Geophysical Research Abstracts
Vol. 12, EGU2010-3093, 2010
EGU General Assembly 2010

Interaction between Antarctic sea ice and synoptic activity in the circumpolar trough

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Different from conditions in the Arctic, total Antarctic sea ice extent does not show large interannual variability and almost no long-term trend is found. On a regional/monthly scale, however, large differences are observed, depending on winds and oceanic currents, thus on the prevailing synoptic weather situation. At the same time, the sea ice influences atmospheric conditions: presence of sea ice considerably changes the energy exchange between ocean and atmosphere, thus the meridional air temperature gradient, which is usually strongest at the sea ice edge. This leads to high baroclinicity in this area and thus favours cyclogenesis. The position and movement of low pressure systems, in turn, together with the local heat balance, determines sea ice extent and concentration. Divergence and convergence of sea ice also depends on the position of the circumpolar trough relative to the sea ice edge, since its position determines whether the atmospheric flow is predominantly easterly or westerly, which leads to sea ice transport to the southwest or the northeast, respectively. The circumpolar trough is usually situated closer to the coast in spring and autumn and moves north in summer and winter.
In this study, meteorological data from the ECMWF ERA-interim reanalysis as well as sea ice extent and concentration derived from passive microwave data (SSMI/SMMR) are used to investigate the interactions between Antarctic sea ice and synoptic activity in the polar ocean.
Special consideration is given to the frequency of regional sea ice minima and warm air advection from lower latitudes. A stable synoptic situation with amplified Rossby waves can lead to regional extrema in sea ice extent. An extreme case was observed in the austral summer of 2001/2002 in the Weddell Sea, when continuous northwesterly winds removed the ice from the northwestern part of the Weddell Sea and drove it to the coast of Coats Land, where usually coastal polynyas are observed in summer.