The Sea Ice System in Antarctic Summer, OSO 2010-11

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Project Summary

In overall behavior, sea ice in the Antarctic has shown a slight increasing extent trend (~1%/decade) during the satellite era (1979-2008) (Comiso and Nishio, 2008). Seasonally, the ice cover generally is at maximum extent in September (19 million km^2) and at its minimum in February (3-4 million km^2). The Bellingshausen-Amundsen (BA) region (60W to 130W) and the Ross Sea region (130W to 160E), however, have shown contrasting trends, with the BA region declining overall, by (-) 5.7% /decade, while the Ross Sea region has increased, by (+)4.2%/decade (Comiso and Nishio, 2008). Because of its larger area, the Ross Sea region gains have exceeded the BA's losses by 50% in absolute area and have amounted to over half the gain seen for the Antarctic region as a whole (Comiso and Nishio, 2008). Primarily because of limited access due to the lesser ice breaking capability of previous research vessels, the Bellingshausen, Amundsen and Ross Seas represent the least studied sea ice region to date in the world's oceans. Worby et al 2008, for example, have shown from ship-based sea ice observations, where ice thicknesses and snow depths were estimated over the circumpolar Antarctic sea ice zone, that the largest area of data gaps is in the southern BA region in all seasons, and in the southeastern Ross region for all seasons except summer.

Our primary objective of the Oden 2010-11 cruise is to collect sea ice physical data and install remote buoys to document the evolution of the ice cover over an annual cycle in the regions of the Bellingshausen, Amundsen and Ross Seas, the least known region in the world. In particular, the sea ice thickness and structure and snow depth data, are important parameters in ice/ocean/air modeling, and ice mass balance calculations. Remote sensing of Antarctic sea ice, because of the inaccessibility of the region, is an important extension of these parameters to regional scales. An objective is also to validate/develop algorithms for remote sensing of Antarctic sea ice and for sea ice modeling using the surface measurements as ground truth.

To reach our goals, the field team from UTSA, plus one PolarTrec teacher (applied for) and supporting staff, will be conducting: 1) Underway measurements of sea ice properties while the Oden is transiting the pack ice zone, using over−the−side EMI measurements of total snow and sea ice thickness; visual observations of sea ice conditions (ASPeCt observations) at hourly or less intervals; and automatic digital camera photos, side looking, to estimate ice concentration, floe sizes and topography, and 2) sea ice mass balance measurements through installing two Ice Mass Balance buoys and four GPS/thermal buoys at six sea ice sampling stations (separated by 50km or greater). At the six sampling stations ice cores will be collected for baseline physical and structural characterization for the buoys and to calibrate underway measurements. Ice cores will be taken for physical properties and structure; ice thickness measurements will be made by drilling and EMI profiling; and snow sampling will be conducted for depths, density, oxygen isotopes, grain sizes and stratigraphy. Additional sampling will be conducted either at stops of opportunity if they occur for other projects, or in collaboration with projects that may require sea ice or snow physical data.