EGU22

Estimation of ^{137}Cs inventory by an ocean general circulation model for the global database interpolation

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May. 26. 2022

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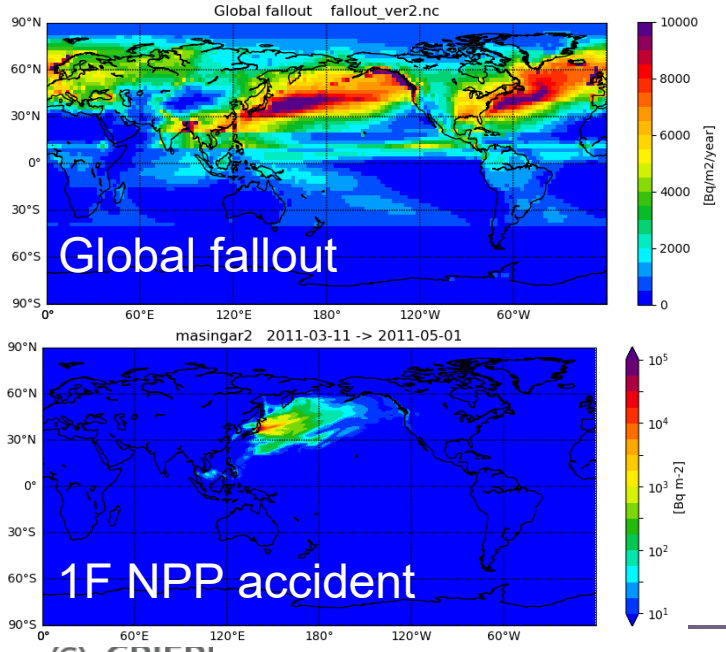
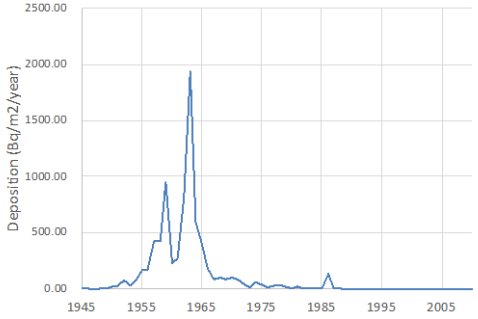
Introduction

- Artificial radionuclide, ^{137}Cs has been supplied into the ocean
- In order to detect future contamination by radionuclides, it is necessary to understand the global distribution of radionuclides, such as ^{137}Cs. For this purpose, observed data have been summarized in a historical database (MARIS) by IAEA and HAM database(Aoyama, 2022).
- The spatio-temporal density of the data in the database varies widely, therefore it is difficult to investigate the inventory by the database.
- Simulations by an ocean general circulation model (OGCM) can be helpful in the interpretation of the database.
- Inventories and fluxes between each basin are investigated by the results by an OGCM.

Model

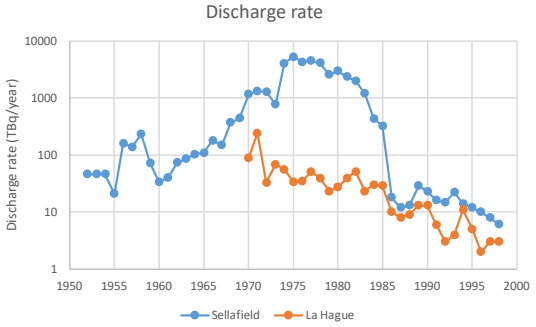
- Parallel Ocean Program version 2 (POP2) of the Community Earth System Model version 2 (CESM2)(Danabasoglu et al., 2020).
- The horizontal resolution is 1.125 degrees in longitude and 0.28 to 0.54 degrees in latitude.
- The simulation period was from 1945 to 2030, and the atmospheric conditions were forced to cycle through repeating normal years.
- Source, Global fallout, Reprocessing plants, Fukushima 1 NPP accident.





