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CLM Coupled in the RegCM4.1 Model: Sensitivity to the Cumulus Convective Schemes over the Amazon Rainforest

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Studies with climate models have shown that the atmosphere exhibits sensitivity to the formulation adopted in the surface-atmosphere interaction. The goal of this work was to analyze the sensitivity of surface fluxes and meteorological variables using two different cumulus convection schemes and dynamic vegetation, over Amazon Rainforest.
In this work we used the Regional Climate Model (RegCM4.1) with CLM land surface scheme. Two numerical experiments were carried out: simulation referred to as RegGrell used Grell cumulus convection and RegEmanuel considered Emanuel cumulus convection.
The simulation period ranges from 1989 to 1992. Initial and boundary conditions are taken from Era-Interim analysis. The annual cycle of simulated atmospheric variables over Amazon Rainforest – Western Amazon (km34 flux tower) and Eastern Amazon (km83 flux tower) –were compared to observed values.
For Western Amazonia, RegGrell presents an underestimation of precipitation during the months of rainy season (January to May), extending a few months into the dry-to-rainy season transition (November - December). RegEmanuel simulated the phase of annual cycle of precipitation very similar to observations, but it underestimated precipitation in almost all months of the year, except in October and December. The temperature was overestimated in all months of the year by RegGrell, while RegEmanuel overestimations occur only during the rainy season (February to April). However, RegEmanuel simulated temperature values closer to observations than RegGrell. Both simulations underestimated the sensible heat flux. RegGrell values are closer to observations than RegEmanuel with a peak in dry season (August-September) and a minimum during the rainy season, which is consistent with observations. Both schemes overestimated the evapotranspiration in the region. The maxima evapotranspiration simulated by RegGrell during the dry season (August to September) explain the overestimation of precipitation in dry period.
For Eastern Amazon, there was an overestimation of precipitation during almost all months (except January, February and April) in RegGrell. RegEmanuel simulated the phase of annual cycle of precipitation very similar to observations with small bias in dry season. The temperature was underestimated in all months of the year by RegGrell, while RegEmanuel overestimated the temperature during almost all months except in July. RegEmanuel temperatures are closer to observations than RegGrell. The phase of annual cycle of sensible heat flux is better simulated by RegGrell than RegEmanuel compared with observations. RegGrell overestimated the evapotranspiration in the region during all months of the year, but it is in phase with observation. In RegEmanuel the evapotranspiration is almost constant for all months of the year.
To summarize, the RegEmanuel showed improvements in the surface flux representation, resulting in temperature and precipitation similar to observations during the dry season while RegGrell agreement with observation is large during the summer.