

Updates on the NOAA Operational Snowfall Rate Product

¹Huan Meng, ²Yongzhen Fan, ²Yulan Hong, ²Jun Dong, ²Vivek Agarwal, ²Felix Ozpaker, ²Ralph Ferraro

¹NOAA, NESDIS, STAR
²University of Maryland, ESSIC

The NOAA NESDIS operational snowfall rate (SFR) product is derived from a constellation of low earth orbit (LEO) satellites operated by NOAA, NASA, and EUMETSAT: S-NPP, NOAA-20, NOAA-21, GPM, Metop-B and Metop-C. The product is derived from measurements from the passive microwave radiometers ATMS, GMI, AMSU-A and MHS. The SFR algorithm consists of a snowfall detection model and a snowfall rate estimation procedure. The detection component is a machine learning (ML) model trained using global ground observations from the NOAA Integrated Surface Database (ISD). The snowfall rate retrieval is based on a one-dimensional variational (1DVAR) approach, enhanced with ML-based initialization and bias correction models.

The SFR algorithm has benefited significantly from continuous development in recent years. These developments include algorithm enhancements and extensions to new generations of satellites and sensors, such as EPS-SG MWS and MWI, GOSAT-GW AMSR3, and AWS PFM MWR. In particular, a new microphysics model has been developed using an ML model to integrate several ice habits into the SFR algorithm. This multi-ice-habit approach outperforms the single-ice-habit method currently used in the operational SFR product by at least 10% overall, and by up to 40% for deep clouds.

One important function of NOAA operations is to support end users with data products and services. In addition to product development, the SFR team also collaborates with users on product applications, especially for weather nowcasting. The team produces products from direct broadcast data to achieve low latency and, through collaborations with NASA and University of Alaska Fairbanks, distributes these data to National Weather Service Weather Forecast Offices to support their nowcasting operations. Another service capability is an interactive website that displays near-real-time snowfall products from more than ten satellites. The website features SFR and a merged radar (MRMS)-SFR product over the contiguous United States, as well as SFR product over other regions worldwide.