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Atmospheric teleconnections generated by land-cover change

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Deforestation of tropical regions significantly affects precipitation at mid and high latitudes through hydrometeorological teleconnections. Five scenarios were produced with the GISS GCM: (1) current climate using current land cover; (2) current climate with a mixture of pasture and brush in most of the Amazon basin; (3) current climate with a mixture of pasture and brush in most of the African equatorial region; (4) current climate with a mixture of pasture and brush in southeast Asia; and (5) current climate with a mixture of pasture and brush in the Amazon basin, Africa, and Asia. For each scenario, six realizations of 12-year runs were produced. Different statistical tests are used to demonstrate the effect of land-cover change in the various regions affected by the deforestation as well as on the regional hydroclimate of other continents. Particular attention is paid to the effects at the seasonal time scale. Teleconnections are clearly identified between tropical and other regions, indicating that the deforestation of Amazonia and Central Africa severely reduces rainfall in the lower US Midwest during the spring and summer seasons and in the upper US Midwest during the winter and spring, respectively, when water is crucial for agricultural productivity in these regions. Deforestation of South-East Asia affects most significantly China and the Balkan Peninsula. On the other hand, the elimination of any of these tropical forests considerably enhances summer rainfall in the southern tip of the Arabian Peninsula. The combined effect of deforestation of these three tropical regions causes a significant decrease in winter precipitation in California and seems to generate a cumulative enhancement of precipitation during the summer in the southern tip of the Arabian Peninsula.