NESDIS Snowfall Rate (SFR) Quick Guide by NASA/SPoRT

What is the NESDIS SFR product?

The NESDIS snowfall rate (SFR) product is derived using passive microwave measurements taken from the Advanced Technology Microwave Sounder (ATMS) aboard Suomi-NPP and Advanced Microwave Sounding Unit (AMSU)/Microwave Humidity Sounder (MHS) aboard a suite of four NOAA and EUMETSAT polar-orbiting satellites. The product has a spatial resolution of approximately 16- km at nadir. The microwave signal is able to penetrate clouds, hence bearing the signatures of the snow inside and beneath the clouds.

What are its advantages?

The SFR product provides a unique, space-based perspective on the locations of frozen precipitation that can be used to easily identify the extent of a snowstorm and the location of the most intense snowfall. These two features might not be readily apparent from traditional IR or VIS satellite imagery or radar.

SFR is most valuable in filling observational gaps in mountains and remote regions where weather stations are sparse and radar blockage and overshooting are common. The SFR algorithm uses multiple channels that are sensitive to different atmospheric levels in order to sample the intensity of snowfall through the entire precipitation layer. This provides an advantage over ground-based radar, which scans single vertical levels and may miss higher concentrations of precipitation above or below the scan of the beam.

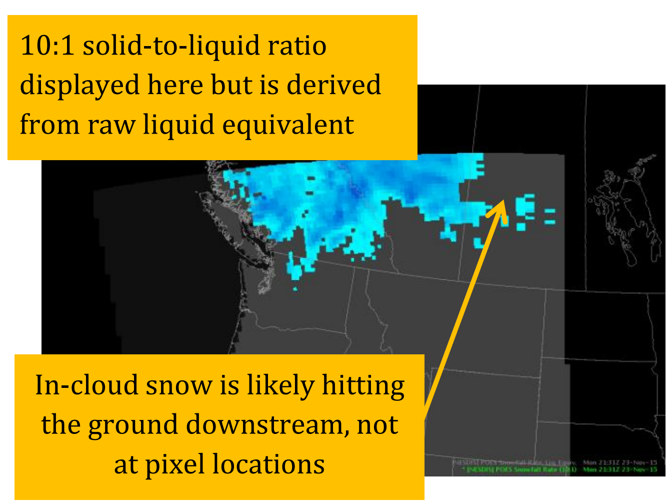
The algorithm performs best for medium to heavy snowfall in mesoscale and synoptic scale systems falling from non-shallow, stratiform clouds.

When and how often is it available?

Currently, the five polar-orbiting satellites provide up to fifty SFR retrievals per day across Alaska. The timing and locations of the overpasses will vary slightly depending on the satellite orbit, but generally there are enough overpasses to be able to track the movement of snow features. ATMS data are obtained via direct broadcast from GINA and processed in real-time at NOAA/NESDIS with a product latency of less than 30 minutes. The AMSU/MHS data are not yet available from GINA, so their latencies between 30 minutes to 3 hours.

What should I be aware of when interpreting?

- **It's liquid:** This is a water-equivalent SFR product. Forecasters can now use knowledge the environmental conditions at the time of the snowfall to select one of three liquid-to-solid conversion displays. The maximum SFR detected by the product is 0.2 in/hour (liquid).
- **Not ground snow:** The SFR product represents snow in the atmospheric column, so there usually is a time lag (average: 1-1.5 hours) between the retrieved SFR and the best correlated ground observations. Thus, high SFR is not always associated with heavy snow at ground level.
- **Over land:** The current SFR product is only retrieved over land due to limitations of available observations over water to train the dataset (masked as dark grey in AWIPS II).
- **Not too cold:** The SFR product is limited to regions where the surface air temperature is 7°F and above (masked as purple in AWIPS II).
- **Light snow:** The minimum detection for the 0.0012 in/hour (liquid), so light snows may not be fully detected.



