# Decadal Variability of Sea Ice Drift in the Weddell Sea for the Period from 1979 to 2006

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AWI · FESOM *Finite-Element Sea-ice Ocean Model* · ESSReS

## 1. Introduction

The knowledge and understanding of sea ice drift variability is essential for an assessment of, e.g., varying ice production rates, deformation processes, ice export and also stratification changes in the ocean. Here the decadal variability of sea ice motion in the Weddell Sea is discussed. Satellite derived ice motion is compared with modeled ice drift from a Finite Element Sea ice-Ocean Model (FESOM) (*Timmermann et. al., 2009*) for the period from 1979 to 2006.

## 2. Data Description

The ice motion data used here are stored on a 25km Equal-Area Scalable Earth (EASE)-Grid and are provided by the National Snow and Ice Data Center (NSIDC), Boulder. Drift velocities are computed by combining Advanced Very High Resolution Radiometer (AVHRR), Scanning Multichannel Microwave Radiometer (SMMR) and Special Sensor Microwave/Imager (SSM/I) data and are available on daily gridded data fields (*Fowler, 2003*). The results from this data set are compared with results obtained from FESOM.

## 3. Results

- No inflow of sea ice into the Weddell Sea from east during 1979 to 1986 (1979 to 1981 barely data)
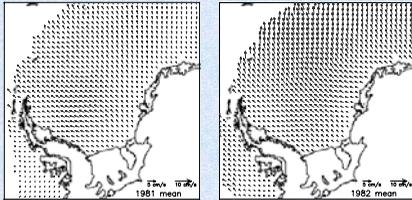


- West/south-westward drift along east coast but still no real inflow from east from 1987 to ~1995
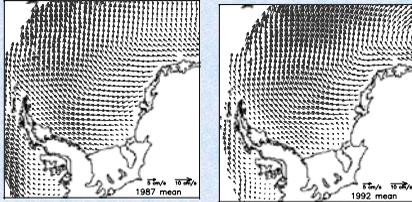
- Inflow into Weddell Sea from the east from ~1995 to 2003
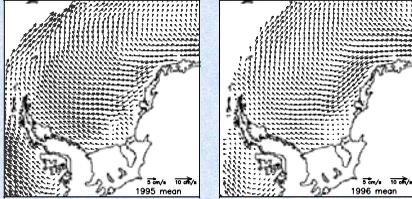
- Barely inflow in 2004 and nearly no inflow into Weddell Sea from the east in 2005 and 2006
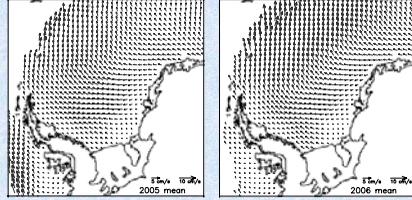
*Fig. 1. Some examples of yearly mean satellite derived drift fields for the Weddell Sea classified by their drift pattern*



*Fig. 2: Mean sea ice drift in the Weddell Sea from satellite derived data for a) 1982 – 86, b) 1987 – 91, c) 1992 – 1996 and d) 1997 – 2001 and e) 2001 – 2006 from NSIDC yearly mean grids.*
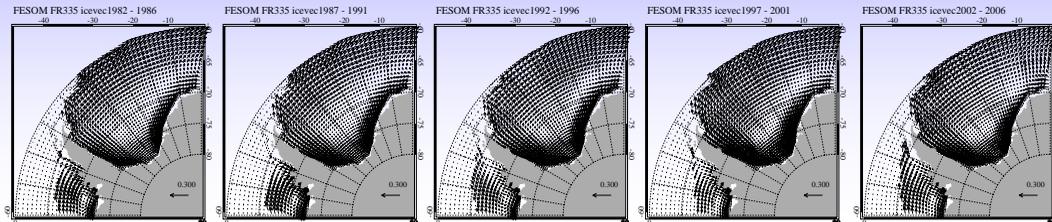


