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The Untapped Potential of Earth System Models

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Abstract

Climate variability and climate change, including changes in extreme weather, are central to human welfare and prosperity, and the functioning of the biosphere in general. Climate change poses risks to many sectors, including agriculture, water, human health, infrastructure, national security, transportation, energy, forests and ecosystems. With the advent of Earth System Models (ESMs), and especially their inclusion of terrestrial and marine ecosystems and biogeochemical cycles, the climate science community's traditional emphasis on the physical climate has been extended to more multifaceted Earth system prediction, including the biosphere and its resources. ESMs offer an opportunity to move beyond physical descriptors of climate states to societally-relevant quantities such as habitat loss, water availability, disease spread, wildfire risk, air quality, and crop, fishery, and timber yields. In short, ESMs provide the means not just to assess the potential for future global change stresses, but also to determine the outcome of those stresses on the biosphere. Earth system prediction is required to inform sound policy that maintains a healthy biosphere and provides the food, energy, and fresh water needed for a growing global population without further exacerbating climate change. The untapped potential of ESMs is, accordingly, to bring dispersed ecosystem research related to climate processes, impacts, adaptation and mitigation into a common, integrative framework. In this talk, I will summarize the current state and future directions of Earth system modeling and prediction, with a focus on developments of relevance to the phytobiomes community, and discuss opportunities for collaboration.