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Beaufort Gyre Exploration Project: Beaufort Gyre (BG) sea ice

Changes in the Beaufort Gyre Region (BGR) during last decade and especially during 2006-2007 were analyzed by *Hutchings and Rigor* (2009) who reported that in summer of 2007 the thinning of multi-year ice was caused by an increase in solar absorption in the upper ocean due to lower sea ice concentration than normal. Their conclusion is in agreement with *Perovich et al.* (2008). Some information about sea ice parameters in the BGR is provided also by *Perovich et al.* (2009).

Here we focus on the changes of sea ice measured by Upward Looking Sonars (ULSs) at locations of our moorings (A, B, C, D, Figure 1). The Fresh Water Content (FWC) in sea ice (FWCI or solid) is formally given by equation (2)

$$FWCI = \int_{zice}^{0} \frac{[Sref - Sice]}{Sref} dz + \int_{0}^{fb} \frac{[Sref - Sice]}{Sref} dz \qquad (2).$$

Here, *zice* is the draft of the sea ice that we measured using Upward-Looking Sonars (ULSs); *fb* is the freeboard of the sea ice. The freeboard can be measured by satellites but here we calculate sea ice thickness (*Hi*, which is *zice+fb*) from the sea ice draft as *Hi=zice* (??/?i), where ?i and ?? are ice and water densities, respectively. Assuming that sea ice salinity (*Sice*) is vertically uniform in the BGR, Sice=1.8 according to *Perovich et al.*, [2009] the FWCI is calculated as

FWCI = 0.948*Hi* (3).

For snow FWC calculations we follow the recommendations of *Sturm et al.* [2002] who analyzed the evolution and spatial distribution of the snow cover on the Arctic sea ice during the Surface Heat Budget of the Arctic Ocean (SHEBA) project. Specifically we assume that the snow has no salt and that the snow water equivalent, *SWE* = 0.343*Hsn* where *Hsn* is snow thickness.

The range of sea ice thickness changes (obtained from ULS records) varies among moorings. The seasonal magnitude of sea ice draft (Figure 2) is approximately 150 cm. The maximum ice draft/thickness in the BGR is observed between May and June and the minimum between late August and early November depending on the year and mooring location. The seasonal transformations of FWCI are discussed in section FWC seasonal transformations.

References

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