**AGU Fall Meeting, Dec. 3-7, 2012**

# Coastal dispersal of radionuclides released from the Fukushima Nuclear Power Plant

Uchiyama, Y.
Department of Civil Engineering, Kobe University, Japan
Ishii, T.
Department of Civil and Earth Resources Engineering, Kyoto University, Japan
Tsumune, D.
Environmental Science Research Laboratory, CRIEPI, Japan
Miyazawa, Y.
Research Institute for Global Change, JAMSTEC, Japan

**ABSTRACT**

The 2011 earthquake off the Pacific coast of Tohoku, Japan, and the subsequent tsunami caused a severe nuclear accident at the Fukushima Daiichi Nuclear Power Plant (FNPP), leading to radionuclides leaking into the coastal ocean. In the present study, a retrospective, double-nested high-resolution numerical experiment is conducted to evaluate oceanic/coastal dispersion of the released cesium-137 (137Cs). The model successfully reproduces the overall ocean state as well as the monitored cesium-137 concentrations. Alongshore distribution of the concentrations is found to be highly inhomogeneous with diluted patterns distributed widely in the south of FNPP, while medium concentration appears in the north. The probability density function of the concentration in the coastal area demonstrates that hotspots may exist along the Sanriku coast, a rias coastline located north of FNPP. Whereas the previous works reported that the FNPP-derived cesium-137 would be transported offshore rather promptly, the present model indicates that cesium-137 substantially sticks to the shore based on a flux budget analysis near the source location. Time-integrated cumulative cesium-137 fluxes at the northern and southern (alongshore) boundaries of the control volume indicate apparent outgoing alongshore transport. In contrast, a net cross-shore flux at the eastern boundary (50 - 100 km offshore) almost vanishes or even becomes negative, viz., a net incoming flux. Therefore the leaked cesium-137 remains in the coastal area with mostly being transported alongshore back and forth. However, we found a meridional asymmetry of the cesium-137 fluxes with more southward transport, mainly attributed to the southward eddy transport.

**AGU Fall Meeting, Dec. 3-7, 2012**

# Submesoscale Frontal Dynamics in the Kuroshio Extension Jet

Ishii, S.
Department of Civil Engineering, Kobe University, Japan
Uchiyama, Y.
Department of Civil Engineering, Kobe University, Japan
Miyazawa, Y.
Research Institute for Global Change, JAMSTEC, Japan

**ABSTRACT**

The Kuroshio current flowing up off the eastern side of Japan is well known to be controlled by mesoscale dynamics, but effects of submesoscale dynamics, O (10) km or less, on the mean structure, eddies, frontal processes, stratifications, etc. have not been fully understood. To this end, and towards a rigorous submesoscale-resolving Kuroshio model, we conducted detailed numerical downscaling experiments with a double nested ROMS at horizontal resolutions of 3 km and 1 km, forced by the assimilative JCOPE2 at 1/12 degree as the boundary condition. According to an energy analysis along the principal frontal directions, energy conversion systems observed in the Kuroshio extension jet can be approximately categorized into two groups by their locations. The first one is right on the Kuroshio axis where the meandering and scale transitions occur mainly through baroclinic frontal instability, while submesoscale eddies are suppressed by the horizontal shear near the Kuroshio axis. The second one is at 1 - 2 degrees apart from the axis with emergence of coherent submesoscale eddies; by comparing to the case in the eastern boundary current system (Capet et al., 2008), the energy conversion rates on the both sides of the Pacific look quite similar to each other, suggesting that the effect of shear instability weakens as going away from the axis. As a result, if sufficiently distant from the Kuroshio axis, the dynamics becomes much closer to that of the eastern boundary current, leading to the forward energy cascade down to the submesoscale mainly through frontogenesis and associated baroclinic instability. In a meridional transect along 143 deg. E across the Kuroshio front, these submesoscale eddies are associated with strong ageostrophic secondary circulations and vertical transport of potential vorticity in the upper ocean.

**AGU Fall Meeting, Dec. 3-7, 2012**

# Impact of the Kurishio paths on oceanic and estuarine circulations in and around Seto Inland Sea, Japan

Kuriyama, T.
Department of Civil Engineering, Kobe University, Japan
Uchiyama, Y.
Department of Civil Engineering, Kobe University, Japan
Miyazawa, Y.
Research Institute for Global Change, JAMSTEC, Japan

