Factors controlling radiocaesium distributions in the western North Pacific in 2011-2013

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The 2011 off the Pacific coast of Tohoku Earthquake and subsequent tsunami on 11 March 2011 caused damages that led to the accident at TEPCO's Fukushima Dai-ichi Nuclear Power Station (FDNPS). Large amounts of radionuclides were dispersed by hydrogen explosions, and radionuclides also leaked from the FDNPS into the terrestrial and marine environments. In the approximately 5 years that have passed since the accident, radiocaesium activities in seawater in the Fukushima coastal area have decreased, but are about 10 times higher than before the accident [1]. There is some controversy about factors affecting radiocaesium in the open ocean, particularly in subarctic area. To improve the accuracy of the diffusion simulation predictions in the ocean, more data are required from many regions regarding temporal changes. This study aimed at elucidating distribution and behavior of dissolved radiocaesium in seawater collected from the western North Pacific during the four sampling periods in 2011- 2013 (Period I; 14 April to 5 May 2011, Period II; 27 June to 4 August 2011, Period III; 4 June to 12 July 2012 and Period IV; 9 July to 29 July 2013). Collected seawater samples were filtered through a 0.2-μm pore size filter and was concentrated by means of improved ammonium phosphomolybdate (AMP) method [2]. In upper-layer seawater (water depth 0-10 m), the dissolved ^{137}Cs activities were relatively high off the Fukushima Prefecture in Periods I and II. In Periods III and IV, the activities at most of monitoring stations were same order. The activity profile patterns at most of stations decreased with increasing water depth were constant at all depth. The activity in middle-layer (water depth 100 or 200 m) was relatively higher than those in upper-layer at KEO in Period II and at JKEO in Period III. At S1, the activity profile patterns were its maximum layer at water depth 100-400 m in Periods III and IV. It seems that maximum layers of ^{137}Cs activity at S1 and KEO had happned because upper-layer seawater including radiocaesium had subducted more deep associated with formation of the North Pacific subtropical mode water. In upper-layer, integrated ^{137}Cs amounts in 35° N-40° N and 140° E-150° E, which zone is located just eastward from the Fukushima Prefecture, were highest compared to those in another zones until Periods II and accounted for more than 50 % of the total ^{137}Cs amounts of each sampling periods. In Periods III and IV, the amounts in divided all zones were small order. It is possible that the amount distributions influenced on several factors such as the location and strength of Kuroshio and Oyashio current and semipermanent eddy.

[1] Nuclear Regulation Authority, (2015) Environmental radioactivity database http://search.kankyo-hoshano.go.jp/servlet/search.top, [2] Aoyama and Hirose (2008) Radiometric determination of anthropogenic radionuclides in seawater, in: Analysis of Environmental Radionuclide, In P. P. Pavel (Ed.), Radioactivity in the Environment (pp. 137–162). Hungary: Elsevier.

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