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OPTIMIZING AN INFRARED CAMERA FOR OBSERVATION OF ATMOSPHERIC GRAVITY WAVES FROM A CUBESAT PLATFORM

Abstract

The NUTS (NTNU Test Satellite) is a satellite being built in a student CubeSat project at the Norwegian University of Science and Technology. The project was started in September 2010 and is a part of the Norwegian student satellite program run by NAROM (Norwegian Centre for Space-related Education). The NUTS project goals are to design, manufacture and launch a double CubeSat by 2014. The satellite will fly two transceivers in the amateur radio bands. Final year master students from several departments are the main contributors in the project

As a main payload, an infrared camera designed to observe gravity waves in the Mesosphere and lower Thermosphere is planned. Gravity waves can be found throughout the atmosphere and originate from flow over topography, convection and jet imbalance. As these waves propagate upwards in the atmosphere they transport energy and momentum. This transport will have an affect on the circulation in the middle atmosphere. At an altitude of approximately 90 km we find a layer of hydroxyl molecules that emit short wave infrared radiation during the night. When gravity waves propagate through this layer, wave patterns in the radiation intensity are observed. These observations have been limited to a few ground stations, and the possibility of global coverage from a satellite will be a useful contribution to further research.

We discuss the design of an off-the-shelf camera system based on the mechanical limitations offered by the CubeSat platform, and the scientific requirements based on data from ground observations. Due to a limited downlink, signal processing techniques and algorithms to make sure the scientific data are detected, restored and compressed are presented.