Geophysical Research Abstracts, Vol. 8, 04092, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04092

The Variety of Sea Ice Drift and Transport Estimates from Models and Observations

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The variability of sea ice motion itself and the associated transport of sea ice has an important effect on the Arctic and Subarctic climate system and is significant to its variability. Hence, it is a key issue to both, the remote sensing as well as the modelling community, to provide reliable sea ice drift fields. This study focuses on the comparison of sea ice drift results from different sea ice-ocean coupled models (AOMIP models) and the validation with observational data, which are mainly based on satellite imagery, in the period 1979-2001.

The comparison revealed two groups of model results according to velocity distributions. One class has a clear frequency mode at relatively low ice drift speeds, below or equal to 3 cm/s, and a short tail towards higher velocities. In these models, sea ice velocities above 10 cm/s occur almost exclusively in summer and early fall. The other class of models shows a more even frequency distribution with large probability for very high drift speeds, between 10 cm/s and 20 cm/s. Observations clearly agree better with the first class of model results. The reason for the different drift speed distributions lies on the one hand in the different parameters and ocean models applied–atmospheric forcing is prescribed in AOMIP–and on the other hand in the feedback of sea ice volume to the ice strength. However, no discrete reason for the differences between models can clearly be determined, causes intertwine.

Moreover, the ability of the models to represent drift variability is tested. We investigated the drift patterns of anticyclonic and cyclonic phases of the wind-driven regimes proposed by Proshutinsky and Johnson (1997). All of the models were found to be capable of producing realistic shifts in the main drift features between the two regimes. The winter of 1994/95 stands out because of its maximum in ice export through the

Fram Strait (Vinje et al., 1998). Though areal exports from models and measurements are alike, the drift patterns in the inner Arctic differ from observations, especially in the Beaufort and East Siberian Seas. The reason for this is found in the wind forcing.

Finally, drift estimates found to be reliable in the main part are then incorporated in the calculation of sea ice transport divergence fields. Sea ice transport unites the three main parameters of sea ice: concentration, thickness and drift, and gives a cumulative impression on the interannual and interdecadal variability of the Arctic sea ice cover.