Spatial and Temporal Patterns of Snowmelt in the Red River of the North Basin using Enhanced Resolution Passive Microwave Data

MARISSA J. TORRES[1], CARRIE VUYOVICH[2], AND MARINA REILLY-COLLETTE[1]

ABSTRACT

The Red River of the North Basin (RRB), bordering eastern North Dakota and western Minnesota, is vulnerable to frequent snowmelt floods due to its flat terrain and low permeability soil. Advancements in passive microwave remote sensing have produced the Calibrated Enhanced-Resolution Passive Microwave Brightness Temperature (CETB), a NASA MEaSUREs product, which provides a high-resolution record of snow mass and snowmelt properties. This dataset, in addition to ground observations and modeled SWE estimates, may provide valuable information to hydrologic forecasters.

We present a regional spatial and temporal analysis of CETB SWE melt patterns in the RRB for snow years 2004-2011. We estimated CETB SWE using a simple empirically based algorithm and compared the spatial patterns to SNODAS modeled SWE estimates. Both CETB and DAV data were evaluated temporally with hydro-meteorological data (e.g., discharge, soil and air temperature) to assess the timing of melt onset in several sub-basins within the region. We identified dates of melt using common DAV melt criterion and dates of the spring pulse in streamflow using the cumulative departure from the mean. We further compared the passive microwave SWE estimates with MODIS snow covered area to confirm regional melt patterns. Preliminary results indicate a lag time as early as two days between initial melt detection and an increase in discharge. Additional observations will be presented.

[1] U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory, Hanover, NH, USA

[2] NASA Goddard Space Flight Center, Greenbelt, MD, USA