CLI MATE-VEGETATION INTERACTIONS: AN EOCENE EXAMPLE

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Numerical climate models have become a significant tool for the study of climate change during Earth history. However, the application of these models is still associated with several significant flaws. A major inadequacy of current efforts is the role and response of vegetation to climate change during Earth history. This is a critical issue as the geologic record is one of the few sources of information on biotic responses to large scale climate change. The capability to predict vegetation patterns is important for three reasons, first to help assess past and future ecosystem changes as a function of climate change, second, to reconcile fossil data and model results when in contrast, and third to better incorporate vegetation-climate interactions in order to improve the quality of climate change predictions. Two major sets of research accomplishments will be addressed: (1) an evaluation of the capability of three biome models to predict present day and past vegetation when driven by climate models or observed data, and (2) the role of vegetation characteristics (effects of grass, tundra, needleleaf evergreen trees, and deciduous trees) on the model climate.

Several major conclusions are evident from this research. First, considerable progress in both climate and biome models is required before accurate biome models are available for the study of past climates. Case studies for time periods such as the Eocene suggest that no-analogue vegetation types may well prove to be a significant limitation in the application of modern biome models to the study of past and future climates. In addition, climate model inadequacies (e.g. in estimates of precipitation or winter temperature) introduce significant errors in predicting vegetation distributions. Second, vegetation is an important variable in climate and the common use of uniform specified vegetation in paleoclimate model experiments introduces error. The specification of different vegetation distributions in the climate models resulted in globally averaged surface temperature differences of as much as 1°C and regional differences of as much as 10°C. This presents the clear need for interactive climate-vegetation models which are appropriate for application to Earth history and for the assessment of climate sensitivity.

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