Evaluation of MRMS Snowfall Products Using SNOTEL Measurements in West Mountainous Region

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1. INTRODUCTION

- Snow as a primary contribution to regional or even global water budgets is of critical importance to our society. Snow can also cause potentially hazardous weather, and rapidly-melting snowpack may cause flooding. For large-scale weather monitoring, ground weather radar-based snowfall observations have become highly desirable. However, verification and refinement of these retrievals requires ground-validation datasets. This study conducts a comprehensive evaluation of Multi-Radar Multi-Sensor (MRMS) snowfall products using the Snow Telemetry (SNOTEL) daily precipitation and Snow Water Equivalent (SWE) datasets.

- Z-S relation applied in MRMS is: 
  \[ Z = 75S^2 \]

2. DATA

Select solid precipitation:
- Daily maximum temperature less than 0 °C

3. RESULTS

A. Snowfall Detectability of MRMS:

Fig. 4. The POD, FAR and CSI by MRMS in terms of daily snowfall accumulation.

Fig. 5. Missing ratio by MRMS in terms of daily snowfall accumulation.

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Fig. 5. Missing ratio by MRMS in terms of daily snowfall accumulation.

B. Quantitative evaluation of MRMS daily snowfall accumulation:

Fig. 6. The color-density scatterplot of SNOTEL SWE and MRMS daily accumulation.

Fig. 7. (a) SNOTEL measured SWE against daily maximum temperature. (b) MRMS measured SWE against temperature. (c) Difference between MRMS and SNOTEL against temperature.

Fig. 8. Snowfall rate dependent underestimation by MRMS snow estimation.

Fig. 9. Difference between MRMS and SNOTEL against radar beam height above ground level.

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Fig. 9. Difference between MRMS and SNOTEL against radar beam height above ground level.

4. DISCUSSION

- A new Z-SWE relation is necessary to enhance radar snowfall estimation.

5. SUMMARIES

- This study investigates detectability and daily snow accumulation assessment of MRMS snowfall products using the SNOTEL daily SWE measurements in Western Mountainous Region.
- By choosing daily maximum temperature less than 0 °C, snowfall events in December, 2014 are chosen to conduct the evaluation.
- The POD of falling snow is moderate (~ 0.4) for light snow and increases with increasing snowfall intensity. The missing ratio is also high for light snow but decreases dramatically with increasing snowfall intensity. The detectability of snowfall of MRMS is generally good.
- The underestimation by MRMS is dependent on temperature and snowfall intensity.
- A new Z-SWE relation is necessary to enhance radar snowfall estimation.

5. REFERENCES