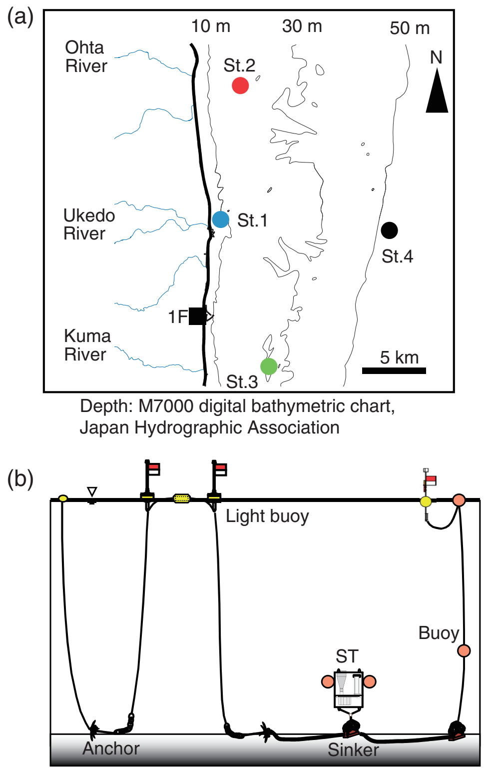
1–10 Impact of Large Typhoons on the Estuary Mass Flux

—Observation of Radioactive Cesium in the Estuary in 2019—



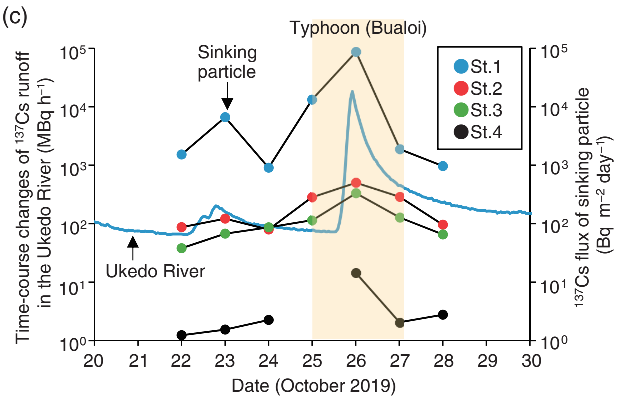


Fig.1-26 (a) Measurement area, (b) methodology, and (c) results summary
(a) Four observation points (St.1–4) were set off the coastal area of Fukushima Prefecture. The lines represent the water depth. (b) Sediment traps were moored at each observation point to collect sinking particles. (c) Comparison of the time-course changes of ^{137}Cs runoff in the Ukedo River (blue line) and the ^{137}Cs flux of the sinking particles captured by the sediment traps.

Dynamic radioactive cesium studies have been conducted since the accident at TEPCO's Fukushima Daiichi NPS (1F) that occurred 10 years ago. Radioactive cesium is likely transported from land to sea, mainly through rivers, although the release of radioactive cesium from 1F into the ocean is limited. Therefore, we have been conducting continuous surveys in the Ukedo River estuary to clarify the radioactive cesium transport mechanisms. Radioactive cesium is transported from rivers to the ocean only during floods (e.g., during typhoons) rather than via continuous outflows. Fine particles that are easily absorbed by radioactive cesium (i.e., the cesium absorbs the fine particles) washed away by the river during flooding and transported to the sea.

To evaluate the transfer mechanism of radioactive cesium to the ocean during floods, we installed sediment traps (STs) at four locations along the coastal area of the estuary targeting the Ukedo River, which has a large basin around the 1F, during the Bualoi Typhoon in 2019. The location of the STs and the methodology used for sediment capture of particles settling toward the seafloor (i.e., sinking particles) are summarized in Figs.1-26(a) and (b), respectively. The radioactive cesium (^{137}Cs) concentration and mass flux (i.e., the mass flow rate of the sinking particles) of the collected particles were measured. The particle samples were collected from October 22nd to October 28th; the typhoon passed through this area on the 25th–26th.

We determined that the concentration of ^{137}Cs in the sinking particles was highest during the typhoon additionally, the highest concentration of ^{137}Cs was present at St.1; this concentration was approximately 100 times that present at St.4, which is 14 km away from the coast and had the lowest concentration of ^{137}Cs.

The movement of ^{137}Cs can be evaluated by the ^{137}Cs flux, which is obtained by multiplying the ^{137}Cs mass flux by the concentration of ^{137}Cs. The ^{137}Cs flux increased significantly as the typhoon approached. In particular, the ^{137}Cs flux at St.1 was approximately two orders of magnitude higher during the typhoon than before or after it. These results correspond well with the observed time course of ^{137}Cs runoff (i.e., flow rate × ^{137}Cs concentration) of the Ukedo River, which was estimated from the water level (i.e., flow rate index) and turbidity (i.e., ^{137}Cs index in river water) at the Ukedo River observation point approximately 3.5 km upstream from the estuary, as shown in Fig.1-26(c). This increase in the ^{137}Cs flux of the sinking particles only occurred during the typhoon; by the end of the observation period, two days after the typhoon had passed, the ^{137}Cs flux had returned to normal.

Overall, we determined that the concentration of ^{137}Cs in runoff from the river to the ocean in the mouth of the Ukedo River during a typhoon was remarkable. However, this effect occurred only within 14 km of the coast and only lasted for two days.

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Reference

Misonou, T. et al., Survey on the Radioactive Substance in the Coastal Areas near Fukushima Prefecture in FY2019 (Contract Research), JAEA-Research 2020-008, 2020, 166p. (in Japanese).