^{137}Cs tracer distribution in an Ocean General Circulation Model

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Objectives

- To understand the global distributions of artificial radionuclides
  - Interpolate and extrapolate the observational data
- To understand the mechanism of the global distributions from 1960s to current and future
  - South Pacific
- ^{137}Cs as a new tracer to assess the skill of OGCMs
  - Difference from previous other tracers

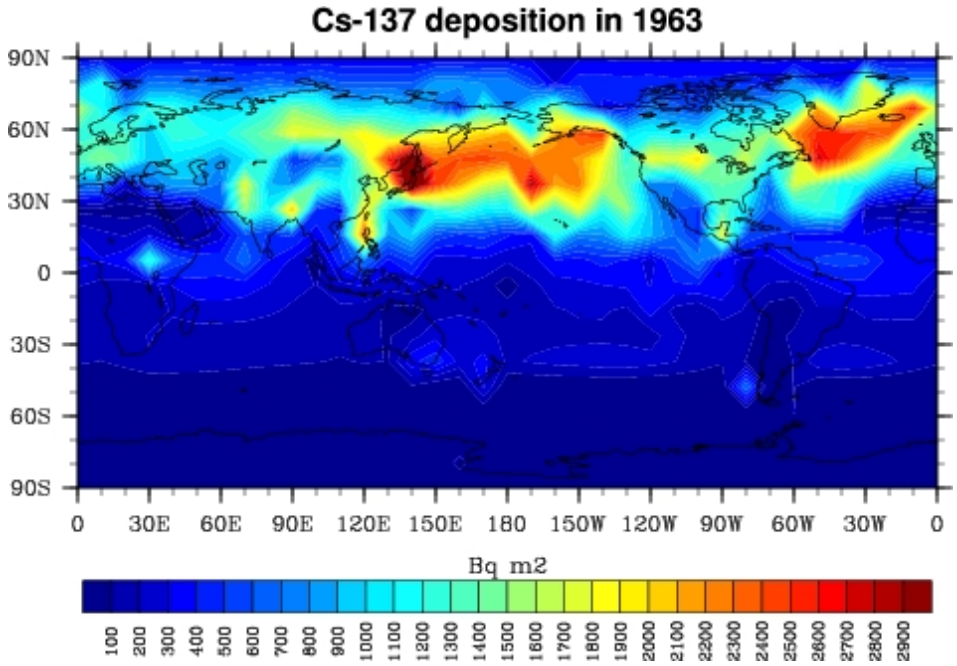
Ocean model

- CCSM3 POP (Keihl and Gent, 2004)
- Horizontal; about 1 degree, Vertical; 45 layers
- 3rd order upwind advection scheme
- KPP scheme (Large et al., 1994)
- Momentum; anisotropic GM scheme (Smith and McWilliams, 2003)
- Tracer; GM scheme (Gent and McWilliams, 1990)
- Near Surface Eddy Flux Parameterization (Danabasoglu et al., in printing)

- Normal Year Forcing (Large and Yeager, 2005)
- Add ^{137}Cs tracer under the POP tracer protocol

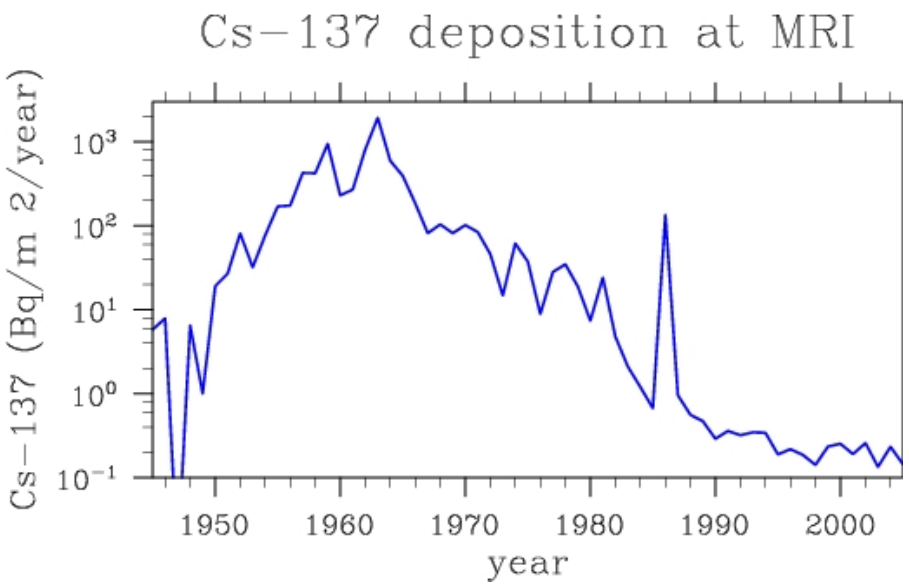
Deposition data

Global distribution of
^{137}Cs fallout (Bq m^{-2})