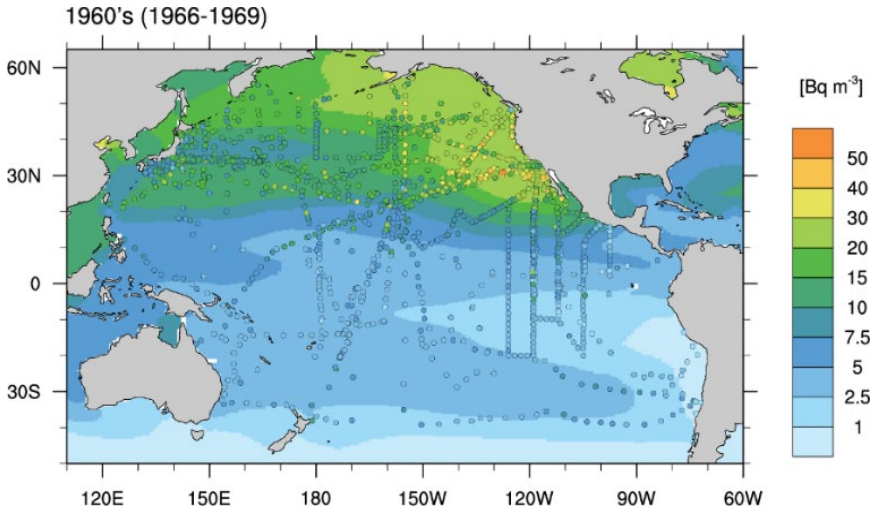
Global fallout

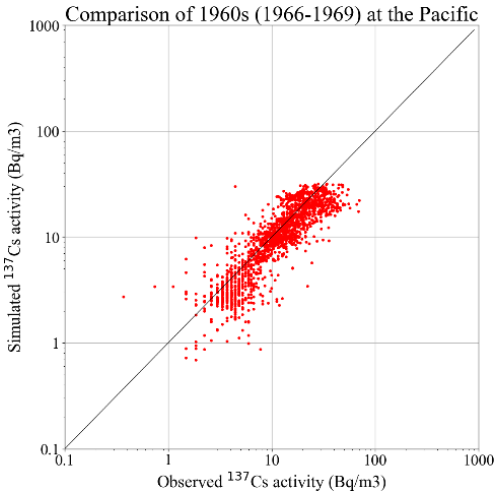
1F NPP accident
March, 2011



Reprocessing plants,
Sellafield, La Hague
Point sources

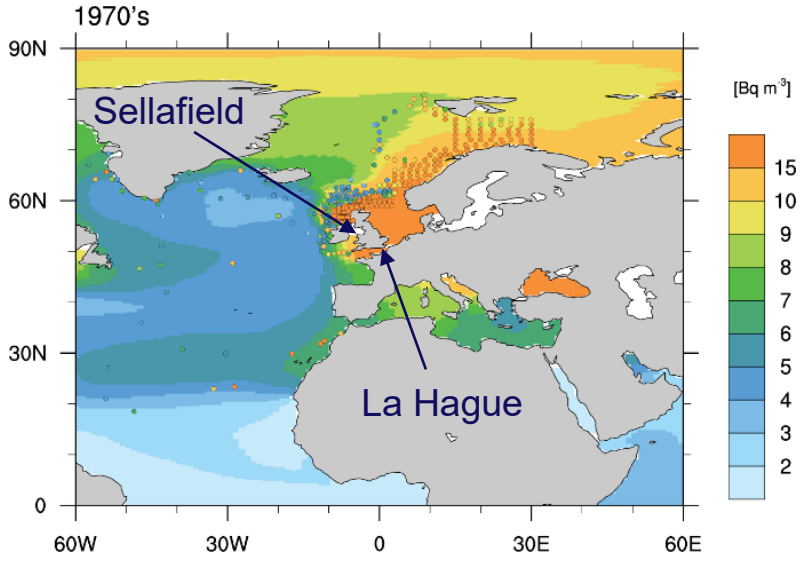
