Continuity of a global, satellite-based terrestrial primary productivity dataset in the VIIRS era achieved with model-data fusion

K. Arthur Endsley 1, Maosheng Zhao 2, John S. Kimball 1, Sadashiva Devadiga 3
1 Numerical Terradynamic Simulation Group, Univ. of Montana 2 Science Systems and Applications Inc. 3 NASA GSFC

Abstract
The NASA Terra and Aqua satellites have been successfully operating for over two decades and have far exceeded their original 5-year design life. However, the era of NASA’s Earth Observing System (EOS) may be coming to a close as early as 2023. We conducted a comprehensive calibration and validation of the MODIS MOD17 product [1,2] and the potential for continuity of multi-decadal ecosystem gross primary productivity (GPP) and annual net primary productivity (NPP) using data from the Visible Infrared Imaging Radiometer Suite (VIIRS) sensors aboard Suomi NPP and NOAA-20.

We combined an 18-year record of eddy covariance flux tower measurements with hundreds of field measurements of NPP from the Oak Ridge National Laboratories Multi-Biome collection to benchmark MODIS MOD17 Collection 6.1 (C61) and to develop the first terrestrial productivity estimates from VIIRS. Plant traits from the literature and the global TRY database [3,4] were used to identify model parameters in a Bayesian model-data fusion. As MODIS-like observations are still needed for global environmental applications, the new VIIRS VNP17 product has the potential to extend these continuous estimates of global, terrestrial primary productivity beyond 2030.

Prior Information on Plant Traits
The NASA Terra and Aqua satellites have been successfully operating for over two decades and have far exceeded their original 5-year design life. However, the era of NASA’s Earth Observing System (EOS) may be coming to a close as early as 2023. We conducted a comprehensive calibration and validation of the MODIS MOD17 product [1,2] and the potential for continuity of multi-decadal ecosystem gross primary productivity (GPP) and annual net primary productivity (NPP) using data from the Visible Infrared Imaging Radiometer Suite (VIIRS) sensors aboard Suomi NPP and NOAA-20.

We combined an 18-year record of eddy covariance flux tower measurements with hundreds of field measurements of NPP from the Oak Ridge National Laboratories Multi-Biome collection to benchmark MODIS MOD17 Collection 6.1 (C61) and to develop the first terrestrial productivity estimates from VIIRS. Plant traits from the literature and the global TRY database [3,4] were used to identify model parameters in a Bayesian model-data fusion. As MODIS-like observations are still needed for global environmental applications, the new VIIRS VNP17 product has the potential to extend these continuous estimates of global, terrestrial primary productivity beyond 2030.