M.S. Defense Announcement
Ryan Gonzalez
Friday, September 20 at 1:00pm

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September 20, 2019
1:00pm

Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
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Consistency in the AMSR-E Snow Products: Groundwork for a Coupled Snowfall and SWE Algorithm

Snow is an important wintertime property due to its role in water resource management and land-atmosphere interactions. The variability of snowfall, both interannually and seasonally, poses a challenge for water resource management decisions. Changes in snow-cover significantly alter the land surface albedo and influence local to regional atmospheric processes. Total land covered by snow is fairly straightforward to measure using satellite remote sensing. The total snow water equivalent (SWE) is hydrologically more useful, but significantly more difficult to measure. In-situ observations of snow are globally sparse and point measurements of snowfall and SWE are not representative of the surrounding area, especially in mountainous regions. Accurately measuring snowfall and SWE is an important first step to understanding complex snow processes for hydrological and climatological purposes.

Satellite passive microwave retrievals of snow offer potential due to consistent overpasses and the capability to make measurements during the day, night, and under cloudy conditions. Snow retrievals are less mature than precipitation retrievals and have been an ongoing area of research. Exacerbating the problem, passive microwave retrievals of snowfall and SWE have historically operated independently while the accuracy of the products has suffered because of the physical and radiometric dependency between the two. In this study, we assess the consistency between the Northern Hemisphere snowfall and SWE products from the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E). This assessment provides insight into regimes that can be used as focal points for a future coupled snowfall and SWE algorithm.

SnowModel, a physically-based snow evolution modeling system driven by the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) reanalysis, is employed to consistently compare snowfall and SWE by accounting for snow evolution. SnowModel has the ability to assimilate observed SWE values to scale the amount of snow that must have fallen to match the observed SWE. Assimilation is performed using AMSR-E, Canadian Meteorological Centre (CMC) Snow Analysis, and Snow Data Assimilation System (SNODAS) SWE to infer the required snowfall for each dataset. Observed AMSR-E snowfall and SWE are then compared to MERRA-2, SNODAS, and CMC inferred snowfall and observed SWE.

Results from the study show significantly different snowfall and SWE bias patterns observed by AMSR-E. Specifically, snowfall is underestimated nearly globally and SWE has pronounced regions of over and underestimation. Snowfall and SWE biases are found to differ as a function of surface temperature, snow class, and elevation. The clearest conclusion from this study is that neither snowfall nor SWE is sufficiently consistent with each other or with other products to be useful at this time.