

Long-term Earth System Data Record of Vegetation Leaf Area Index From Multiple Satellite-Borne Sensors: Evaluation and Validation

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Abstract:

The evaluation of a new global monthly leaf area index (LAI) data set for the

period July 1981 to December 2006 derived from AVHRR Normalized Difference Vegetation Index (NDVI) data is described. The theoretical principle in retrieving LAI from NDVI is based on a physical algorithm rooted on the radiative transfer theory of canopy spectral invariants. Establishing the consistency and validity of the long-term coarse resolution LAI product is a challenging task. Here, the implementation, production and evaluation of the data set are described. The data set is evaluated both by direct comparisons to ground data and indirectly through inter-comparisons with similar data sets. The indirect validation showed satisfactory agreement with existing LAI products, importantly MODIS, at a range of spatial scales, and significant correlations with key climate variables in areas where temperature and precipitation limit plant growth. The data set successfully reproduced well-documented spatio-temporal trends and interannual variations in vegetation activity in the northern latitudes and semi-arid tropics.

Comparison with plot scale field measurements over homogeneous vegetation patches indicated a 7% underestimation when all major vegetation types are taken into account. The error in mean values obtained from distributions of AVHRR LAI and high-resolution field LAI maps for different biomes is within 0.5 LAI for six out of the ten selected sites. These validation exercises though limited by the amount of field data, and thus less than comprehensive, indicated satisfactory agreement between the LAI product and field measurements. Overall, the intercomparison with short-term LAI data sets, evaluation of long term trends with known variations in climate variables, and validation with field measurements together build confidence in the utility of this new 26 year LAI record for long-term vegetation monitoring and modeling studies.

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