Geophysical Research Abstracts
Vol. 15, EGU2013-6797, 2013
EGU General Assembly 2013

The impact of oceanic circulation and phase transfer on the dispersion of radionuclides released from the Fukushima Dai-ichi Nuclear Power Plant

Youngjin Choi, Shinichiro Kida, and Keiko Takahashi
Japan Agency for Marine-Earth Science and Technology, Earth Simulator Center, Japan (kidas@jamstec.go.jp)

The mechanism behind the oceanic dispersion of radionuclides from the Fukushima Dai-ichi Nuclear Power Plant is investigated by using a numerical model that is capable of simulating the migration of radionuclides between seawater, particulates, and bottom sediments. Past modeling studies have investigated the dispersion of radionuclides but lacked changes in phase and we find the inclusion of this process to make significant differences in the amount of radionuclides that disperses to the open ocean or remain near the coast.

The numerical model is a Lagrangian particle tracking – ocean circulation coupled model that is focused on the region close to Fukushima. The concentrations of radionuclides are solved for those dissolved in seawater and those adsorbed in particulates and bottom sediments. Radionuclides changes their phase through desorption, adsorption, settling, and erosion. Movements of the radionuclides are based on that solved in the ocean circulation model.

Model results show part of the radionuclides dispersing rapidly to the interior of the North Pacific along the Kuroshio Extension once they enter a meso-scale Kuroshio eddy. However, many radionuclides are found to remain near the coast within the shelf-break with their spatial pattern oriented strongly to the north of the Power Plant. Such asymmetry is due to the northward flow field established during the first month of the release and that most of the adsorption to bottom sediments occurred during the first month. If the offshore advection were weak during this period, many radionuclides will be adsorbed to bottom sediments and remain on the coast for more than a few months even if the flow strengthens later on. If vertical mixing is weak, however, less radionuclide reach the sea floor and get adsorbed to bottom sediments. More radionuclides will then quickly disperse to the open ocean along the Kuroshio Extension. We find the amount of radionuclides in the open ocean to double when the magnitude of vertical mixing is an order of magnitude smaller.