*Fig. 3: Mean sea ice drift in the Weddell Sea from FESOM results for the same time periods as in Fig. 2.*
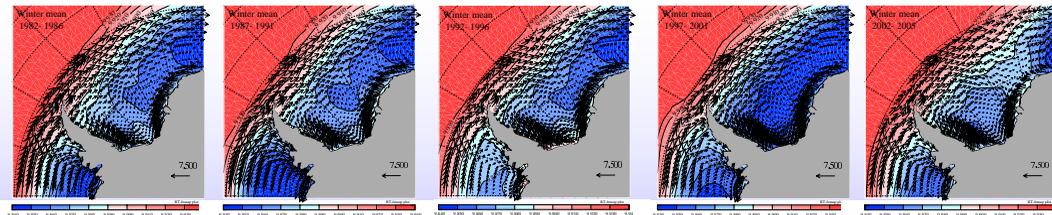


*Fig. 4: Mean sea level pressure and wind vectors for the time periods in Fig. 2. Data from NCEP Reanalysis Project*
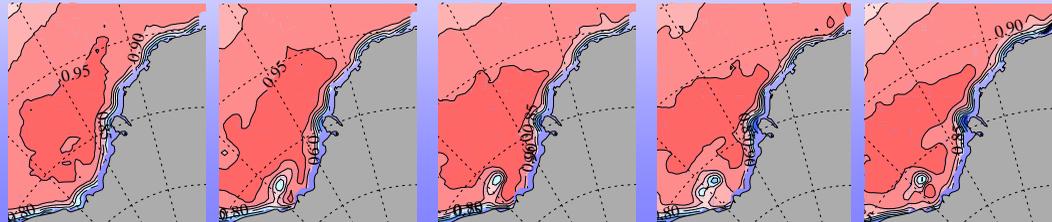


*Fig. 5: Mean September ice concentration from SSM/I data for the time periods in Fig. 2 provided by NSIDC.*

Drift estimates from satellite data show no inflow to the Weddell Sea from the east for the first decade (1979-1986) and barely for the years from 1987 to 1991. Only from 1992 we see a notable ice import into the Weddell Sea from the east.

Modeled data from FESOM show on the contrary a strong inflow of ice from the east for all decades.

Sea level pressure means from NCEP Reanalysis data and ice concentration data from SSM/I give no evidence for the unusual drift pattern derived from satellite data for the first decade. Just the absence of inflow since 2004/2005 is consistent with the pressure fields from NCEP Reanalysis data and is confirmed by lower ice concentrations along the east coast.

- Inflow into Weddell Sea in all years present
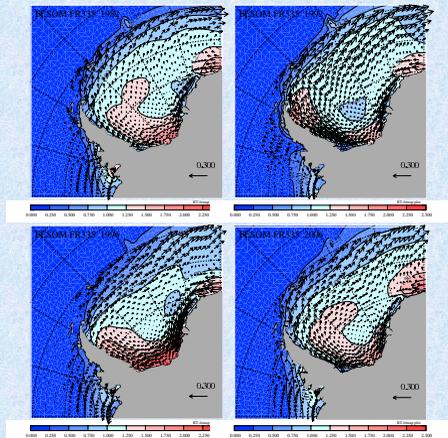


*Fig. 6: Examples for model results from FESOM with ice thickness and drift comparable to the observational data shown on the left side.*

## 4. Conclusion

- Pressure fields, wind, ice concentration and model data give no explanation for unusual drift pattern for the first period (1982-1986) ⇒
    - Satellite derived data not reliable before 1987?

- Drift pattern changes since 2004 ⇒
    - low ice concentration and modified sea level pressure support this hypothesis

## 5. Outlook

- interannual variability of ice drift and further accuracy study
- deformation processes, ice export and fresh water flux

## 6. References

**Fowler, C. 2003,** updated 2007. Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors, 1979-2006. Boulder, Colorado USA: National Snow and Ice Data Center. Digital Media.

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**Timmermann, R.**, Danilov, S., Schröter, J., Böning, C., Sidorenko, D., Rollenhagen, K.(2009).Ocean circulation and sea ice distribution in a finite element global sea ice -- ocean model, Ocean Modelling, doi:10.1016/j.ocemod.2008.10.009., doi:10.1016/j.ocemod.2008.10.009 .

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