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EDITORIAL

Editorial—International Workshop on Modeling the Ocean (IWMO) special issue part 2 in ocean dynamics

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This is part 2 of the Special Issue for the First IWMO (http://phyoce.es.ntnu.edu.tw/2009WMO/) held on Feb 23–26, 2009, at the National Taiwan Normal University (NTNU) campus in Taipei, Taiwan. Part 1 was published in May in Ocean Dynamics and consisted of 12 papers that covered a wide range of topics from numerical schemes to process studies and realistic simulations. Part 2 also includes many interesting papers and also covers a wide range of topics. As in part 1, all papers underwent the usual rigorous process of reviews and revisions. There were at least two reviewers for each paper. Some of the reviewers were from the Workshop attendees, but many were solicited from the scientific community at large. A summary of the papers follow.

Wang and Wang presented observations and modeling of a sediment gravity current (hyperpycnal plume) over a tidal cycle at the mouth of the Yellow River (Huang He) on the inner shelf of the Yellow Sea, China. They observed that the suspended sediment concentration causes high stratification of the water column near the bottom at the beginning of the flood and weaker stratification at ebb or late flood and modeled the phenomenon with a sediment transport model coupled to the Princeton Ocean Model. Tidal straining, which causes the cross-shelf sediment concentration to be vertically sheared with opposite sign during flood (when the shear is negative) and ebb (positive), is proposed to be the mechanism that causes the observed asymmetry. The authors concluded that tidal straining can give rise to important intra-tidal variability in sediment-induced stratification, as well as to asymmetries in the sediment concentration in tidal estuaries.

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Chen et al. presented temperature measurements near the shallow step of the Dongsha Atoll in the northern South China Sea; these show diurnal drops in temperature of as much as 5~6°C lasting for a few hours. The authors proposed that the phenomenon is caused by the merging and breaking of internal solitary waves produced by the K1 tide. The waves originate at the Luzon Strait and propagate westward to the Dongsha Atoll. The Princeton Ocean Model at high resolution (horizontal grid=100 m and 31 vertical sigma levels) was used to simulate the wave propagation and breaking process. As the wave shoals and breaks, a tidal bore is produced and runs up the slope, bringing cold water to the step. Merging of multiple waves lengthens the duration of the cold-water events.

Hsin et al. examined the intra-seasonal variations of the Kuroshio southeast of Taiwan using satellite sea-surface height and sea-surface temperature data and numerical modeling with the Princeton Ocean Model at 1/8° horizontal resolution and 26 sigma levels. The authors found two regimes of current variability, one for the inner and the other for the outer portions of the Kuroshio. In the outer portion, east or offshore of the maximum velocity core of the Kuroshio, the authors found intra-seasonal variations with timescales of 30~180 days dominated by eddies that propagate from the Pacific Ocean's interior. Inshore of the Kuroshio (the inner portion), much shorter timescales of 14~28 days were found. The authors attributed these shorter temporal scales to local wind stress curl and typhoon activities.

Ezer and Liu proposed a methodology which makes use of satellite (Landsat) imagery at different tidal stages to first obtain the shoreline of a tidal estuary with extensive mudflats and inundation—the Cook Inlet, Alaska. The method then combines the shoreline data with statistics of observed sea level at a tide gauge station, as well as the results of a model simulation with wetting and drying using the Princeton Ocean Model, to obtain time-dependent variation of the mudflats. Extensive analyses are provided, and various applications of the method are demonstrated.

Galperin and Sukoriansky provide an overview of their quasi-normal-scale elimination spectral theory of turbulence, emphasizing in particular its potential applications in oceanography. Unlike the more conventional turbulence closure schemes, the theory includes scale dependency of processes which can contribute to small-scale turbulence mixing, in particular internal waves and flow anisotropization in stably stratified flows. The authors show analytically by making the weak-stratification approximation how turbulence is modified by increased anisotropy and gravity wave radiation and moreover provide an expression for the dispersion relation for internal waves in the presence of turbulence. Because of flow anisotropization and internal waves, the concept of the critical Richardson number becomes unnecessary. The theory is promising in advancing the state of turbulence parameterization in ocean (and atmospheric) modeling.

Qiao et al. reviewed their previously developed coupled model of wind–wave and ocean current and tested it on a (near) global domain based on the Princeton Ocean Model. It is known that the original Mellor and Yamada (1982; M–Y; for references, see the paper) turbulence parameterization scheme yields too shallow surface mixed layer. This paper proposes that effects of wave-induced mixing be included as nonzero wave–current, wave–temperature, and wave–salinity correlations parameterized using Prandtl's mixing length idea. Compared to the M–Y scheme, the new scheme shows improved mixed-layer depths when checked against observed climatology. For this initial testing, the authors did not turn on the fully coupled version of the model, as the effects of currents on waves were neglected. Future work could perhaps focus on this, as well as on comparing their scheme with the newer M–Y with wave breaking (Mellor and Blumberg 2004) and also on resolving the question of why the wave–current (and wave–tracer) correlations should be nonzero.

We wish to thank the Chief Editor Dr. Joerg Wolff for "keeping us on track" with the Special Issue. We also thank the National Science Council of Taiwan and the National Taiwan Normal University for co-sponsoring the IWMO. We are grateful to Dr. C.-T. Chen of NTNU for co-organizing the IWMO and for his help in making it a success. Last but not least, we thank all the reviewers—their dedication to scientific rigors makes this Collection a special treat to read.