

ISS nocturnal images as a scientific tool against Light Pollution

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Abstract. The potential of the pictures of the Earth taken at night from the International Space Station (ISS) with a Nikon D3s digital camera to fight against light pollution is shown. We show that RAW pictures should be used to obtain fluxes. We have developed a method to perform absolute photometric calibration measuring fluxes of the stars recorded in the pictures and also calibrated sources at earth.

Keywords. Light Pollution, Remote sensing, Photometry

ISS nocturnal images: Flux calibration and colors.

Images of the Earth at night inform us of the light emitted to the atmosphere that is a key parameter for Light Pollution studies. Radiance calibrated, single spectral band (0.47-0.95 micron) DMSP-OLS satellite images of the Earth have been used up to now. Pictures taken by astronauts aboard the International Space Station (ISS) with a Nikon D3s digital camera could provide better spatial resolution and also RGB color information. Since the detector is a linear CMOS, pictures can be calibrated in radiance.

Information extracted from colors of ISS pictures. The three RGB channel images obtained after splitting the RAW pictures is used to get information on lighting since lamp type is defined by its spectrum. Although JPEG files could be used to get an idea of the lighting type, JPEG compression lost intensity and color information.

Absolute photometric calibration of nocturnal ISS pictures. A previous step before using the pictures to obtain fluxes emitted to the space is photometric calibration. On the one hand we have performed absolute calibration using sources at Earth. We have compared radiance calibrated images of Madrid at night taken with an airborne spectral radiometer with the RAW file of a nocturnal image of Madrid obtained from ISS†. The selected area is lighted by isolated lamps of sodium (HPS) whose spectrum matched that obtained with the hyperspectral data.

On the other hand we have calibrated using fluxes of standard stars (the astronomers way) measured on a wide angle picture taken from ISS that contains also the Iberian peninsula at night. Since the spectral response of the G channel of DSLR cameras is similar to the astronomical Johnson V band, we have plotted integrated star counts in G channel versus tabulated fluxes of the stars in Johnson V. The calibration factor is obtained from the tight linear relationship that we fit without the need of a color term.

The calibrated nocturnal images of the Earth at night taken from ISS will provide a measure of light pollution both on radiance and color. Information on lighting efficiency will be obtained when compared with energy consumption data.

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