1. Introduction

The VIIRS onboard the Suomi National Polar-Orbiting Partnership (SNPP) satellite provides a panchromatic Day/Night Band (DNB, 500 – 900 nm) that can detect signals from very dim nighttime scene. DNB data have been applied in many areas such as city lights with power assumption, urban expansion, fishing boats, air glow, aurora, and lighting. However, DNB observations at high latitudes are affected by stray light, which is detector, HAM side, scan angle, and spacecraft solar zenith angle and azimuth angle dependent. Two methods have been developed by NOAA and NASA to remove stray lights from the affected regions. The purpose of this study is to compare the two DNB stray light correction methods to investigate potential improvements to the NOAA method.

2. NOAA Operational VIIRS DNB Stray Light Correction

- NOAA operational processing adopted a method initially developed by NG (Liao et al., 2013; Mills et al., 2013) which uses manually staged stray light contaminated earth view data during 3-day of new moon period. Detector, HAM side, scan angle, and spacecraft solar zenith angle dependent stray light correction look-up table (LUT) is fitted using the selected data for each month. 20-30 granules are usually selected per month for each hemisphere.
- 12 LUTs were developed using 1 year of new moon data (July 8, 2013 – May 28, 2014). Overall, the correction can be reused. IDPS has been recycling the 12 LUTs since June 2014.
- STAR successfully transitioned the SNPP DNB Stray Light correction from NG to STAR in late 2014.
- STAR has been supporting operational stray light correction LUT (plotted in Fig. 3) since January 2015.

3. Comparison of NOAA/NASA DNB Stray Light Corrections

- NASA VIIRS team follows the same principle as the NOAA method and developed a statistically-based method that automatically generates monthly stray light correction LUT using one day of earth view data during the new moon without the fittings (Lee et al., 2014).
- NOAA & NASA stray light LUTs share many common features:
  - Stray light contamination is stronger in the Northern Hemisphere.
  - NOAA and NASA LUTs are generally consistent for the Southern Hemisphere.
  - NASA and NOAA LUTs show similar detector-dependent patterns.
- Differences between HAM-A and HAM-B are small in NOAA and NASA LUTs.

4. Arctic DNB Stripping Case Study

- The less smooth NOAA LUTs may cause more striping. NASA LUTs show larger monthly variations compared to those from NOAA in the Northern Hemisphere.
- NOAA LUTs are generally smoother due to the use of more data to generate a LUT than the NOAA/NASA method.
- Solar vector error correction may also reduce striping, but its impacts are small. However, detector-dependent striping still exists in some regions. More new moon data may be required to better characterize stray light.
- The SC solar azimuth angle mismatch between October 2014 DNB observations and 20131005 LUTs due to 2014 SNPP orbital change may also cause striping. This issue will be studied in the future.

4. Summary and Future Work

- The NOAA and NASA DNB stray light correction methods were analyzed using 12 LUTs developed based on July 2013 – May 2014 new moon data.
  - Stray light characterizations for the Southern Hemisphere are generally consistent.
  - Larger differences exist for the Northern Hemisphere between the two methods.
- Based on the Arctic DNB-stripping case study, increasing Lstmax_median threshold may reduce striping in the NOAA operational DNB nighttime product in the Northern Hemisphere.
- NASA LUTs are smoother than those from NOAA, indicating more new moon data need to be used in order to improve the NOAA LUTs.
- Solar vector error correction may also reduce striping, but its impacts are small.
- More work is needed to investigate the impact of the Oct/Nov 2014 SC solar azimuth angle mismatch on NOAA operational stray light correction.

References

   Zarate Observing Systems (AIVS, 8060-37), San Diego.