Ref.#: Fr_7
h2kheyro@uwaterloo.ca

ABSTRACT

Ice thickness retrieval over large Arctic lakes from MODIS and AMSR-E data for operational data assimilation

Homa Kheyrollah Pour[1] C.R. Duguay[1] K.A. Scott[2] K.-K. Kang[1]
[1]*University of Waterloo, Geography and Environmental Management, Canada,* [2]*Department of Systems Design Engineering, University of Waterloo, Canada,*

Accurate measurements of ice thickness acquired at high temporal frequency are important for the improvement of operational sea and lake ice data assimilation systems. Retrieval of ice thickness is challenging in high latitude regions, at a time when such measurements are increasingly being requested by operational ice centres. The majority of current sea ice forecasting system assimilates data from passive microwave sensors with coarse spatial resolution (tens of km). Ice thickness observations are not typically directly assimilated.

This study, currently being conducted as part of the Marine Environmental Observation Prediction and Response Network (MEOPAR) project, aims to improve retrieval algorithms for the estimation of sea ice and lake ice thickness using data from the Moderate Resolution Imaging Spectroradiometer (MODIS) on board the NASA's Aqua (EOS PM) and Terra (EOS AM) satellites. The accuracy of ice thickness retrievals are investigated based on MODIS Ice Surface Temperature (IST) using a heat balance equation and snow/ice parameterization using the 1-D thermodynamic lake ice model (Canadian Lake Ice Model, CLIMo). Great Slave Lake and Great Bear Lake, two large lakes located in the Mackenzie River basin in Canada's Northwest Territories, are used as test sites due to the availability of in-situ snow and ice thickness data for validation. This allows examination of one of the main sources of uncertainty in these algorithms, the snow thickness parameterization. Retrieved ice thicknesses are compared with those obtained from the Advanced Microwave Scanning Radiometer—Earth Observing System (AMSR-E) and in-situ measurements from Canadian Ice Service (CIS) for the period of 2002-2008.

This presentation will report errors in estimated ice thicknesses from MODIS and AMSR-E/AMSR-2, which are calculated based on a relationship calibrated with in-situ ice thickness under clear-sky conditions. Further evaluations of the retrieval algorithms are also planned over the Great Lakes of North America and over the Beaufort Sea, where airborne EM thickness measurements have been acquired through the MEOPAR project, with the intent of improving our ability to forecast changing ice conditions. Due to the spatial resolution of 1km, the ice thickness from MODIS may also be useful toward sea ice forecasting in regions where higher spatial

resolution is required.