**The importance of large scale sea ice drift and ice type distribution on ice extent in the Weddell Sea**

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1. **Introduction**

The regular analysis of sea ice extent has become possible since the beginning of satellite observations. Ice extent changes are an indicator for changes in the atmosphere and the ocean. On the other hand sea ice extent variability modifies the exchange of heat, moisture and momentum between ocean and atmosphere. Therefore, an understanding of causes of its variability is required for an adequate simulation of those fluxes and thus for climate modeling.

During the last three decades mean annual ice extent in the Arctic has decreased by about 4.57% per decade while the ice cover in the Southern Hemisphere is increasing by about 2.09%. For understanding this contrary behavior it is necessary to determine the causes for the increase of sea ice extent in the Southern Ocean.

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2. **Drift and Wind speed**

Fig. 1: Arctic and Antarctic sea ice extent and trends from November 1978 to December 2006. Data: Monthly mean ice extent from NSIDC

Fig. 2: Weddell Sea ice extent and trend from November 1978 to December 2006. The large amount of perennial ice makes the Weddell Sea an area of particular interest. Data: 2 day means of ice extent from NSIDC

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3. **Divergence and Convergence**

Fig. 3: Weddell Sea temperature trends from November 1978 to December 2006. Trends are mainly positive. Data: NCEP/NCAR Reanalysis Project

Fig. 4: a) Ice drift and b) wind speed trends for February (top) and August (bottom). Colored background indicates trend while arrows in a) show mean drift. Drift trends are low in spring and high in winter. c) Trend of ratio between Drift speed and wind speed for February (top) and August (bottom).

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4. **Ice type distribution**

Not only ice drift changes can modify ice extent but also ice type distribution (First Year Ice, FYI; Second Year Ice, SYI). Therefore the contribution of FYI and SYI in the Weddell Sea has been analyzed. Ice type distribution is calculated by using satellite data from the QuikSCAT/SeaWinds sensor. For SYI a 20 year trend from January 1979 to December 2006 is provided by the Department of Oceanography from Space, Institut Français pour l’Exploitation de la Mer.

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5. **Conclusion**

- Ice drift velocity trends are low in summer and high in winter, showing increasing velocities in the eastern part of the Weddell sea. This would explain an increase in winter ice extent.
- Along the Antarctic Peninsular drift speeds are decreasing in winter higher consolidation of ice would result in higher ice thicknesses and therefore for an increased summer ice extent.
- Wind speeds also show mainly positive trends but not as strong as ice drift velocity does. Which other parameters could be responsible for those ice drift changes?
- Ice drift is generally convergent in summer and also shows a trend towards higher convergence. Higher drift speeds would explain an increased ice extent in summer.
- In winter ice drift in the central Weddell Sea is divergent with a trend towards higher divergence. Ice drift is pushed to the edges. This would explain a higher ice extent in winter.
- Further investigations on seasonal and interannual behavior of sea ice properties are required.

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6. **Future plans**

- Seasonal changes in ice extent for the Weddell Sea
- Seasonal analyzing of trends for:
  - Ice concentration
  - Temperature
  - Modelled ice thickness distribution using the Finite Element Sea ice Ocean Model (FESOM)
- Long term ice type distribution, backward calculations from FESOM
- Comparison of drift regimes from NSIDC data and FESOM and evaluation with PAR buoy data
- Interannual variability

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7. **Literature**


[FESOM](http://www.esrl.noaa.gov/psd/)

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