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HYPERSPECTRAL OBSERVATIONS OF VEGETATION PHENOLOGY AT HOURLY TIMESCALES WITH A CONSTELLATION OF SMALL SATELLITES.

Abstract

This study considers an idea to create a constellation of small **S**atellites **O**bserving **L**ake and **V**egetation **E**nvironments (SOLVE) to enable hourly revisit times, to complement observations made by larger satellites. Each spacecraft will carry a miniaturized version of a hyperspectral imaging spectrometer. The aim of the study is to consider several options for the mission capabilities, establish a preliminary schedule and the total cost of the mission.

Hyperspectral remote sensing brings in a new dimension to remote sensing observations of vegetation and water processes on Earth. Applications can vary from a purely scientific exercise to discover new phenomena, to precision farming and disaster relief management. A number of large satellites, carrying imaging spectrometers, will be launched in the next decade. However, they will only be able to look at weekly scales, revisiting target areas once or twice a week. We expect that these data will be heavily exploited by the science community at first. The focus of the mission will be to insert processed products into existing e-farming solutions and address other societal challenges.

In this work, we have defined a parameter space of science requirements, which will complement existing and future hyperspectral missions currently in development. We considered a baseline of 6 satellites placed into 3 orbital planes, with 2 (optionally more) satellites per plane. A number of small satellites platforms have been identified from a fast growing market of providers. The SOLVE constellation will complement existing and future hyperspectral missions currently under development. Measurements will be taken on hourly timescales, providing a new look on the phenology of plants. Hyperspectral missions produce a lot of data and our study has considered an innovative instrument concept to utilize latest techniques in

compressive sensing. One of the questions we are asking is whether large-scale fields can be monitored efficiently, while increasing productivity. We will also address complementarity between the SOLVE constellation and High Altitude Platforms (HAP) and Unmanned Aerial Vehicle (UAV) platforms.

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