



Hindcast of ^{137}Cs in the North Pacific Ocean from 1945 to 2013 by eddy-resolving ROMS

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We conducted the hindcast of ^{137}Cs activity in the North Pacific Ocean from 1945 to 2013, before and after the Fukushima Dai-ichi Nuclear Power Plant (1F NPP) accident. We used the Regional Ocean Model System (ROMS) with high resolution ($1/12^\circ$ - $1/4^\circ$ in horizontal, 45 levels in vertical), of which domain was the North Pacific Ocean. This model employed the CORE normal year forcing data for a driving forcing and the 50 years averaged SODA data for boundary conditions. The reconstructed global fallout due to atmospheric nuclear weapons' tests and Chernobyl accident was employed for atmospheric input flux of ^{137}Cs from 1945 to 2013. After the accident, the atmospheric deposition and direct release of ^{137}Cs from 1F NPP were also employed for input condition. Five ensemble calculations of ^{137}Cs activity were conducted by moving the start period of the input flux for one year. The simulated vertical distributions of ^{137}Cs activity along 165°E represented the overall patterns of the observed ^{137}Cs activity before (in 2002) and after (in 2012) the accident, in particular the high activity core of the ^{137}Cs around North Pacific Subtropical Mode Water and Central Mode Water, indicating that this model can represent the subduction process and formation of the Mode Waters. The simulated ^{137}Cs activity in the surface ranged from 0.75 to 2.0 Bq m^{-3} in the north of Kuroshio Extension in 2011 before the accident. The main body of high ^{137}Cs activity water from 1F NPP was transported in the northern part of Kuroshio Extension after the accident. In Sep. 2012, 18 months after the accident, the main body of high ^{137}Cs activity water ($\geq 10 \text{ Bq m}^{-3}$) was located at around 40°N , 150°E - 160°W . The water over 10 Bq m^{-3} of ^{137}Cs activity was not detected in surface layer, but in the layer of $\sigma_\theta=25.8$ - 26.2 at two small areas (44°N , 180°W - 165°W and 48°N , 160°W - 140°W). This model simulation suggests that the main body of high ^{137}Cs activity water from 1F NPP has never reached the coast of the North American Continent after the accident.