Methods of ground based electromagnetic (EM) and drill-hole ice and snow thickness and melt pond depth measurements

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Both drill-hole and EM measurements were carried out along linear profiles with a point spacing of 4 or 5 m. Drill-hole measurements mainly served to validate the EM method along 100-200 m profiles [*Haas et al., 1997*]. The choice of floes was such as to include only those typical of the larger region with extensive level ice patches separated by ridges or ice rubble. No particular effort was made to avoid deformed ice or ridges on these floes. If possible, pressure ridges were preferably crossed perpendicular to their longitudinal extension to reduce sampling bias in the occurrence of ridged ice probability.

From drill-hole measurements, ice thickness (to within +/-3 cm), draft (to within +/-3 cm) and freeboard (to within +/-2 cm) as well as the thickness of the snow layer (to within +/-1 cm) or of the weathered surface ice layer (to within +/-1 cm) have been determined. It is important to note that EM sounding only yields the total ice thickness, i.e. the sum of ice plus snow or deteriorated surface layer thickness, or the ice thickness plus meltwater depth in case of melt ponds. Therefore, snow and deteriorated surface layer thickness, or meltwater depth have to be measured independently to yield ice thickness, as has ice freeboard if it is of interest.

Here, we determined the elevation of the ice or snow surface with a laser leveling device. Snow depth was determined with a ruler stick. In case melt ponds were present along the profiles, their extent and depth was determined with ruler stick and tape measure.

EM draft was calculated by subtracting EM derived ice thickness from surface height.