^{137}Cs activity in the North Pacific

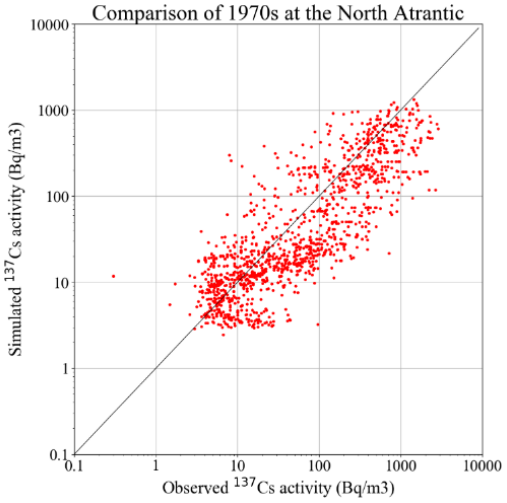




North Pacific

Global fallout



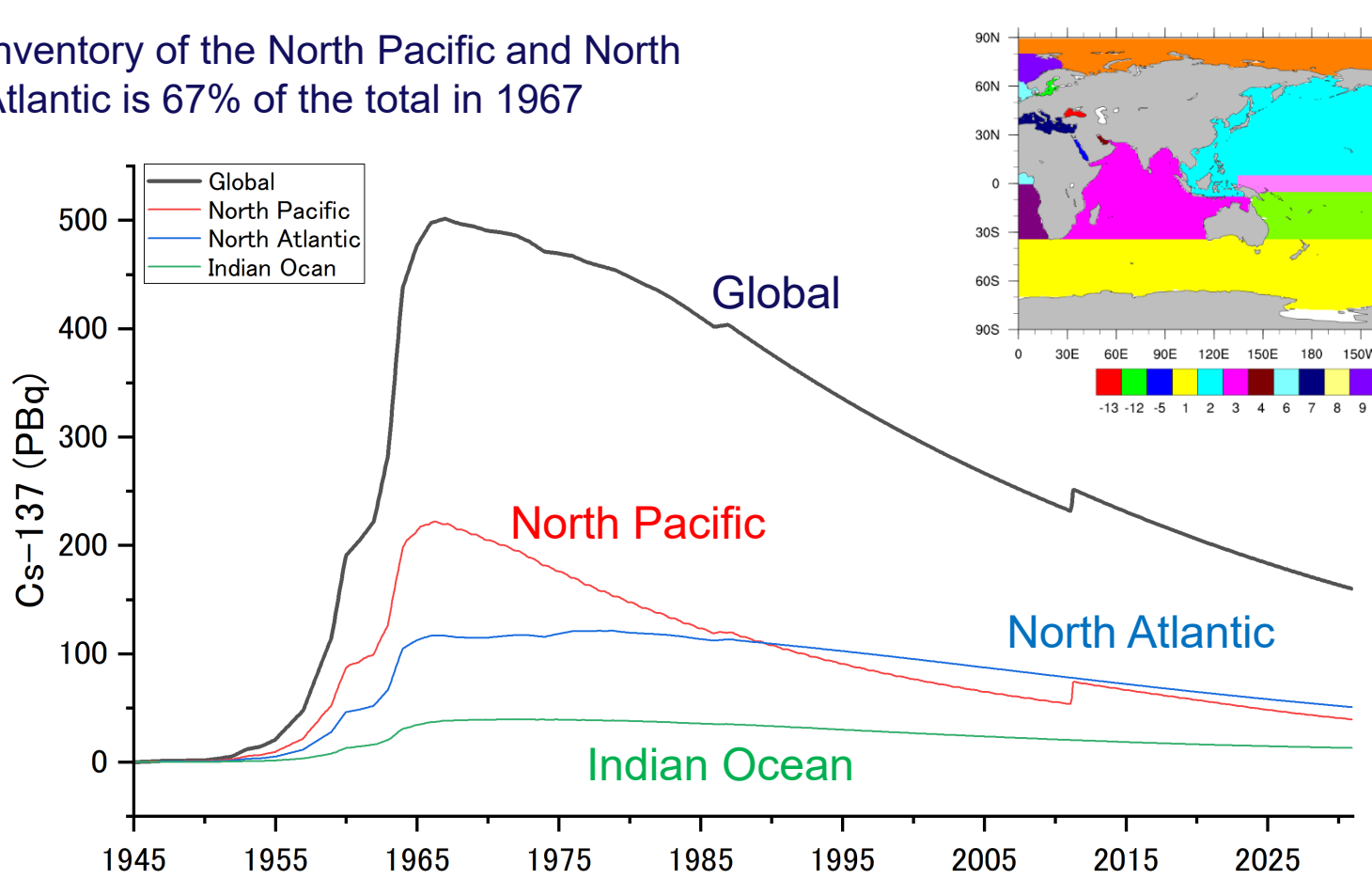


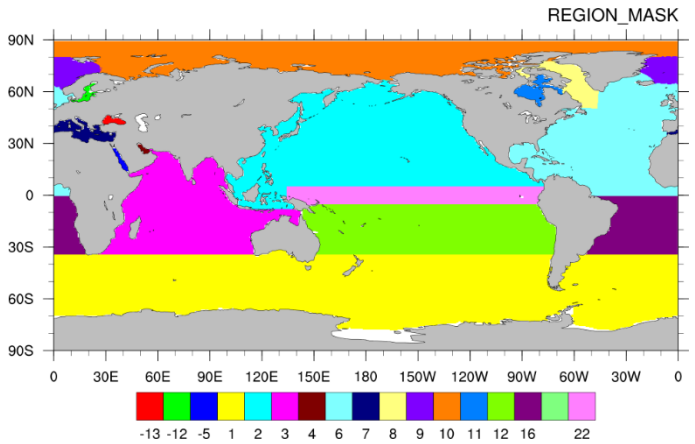
North Atlantic

Global fallout
+
Reprocessing Plants

Temporal change of Inventory

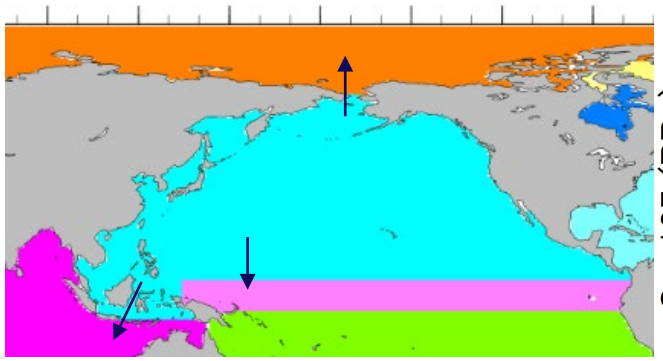
Inventory of the North Pacific and North Atlantic is 67% of the total in 1967

