

ON-ORBIT CALIBRATION AND VALIDATION OF THE SKYBOX IMAGING CONSTELLATION

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ABSTRACT:

With the successful launch of SkySat-2 on 8 July 2014, Skybox Imaging created a satellite constellation. The calibration and validation activities that occur immediately after the launch of each satellite are crucial to ensure accurate georeferencing, to provide radiometric uniformity, and to confirm an acceptable MTF for all imagery products distributed to customers.

The interior orientation of each SkySat focal plane is calibrated against multiple reference images of wilderness areas with low annual cloud cover and flat terrain. The reference images themselves were collected by other satellites whose GSD was less than 1 meter at nadir. Following least squares fits, the remaining 90th percentile of SkySat interior error is less than a pixel (~1 meter) at nadir. The exterior orientation of the SkySat satellites are monitored with images of ground control points (GCPs) distributed across all latitudes with land. Quarterly statistics generated by each satellite reveal the 90th percentile of circular error (CE90) of the georeferencing.

The radiometric uniformity of all SkySat detectors is checked using mid-altitude clouds as flat field targets. Statistical analyses using over a thousand cloud images are used to find non-uniformity gains and offsets that remove all observable artifacts. Absolute radiometry is accomplished through imaging of ground-based RObotic Lunar Observatory (ROLO) calibrated source regions of the lunar surface.

The MTF of every SkySat optical train is assessed through images of edge targets around the world. Both the in-track and cross-track MTFs for all the spectral bands (panchromatic, blue, green, red, and NIR) on each detector are assessed using a combination of in-house tools and collaboration with industry partners. Results show the MTFs display the expected wavelength dependent variation.

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