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KEYNOTE

EXTENDED ABSTRACT ONLY

The challenges of modelling climate change impacts in non-linear water resources systems

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Abstract: Assessing climate change impacts in complex and non linear systems is challenging because of system feedbacks, poor conceptual understanding of the important ecologic and hydrologic drivers of the system, inability to holistically model all of these processes and the impacts of natural variability over multiple timeframes ranging from weeks to years through to decades. This complexity means that a variety of methods should be considered that can identify threshold behaviours and stakeholder-relevant impacts. This presentation will present an overview of recently developed methods that can address some of these issues, using the Thirlmere Lakes National Park climate change assessment as a case study.

Thirlmere Lakes National Park which is a system of five lakes south west of Sydney. Declines in water levels in the lake system over the last two decades led to community concerns about the sustainability of the lake system. The Thirlmere Lakes Research found that climate variability explained between 80 to 98% of the long term variations in lake levels, suggesting that the lakes may be vulnerable to anthropogenic climate change in the future (Chen et al. 2021). In this case study, two methods were used to investigate climate change impacts on the lake system. Firstly regional climate model (RCM) simulations available from the NSW Government NARCLiM project were bias corrected (Mehrotra et al. 2018). Because of the limited number of RCMs and driving GCMs used for the transient NARCLiM simulations (3 GCMs and 2 RCMs), a bottom up climate change assessment was also carried out to understand potential threshold behaviours in the lake system that not been sampled in the NARCLiM models.

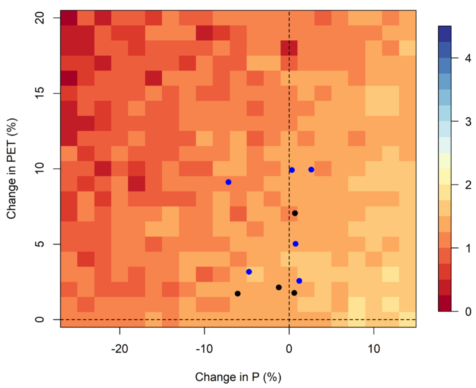

Figure 1. Median simulated water depths (m) for Lake Gandagarra for changes in annual rainfall and evapotranspiration. Dashed lines show historical climate, black (blue) dots show NARCLiM RCP4.5 (RCP8.5) projections.

The impacts of climate change were evaluated by focusing on key properties of interest to the community and for long term management of the system. The NARCLiM simulations suggest that water levels will be slightly higher under RCP4.5 and similar to historical levels for RCP8.5. The range of bottom up simulations included far more cases with drier conditions (Figure 1) and when these are coupled with increases in evapotranspiration, up to 80% of the scenarios lead to lower median water levels in the lakes than historically. The bottom up climate change assessment allowed a far wider range of future outcomes to be explored to understand the varying responses of the five lakes. The project is particularly interesting because the storage in the lakes amplifies biases in the hydrological modelling and highlights areas to focus on in future method development.

REFERENCE

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