Aoyama et al, 2006

Temporal observations at the MRI
From 1958-2005 (Igarashi et al., 2003)
Estimated from Ice core from 1945 to 1957
(Aoyama, 1999)



Passive tracer + decay

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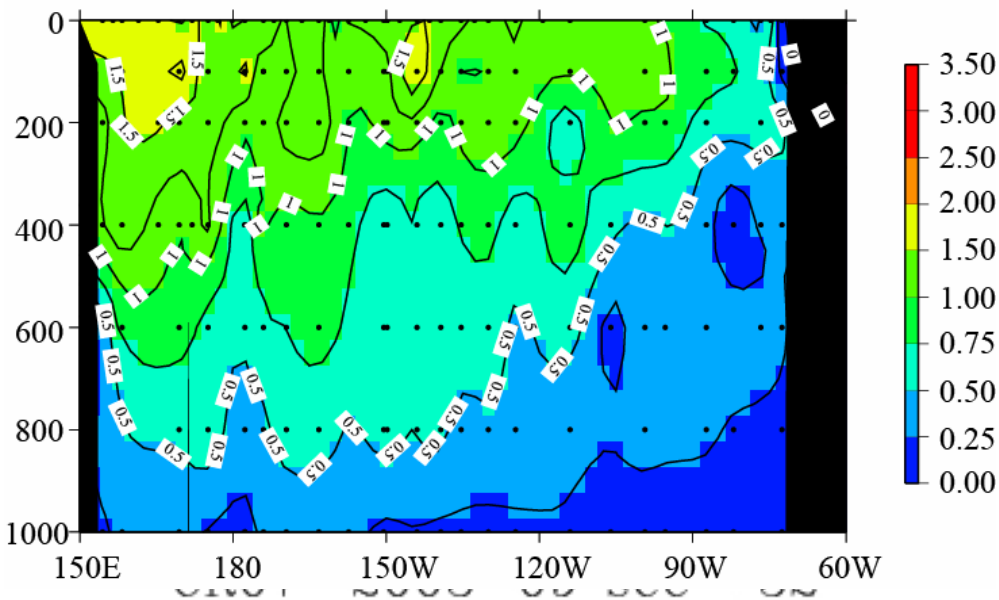
