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Application of CubeSat pico-satellite technology to augment accurate Earth Observation measurements

J. E. Murray, C. Belotti, A. Last, P. Brown, **H. L. O'Brien**, R. Toumi

Space and Atmospheric Physics Group, Blackett Laboratory, Imperial College London, UK
(j.murray@imperial.ac.uk)

Abstract

We propose to evaluate the capability of a CubeSat platform for use as an Earth Observation (EO) tool in the UV – NIR spectral region. We will develop a prototype Fourier Transform Spectrometer (FTS) working as close as is technically feasible to the operational restrictions imposed by a typical CubeSat unit. The aim is to demonstrate the application of current pico-satellite technology coupled with innovative use of advanced digital micro-controllers and signal processing elements to discover under what constraints these systems will achieve measurements of sufficient signal-to-noise and accuracy to complement the large scale missions of EO. This prototype instrument will aim at the CO_2 and CH_4 bands around 1.6 μm. The Earth's spectral signal in this region is relatively weak and will test the limits of detector technology. The instrument sensitivity measured in the 1.6 μm band will be extended to the visible – UV region using the results obtained in this study coupled with models of the various top of the atmosphere radiance fields.

As an initial benchmark for successful evaluation of CubeSat potential for EO science there are several areas that need addressing. Can the viewing geometry of a CubeSat instrument be adequately known and, is it possible to make sufficient spectral measurements at adequate resolution and radiometric accuracy to retrieve atmospheric and surface properties. The issue of pointing accuracy can be resolved by the use of commercial units. The issue of spectral resolution and signal-to-noise will be addressed in a trade-off study. The final test of calibration will be a comparison with other well calibrated instrumentation, such as the GOSAT satellite.