Millennium-scale changes in ocean carbon cycle under global warming

*Akitomo Yamamoto[1], Ayako Abe-Ouchi[1], Yasuhiro Yamanaka[2]

1.Atmosphere and Ocean Research Institute, The University of Tokyo , 2.Graduate School of Environmental Science, Hokkaido University

The oceanic uptake of anthropogenic CO_2 from the atmosphere is expected to persist for a thousand years or more. Understanding the oceanic carbon uptake is essential for predicting the air-borne fraction of CO_2 emissions and thus degree of climate change. Warming of ocean surface waters and changes in the ocean circulation and biological pump would reduce the oceanic uptake of CO_2, which is known as climate-carbon cycle feedback.
In this study, we simulate multimillennium changes in ocean carbon cycle under quadrupling of atmospheric CO_2, using GCM (MIROC) and an offline biogeochemical model. We also carry out a number of sensitivity runs in order to isolate the individual feedback mechanisms.
The oceanic uptake is 2050 Pg C, and the reduction of uptake due to global warming is about 30% at the end of simulation. These values are comparable to the previous studies (Plattner et al, 2001; Schmittner et al, 2008). The increase in SST and weaker soft-tissue pump are the dominant mechanisms of climate-carbon cycle feedback. Important biological mechanisms are reduction in new production due to reduced nutrient supply and increase in remineralization rate due to seawater warming.
I will also discuss the effect of ocean circulation change on the oceanic uptake.

Keywords: ocean carbon cycle, multi-millennium simulation, climate-carbon cycle feedback