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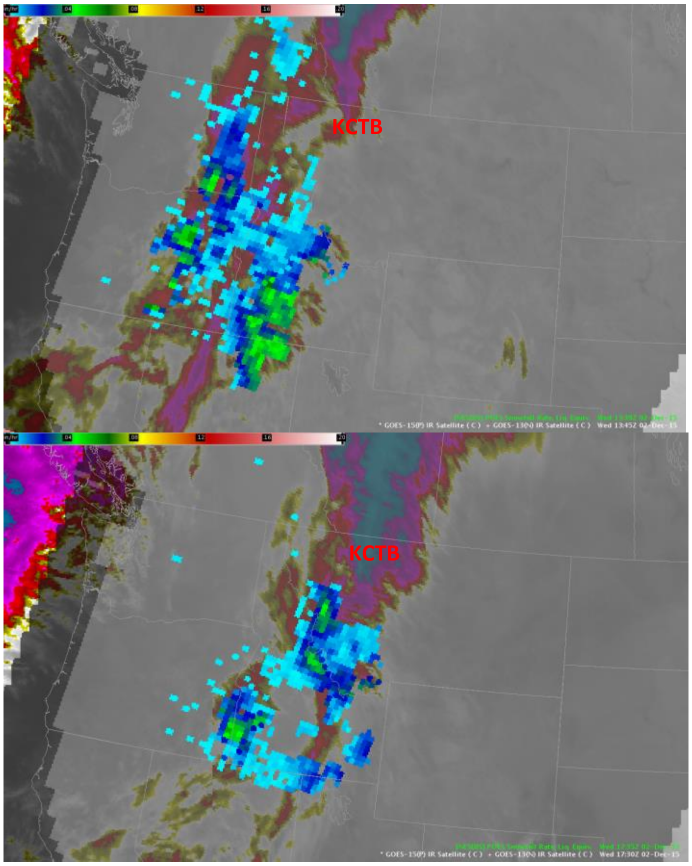


Use Cases

Tracking Snowstorms

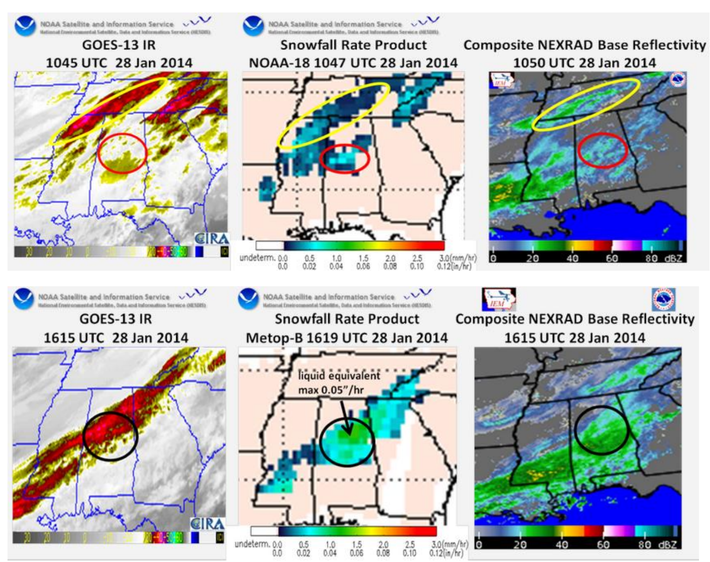
The SFR product should be used to gain additional insight into cloud and precipitation features detected on radar and GOES satellite. Because the SFR product is derived from polar-orbiting satellites, the product cannot be looped like a radar or GOES images. However, this product has the advantage of adding quantitative information regarding snowfall detection and/or rates not available from these data sources.

The images to the left show how the SFR product can be used together with GOES IR imagery to detect and track areas of the heaviest snowfall associated with cloud features. It also shows that just because IR imagery is indicating cold cloud tops that snowfall might not be present. In this example, the GOES imagery may be giving indications of snowfall in northern Montana; however, the SFR product does not show snow in this area. The Cut Bank Municipal Airport (KCTB) was not reporting snow at either of these times, which indicates potential added value of the SFR product.

Short-Term Forecasting

Under the right conditions, SFR can be used as a short term forecast product. In-cloud snow not reaching the surface can seed existing clouds to increase the likelihood of snow reaching the surface for future areas of precipitation. Many times, radar will not see high enough in the atmosphere to detect in-cloud snow.

The example on the right is from the Birmingham, AL surprise snow on Jan 28, 2014. At around 1045 UTC (top row), the SFR product (upper middle) showed snow in-cloud but no snow was observed at surface in Birmingham. Satellite (upper left) and radar (upper right) gave limited indications of the magnitude of in-cloud seeding that was occurring. Later, at 1553 UTC, snowfall was reported at BHM and later intensified. At 1615 UTC (lower row), a major winter event was occurring in Central Alabama with the IR (lower left), SFR product (lower middle), and NEXRAD (lower right) all reporting snow.



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