

## Recent Developments to NOAA Snowfall Rate Products

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The NOAA/NESDIS land snowfall rate (SFR) products are retrieved from passive microwave observations taken by both sounders and imagers such as ATMS and GMI. The first sounder product was transitioned to NESDIS operation in 2012. The algorithms have benefited from continuous development since then. Recent advancement includes machine learning (ML) snowfall detection, ML-enhanced snowfall rate estimation, and SFR extension to over ocean among others. This presentation will mainly focus on the development of the ocean SFR algorithm for S-NPP ATMS and the validation of the land SFR product. Some examples of product applications will also be presented. A companion presentation will be devoted to the ML-related algorithm improvement.

The ATMS ocean SFR follows the same framework as the land algorithm, i.e. a statistical snowfall detection (SD) algorithm and a 1DVar-based snowfall rate estimation algorithm. The SD algorithm is a logistic regression model and was trained with the CloudSat 2C-SNOW-PROFILE snowfall data. SFR is derived from cloud properties retrieved using a 1DVar inversion model. The estimates are further improved using a bias correction model that was developed using the CloudSat snowfall rate retrievals. The land SFR was validated against a host of data sources including ground observations, ground and space radar estimations, and snowfall analysis and reanalysis.