VIIRS Snow Cover / Depth EDR, Provisional Data Quality
Last Updated: 12/11/2013
Read-me for Data Users

The Joint Polar Satellite System (JPSS) Algorithm Engineering Review Board approved the release of the VIIRS Snow Cover / Depth Environmental Data Record (EDR) with a Provisional level maturity as of October 15, 2012 (IDPS Build Mx6.4). This data product is represented by Collection Short Names (CSNs) VIIRS-SCD-BINARY-SNOW-MAP-EDR (Binary Snow Map) and VIIRS-SCD-BIN-SNOW-FRAC-EDR (Snow Fraction). An evaluation of the products generated after that date has shown them to satisfy the criteria for Provisional-level maturity. Those criteria are:

- Product quality may not be optimal
- Incremental product improvements are still occurring
- Version control is in affect
- General research community is encouraged to participate in the QA and validation of the product, but need to be aware that product validation and QA are ongoing
- Users are urged to consult the EDR product status document prior to use of the data in publications
- Ready for operational evaluation

The Board recommends that users be informed of the following product information and characteristics when evaluating the Binary Snow Cover Map product of the Snow Cover EDR:

- The Binary Snow Cover Product has been generated since February 2012, however the time series of the derived product is not consistent. Inconsistency occurred due to several modifications that have been introduced to the cloud detection algorithm and hence to the cloud mask during the time period from February 2012 to August 2013.
- Performance of VIIRS Cloud Mask (VCM) remained non-uniform and suboptimal during much of the monitoring period. This adversely affected the accuracy of the Binary Snow Map product causing both snow misses and false snow identifications. Improvements to the VCM are currently underway and will be reflected in future versions of the Snow Cover EDR.
- The cloud mask supplied with the product is not binary (yes/no) but is formulated in terms of four-category cloud confidence. Providing four categories of cloud confidence instead of a yes/no cloud flag is somewhat confusing since it allows for generating three different snow cover maps with the same Binary Snow Map product. At this time we recommend using a conservative cloud mask that incorporates "cloudy", "probably cloudy" and "probably clear" cloud confidence categories; i.e., binary snow cover should be based on confidently clear pixels only.
- Users have to be aware that the land/water mask supplied with the product through quality flag 2 is not accurate. It contains spurious inland water bodies that result from inaccurate identification of ephemeral water and subsequent modification of the land/water mask at earlier stages of VIIRS data processing. The occurrence of ephemeral water misclassification has been traced to cloud shadows. Similar effects may occur from topographical shadows.

- The conclusion on the realistic representation of the global snow cover distribution by the current VIIRS Binary Snow Map product and on its accuracy has been made based on the analysis of the product during the 10-month time period from November 2012 to August 2013. We do not expect a serious degradation of the quality of the snow product during the remaining months of the year.

The Board further recommends that users be informed of the following caveat information with regard to the Snow Fraction product of the Snow Cover EDR:

It is important to note that with the current approach the physical meaning of the Snow Fraction generated from VIIRS data is principally different from the one of snow fraction produced from MODIS by the NASA MODIS team, and that which will be produced for GOES-R. The VIIRS product is calculated at the multi-pixel level and is meant to characterize the patchiness of snow cover on the ground. The MODIS and GOES-R products are estimated at a subpixel level and incorporate the effect of both patchiness and the snow masking by the tree canopy.

VIIRS Snow Fraction is reported mostly in 25% increments. It may also be reported in 33% increments if one pixel out of four in the 2x2 block is invalid. Because of the rough quantization of the snow fraction data reaching the required accuracy of 10% within the entire range of possible snow fraction values is not feasible.

An alternative, more advanced approach to snow fraction retrieval is necessary. The new approach should derive the snow fraction at a sub-pixel level. Two approaches will be considered: an NDSI regression-based snow fraction, and a spectral unmixing approach. The NDSI regression method has MODIS heritage and is potentially easy to implement with a relatively low impact on the current operational system. A method to estimate sub-pixel snow fraction called the Multiple Endmember Spectral Mixture Analysis (MESMA) was originally developed for NPOESS. It was implemented and delivered for use in the IDPS. It is a robust approach that takes advantage of the range of spectral information available with VIIRS. A variation of the MESMA approach is being used for GOES-R. Both approaches require extensive testing.

The VIIRS Snow Fraction has met the provisional maturity stage based on the provisional criteria. Validation and evaluation of this product will continue. However without a major revision and modification of the algorithm the product is unlikely to reach the validated maturity status.

Additional information on VIIRS and algorithm theoretical basis documents (ATBDs) is available at: http://www.star.nesdis.noaa.gov/jpss/ATBD.php.

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