

# A study on the effects of sulfate aerosols on ocean circulation and the consequent atmospheric feedback

\*Yuki Kusakabe<sup>1</sup>, Toshihiko Takemura<sup>2</sup>

1. Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, 2. Research Institute for Applied Mechanics, Kyushu University

Sulfate aerosols are generally known to have negative radiative forcing and then cool the earth. The effects on the atmosphere are not uniform globally, and regional variations have been simulated by atmosphere-ocean coupled global climate models. Although Collier et al. (2013) showed that anthropogenic aerosols can alter the ocean circulation, on the other hand, there are no detailed analysis of it due to specific anthropogenic aerosol components in past studies. Then, in this study, using sensitivity experiment data from MIROC-SPRINTARS it is examined how sulfate aerosols affect ocean circulation and atmospheric feedback. In the sensitivity experiment, the anthropogenic emissions of SO<sub>2</sub>, a precursor of sulfate aerosol, are perturbed to be 0, 0.3, 0.5, 0.8, 1.5, 2, 5 and 10 times from the current emissions. The calculations were performed for 100 years in the equilibrium experiments, and the data in the last 50 years were used for analysis. The results show that spatial distributions of changes in sea surface temperature (SST) are similar to those of surface air temperature. A peculiar perturbation of SST is shown in the mid-latitude of the North Atlantic, which the SST increases (decreases) due to an increase (decrease) in SO<sub>2</sub> emission. Analysis of ocean currents and wind fields suggests that strengthening or weakening of westerly winds by sulfate aerosols perturbation may change a flow path of the Gulf Stream, causing the characteristic change in SST.

## Reference

Collier, M.A., Rotstayn, L.D., Kim, K.Y., Hirst, A.C., and Jeffrey, S.J. 2013. Ocean circulation response to anthropogenic-aerosol and greenhouse gas forcing in the CSIRO-Mk3.6 coupled climate model, doi: 10.22499/2.6301.003.

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