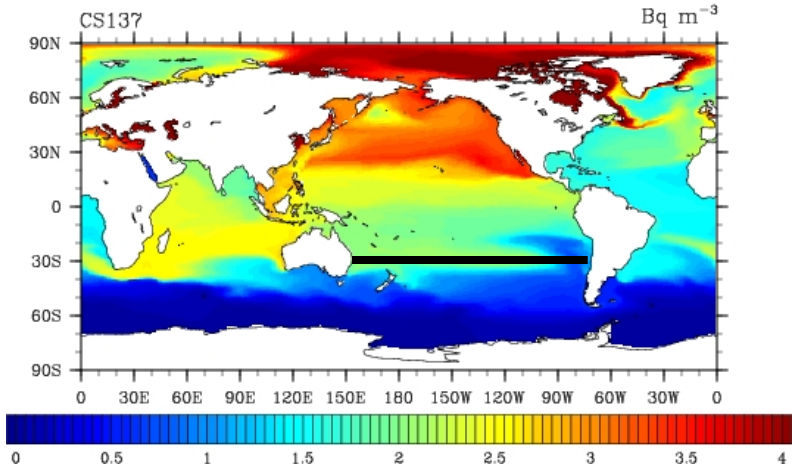
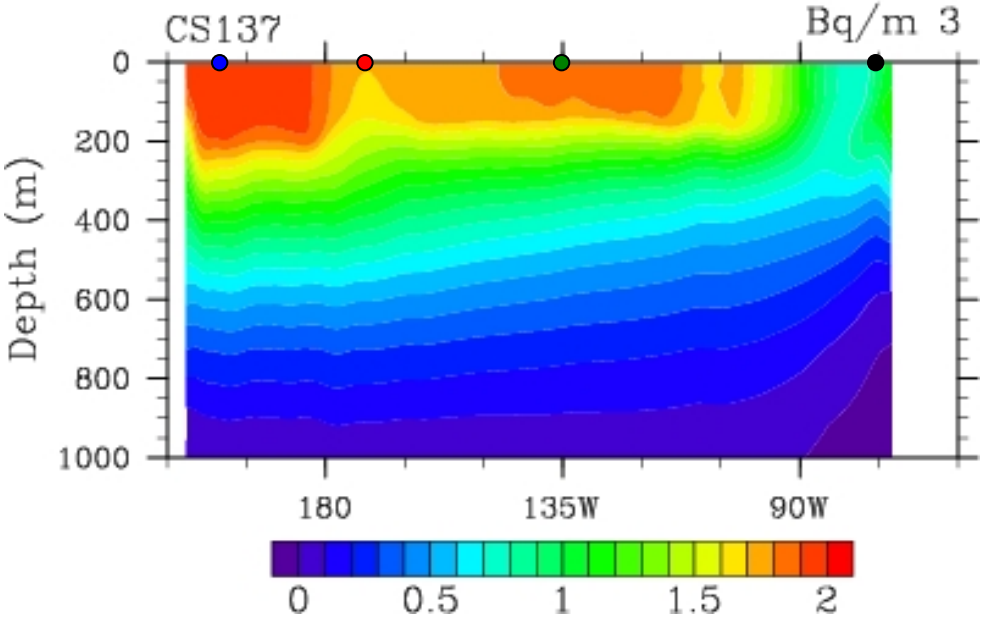
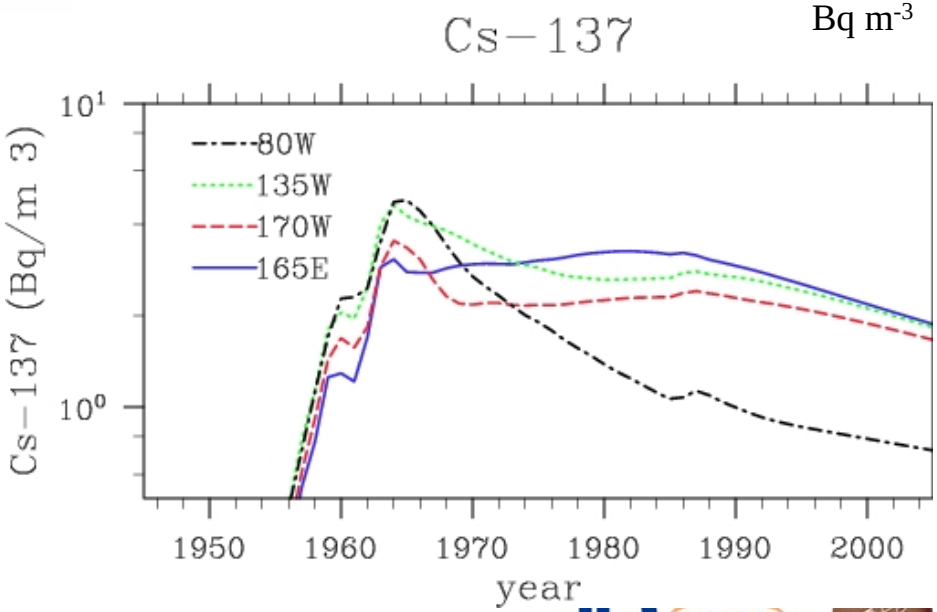
^{137}Cs section in the Pacific Ocean along 32 deg. S (BEAGLE2003 P06)









