On-orbit Suomi NPP Day-Night-Band (DNB) geolocation training and accuracy evaluation

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Introduction

The Suomi NPP (S-NPP) spacecraft, launched on 28 October 2011, hosts the Visible Infrared Imaging Radiometer Suite (VIIRS) sensor. The VIIRS sensor includes a Day-Night-Band (DNB) which is unique in its ability to monitor the spatial distribution of Earth’s surface at night. After launch, it was observed that the geolocation of DNB was off by approximately 2.3 km at nadir. After initial adjustment to the instrument mounting matrix in the geolocation algorithm, the error was reduced to 1 km at nadir. In order to remove the residual DNB geolocation error on the ellipsoid, a training algorithm utilizing imagery matching with Landsat imagery was developed for Suomi-NPP that have very accurate DNB spatial and spectral characteristics. After initial DNB geolocation update on Feb 15, 2013, the DNB geolocation uncertainty estimated to be 340 meters at nadir and 1141 meters at the edge of scan.

Results of Geolocation Training

Initial DNB geolocation update (LUT03) on March 30, 2013 removed the majority of pointing error but still had a residual of approximately 300 meter at nadir. Geolocation error for negative altitude targets indicates the need for terrain correction. After S-NPP launch had a large error of approximately 2.3 km at nadir. After training, DNB geolocation algorithm was updated to preserve 240 meter at nadir and 1141 meter at the edge of scan. Approximately 85% of the initial pointing bias was removed. Hour one altitude targets indicates the need for terrain correction in the DNB geolocation algorithm which will be implemented in 2014.

Final DNB geolocation update (LUT07, Feb 15, 2013) resulted in pointing uncertainty of 7.2 ± 37 meter (1σ) in the scan direction and 12.2 ± 77 meter (1σ) in the track direction. This corresponds to 3σ geolocation uncertainty of 240 meters at nadir and 1141 meters at the edge of scan.

Conclusions

- DNB geolocation after S-NPP launch had a large error of approximately 2.3 km at nadir.
- After training, DNB geolocation algorithm was updated to preserve 240 meter at nadir and 1141 meter at the edge of scan. Approximately 85% of the initial pointing bias was removed.
- Hour one altitude targets indicates the need for terrain correction in the DNB geolocation algorithm which will be implemented in 2014.

Long Term Trend

DNB geolocation is stable long term. There is a minor long term oscillation in the geolocation error. As of Nov 2013, the geolocation uncertainty is 4.8 ± 33 meter (1σ) in the scan direction and -20 ± 60 meter (1σ) in the track direction.

References