



www.adeepakpublishing.com

Knuuttila, O. et al. (2022): JoSS, Vol. 11, No. 3, pp. 1165–1186
(Peer-reviewed article available at www.jossonline.com)



www.JoSSonline.com

In-Space Radiometric Calibration of Nanosatellite Camera

Olli Knuuttila and Esa Kallio

Aalto University School of Electrical Engineering, Finland

Noora Partamies and Mikko Syrjäsoo

The University Centre, Svalbard, Norway

Olli Knuuttila, Kirsti Kauristie, Viktoria Sofieva, Ari-Matti Harri, Antti
Kestilä, Jarmo Kivekäs, Petri Koskimaa, Jouni Rynö, and
Johanna Tamminen

Finnish Meteorological Institute, Finland

Petri Kärhä

Aalto University School of Electrical Engineering, Finland

Juha-Matti Lukkari

Huld Oy, Finland

Arno Alho

Iceye Oy, Finland

Tuija Pulkkinen

University of Michigan, MI US

Abstract

Spacecraft payloads commonly include camera instruments; small satellites in particular provide new platforms for camera instruments. However, there remain challenges to the effective use of the images they produce in scientific and technological applications. This work presents a case study where images taken by the 1-unit (10 cm x 10 cm x 10 cm) Suomi 100 nanosatellite have been analyzed. Methods are introduced to overcome camera calibration difficulties, especially those caused by limited on-ground calibration and practical operational limitations. The methods developed in this study provide continuous space-based camera calibration during the lifetime of the satellite mission, forming the basis for the reliable usage of camera images. As an example of the approach developed, it is demonstrated how the camera calibration and image-processing methods can be used to maximize the scientific return of a small satellite's image of aurorae.

Corresponding Author: Olli Knuuttila – Email: olli.knuuttila@aalto.fi

Publication History: Submitted – 07/03/21; Revision Accepted – 04/27/22; Published – 10/06/22