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PARALLEL SESSION A : BENEFITS OF DOWNSCALING
A2: MODELS OF THE COUPLED REGIONAL CLIMATE SYSTEM

Vegetation -climate feedbacks modulate rainfall patterns in Africa under future radiative forcing

Minchao Wu WU

Lund University - Sweden

Africa has been undergoing significant and rapid changes in climate patterns and vegetation in recent decades. Continued changes may be expected over the coming century, especially for the savannah areas where a fine balance between coverage of trees and grasses is upheld by seasonal patterns of water availability. Vegetation cover and composition imposes important influences on the physical climate system, and climate-driven changes in vegetation patterns may feed back to climate via shifts in surface-atmosphere energy balance, hydrological cycling and resultant effects on air pressure patterns and atmospheric circulation. The potential role of such feedbacks in the future evolution of African climate has not been previously addressed in detailed studies. We used a regional Earth system model uniquely incorporating interactive vegetation-atmosphere coupling to investigate the potential role of vegetation-mediated biophysical feedbacks on climate dynamics in Africa in an RCP8.5 future climate scenario. The model was applied at high resolution (0.44 x 0.44 degrees) across the African continent forced by lateral boundary conditions from the CanESM2 general circulation model. We found that changed vegetation patterns associated with a CO2 and climate-driven increase in net primary productivity particularly over sub-tropical savannah areas not only imposed important local effect on regional climate by altering surface energy fluxes, but also resulted in meso-scale remote effects over central Africa by modulating the land-ocean thermogradient, near-surface circulation and moisture inflow via the Atlantic Walker circulation feeding the central African tropical rainforest region with precipitation. The vegetation-mediated feedbacks were in general negative with respect to temperature, dampening the warming trend simulated in the absence of feedbacks, and positive with respect to precipitation, enhancing rainfall reduction over rainforest areas. Our results emphasize the importance of accounting for vegetation-atmosphere interactions in climate model projections for tropical and sub-tropical Africa.

Minchao Wu[1], Guy Schurgers[2], Benjamin Smith[1], Patrick Samuelsson[3], Christer Jansson[3], Joe Siltberg[1], Wilhelm May[4], Paul Miller[1], Markku Rummukainen[4]

[1]INES, Lund University, [2]University of Copenhagen, [3]SMHI, [4]CEC, Lund University