

VIIRS Cloud Mask IP Release, Validation Stage 2 Data Quality
Last Updated: 02/10/2014
Read-me for Data Users

The JPSS Algorithm Engineering Review Board released the VIIRS Cloud Mask (VCM) Intermediate Product (IP) (collection short name VIIRS-CM-IP) to the public with a Validation Stage 2 level maturity as of 24 September 2013. Validation stage 2 data quality is defined such that an algorithm output has been shown to meet threshold performance attributes, using a **moderate** set of samples, as identified in the JPSS Level 1 Requirements Supplement with the exception of S-NPP Performance Exclusions. The VCM has no exclusions tied solely to S-NPP.

The Board recommends that users be informed of the following product information and characteristics when evaluating the VIIRS Cloud Mask IP.

1. The VCM validation effort continues, as it has been verified using only a moderate sample size to date. As of early 2014 the vast majority of granules produce a reasonable analysis, and errors are tied to very specific circumstances or isolated events, as described below. Limitations from ancillary data sets can also lead to isolated analyses that are substandard.
2. The VCM depends upon accurate values of the Normalized Difference Vegetation Index (NDVI), from which thresholds are determined for land/coast/desert backgrounds. In late January 2013 the gridding process, where the NDVI used by the VCM is updated every 17 days, was initiated. However this process had issues, such that the actual update often inserts monthly climatological values. Areas with values of the NDVI between 0.25 and 0.4 are showing great sensitivity to small differences in the underlying NDVI values, which may lead to errors when the real value has deviated from climatology. These areas will be prone to errors in the cloud analysis until the values return to near climate values. The related thresholds have been tuned to mitigate this error, but it may still be found over areas where deviations from the norm have developed. The most typical error noted is false alarms, when the VCM identifies cloud as present when in reality it does not.
3. The VCM also depends upon an accurate snow and ice cover. As of January 2013 this became a monthly update based on a snow/ice cover analysis supplied to the program. This has proven adequate when the snow/ice cover changes little, but can induce errors in transition seasons where the snow/ice cover may change rapidly. The VCM software was improved to sharply reduce these impacts for the daytime analysis in August 2013, but due to the nature of remote snow detection cannot do so at night. Therefore user's need to keep in mind cloud cover errors is possible at night in areas where the supplied snow/ice cover does not match reality.
4. Leakage remains a main concern, though the VCM now meets all of its leakage requirements. Concerns have been voiced by numerous downstream EDR Cal/Val teams of leakage from cloud edges over open water. This occurs in scattered areas of open water around the globe. Although the raw number of pixels impacted is small, the issue can be seen in many open water granules. A mitigating algorithm update is known, but requires an input currently not available in the JPSS ground system. That is being worked, but no delivery date has been set. This issue is primarily seen in daytime granules.

5. The focus approaching validation stage 2 has been on the daytime performance; relatively less work has been done with the nighttime output. Although the VCM is meeting requirements for all required nighttime cases, errors have been noticed, especially during polar night (areas of the earth where the sun does not rise above the horizon over a 24-hour period). Substantial changes to improve these analyses are well under development, and should be implemented sometime in the summer of 2014. However the accuracy of the analysis in polar night will always be challenged since VIIRS does not contain either a water vapor or carbon dioxide band.
6. The VCM is required to identify if a cloud detected is in reality an aerosol. The initial algorithm contained many issues related to this differentiation, but those covering cloud/aerosol differentiation over water have been addressed. Concerns remain with this differentiation over land, and improvements are under evaluation. A previous test for possible volcanic ash has been turned off within the VCM, as this parameter is no longer required by the JPSS program.
7. The next step in the VCM validation process is the move to validated stage 3 status, which depends on the following factors: 1) advancement of VIIRS SDRs to validated stage 3, 2) implementation of a daily snow/ice cover update, 3) agreement with the program on how to improve the NDVI update process and, 4) software changes to mitigate the identified problems above.

Additional information on VIIRS and the algorithm theoretical basis document (ATBD) are available at <http://www.star.nesdis.noaa.gov/jpss/ATBD.php>

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