and boundary conditions are essential for developing reliable decadal-scale climate projections.

Other abstracts in the session considered diverse topics and approaches: Downscaled projections of future climate in the California Current (Dr. Francisco Werner); the role of model resolution on the air–sea CO<sub>2</sub> exchange (Dr. Jerome Fiechter *et al.*); regional biogeochemical downscaling in coastal British Columbia (Dr. Angelica Peña *et al.*); ensemble regional predictions in the Bering Sea (Dr. Albert Hermann *et al.*); Dynamical downscaling of global models in the western Pacific (Dr. Chan Joo Jang); the role of a wave mixing parameterization in improving projections (Dr. Fangli Qiao) and a look at a global 1/10° model.



Dr. Fangli Qiao (First Institute of Oceanography, State Oceanic Administration, China) comparing mixed layer depths of two different oceans with and without wave effects.

Overall, the presentations can be categorized into three main topics: 1) additional value (*e.g.*, addressing known biases, coastal currents, *etc.*) derived from regional climate models, 2) regional projections of future climate and 3) applications of regional downscaling to ecosystem studies.

The main topic during the open discussion period focused on the question of what resolution is desirable in regional studies. The participants noted that the answer may depend

on the region and dynamics of interest. Furthermore, it may be necessary to adjust model resolution after an initial exploratory investigation. Another topic during the discussion was on the need and future of ensemble modeling in regional settings and the unique challenges that could emerge. Of note was the conversation on the

expected number of ensemble members and the need for multi-model ensembles. Finally the participants discussed the topic of bias propagation from global to regional models and from physics to biogeochemistry. The discussion focused on ways to identify and quantify model biases in the different model components.



*Dr. Enrique Curchitser (enrique@esm.rutgers.edu) is an Associate Professor at the Department of Environmental Sciences and the Institute of Marine and Coastal Sciences at Rutgers University, USA. His main research interests are at the intersection of climate and ecosystems. His current projects range from downscaled coupled bio-physical modeling in the California Current and Bering Sea, the impact of climate change on coral bleaching in the Coral Triangle and on the role of the Gulf Stream in the climate and social systems of the northeast U.S. He is a member of the PICES Physical Oceanography and Climate Committee, Working Group 27 on Climate Variability and Change in the North Pacific and co-chairs Working Group 29 on Regional Climate Models.*

*Dr. Jang Joo Chan (cjiang@kiost.ac) has been a Principal Research Scientist in the Ocean Circulation and Climate Research Division of the Korea Institute of Ocean Science and Technology since 2011. His research interests include analysis and modeling of climate change in the North Pacific Ocean, focusing on Korean waters, circulation–ecosystem couple modeling, and turbulence modeling. He is a member of the PICES Physical Oceanography and Climate Committee, Working Group 27 on Climate Variability and Change in the North Pacific and co-chairs Working Group 29 on Regional Climate Models.*