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EFFECT OF SATELLITE FORMATION ARCHITECTURES AND IMAGING MODES ON ALBEDO ESTIMATION OF MAJOR BIOMES

Abstract

Satellite constellations are gaining momentum in their application to earth science missions owing to their unique ability to increase observation sampling in spatial, spectral and temporal dimensions simultaneously. Our research focuses on the use of satellite formations with narrow field-of-view spectrometers to measure earth reflectance over the full angular hemisphere and over a wide range of solar illumination angles, thereby providing angular distribution models for the Earth's albedo and Radiation Budget with unprecedented accuracy. The design space has multiple variables and multiple objectives. The variables include biomes or geographies of interest such as desert and snow, parameters of the formation such as number of satellites and orbital elements and the imaging mode such as dwell time per ground target and reference selection. The objectives include maximization of science performance or minimization of albedo estimation errors for the different biomes and minimization of delta-V required for launch, initialization and maintenance of the formation. Previous studies have explored the tradespace of formations in a local horizontal local vertical frame as well as the effect of imaging modes on albedo determination accuracy. This paper will use multi-angular reflectance data collected by NASA's airborne instrument called the Cloud Absorption Radiometer (CAR) as truth data and compare numerous architectures in the global design space, i.e. full lifecycle global propagation, in terms of the mentioned objectives. AGI's Systems Tool Kit, commanded using a MATLAB engine, will be used to propagate the satellite orbits and compute coverage for the required regions, followed by albedo product computations.