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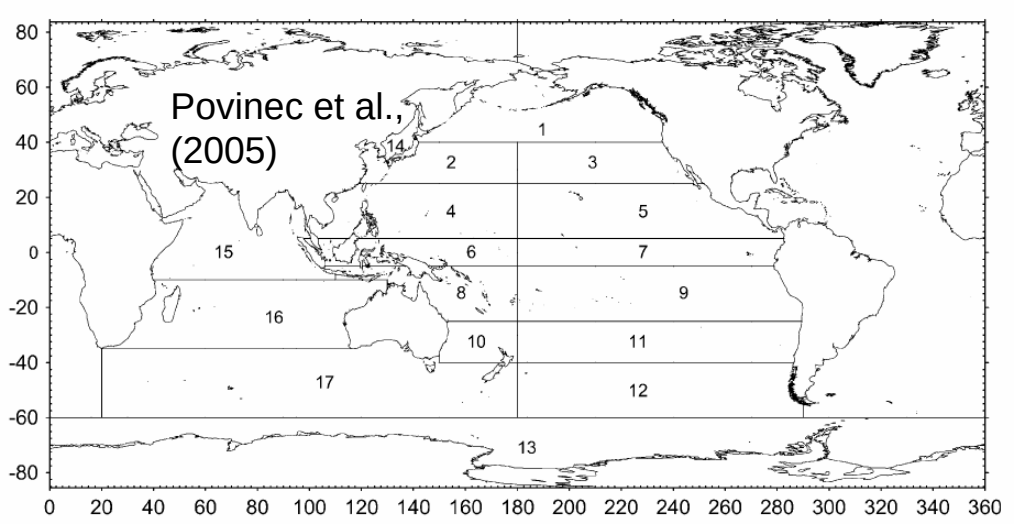
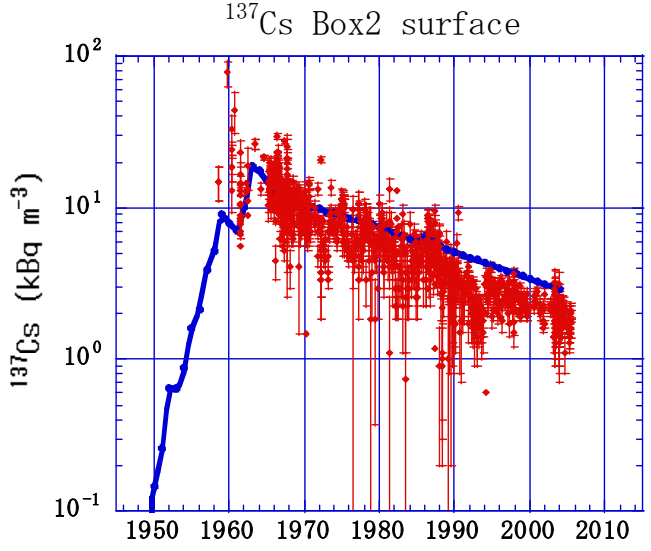
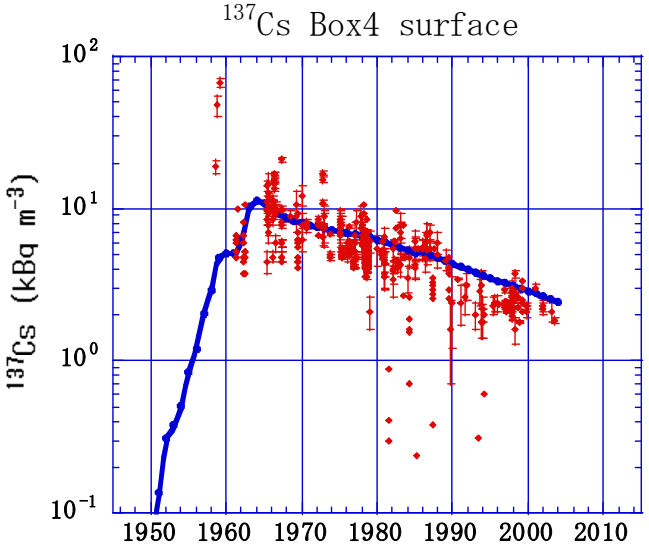
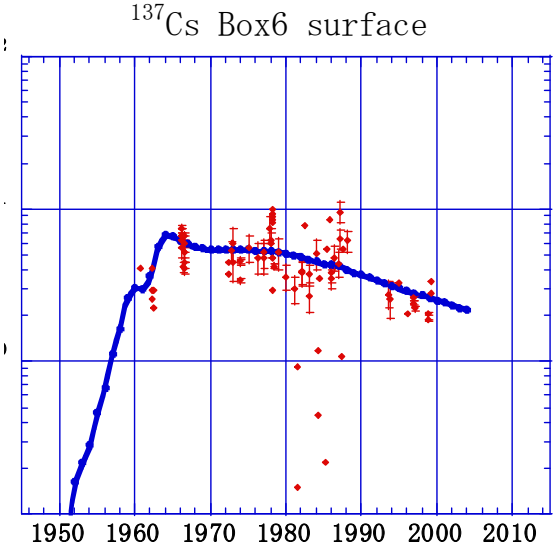
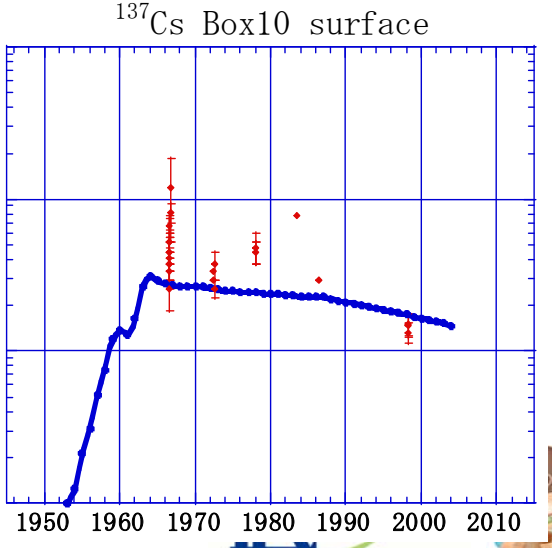
Temporal variation of surface ^{137}Cs concentrations Obs.(HAM database) vs Cal.



