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Global Water Resources and the Limits to Groundwater Use

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Humans have impacted the hydrological cycle since the invention of agriculture, but these impacts have grown to global proportions over the last 60 years. The indirect effects of anthropogenic climate change may be the largest, but the direct impacts by dam building, water withdrawals and the emission of pollutants is still formidable, even by comparison. In the first part of this lecture, I will briefly go over the impacts of human water use on global hydrology and water resources and how these impacts have been assessed by observational evidence and global hydrological models. This will also provide the opportunity to highlight some recent advancements in global hydrological modelling. The second part of the lecture will focus on the impacts of human water use on groundwater resources. After reviewing past assessments of global groundwater depletion rates, I will show results of ongoing research in our group on the limits to global groundwater use. These include: physical limits, related to groundwater-surface water interaction, permeability constraints and salinity; economic limits, related to the costs of groundwater extraction when wells become deeper; and ecological limits, related to the impacts of groundwater extraction on groundwater dependent ecosystems.