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The Potential of Moonlight Remote Sensing: A Systematic Assessment with Multi-Source and Multi-Moon phase Nightlight Data

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Increased observation frequencies are current trends in optical remote sensing. However, there are still challenges at the night side when sunlight is not available. Due to their powerful capabilities in low-light sensing, nightlight satellite sensors have been deployed to capture nightscapes of the Earth from space, observing anthropomorphic and natural activities at night. At present, most nightlight remote sensing applications have mostly focused on artificial lights, particularly within cities or self-luminous entities such as fisheries, oil, shale gas, offshore rigs, and other self-luminous bodies. Little attention has been paid to examining the potential of nightlight remote sensing for mapping land surfaces in low-light suburban areas using satellite remote sensing technology. Observations taken under moonlight are often discarded or corrected to reduce the lunar effects. Some researchers have discussed the possibility of moonlight as a useful illuminating source at night for the detection of nocturnal features on Earth, but no quantitative analysis has been reported so far. This study aims to systematically evaluate the potential of moonlight remote sensing with the whole month of mono-spectral Visible Infrared Imaging Radiometer Suite/Day-Night-Band (VIIRS/DNB) and multi-spectral Unmanned Aerial Vehicle (UAV) nighttime images. The present study aims to:1) to study the potential of moonlight remote sensing for mapping land surface in low-light suburban areas; 2) to investigate the Earth observation capability of moonlight data under different lunar phases;3) to make two daily uniform nightlight datasets(moonlight included and removed) for various night scenes researches, like weather diurnal forecast, circadian rhythms in plants and so on; 4) to discuss the requirements for the next-generation nightlight remote sensing satellite sensors.