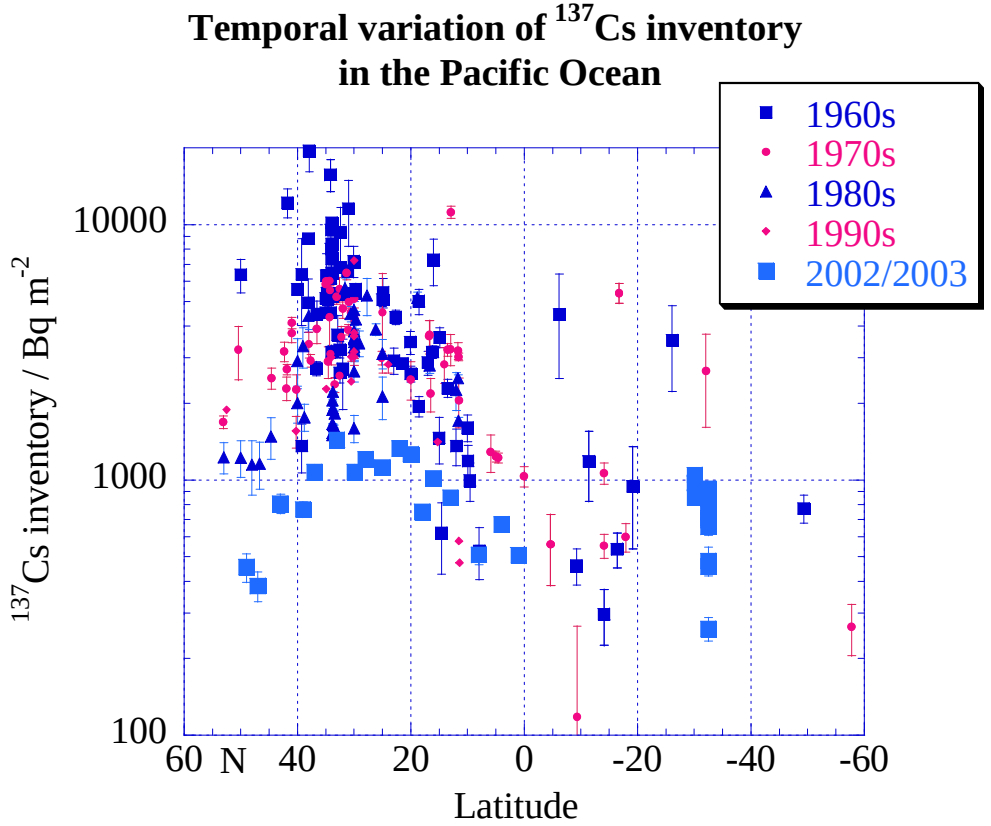


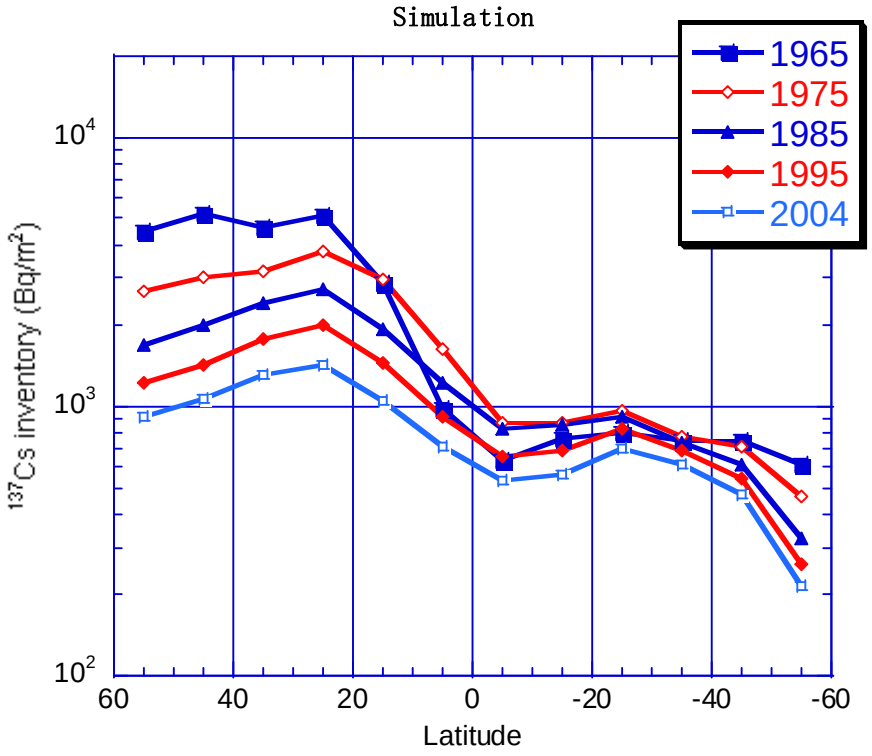




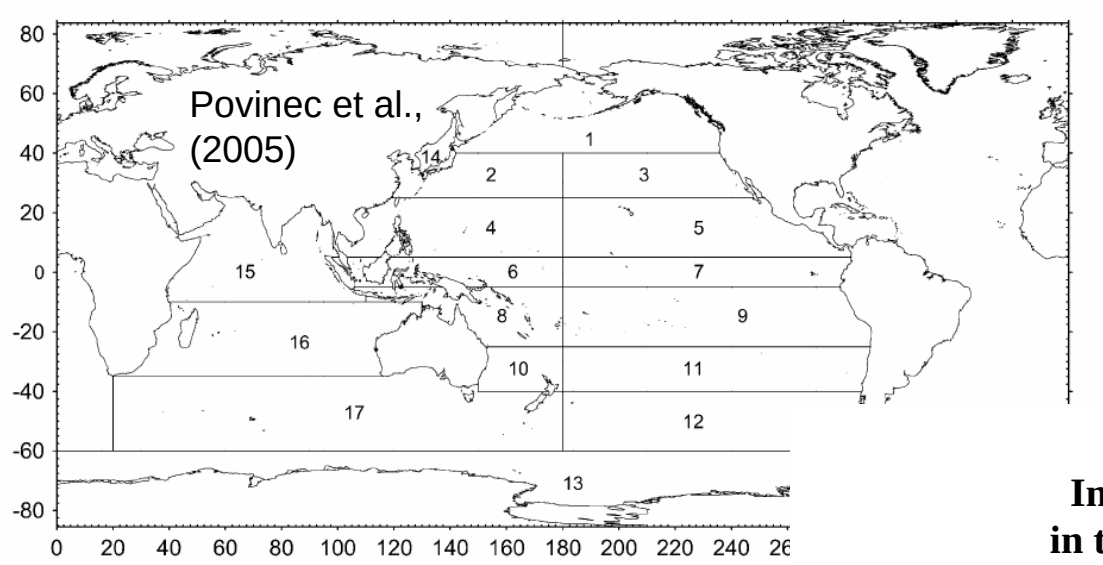


