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Novel-state Dynamic Global Vegetation Models for water and food assessments

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Major strands of recent developments of Dynamic Global Vegetation Models (DGVMs) include the process-based representation of human land use (in addition to the natural vegetation) and the improved computation of terrestrial water fluxes. For instance, the LPJ model has been recently advanced towards a novel-state DGVM, LPJmL, that now represents the world's major crop types and their management under irrigated and rainfed conditions.
Based upon recent LPJmL applications, this keynote talk demonstrates the potential of thus enhanced DGVMs to address, in an internally consistent way and at global scale, crucial questions of 1) anthropogenic interferences with the terrestrial water cycle; 2) crop production under climate and CO2 change; 3) water scarcity and water management; and 4) land and water demand for sustainable bio-energy production.
A focus of the presentation is on the extent to which various water management strategies can contribute to sustain food production for a growing world population under conditions of climate change: Results indicate that further cropland expansion in the future appears to be inevitable, even if all water available on present cropland was used most effectively.
An outlook provides prospects for future model developments and applications such as assessments of water scarcity and crop yields under a large range of climate change scenarios, and evaluations of regional and global trade-offs of land and water use for different purposes.