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Comprehensive Study on the Influence of Evapotranspiration and Albedo on Surface Temperature Related to Changes in the Leaf Area Index

Jiawen Zhu and Xiaodong Zeng

International Center for Climate and Environment Sciences, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing,China (zhujw@mail.iap.ac.cn)

Many studies have investigated the influence of evapotranspiration and albedo and emphasize their separate effects but ignore their interactive influences by changing vegetation status in large amplitudes. This paper focuses on the comprehensive influence of evapotranspiration and albedo on surface temperature by changing the leaf area index (LAI) between 30°N–90°N. Two LAI datasets with seasonally different amplitudes of vegetation change between 30°N–90°N were used in the simulations. Seasonal differences between the results of the simulations are compared, and the major findings are as follows. (1) The interactive affects of evapotranspiration and albedo on surface temperature were different over different regions during three seasons (March–April–May (MAM), June–July–August (JJA), and September–October–November (SON)), i.e. they were always the same over the southeastern United States during these three seasons but were opposite over most regions between 30°N–90°N during JJA. (2) Either evapotranspiration or albedo tended to be dominant over different areas and during different seasons. For example, evapotranspiration dominated almost all regions between 30°N–90°N during JJA, whereas albedo played a dominant role over northwestern Eurasia during MAM and over central Eurasia during SON. (3) The response of evapotranspiration and albedo to an increase in LAI with different ranges showed different paces and signals. With relatively small amplitudes of increased LAI, the rate of the relative increase in evapotranspiration was quick, and positive changes happened in albedo. But both relative changes in evapotranspiration and albedo tended to be gentle, and the ratio of negative changes of albedo increased with relatively large increased amplitudes of LAI.