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The Drought Interest Group: Using ecosystem functional types as lower boundary conditions in simulations of droughts in Southern South America

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Land surface processes occur across a range of timescales from rapid energy and water exchange with the atmosphere on short time scales to changes in soil moisture, vegetation structure (due to human-induced changes) and vegetation phenology on longer timescales. However, many numerical models for weather forecasting that consider the atmosphere and land surface as a coupled system, represent vegetation with land cover patches fixed in time. Hence, they are insensitive to any vegetation variability. In order to include biosphere processes and their effects over the atmosphere, it is desirable that climate models represent the vegetation dynamics. In this work we examine the advantages of using Ecosystem Functional Types (EFTs) as a replacement of the conventional land cover types in the Weather Research and Forecasting Model/Noah (WRF/Noah). EFTs are groups of ecosystems that share functional characteristics in relation to the amount and timing of the exchanges of matter and energy between the biota and the physical environment. EFTs are defined on a yearly basis, therefore, intermediate and long-term ecological phenomena and land surface processes are better represented. As such, they can reproduce vegetation changes resulting from either land use or natural changes. To evaluate the performance of the new land cover data, long-term simulations with conventional land cover representation were compared with simulations using EFTs as lower boundary conditions during the severe drought of 2008 in southern South America. The results show that the model is sensitive to land use changes and vegetation variability, reducing the precipitation bias over the drought region and over another region of large precipitation to the north. This suggests that a better representation of the surface processes was achieved, and thus could contribute to the predictability of the system.