Climate change impacts on the water, energy, and food nexus: a
global quantitative assessment

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Understanding the global interactions between water, energy and food production under climate change is crucial to identify arising synergies and conflicts between these sectors. Existing literature mainly focuses on the water-energy-food (WEF) nexus at a case study level as well as at policy and decision making level. Global quantitative assessments of the WEF nexus are still limited. Quantifying the nexus is challenging because it requires a framework which includes knowledge from three different fields. This becomes even more complex if we want to incorporate future climate projections and look at a global scale.

Two approaches can be followed to quantify the WEF nexus. One is to use an integrated assessment model, a model that includes modules for water, energy and food. Another approach is to use separate cutting edge models from each field and bring these different model outputs together. The Inter Sectoral Impact Model Intercomparison Project (ISIMIP) gives us the opportunity to apply this second approach. In ISIMIP, many model groups provide impact model data for a variety of sectors with the same climate forcing and climate scenarios on a global scale. This means we can not only use data from the water, energy and food sectors, but we can also use multiple models per sector. This approach allows us to use unique insights from the sectoral inter-comparison studies and see their implications for the WEF nexus.

This study aims to identify WEF nexus ‘hot spots’ and how they might change in the future. Here we want to focus on locations where WEF conflicts might arise as well as spots with high development potential. We do this by, first, looking at global spatially distributed demand and supply model data per sector finding areas of surplus and deficit. Second, we combine them into several maps displaying integrated WEF nexus hot spots and their progression into the future. This study is meant to create a better global understanding of the interactions between water, energy and food sectors and how they will develop over time. The resulting maps identify regions of conflict or synergy, and can be used not only as a basis for future studies assessing resource conflicts but also as an indicator of where to harness arising opportunities.