This research project addresses mean convection in the Greenland Sea, one of the world ocean in which this process occurs. Convection is the process by which surface waters are taken to the intermediate or deep ocean, forming the surface termius of a circulation system which exercises considerable influence over the climate. Convection constitutes a negative feedback for the radiation-climate interaction; surf-face cooling can bring warm water up to the surface in opposition to the usual picture in which surface cooling results in ice formation which reduces insulation and further cools the air-seasystem. Finally, convection in the Greenland Sea requires the presence of a fresher layer originating in the summer meltwater of the East Greenland Current. “J”bus, this convection can be shut down fully in one year, significant since the discovery in ice sheet cores that important climate changes have occurred over only 3-year intervals.

Satellites are essential for this study. The convecting regions of the ocean occupy less than 1% of its area while 3/4 of the oceanic volume moves through them during the renewal cycle. Convecting plumes are probably only a few hundred meters across, the convecting regions may be as small as 10 km, and the life spans of these features are measured in mere clays. In two polar seas, the Weddell and the Greenland Seas, ice growth is the brim source to bring the surface waters to the salinity of the deep waters. An additional aspect of convection is thus seen to be the logistical difficulties imposed by the ice. These logistical difficulties, the plume time and space scales, and the capability of satellite systems in ice monitoring all suggest use of satellite data.

In this program SSM/I data have been used to characterize the regional behavior of Greenland Sea ice and ERS-1 SAR data have been used to help specify physical processes on the surface. Comparing the SSM/I data for 1989 with ocean mooring data indicated that the well known retreat (called Nordbukta) in the Greenland Gyre ice protuberance (called Odden) was the consequence of convection (Aagaard, K., A. Roach and F. Carney, Atmosphere-Ocean, 1993, in press). “This convection was seen to propagate both (or either) down wind and up the surface salinity gradient, and a number of questions were raised as to the initiation and evolution of the convection. An examination of the ice edge structure, showed that ice typically forms when there is still oceanic sensible heat available; thus, the heat lost through the ice cover is greater than the heat advected away as ice, and this balance is important as the ice growth part relates directly to the brine generation. Using ERS-1 SAR data we have been able to identify ice edge features that are very similar to modeled plumes and to tentatively confirm that the northern Odden ice is pancake in form. The plume observation is the first such identification, and is very exciting; it has further helped to clarify the likely processes working in the convinging water. The plumes that we think we see have a very interesting property; they are topped by ice; ice is thus not only at work in the initiation of convection but in its maintenance, as well. Ice will only form and grow on the, freshened top layer of the sea, and our hypothesis that ice drives the convection emphasizes the importance of this fresher layer. This project cent investment produce interesting and useful results and 10 point to future work.

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