3.069 Longitudinal distributions of DMS and pCO2 in the surface seawater and atmosphere in the subarctic North Pacific during the summer cruise of 2007 (MR07-04) .

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Abstract:

In order to investigate the longitudinal distributions of major climate relevant gases, such as dimethylsufide (DMS) and carbon dioxide (CO_2), in the subarctic North Pacific in the summer, continuous measurements of these gases in both the surface seawater and atmosphere were carried out during the transect cruise at 47°N from 160°E to 120°W in the summer of 2007 by R/V Mirai (MR07-04 cruise). Abrupt increases in the DMS concentration in both the surface seawater and atmosphere were observed between 180° and 160°W from 1-5 nM (160°E-180°) to 30 nM (180°-160°W) for seawater DMS and from several hundred pptv (160°E-180°) to 1-3.5 ppbv (180°-160°W) for atmospheric DMS. The sea-air DMS flux was estimated to be the highest (100-150 μmol/m^2/day) between 180° and 170°W due to the high seawater DMS concentration and high wind speed associated with low-pressure systems. The atmospheric pCO_2 was approximately constant (370 μatm), and the seawater pCO_2 exhibited large variations, ranging from 320 to 400 μatm. While the seawater pCO_2 was lower than the atmospheric pCO_2 for most measurement positions at this latitude, the seawater pCO_2 was sporadically higher than that in air at 170°E and between 170°W and 160°W. At the latter longitude where a high DMS flux was calculated, CO_2 was emitted into the atmosphere, i.e., the ocean was a source of atmospheric CO_2 (2-10 mmol/m^2/day). The concentration of bio-Ca in the suspended particles of seawater was high at this longitude, suggesting an increase in coccolithophores, which are known as high DMSP producers, and CO_2 was released into the seawater when forming coccoliths. From our discussion based on our measurement data and the literature, it can be said that the production of DMS and CO_2 in the seawater was likely to be enhanced between 170°W and 160°W due to increases in coccolithophores.