**ABSTRACT**

The estuarine circulation and associated material dispersal in Seto Inland Sea (SIS), Japan, have been reported largely affected by the intrusion of the Kuroshio water through its two narrow channels, the Bungo and Kii Channels (**Figures 1 and 2**). In addition, freshwater inputs and the complicated coastline, topography and over 3,000 islands could modify the influxes through nonlinear processes, and substantially enhance intrinsic variability in the estuary. In the present study, a double nested oceanic modeling framework based on ROMS downscaled from the JCOPE2 dataset is developed to examine the interaction between the estuarine and the Kuroshio water at a horizontal grid resolution of 600 m. The model result is compared with the observation of tidal and subtidal surface elevations, stratification, and velocity structure around the Kuroshio path to show a reasonable agreement. A mass flux budget analysis is then conducted by estimating the fluxes at the two channels, the freshwater discharges from the major rivers in SIS, and the precipitation/evaporation; the former has a comparable contribution to the sum of the latters. The net flux at the channels are found to be closely related to the patterns of the Kuroshio path, measured by a distance from the each channel, suggesting that the Kuroshio intrusion plays an important role in forming a seasonal variability of SIS.

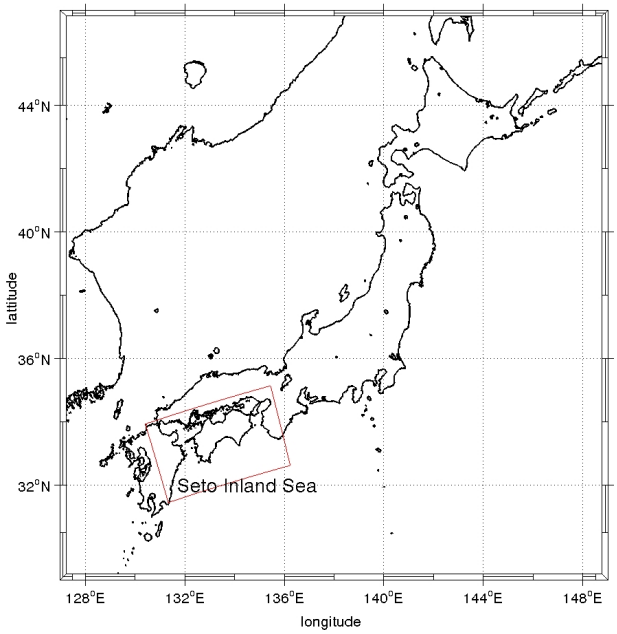


**Figure1**: The geographical location of the Seto Inland Sea model (ROMS-L2).

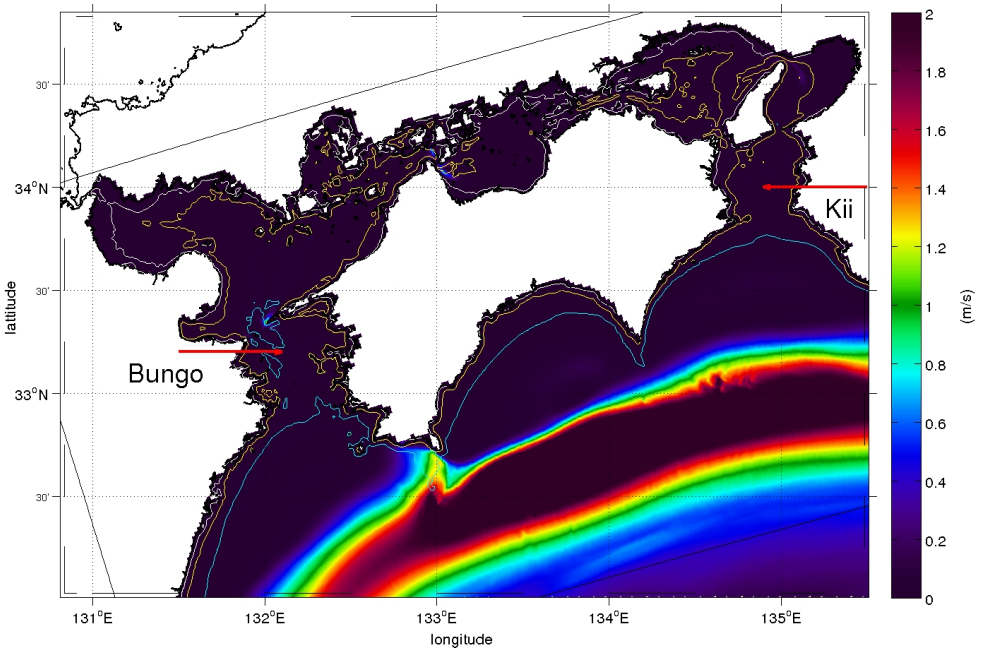


**Figure2**: Isobaths (white, yellow and blue lines denoting 10, 30, 100 m deep, respectively) on a monthly-averaged surface velocity magnitude in April, 2009 (color) around Seto Inland Sea.