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Estudos e Modelagem do Tempo e Clima

INFLUENCE OF THE SOUTH AMERICA RAINY SEASON ONSET ON SURFACE PROCESSES IN IBIS-OFFLINE SIMULATIONS

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ABSTRACT

The onset of the South American Monsoon System (SAMS) is characterized by the rapid shift of intense convective activity from the northwestern Amazon basin to southern South America (SA), and determines the timing of the rainy season onset. Surface-atmosphere interactions affect the large-scale circulation and consequently influence the SAMS. Climate models that include realistic representation of these biophysical processes are therefore expected to provide more accurate predictions of weather and climate over the SAMS region. The objective of this study was to evaluate how atmospheric forcings affected land surface processes in years when the rainy season onset occurred early (2006-2007), neutral (2004-2005) and late (2008-2009). Experiments were performed using the Integrated BIosphere Simulator (IBIS) model, forced with reanalyses data. The sensitivity of the IBIS model was evaluated using two different vegetation maps: a natural map (NAT, which did not account for land-cover change, LCC) and an updated map (DEG), which merged the original map with a LCC map of the Brazilian territory. In the updated map, degraded natural biomes in the Brazilian territory (mainly the Atlantic Forest and the Cerrado) were replaced by cultivation areas or pasture and, for this reason, showed changes in the surface variables. Simulations were performed offline to assess the impact of changing the land surface cover with the atmospheric state forcing. The difference between the simulations with the NAT and the DEG map was calculated for September–November (SON) and December¬–February (DJF). These differences showed that, DEG simulations have reduced soil moisture over the central and southern Brazil area in SON and DJF compared to the NAT simulations. In the same area for DEG simulations, the albedo increased, and thus more short-wave radiation was reflected in response to the reduction in soil moisture, resulting in reduction of latent and sensible heat fluxes at the surface. The replacement of forest-type vegetation (Atlantic Forest) by shorter vegetation (pasture) also induced a reduction in evapotranspiration, contributing to the reduction of latent heat flux. In SON, the long wave emission temperature decreased in an area close to the São Paulo State's coast. This occurred because the reduction of surface roughness increased flow along the eastern coast, promoting cooling in this area. However, in DJF, the temperature increased, when the eastern flow is less intense. Other variables were analyzed, as net primary productivity and leaf area index, which also presented differences between the two simulations NAT and DEG. Overall, the simulation differences occurred mainly due to the vegetation map cover change (NAT and DEG). Even though the onset timing (early, neutral and late) had only a subtle effect on the results, updating the vegetation map was found to have a greater impact on surface processes in the early onset year experiments, a pattern that needs to be further investigated. The final step in the analysis will be to investigate whether using the updated vegetation map reduces the differences between the simulations and the observational data, mainly over the area 15-25°S, 40-50°W, where the natural biomes were more degraded.

KEY-WORDS: IBIS-OFFLINE, Surface Processes, South American Monsoon System, Vegetation Map.

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