B07-P01

ENHANCING CALCULATION OF THIN SEA ICE GROWTH

Igor Appel *(IMSG at NOAA/NESDIS, United States)*

iappel@earthlink.net

This study compares two different models developed to calculate sea ice growth and applicable to retrieve sea ice thickness from remote sensing data: Ice Age Model (IAM) initially proposed to calculate ice age (thickness) on the basis of the Visible Infrared Radiometer Suite (VIIRS) observations onboard the Suomi National Polar-orbiting Partnership (SNPP) platform and One dimensional Thermodynamic Ice Model (OTIM) replacing IAM. These two methods created completely independently by different groups of authors have many similar features and their direct comparison could serve as a very general estimate of errors in calculations of sea ice growth.

The models use different realizations of the same energy balance equation applied to estimate ice thickness and including the heat fluxes of different origination: radiation, turbulent fluxes, and ice heat conductivity. Existing sensitivity studies demonstrated that the uncertainty in surface albedo and snow depth are the main factors causing errors in ice thickness estimations. The errors related to the influence of surface albedo are so significant that additional efforts are required to determine the limits of the models applicability to practical usage.

Snow depth on ice is other source of significant errors causing more than 50% uncertainty in ice thickness retrieval. Therefore, it is necessary to get accurate estimates of snow depth. Snow accumulation on ice in IAM is modeled as a function of snowfall rate and ice grow and therefore works as a negative feedback modifying surface temperature and suppressing errors in ice thickness calculations.

A principal difference between the OTIM and IAM models is significant. The former bases its calculations on information on surface temperature and air temperature and is very sensitive to the changes in the difference between air and surface temperatures. The latter uses only air temperature and includes surface temperature as an unknown model parameter.

If the information on both temperatures is reliable, both retrievals provide consistent results. However if the air and surface temperatures are not in agreement, the errors in ice thickness could be large. On the contrary, IAM algorithm bases its calculations only on air temperature having surface temperature as an internal parameter of the model. It means that air and surface temperature are always in agreement.

Current efforts are focused on the heat flux not included in the original thermal balance equation and on a better account for ice salinity and conductivity as well as a specific heat of ice formation to account for existing discrepancies.

It is important to emphasize that retrieval of ice thickness (age) should draw more attention, because the “techniques provide an unprecedented opportunity to monitor the cryosphere routinely with relatively high spatial and temporal resolutions.”