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Improvements to the Simplified Level 2 Prototype Processor for Retrieving Canopy Biophysical Variables from Sentinel 2 Multispectral Instrument Data

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The Sentinel 2 (S2) constellation mission was designed to facilitate the systematic mapping canopy biophysical variables at medium resolution on a global basis and in a free and open manner. The mission concept requires the development of downstream services to map variables such as the fraction of absorbed photosynthetically active radiation (fAPAR), fraction of canopy cover (fCOVER) and leaf area index (LAI) using Level 2A surface reflectance inputs from the S2 ground segment. Currently, free and open products generation can be performed using the Simplified Level 2 Prototype Processor (SL2P) applied on a product granule basis. Considering that the processor is a prototype this study addresses three questions: 1) Can the SL2P algorithm, or subsequent versions, be engineered to facilitate systematic product generation over large extents in a free and open manner? 2) What is the uncertainty of SL2P products over North America during the growing season? 3) Can the uncertainty be reduced by changing the calibration database used within SL2P?

To facilitate validation and product generation, SL2P was ported to a Google Earth Engine application (the Landscape Evolution and Forecasting Toolbox). This now allows mapping of up to one million square kilometers in near real time using either the original SL2P algorithm or updated versions. SL2P uncertainty was quantified over North America using direct comparison to 20 in-situ sites within the National Environmental Observing Network in the continental United States of America and within a Canada wide field campaign over forests and shrublands conducted by Canada Centre for Remote Sensing. SL2P outputs were also compared to MODIS and Copernicus Global Land Service products over the Belmanip II regional sites and 30 additional forested regions in North America. Results from NEON validation indicate SL2P is generally within uncertainty requirements except for forests; where it underestimates fAPAR, fCOVER and LAI. Results for other sites will also be presented. To address the forest bias, SL2P was recalibrated using simulations from the FLIGHT 3D radiative transfer model representative of North American forests. The uncertainty of the recalibrated SL2P algorithm will be compared to baseline SL2P estimates to determine if increased model complexity is warranted.