Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05783, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05783
EGU General Assembly 2008

Potential of AMSR-E for estimating lake ice thickness on Great Bear and Great Slave lakes, Canada

K.-K. Kang (1), **C.R. Duguay** (1), S.E.L. Howell (1), C.P. Derksen (1,2) and R.E.J. Kelly (1)

(1) Cryosphere Research Group, Department of Geography, University of Waterloo, Waterloo, Canada, (2) Climate Research Division, Science and Technology Branch, Environment Canada, 4905 Dufferin Street, Toronto, Ontario, M3H 5T4, Canada (showell@fesmail.uwaterloo.ca / Fax: +1-519-888-4567)

Lake ice growth and decay include: freeze-up in the autumn; a long period of growth and thickening in winter; a short period of ice melting and thinning, and finally, break-up and the complete disappearance of the ice cover in spring. The sensitivity of freeze-up and break-up dates, and therefore ice cover duration, to climate variability and change has been demonstrated in several investigations. Freeze-up and break-up have shown to be strongly correlated with air temperatures in the preceding months, usually 1-2 months, leading to the events. The response of ice thickness to climate, however, is not as clear since ice growth is influenced by both air temperature and snow cover. Ice cover duration and thickness are both expected to decrease with climate warming. Ice thickness measurements are not only of relevance to climate studies; they are also of interest to economic activities that rely on the use of ice roads for winter transportation of goods to northern communities and to the tourism industry (e.g. ice fishing and snow machining). Passive microwave remote sensing data from current spaceborne platforms could provide a means to obtain frequent (daily) ice thickness measurements on large lakes. Investigations conducted over two decades ago have shown in a very preliminary manner (limited field measurements concurrent with airborne surveys) that acquisitions at frequencies around 5-6 GHz are particularly promising in this respect.

The primary objective of this study was to investigate the sensitivity of brightness

temperature (TB) at 6.9 and 10.65 GHz from AMSR-E channels to the seasonal wintertime evolution of lake ice cover thickness on two large lakes in northern Canada: Great Bear Lake (GBL) and Great Slave Lake (GSL). The evolution of TB (horizontal and vertical polarizations) derived from AMSR-E level 2A raw brightness temperature product (AE_L2A) was compared to daily ice thickness obtained with a numerical lake ice model over the course of two winter seasons (2004 and 2006). The major finding of this research is that the increase of brightness temperature at both 6.9 and 10.65 GHz is strongly influenced by ice growth. Over 80% of the variations in brightness temperature on GBL and GSL can be explained by ice thickening. The strongest relation was found between TB measured at vertical polarization and simulated lake ice thickness over the same period. It is concluded that AMSR-E data could be used to estimate lake ice thickness on very large lakes such as GSL and GBL.