Fukushima-derived radiocesium in the subarctic region of the North Pacific Ocean in the summer of 2017

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The accident of Fukushima Dai-ichi Nuclear Power Plant occurred in March 2011 resulted in release of 20-40 PBq radiocesium into the environment. It is estimated that 70-80% of them deposited and discharged in the North Pacific Ocean and most of them are dissolved in seawater. Therefore, Fukushima-derived radiocesium has been spreading throughout the North Pacific along the surface water currents with dilution by seawater mixing. Previous studies revealed that radiocesium deposited and discharged in the coastal area of Japan was transported eastward along the surface current in the mid-latitude of the North Pacific Ocean and reached the west coast of the North American continent in 2015, about four years after the accident. We collected seawater samples during Japan Agency for Marine-Earth Science and Technology "Hakuho Maru" cruise conducted in the North Pacific in the summer of 2017 and measured activity concentrations of radiocesium in them. Because the activity concentration of Fukushima-derived ^{134}Cs has decreased to less than 1 Bq m^{-3} due to dilution and radioactive decay (its half-life is about 2 years), it is difficult to measure it unless it is concentrated. For the concentration, Cs resin (potassium nickel ferrocyanate on polyacrylnitrile, KNiFC-PAN) manufactured by Triskem was used. About 40 L of seawater sample was passed through 5 ml (about 1 g) of the Cs resin at a flow rate of 50 ml min^{-1} to concentrate the radiocesium in the resin. Stable cesium (^{133}Cs) chloride was added as a carrier to the seawater sample (concentration was about 100 ppb), and the recovery rate of radiocesium was estimated to be about 95% from a difference in ^{133}Cs concentration before and after the passing through the seawater sample. After washing the Cs resin in our laboratory on shore, activity concentrations of ^{134}Cs were measured using gamma ray spectrometers (Ge semiconductor detectors) in Japan Agency for Marine-Earth Science and Technology and Kanazawa University. According to vertical transection along with the two observation lines of east-west (47 north degree line) and north-south (145 west degree line) across the Gulf of Alaska in the eastern North Pacific, the activity concentration of Fukushima-derived ^{134}Cs in surface layer shallower than 300 m depth in the eastern and northern stations, namely stations closer to the coastal area of the North American continent was relatively high (the maximum decay-corrected concentration was 6 Bq m^{-3}). This suggests that Fukushima-derived ^{134}Cs reached the North American continent has been transported northward along the continent and then westward in high latitude (50-60 north degree) of the North Pacific. These results imply that Fukushima-derived ^{134}Cs will return to the coastal area of Japan along the anti-clockwise circulation in the subarctic area of the North Pacific (North Pacific subarctic gyre) within the next few years.

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