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^{137}Cs and ^{134}Cs activity in the North Pacific Ocean water from 1945 to 2020 by eddy-resolving ROMS

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We conducted the simulation of ^{137}Cs activity in the North Pacific Ocean (NPO) water from 1945 to 2020, before and after the Fukushima Dai-ichi Nuclear Power Plant (1F NPP) accident. Using the Regional Ocean Model System (ROMS) with high resolution (1/12°-1/4° in horizontal, 45 levels in vertical), of which domain was the NPO, we preliminarily estimated a factor multiplying the total ^{134}Cs fluxes, which have been estimated for the atmospheric deposition and the direct discharge from the accident. The direct comparison of the observed and calculated ^{134}Cs showed that the total ^{134}Cs flux was 1.6 times greater than the previous estimates. We re-calculated the ^{134}Cs activityies in the NPO water using the flux multiplied by 1.6 and confirmed the improvement of the simulation by the multiplied flux, which suggested that ^{134}Cs and ^{137}Cs inventories in the NPO increase by about 16PBq, respectively, due to the accident. For the hindcast and forecast of the ^{137}Cs activityies in the NPO water, we calculated the ^{137}Cs activityy in the NPO water from 1945 to 2020 by using the global fallout flux due to atmospheric nuclear weapons' tests and the Chernobyl accident and the estimated fluxes of the 1F NPP accident. For the calculation, five ensemble calculations of ^{137}Cs activity were conducted by moving the start period of the input flux for one year. The ^{137}Cs activity in the surface water showed that the plume due to the 1F NPP accident with relatively higher activity than 5 Bq m^{-3}, which was lower than that in 1985, was transported to the western area of 135°W in 2015. The peak year of the ^{137}Cs activity can be estimated from the hindcast and forecast. The ^{137}Cs activity in the surface water north of 30°N shows that the ^{137}Cs peak in 2011 occurs up to 180°, but the peak from 2012 to 2017 is distributed from near 180° to 90°W. The total inventory of ^{137}Cs in the NPO increased up to 77 PBq in 2011 and gradually decreased to 61PBq in 2018 by transport outside of the domain, which is almost the same as that in Dec. 2010. The whole amount of ^{137}Cs in the subsurface layer (200-600m depth) is larger than that in the surface layer (0-200m depth) since the 1F NPP accident except 2011.