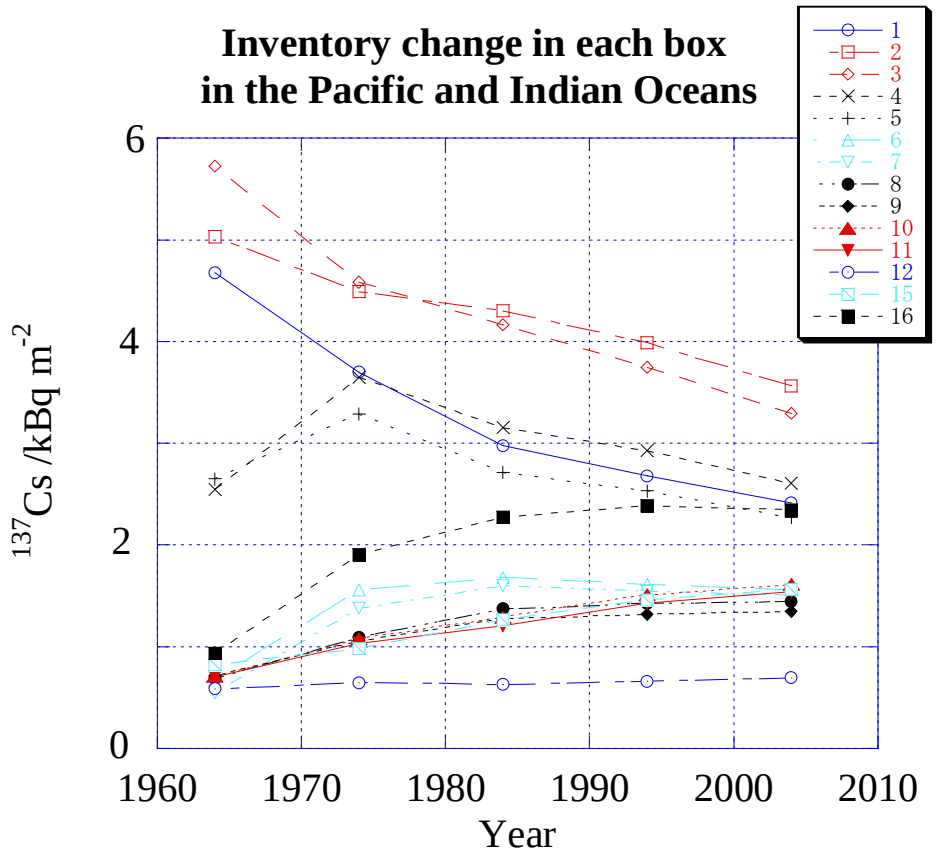
Temporal variation of ^{137}Cs inventory in the Pacific Ocean



