SATELLITE-DERIVED DYNAMICS OF SOUTHERN OCEAN SEA ICE

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Antarctic ERS-2, RADARSAT Synthetic Aperture Radar and ERS-1/2 Scatterometer images were analyzed with SMMI radiometer image time-series data to investigate seasonal variability in satellite-tracked sea-ice dynamics in the Southern Ocean during 1992. Supporting field data were acquired during 'in-situ' experiments including the winter 1992 Ice Station Weddell and Winter Weddell Gyre studies. A variety of surface measurements were made during these experiments including Argos-buoy deployment and GPS drift measurements. These are used in conjunction with International Program for Antarctic Buoys drift trajectories for ice-motion tracking validation.

Comparisons between gridded SSMI ice-motion vectors and ECMWF/NCEP analyses indicate that large-scale drift is forced predominantly by the long-term mean, large-scale synoptic pressure field. Only sub-daily SAR sea-ice tracking can capture high-frequency fluctuations, driven by polar lows or tidal forcing. In these cases, sea-ice drift can respond rapidly to changes in forcing on semi-diurnal time scales depending on the location with respect to the coastline. Seasonality of ice drift, particularly in the Weddell and Ross Seas, is linked to ice extent and compactness, and internal ice stresses transmitted through the pack ice from the coast. Three-monthly seasonal climatologies are presented of austral winter of ice drift in the Southern Ocean. The large Weddell and Ross Sea gyres are clearly resolved along with key seasonal and spatial attributes of their cyclonic circulation. Regional time series of ice dynamics parameters are used to illustrate correlations with meteorological forcing. Persistent divergence such as that occurring in the Ronne-Filchner polynya system results in large fractions of new ice. Similarly, convergence zones produce large fractions of deformed ice and characterize the dynamics of regions where perennial ice is observed. High shear strains also help delineate the axis of the Antarctic divergence in many places in the ice cover. In these regions, the separation between the coastal 'east wind drift' and ACC-dominated drift regimes is characterised by zonally extended regions of intense shear.

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