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Climate mitigation policy implications for global irrigation water demand

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Description / Abstract

Measures to limit greenhouse gas concentrations will result in dramatic changes to energy and land systems and in turn alter the character of human requirements for water. This paper employs the global change assessment model (GCAM), an integrated assessment model, to explore the interactions of energy, land, and water systems under combinations of three alternative radiative forcing stabilization levels and two carbon tax regimes. The paper analyzes two important research questions: i) how large may global irrigation water demands become over the next century, and ii) what are the potential impacts of emissions mitigation policies on global irrigation-water withdrawals.

The paper reveals that increasing population and economic growth could more than double the demand for water for agricultural systems in the absence of climate policy, and policies to mitigate climate change further increase agricultural demands for water. The largest increases in agricultural irrigation water demand occur in scenarios where only fossil fuel emissions are priced (but not land use change emissions) and are primarily driven by rapid expansion in bio-energy production. Regions such as China, India, and other countries in South and East Asia are likely to experience the greatest increases in water demands.

Finally, the paper tests the sensitivity of water withdrawal demands to the share of bio-energy crops under irrigation and concludes that many regions have insufficient space for heavy bio-energy crop irrigation in the future—a result that calls into question the physical possibility of producing the associated biomass energy, especially under climate policy scenarios.

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