10.6 COMPARISON OF PRECIPITATION TYPE ALGORITHMS

A. TOKAY[1], B. SWICK[2], P. KIRSTETTER[3]. D. MARKS[4], J. PIPPITT[4], W. A. PETERSEN[5], D. B. WOLFF[6]

[1] University of Maryland Baltimore County and NASA Goddard Space Flight Center, Greenbelt, MD, USA

[2] St.Cloud State University, St.Cloud, MN, USA

[3] University of Oklahoma, Norman, OK, USA

[4] Science Systems and Applications Inc and NASA Goddard Space Flight Center, Greenbelt, MD, USA

[5] Marshall Space Flight Center, Huntsville, AL, USA

[6] NASA GSFC Wallops Flight Facility, Wallops Island, VA, USA

tokay@umbc.edu

A Level One requirement as specified by the National Aeronautics and Space Administration (NASA) Global Precipitation Measurement (GPM) program is to detect falling snow at an effective resolution of five km for the dual frequency precipitation radar (DPR) and 15 km for the GPM microwave imager. An S-band dual-polarized radar-based precipitation type algorithm, referred to as Hydrometeor Identification (HID) is considered a validation tool for GPM DPR precipitation type algorithms over the continental United States. The HID algorithm initially classifies the precipitation type at each radar pixel based on ten possible categories with temporal resolution of five or ten minutes based on scanning protocol. The DPR algorithm classifies precipitation type as either rain or snow, so for the comparative studies, the HID algorithm has been simplified to rain, snow, and mixed precipitation.

This study uses the Automated Surface Observing System (ASOS) present weather sensor to evaluate the performance of HID. The ASOS precipitation sensor is a light-emitting diode weather identifier (LEDWI), and works on the principle of optical phenomenon scintillation. Outside of missing data unidentified and no precipitation, the LEDWI reports rain and snow at light, moderate, and heavy intensities.

ASOS reports present weather, surface temperature, and several other observables at one-minute resolution. For this study, the database consisted of 11 ASOS stations covered by ten radar sites from the winter of 2014-2015. A total of 172 days were identified as snow, cold rain, or a mixed precipitation event. Qualitative and quantitative assessments were performed taking into account the freezing level and the radar sampling height. For the qualitative assessment, event based diagrams were made to compare each product at its native resolution. For the quantitative assessment, comparisons were made at radar resolution.

Considering LEDWI precipitation type as a reference, comparative studies have been also done through other methods and in-situ instrumentation adjacent to the ASOS site. The National Severe Storm Laboratory Multi Radar Multi Sensor (MRMS) product uses a deterministic approach to determine the precipitation type as rain or snow at its radar pixel. The approach is based on the Rapid Refresh model output temperature (T) and wet-bulb temperature (WB) thresholds. The

ASOS measured T and calculated WB is used to regenerate an MRMS like product. A probabilistic MRMS precipitation type algorithm where probability of snow has been determined based on T and WB has also been under development and is included in the comparative study. Look-up tables of frozen precipitation were also presented based on T and WB over land and ocean by Sims and Liu (2015). Performance of probabilistic methods is evaluated through the Brier score.

One of sites, NASA Wallops Flight Facility, is also equipped with three different type optical disdrometers including the OTT Parsivel2 disdrometer, that has built in synoptic code as present weather sensor. A cross comparison of ASOS and Parsivel2 precipitation type is included in the presentation.