Quantifying Skyglow With a Consumer Camera

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The use of artificial light at night has increased rapidly in the last century, elevating artificial skyglow levels due to unwanted light scattering. The consequences are many and range from environmental concerns to deteriorated conditions for ground-based astronomical observations. The aim of this project is to investigate if a consumer-grade digital camera can be used to quantify artificial skyglow, and, if so, to what degree method is reliable and produces accurate results. In this study, a Panasonic Lumix DMC-ZS100 consumer digital camera is used to quantify artificial skyglow. The zenithal sky luminance was measured at seven sites in southern Stockholm County, Sweden, using a scene of known luminance for calibration. The response curve of the camera sensor was separately investigated, confirming the average gray values to be linearly related to luminance levels. The average gray values of the RAW images were used, both in determining the proportionality and when calculating the final luminance values, taking relative camera exposure into account. The calculated luminance values were compared to satellite data from the VIIRS-DNB sensor onboard the Suomi NPP satellite, showing clear correlation between collected and satellite data, differing by an average of 11% from the satellite data. No clear trend could be observed in the deviations from the reference data, and the variation range at each location accounted for <1% of respective reference value, indicating the presence of small stochastic errors such as airglow and varying starlight due to different camera positioning. As these factors are not accounted for in the reference data, they would have to be accurately modeled and subtracted for a better comparison in the future.

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