**SNPP and NOAA-20 VIIRS Day/Night Band Calibration Performance Monitoring and Applications**

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**Abstract**

- The VIIRS Day/Night Band (DNB) sensors onboard NOAA-20 and SNPP satellites, having 50 minutes apart along the same orbit, provide nighttime imagery of clouds, nocturnal lights, auroras etc., and have been used for a variety of studies involving both geophysical and socio-economic activities.
- Recent SNPP and NOAA-20 DNB calibration algorithm updates focused improving imagery quality of DNB by addressing the striping in high aggregation zones due to residual nonlinearity.
- To synchronize with the improved DNB calibration algorithm, monthly DNB stray light correction LUTs for SNPP and NOAA-20 have also been updated. This paper reports updates that have been performed for SNPP and NOAA-20 DNB stray light correction and evaluate the improvements in DNB imagery product.
- Examples of applications of DNB data products in observations of auroras activities during severe solar storms, deep convective cloud monitoring, observation of light emissions from lava flow, during volcanic eruption and monitoring of impacts of global events on social activities are also given.

**SNPP and NOAA-20 DNB Calibration Update and Stray Light Correction**

- Details on recent updates and development of SNPP and NOAA-20 DNB calibration can be found in the poster by Gu et al. presented in this session. The calibration algorithm improvements are mainly to reduce strong striping at the end aggregation zone.
- DNB stray light has been observed over both the Northern and the Southern Hemisphere. Origin of the DNB stray light may be due to the leaking of solar light near the extended zone and the stray light diffused from adjacent pixels.
- To maintain consistency between DNB stray light correction and calibration algorithm update, monthly DNB stray light correction LUTs have been routinely generated by NOAA/STAR for operational DNB data production.

**Inter-Comparison of Radiometric Performance between SNPP and NOAA-20 DNB**

- For NOAA-20 DNB, as synchronized with the improved DNB calibration algorithm and maintain consistency between DNB stray light correction and calibration algorithm update, monthly DNB stray light correction LUTs have been routinely generated for one additional full year until November, 2020.

**Applications of Day/Night Band**

**Aurora Activities during Severe Solar Storm Observed by SNPP DNB**

- The DNB radiance map over southern hemisphere in solar magnetic (SM) coordinates from UT 6:31 on June 22 to UT 18:19 on June 23, 2015. Two central mass ejections (CME) occurred on June 19 and 21, 2015 and had made their way to Earth to cause a G4 (severe) geomagnetic storm on June 22, 2015. Overall evolution of auroras such as initial appearance, growth, expansion and decay phases were observed in successive DNB overpasses. DNB observations monitored spatial and temporal variation of aurora activities and help understand particle/plasma flow and electromagnetic energy coupling in Sun-Magnetosphere-Ionosphere system during geostrophic events.

**Deep Convective Cloud Observation under Moon Light**

- Footprint of deep convective cloud observation under moon light by DNB provides unique opportunity to perform inter-calibration between SNPP and NOAA-20 using lunar radiances. (Cao et al., 2019)

**DNB Observation of Lava Flow during Hawaii Kilauea Volcano Eruption**

- Night light observation of Deep Convective Cloud under moon light by DNB provides unique opportunity to perform inter-calibration using DNB radiances between SNPP and NOAA-20 using lunar radiances. (Cao et al., 2019)

**Global Event Impact Monitoring: Nocturnal Light Variation before and after Wuhan City Lockdown due to Coronavirus Outbreak**

- The DNB data enable real-time monitoring of natural disaster events. The observation of light emissions from high temperature lava flows during Hawaii Kilauea volcano eruption by DNB shows the entry of lava into ocean on May 21, 2018, which is consistent with the in-situ measurements by USGS.

**Summary**

- Maintained consistency between SNPP/NOAA-20 DNB stray light correction and recent DNB calibration algorithm update.
- Improved DNB stray light quality with updated stray light correction for SNPP by removing nonuniform stray light.
- Radiometric bias mapping of SNPP and NOAA-20 DNB over pseudo-invariant calibration sites under moon light shows the radiometric consistency between SNPP and NOAA-20 DNB to within 5%, with SNPP being higher. Part of this bias is due to the spectral response differences and the use of different solar irradiance spectra for DNB calibration. The rest may be from the calibration uncertainties.
- DNB observation of Deep Convective Cloud enables inter-calibration between SNPP and NOAA-20 DNB using lunar radiances.
- SNPP and NOAA-20 DNB data enable applications in monitoring large spatial scale and temporal variation of aurora light during severe solar storms, nocturnal light variation during global social events, and monitoring light emission variation during global natural disaster events such as lava flow due to volcano eruption.

**References**