



Distribution of radionuclides in the surface sea water developed by aerial radiological survey

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This study provides new data analysis method of aerial radiological survey to monitor the distribution of anthropogenic radioactivity in surface seawaters as a first attempt. The aerial radiological survey was performed by the U.S. Department of Energy National Nuclear Security Administration (DOE/NNSA) within a 30 km radius of the Fukushima Daiichi Nuclear Power Plant (FNPP1) on 18 April 2011. We found good correlations between the observed concentrations of FNPP1 derived radionuclides (^{131}I , ^{134}Cs , ^{137}Cs) in the surface seawater and gamma-ray dose rates by aerial radiological surveys (correlation coefficients for ^{131}I , 0.89; ^{134}Cs , 0.96; ^{137}Cs , 0.95). The detection limits of ^{131}I , ^{134}Cs , and ^{137}Cs in surface seawaters for the aerial radiological survey are 25, 21, 24 Bq L⁻¹, respectively. Based on these relations, we find that the area with high concentrations of the FNPP1 derived radionuclides spread south-southeast from the FNPP1. The maximum concentrations of ^{131}I , ^{134}Cs , and ^{137}Cs reached 303, 456, and 528 Bq L⁻¹, respectively. The $^{131}\text{I}/^{134}\text{Cs}$ ratios in surface waters of the high activities area are about 0.6-0.7. Considering the radioactive decay of ^{131}I (half-life: 8.021 d), we confirm that radionuclides in the surface seawater of this area are due to direct release from FNPP1 to the ocean. From these results, it is concluded that the aerial radiological survey is very effective to investigate the accurate distribution of anthropogenic radioactivity in the surface seawater. Furthermore, the model reproduced the distribution pattern of the FNPP1 derived radionuclides in surface seawater obtained by the aerial radiological survey, although simulated results by regional ocean model are underestimated.