Ocean dispersion model simulations for ^{137}Cs distribution derived from the Fukushima Daiichi Nuclear Pawer Plant Accident

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Introduction

- ✓ Ocean dispersion model simulations were carried out in the early stages of the Fukushima Daiichi Nuclear Power Plant (1F NPP) accident.
- ✓ Interpolation of sparse observed data by the model can produce visual color contours, which are useful for understanding the phenomena.

Model inter-comparison

- ✓ 11 ocean dispersion models inter comparison were summarized(SCJ, 2014).
- ✓ Some model can represent meso-scale eddy to reduce ^{137}Cs activity off Ibaraki coast, southern part of 1F NPP (Fig. 1).
- ✓ Comparison between observation and model is difficult due to the large spatio-temporal variability and complex distribution.
- ✓ Source terms (Direct release, Atmospheric deposition) were not unified.

Long-term simulation

- ✓ long-term simulations were conducted by 2016 (Tsumune et al., 2020) and extended to September 2020(Fig. 2), with the source of direct release and river discharge of dissolved ^{137}Cs.
- ✓ Annual averaged surface ^{137}Cs activity is in good agreement with observation(Fig. 3 and 4).
- ✓ Normalized annual averaged ^{137}Cs activity distributions in the regional ocean were similar for each year from 2013 to 2016(Fig. 5). This result suggests that the annual averaged distribution is predictable in case that treated water by ALPS will be discharged to the ocean from 1F NPP site.
- ✓ Impact of dissolved ^{137}Cs from rivers was small by 2016.

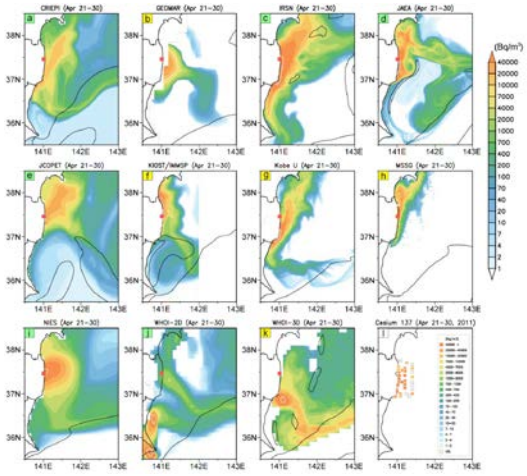

Fig.1 Surface ^{137}Cs activity averaged over a 10-day period from April 21 to 30, 2011. Black line show general location of Kuroshio

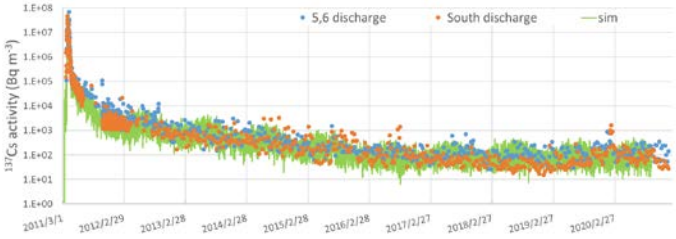

Fig. 2 Observed and simulated surface ^{137}Cs activity adjacent to 1F NPP

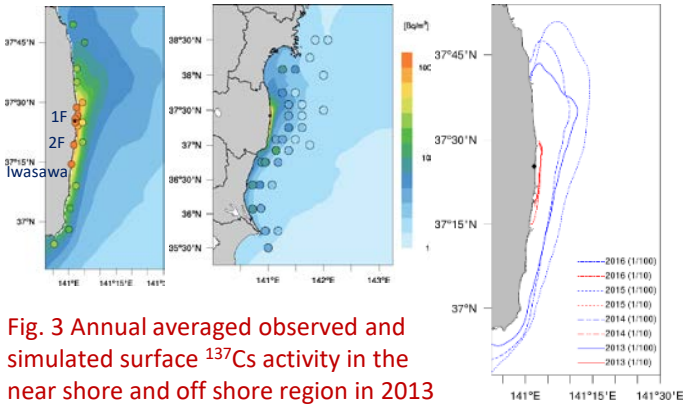

Fig. 3 Annual averaged observed and simulated surface ^{137}Cs activity in the near shore and off shore region in 2013

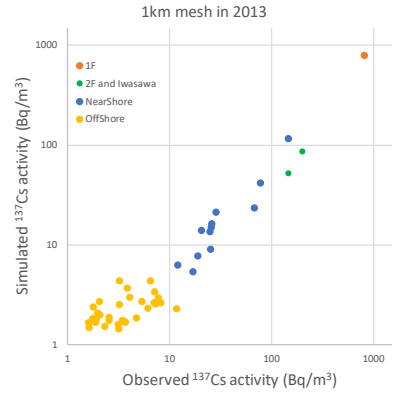

Fig. 4 Comparison between measured and simulated surface ^{137}Cs activity (R=0.973)

Fig. 5 Annual averaged distribution of ^{137}Cs activity normalized by the maximum ^{137}Cs activity in front of the 1F NPP site.

Future perspective

- ✓ In the future, model inter-comparison using a unified source term will be important.
- ✓ The range of direct leakage rate estimates from multiple models has become smaller.
- ✓ Since the distribution of atmosphere deposition (Region, Pacific Ocean) is not yet known, which needs to be estimated by atmospheric and oceanic models.
- ✓ Heavy rains in October 2019 increased the ^{137}Cs activity at 2F and Iwasawa coast. This indicates the possibility of re-leaching from estuarine sediments, which needs to be estimated by river and oceanic models.
- ✓ A combined approach of atmospheric, riverine, and oceanic models is needed to establish a unified source term

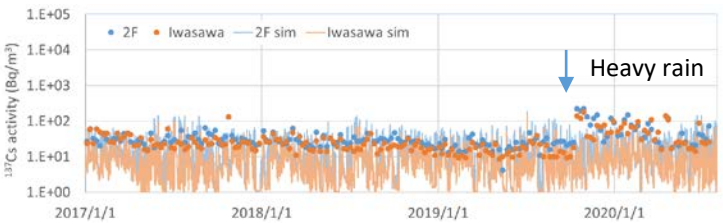

Fig. 6 Observed and simulated surface ^{137}Cs activity adjacent to 2F NPP and Iwasawa coast