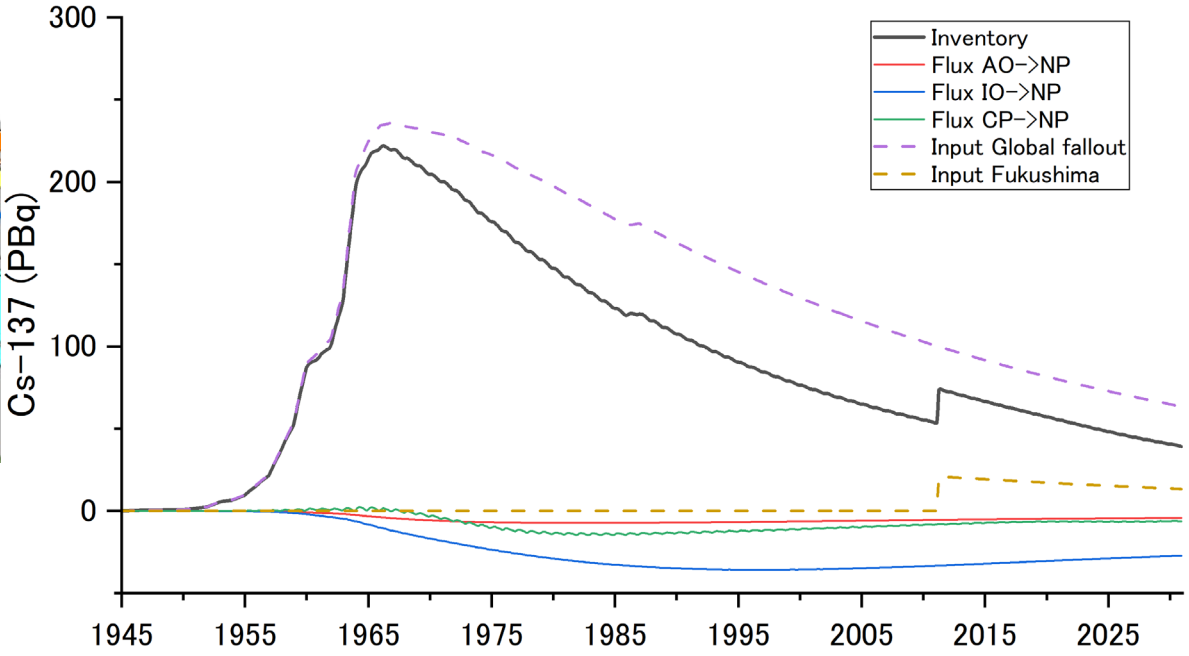




[Inventory] = [Decay corrected cumulative input] (Global ocean)
[Inventory] = [Decay corrected cumulative input]
+ [Decay corrected cumulative flux] (Ocean basin)

