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ESTIMATING MONTHLY CO2 FLUX DISTRIBUTION IN THE ARCTIC AND ITS SPATIO-TEMPORAL VARIABILITY

Sayaka Yasunaka *(JAMSTEC, Japan)*
Masahiko Murata *(JAMSTEC, Japan)*
Eiji Watanabe *(JAMSTEC, Japan)*
Naohiro Kosugi *(MRI, Japan)*
Daisuke Sasano *(MRI, Japan)*
Masao Ishii *(MRI, Japan)*
Shigeto Nishino *(JAMSTEC, Japan)*
Hiroshi Uchida *(JAMSTEC, Japan)*

yasunaka@jamstec.go.jp

204 monthly maps of air-sea CO2 flux were produced for the Arctic from January 1997 to December 2013 from surface ocean partial pressure of CO2 (pCO2_o) estimation using a self-organizing map of temperature, salinity, sea ice concentration, and atmospheric pCO2 (pCO2_a). pCO2_o data were obtained from underway observation and also calculated from bottled biogeochemistry data. Using the mapping results, we investigated the spatio-temporal variability of Arctic CO2 flux in seasonal and interannual time scales.

Large CO2 influx appeared in Greenland Sea, Barents Sea, and Chukchi Sea, because of slight coverage of sea ice and strong wind (Fig. 1). Seasonal and interannual variability was also relatively large in these regions. Seasonal and interannual variability of CO2 flux largely depended on wind variability almost all area, and partly depended on sea ice melting in seasonal ice zone.

The Arctic Ocean annual CO2 uptake of 150 TgC was estimated, consistent with estimates based on extrapolations of sparse data. The Arctic Ocean CO2 uptake showed interannual change; large uptake when wind was strong and sea ice area was narrow; maximum annual uptake of 190 TgC in 2007 and minimum of 90 TgC in 2001. Furthermore, the CO2 sink was enhanced by 2 TgC/yr associated with shrinking sea ice coverage.

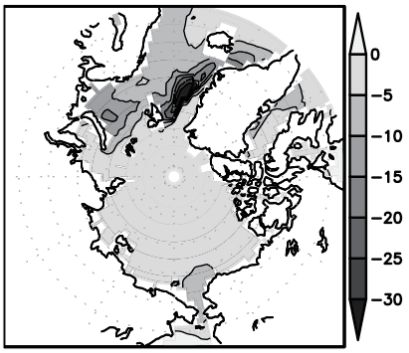

Figure 1. 18-year annual mean of CO_2 flux (negative means influx) [mmol/m2/day].