

## A CONCEPTUAL MODEL OF THE LARGE-SCALE DISTRIBUTION OF SEA ICE ALGAE OFF EAST ANTARCTICA

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**Introduction:** Sea ice provides a habitat for algal communities which contribute significantly to overall primary production of the ice-covered Southern Ocean and may serve as an important food resource for pelagic herbivores like Antarctic krill, particularly during winter and early spring when food in the water column is scarce. We developed a simple model of sea ice algae distribution in East Antarctica (80-150E) based on the assumption that the growth of algae in sea ice is primarily limited by the availability of photosynthetically active radiation (PAR).

**Methods:** We used daily ice cover and drift data to deduce the motion of the ice field. PAR was calculated from the NCEP-NCAR downward solar radiation flux and the time-integrated PAR exposure of a set of grid points on the ice field was calculated for the autumn to summer period from 1979/80 to 2001/02.

**Results:** The time-integrated PAR showed a latitudinal gradient, with the highest values within approximately 2 degrees latitude of the coast in the sector 80-140E. Moderate values extended to approximately 62S, with a "tongue" projecting as far north as 60S at the eastern edge of Prydz Bay (80E). The long-term mean (1998/99 - 2001/02) time-integrated PAR showed a good agreement with estimates of open-water summer chlorophyll-a (SeaWiFS) in the sea ice zone (Spearman  $r=0.87$ ,  $p<0.001$ ). The spatially-averaged time-integrated PAR in the region 80-140E showed a strong correlation with seasonally-resolved records of methanesulphonic acid (MSA) from ice cores at Law Dome (Spearman  $r=0.73$ ,  $p<0.02$  over the period 1979/80 - 1994/95). MSA is a product of biological activity in the surface ocean water. We are in the process of collating data from sea ice cores for direct validation of the model results.

**Conclusions:** This model provides a foundation for a sea ice primary production model which will include snow thickness and sea ice thickness data to estimate the PAR levels at the bottom of the sea ice floes. Sea ice cores from East Antarctica indicate that this is where most of the sea ice algae biomass is found.