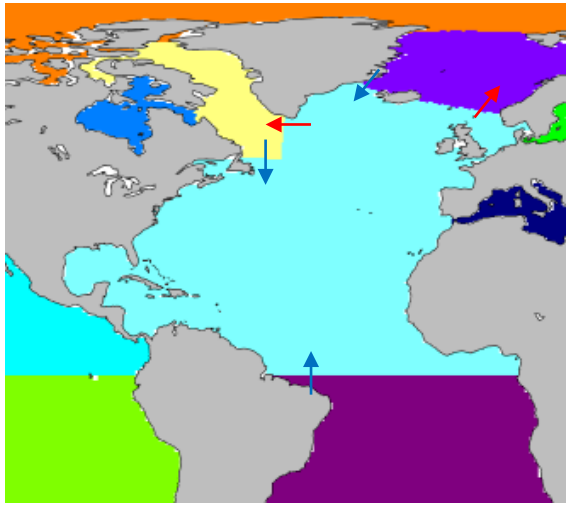
North Pacific

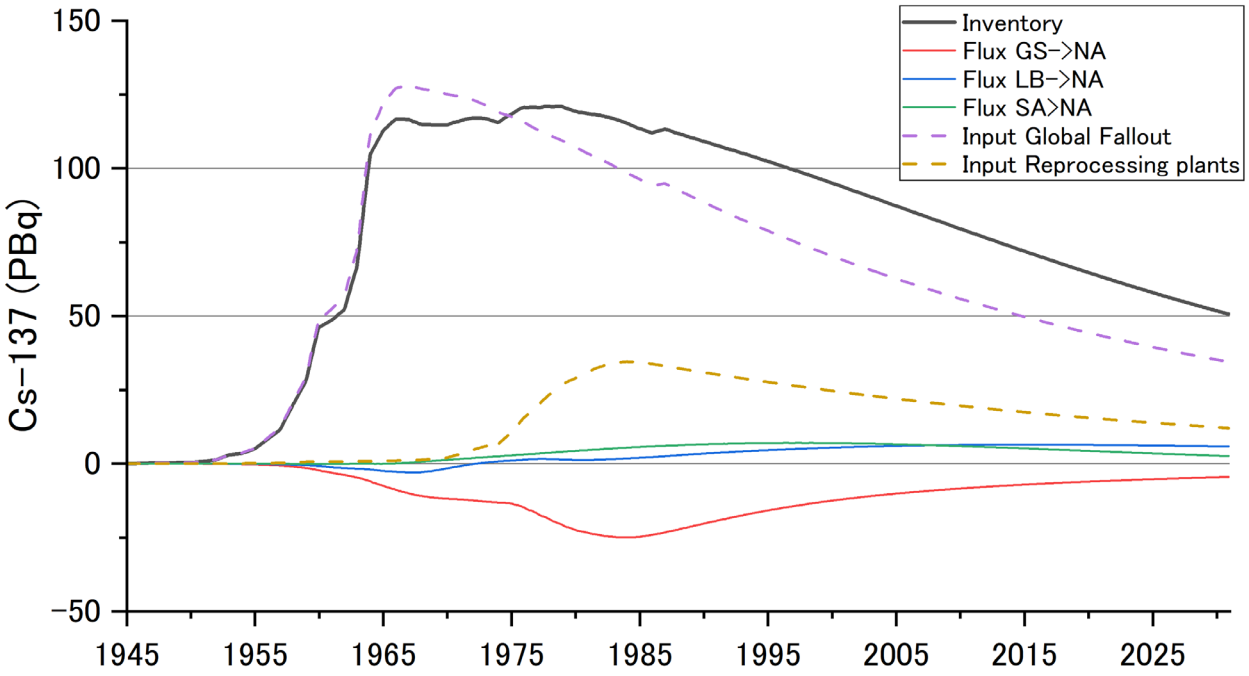




- ✓ Inventory is smaller than input.
- ✓ Fluxes from the North Pacific to the Indian Ocean, Arctic Ocean, and Central Pacific were positive, and the North Pacific was a source of supply for other ocean basins.
- ✓ The 1F NPP accident caused a 20% increase in the inventory in 2011.

North Atlantic

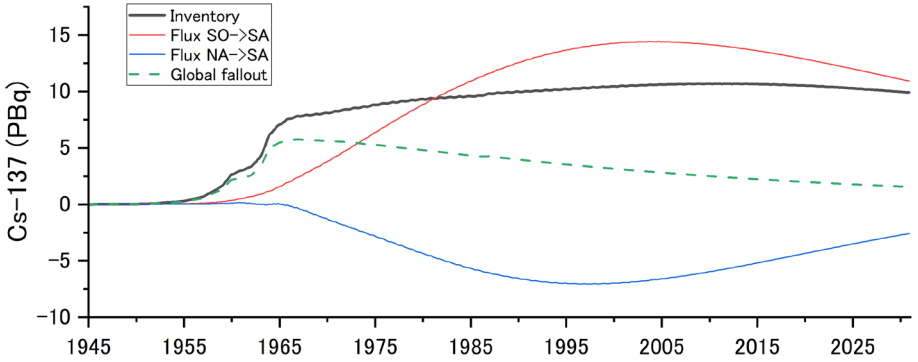




- ✓ In 1984, ^{137}Cs from reprocessing plants accounted for 30% of the total inventory.
- ✓ The outflow flux from the North Atlantic to the Greenland Sea is larger than the other fluxes and is a source of supply to other ocean basins.

Summary

- The time series of ^{137}Cs inventory in each ocean basin and the fluxes among ocean basins were quantitatively analyzed by OGCM simulations, and the predictions for the next 10 years were made.
- The ^{137}Cs activity concentrations by global fallout can be detected in the global ocean after 2030. The OGCM simulations will be useful in planning future observations to fill the gaps in the database.



Inventory in the South Atlantic

few observational data are available