

Sensitivity Map of LAI to Precipitation and Surface Air Temperature Variations in a Global Scale

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Abstract

In Climate model and Ecosystem research, Leaf Area Index (LAI) is an important variable that impacts the land-surface process by influencing the surface roughness, albedo, and transpiration rate and rainfall interception in various ecosystems. However, recent studies show the sensitivity of LAI to climatic change is difficult to be determined. In that case, to study the relationship between LAI and climatic indexes (e.g., rainfall, temperature) is essential.

In current study, we used the newly released ISLSCP-II / LAI dataset, and temperature and precipitation datasets were produced by ECMWF and CMAP respectively. Correlations of the 9-year monthly time series of LAI with those of temperature and precipitation were calculated separately using statistical linear correlations. Both monthly total (seasonal cycle included) and monthly anomaly (seasonal cycle removed) correlations were calculated.

The results show that the high total correlation between the annual cycles of temperature and LAI in the Northern Hemisphere middle and high latitudes. The largest anomaly correlations, approximately 0.4 to 0.6, tend to occur in the tropics. The other relatively large values occur in Tibetan plateau, Siberia, other extreme northern regions, and northwestern U.S. .The largest extratropical LAI- precipitation total correlations (>0.78) occur in eastern Asia, the interior of northern North America, and Sahel region. The strongest negative correlations occur over some regions of middle and high latitudes, e.g., northwestern U.S., middle Asia, and Chile. The most significant feature of LAI-precipitation anomaly correlations is the negative anomaly correlations in Siberia, northern Asia, and northwestern North America.

This study results indicate that sensitivity of LAI to climatic index is different in various ecosystem with global scale. In addition, it could be useful for us to understand LAI role in land surface process as well as climate model & ecosystem research.