Ocean Science Symposium 2015, Busan

Keynote Presentation :

- **09:00 – 09:35 Dunxin Hu and Alex Ganachaud**
- **09:35 – 10:10 Arnold L. Gordon**
- **10:25 – 11:00 Wenju Cai**
- **11:00 – 11:35 Detlef Stammer**
- **11:35 – 12:10 Kyung-Ryul Kim**

The first day

26-Oct-2015, 09:00 – 12:10

Keynote presentation 1 :

On Study of Ocean Circulation and Climate in the western Pacific

Dunxin Hu
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Abstract

The study of ocean circulation in the western Pacific Ocean started from Schott (1939) as individual and followed by some large scale studies afterward, such as SCORPIO observations in 1967 across the South Pacific Ocean from Australia to south America and CSK (Cooperative Study of the Kuroshio) during 1960s-1970s in northwestern Pacific Ocean. Especially, TOGA/WOCE were carried out from middle 1980s to early 2000s. Since early this century two international programs have been carried on, i. e., SPICE (2008---- Southwest Pacific Ocean Circulation and Climate Experiment) and NPOCE (2010— Northwestern Pacific Ocean Circulation and Climate Experiment). In the present talk the above will be reviewed and their scientific achievements including new findings revealed and breakthroughs will be presented. Finally, some remaining scientific questions and future directions will be raised and proposed for discussion at the 2nd Open Science Symposium on Western Pacific Ocean Circulation and Climate.

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Keynote presentation 2 :

The Indonesian Throughflow and the regional ocean and climate systems

Arnold L. Gordon

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Abstract

Pacific waters weave their way, as the Indonesian Throughflow (ITF), within a complex array of seas and straits of the expansive archipelago stretching from Southeast Asia to Australia. En route to the Indian Ocean the Pacific stratification is altered by the monsoonal forcing and vigorous tidal induced vertical mixing into a unique Indonesian thermohaline profile, which leads to a cooler than expected SST. The primary inflow is composed of North Pacific water within Makassar Strait, with lesser amounts entering into the eastern seas and via Karimata Strait from the South China Sea. The Makassar transport profile displays a maximum within the thermocline, as the surface layer transport is inhibited by the buoyant South China Sea throughflow. The Makassar transport profile responds to the SCS throughflow, which varies seasonally and with ENSO: greater SCS throughflow during the boreal winter and during El Niño, which reduces the Makassar transport and deepens the transport maximum core. However, the transport weighted temperature (heat transport) is more sensitive to the SCS effect, with warmer Makassar throughflow summer and La Niña when reduced SCS throughflow weakens 'freshwater plug' allowing increased transport of warmer upper thermocline Pacific water via the Mindanao Current. The greater heat transport during summer and La Niña is a consequence of increased transport in the warm 0-300 m layer, with decreased transport in the cooler 300-750 m layer. Seasonality increases during La Nina when the SCS surface layer becomes fresher as SCS throughflow is reduced, increasing the effectiveness of the monsoonal forcing the Karimata Strait throughflow.

While not as intense as the on/off ITF model experiments, the changing ITF profile is expected have a large effect on the Indian Ocean stratification and SST, with implications to the Indian Ocean Dipole, Madden-Julian Oscillations, to the Asian monsoon. The SCS and ITF variability both seasonally and with ENSO can be linked to the latitude of the North Equatorial Current Bifurcation along the eastern margin of the Philippines. There is substantial seasonal and ENSO related changes in the SST: cooler in the expansive Banda Sea in boreal summer when Ekman induced upwelling is strong and during El Niño when the regional thermocline shallows. The SST and associated air-sea exchange plays a key role in the behavior of MJO passing over the Indonesian seas. Intraseasonal variation accounts for about 30% of SST variability with MJO expression evident at 35-45 days, amplified during the boreal winter and during La Niña periods of warmer SST. During summer and El Niño periods shallower thermocline is favorable for the role of ocean processes to lower the SST attenuating MJO passing over the Indonesian seas.

Present and merging international programs (e.g. IIOE-2; YMC; NPOCE) within the maritime continent and new satellite and in situ observations, hold out the promise of a deeper understanding of the Indonesian sea and its role in the regional and larger scale ocean and climate systems.

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Keynote presentation 3 :

Why some El Niños are extreme?

Wenju Cai and co-authors

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Abstract

Why some El Niños grow into extreme intensity while others don't is a long-standing scientific issue. Here, we show that the mean state associated with a positive phase of the Pacific Decadal Oscillation (PDO) promotes development of strong El Niño events. This association of a positive PDO with more frequent strong El Niño is produced by the majority of 17 climate models participating in Coupled Model Intercomparison Project Phase 5 (CMIP5) with a strong intermodel consensus. Because a positive PDO phase is in part a response to El Niño, a positive feedback across time scales operates, substantially influencing the frequency of strong El Niño from one decade to another. This decadal influence must be taken into account in projection of El Niño change under greenhouse warming.

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Keynote presentation 4 :

The influence of Greenland Ice Mass Loss on Sea Level Changes in the Western Tropical Pacific

Detlef Stammer, Neeraj Agarwal, A. Köhl and C.R. Mechoso

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Sea level is expected to rise significantly over the next century. This change will happen on global average. However, sea level change will also have a substantial regional dependency due to several processes residing in the ocean, but also in the solid earth. One cause for regional sea level pattern to occur is the mass loss from polar ice sheets such as Greenland. The talk will discus how this mass loss can impact the western tropical Pacific. Involved processes occur on various time scales, the fastest of which will involve atmospheric teleconnections causing the Pacific to react with an ENSO type pattern.

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Keynote presentation 5 :

East/Japan Sea: A Small Sea with Big Questions

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Oceans are undergoing changes. The key issue is whether these changes are part of natural cycles or are related to recent global changes associated with human activities.

The studies, carried out during international CREAMS (Circulation Research for East Asian Marginal Seas) program for the East Sea in 1990′s, have confirmed the existence of most dramatic changes within the Sea: warming of whole body and decrease of dissolved oxygen concentration in deep layers. The analysis of DO profiles, in particular, strongly suggested that these changes are due to transition in the mode of the sea's conveyor belt system from bottom water formation in the past to intermediate water formation at the present time. These changes had remarkable resemblance to the changes anticipated in the world ocean circulation system associated with global warming in the future, allowing us to publish a paper(Geophysical Research Letters, 28(17), 3293-3296) titled:

"The East (Japan) Sea in Changes: A Clue to Future Changes in Global Oceans?"

We believe that East Sea may serve as a miniature test ocean for global changes in the future, meriting careful time-series studies to understand the effects of global changes on the ocean. The potential for the study of East Sea raising BIG questions for the oceans will be further discussed.

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