Future projections of regional climate change: challenges and perspectives

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There is a high level of confidence in the thermodynamic responses of the climate system to anthropogenically induced warming, which includes increasing global mean surface temperature, rising sea level, and increasing atmospheric moisture content and global mean precipitation.

However, the level of confidence associated with dynamic responses, which mediate impacts at the regional scale (e.g., location and strength of tropical rainbands, expansion of arid zones and location and strength of storm track), is much lower. The lack of theoretically based constraints, the small signal-to-noise ratio in circulation changes, and hence, difficulty in detecting these changes in observations, and lack of model-to-model agreement have all contributed to the large uncertainty that still affects aspects of climate change related to changes in the atmospheric circulation.

Here, I will review existing challenges in accurate and robust projections of regional climate change and highlight a path forward that leverages theoretically based understanding and hierarchical modelling approaches.