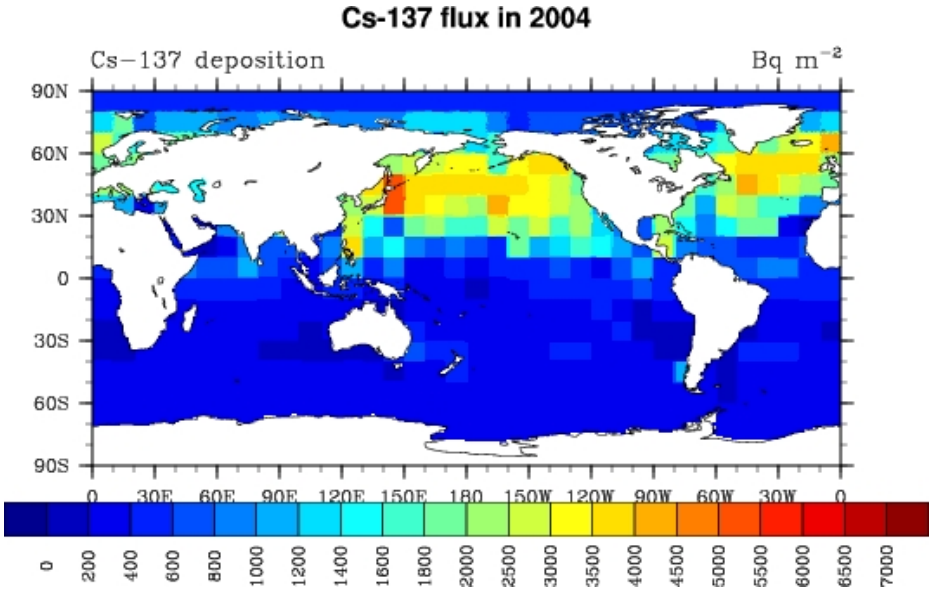


Temporal variation of ^{137}Cs inventory

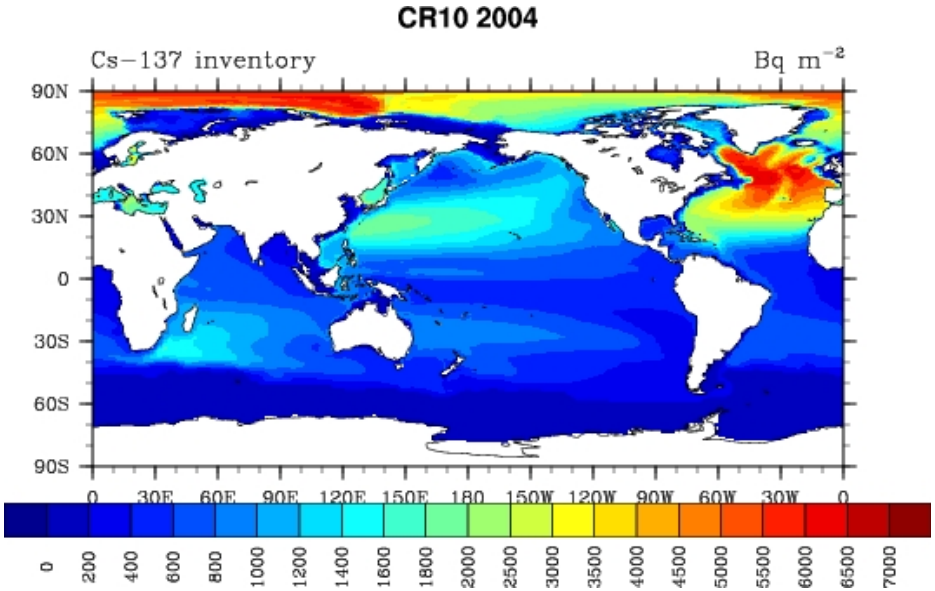




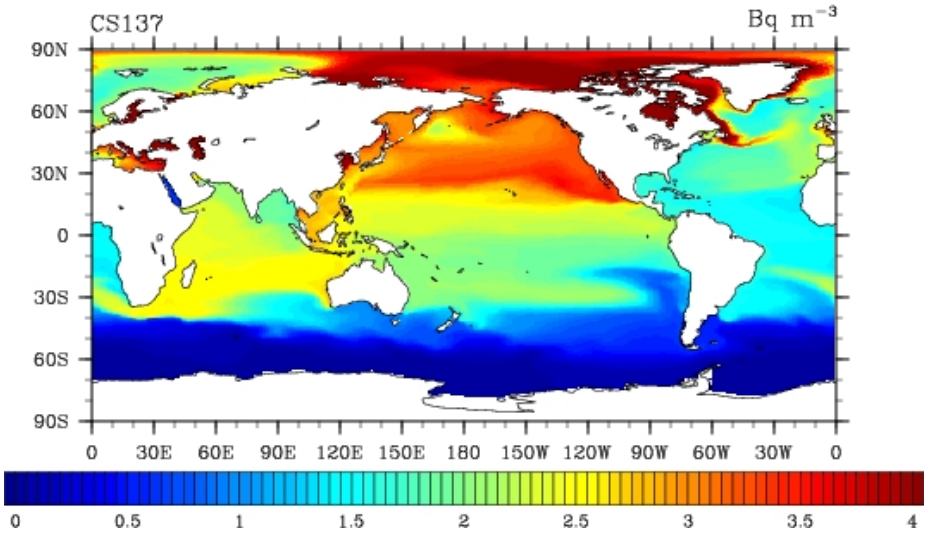
Decay corrected cumulative deposition



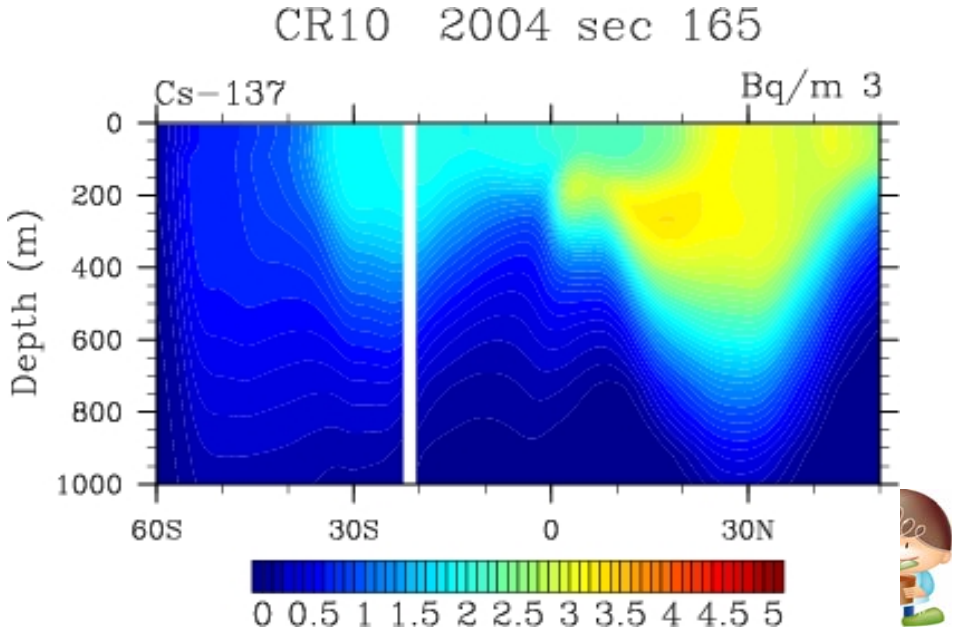
Inventory



Surface concentration



Section at 165E



Conclusions

- Input of ^{137}Cs in the North Pacific is larger than the one in the South Pacific
- Inventory of ^{137}Cs decrease in the North Pacific and increase in the South Pacific
- ^{137}Cs tracer moved from North Pacific to South Pacific
- ^{137}Cs is a good tracer to understand the material cycle in the ocean in the several decades