# Global maps of ecosystem functional properties with the SCOPE model on Google earth engine Sentinel-2 composites

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To monitor ecosystems at large spatial scale multiple data sources are needed. We developed a methodology to simulate ecosystem functional properties (EFPs): light use efficiency (LUE), water use efficiency (WUE), and evaporative fraction (EF) with Soil Canopy Observation, Photochemistry and Energy fluxes (SCOPE) model at global scale using weather and optical satellite data.

EFPs, metrics that integrate ecosystem processes and environmental conditions, are calculated from ecosystem fluxes: gross primary productivity (GPP), sensible (H) and latent (LE) heat flux. These fluxes were simulated by SCOPE from weather parameters and plant traits (leaf area index (LAI), leaf chlorophyll content (Cab)). The weather data was taken from ECMWF ERA5-Land dataset, the plant traits were retrieved with look-up table (LUT) from Sentinel-2 Level 2 composites, exported from Google Earth engine at 10 km resolution.

LUT retrieval was optimized on a synthetic dataset to reach acceptable quality for the key drivers of GPP flux: LAI ($R^2$ = 0.75) and Cab ($R^2$ = 0.62). The global retrieved LAI showed some discrepancies with MODIS LAI product MCD15, especially in forest regions (RMSE = 1.73 $m^2$ $m^{-2}$). As a consequence, SCOPE-simulated GPP was lower in those regions, compared to MODIS GPP product (MYD17) (RMSE = 0.81 kgC $m^{-2}$ $yr^{-1}$). SCOPE-simulated heat fluxes were compared to ECMWF energy flux from ERA5-Land dataset ($RMSE_H$ = 35.4 W $m^{-2}$, $RMSE_{LE}$ = 41.6 W $m^{-2}$). EFPs validation is in progress.

The discrepancies in LAI can be explained by the fact that we did not use plant functional type information during LUT retrieval, in contrast to the MODIS algorithm. Significant overestimation of LE in dry areas is the consequence of the absence of water balance routine in SCOPE model. We consider SCOPE to be a promising tool for optical and weather data fusion.