Creation of heat/salt flux data set in the Okhotsk Sea using AMSR-E sea ice data

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Heat flux between atmosphere and ocean in sea-ice zones has not been understood well. Since sea ice acts as heat insulator, air-ocean heat flux is greatly affected by both ice concentration and ice thickness. Some meteorological data sets (e.g. ERA-40, NCEP/NCAR, and OMIP) provide air-ocean heat flux in sea-ice zones. However, in making these data sets, the ice concentration and thickness are not taken into account. For example, the effect of coastal polynya, high air-ocean heat exchange area due to the thin ice thickness, is neglected. Ice freezing and melting cause large salt and fresh water flux, respectively. However, the amount and the spatial distribution are also unknown. In this study, heat/salt flux data set is created in the Sea of Okhotsk. In the heat flux calculation, ice concentration and thin ice thickness are taken into consideration. Salt supply due to freezing and fresh water supply due to melting are considered in the salt flux. The ice concentration, thickness, and motion are derived from AMSR-E. This heat/salt flux data set will be useful for validating and providing boundary conditions for coupled atmosphere-ice-ocean models. From the heat/salt data set, an annual mean map of the net heat budget shows a distinct contrast, significant cooling of the ocean in the north and heating of ocean in the south. This contrast is a result of negative heat transfer by both sea ice and the southward East Sakhalin Current. Large amount of sea ice formation in the north, its southward transport, and its melting in the south provide salt flux in the north and fresh water flux in the south. From a monthly salt budget map, a large amount of ice melting is shown at the ice edge during whole winter. In the ice melt season, remarkable ice melting is shown at the coastal polynya region probably due to large solar heating of the upper ocean. This indicates that the coastal polynya works as “meltwater factory” in the ice melt season, contrasting with its “ice factory” in winter. In the coastal polynya region, interannual variability of the spatial distribution of phytoplankton bloom estimated from Aqua/MODIS chlorophyll data corresponds well with that of the remarkable ice melt region. This suggests that intensification of the upper ocean stratification by the ice melting enhances the phytoplankton growth.