Predicting the impact of climate change on vineyard irrigation demand in the Riverland

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Introduction

Climate change may increase demand for irrigation water across the Murray-Darling Basin as higher temperatures and changes in rainfall interact to change crop irrigation requirements. The establishment of a perennial crop is a 20 year plus investment. This project will help provide growers confidence they can supply their crops irrigation requirements to underwrite this investment.

Methods

- The soil moisture component, including the trigger irrigation option, of the HYDRUS-1D model was used to estimate vineyard irrigation requirements.
- Downscaled global climate model projections (GFDL ESM2 M) for the six climate variables: rainfall, maximum and minimum temperature, areal potential evapotranspiration, solar radiation and vapour pressure deficit for a high emissions scenario (RCP8.5) were used as inputs.
- Soil parameters and the climate data from the Loxton Hub in the South Australian Riverland were used; gridded data with updated models and projections will be used for future work.
- As this project progresses additional crops will be included, and the accuracy and relevance of the irrigation models will be confirmed through targeted interviews with growers and advisors.

Results

- For the model used, seasonal rainfall was reduced by 27% and potential evapotranspiration increased by 8.2% through to 2099.
- Seasonal irrigation requirements increased from 4.2% for 2020-2039 through to 17% for 2080-2099.
- Not all the climate variables that influence evapotranspiration are impacted by climate change.
- Seasonal irrigation requirement had a strong negative correlation with seasonal rainfall (data not shown), even in this arid environment.

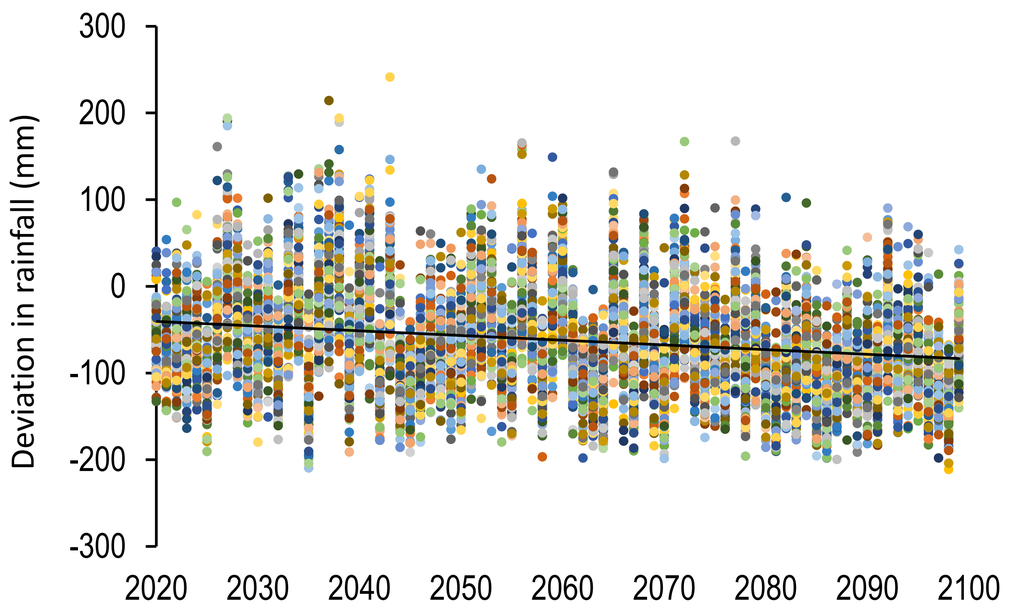

Figure 1: Predicted deviations of seasonal (1st July to 30th June) rainfall from the historical mean value (265 mm) in 100 realizations of the downscaled GCM (GFDL ESM2 M) data for Loxton.

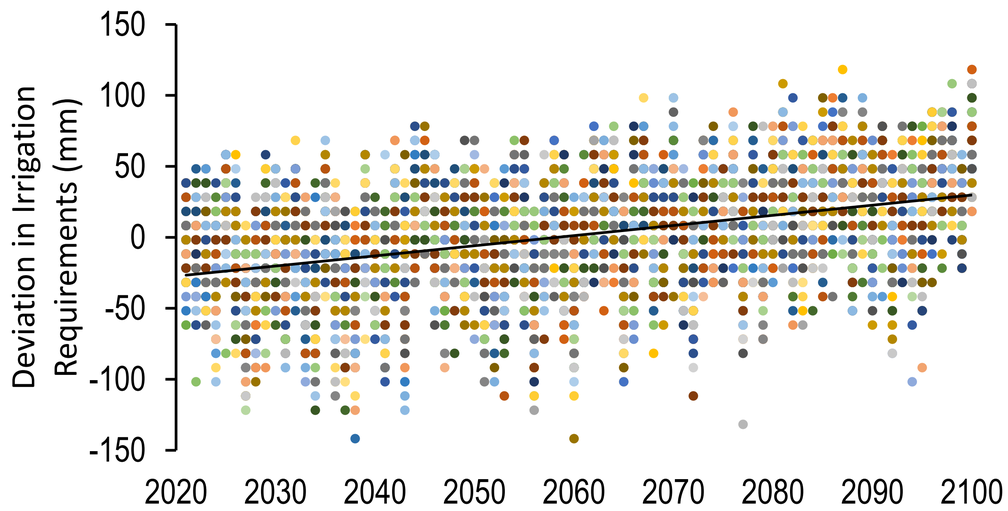

Figure 2: Deviations in the model-predicted seasonal irrigation requirements of viticulture at Loxton from the mean baseline (2005–2015) value.

Conclusions

Lower rainfall and to a lesser extent higher evapotranspiration were drivers of increasing irrigation demand.

Care is needed in interpreting how evapotranspiration is impacted by climate change, as its impact on parameters such as wind speed and vapour pressure deficit are poorly understood.

The project will utilise more recent GCM's and a geospatial approach to map changes in irrigation demand across the Murray-Darling Basin.

FURTHER INFORMATION

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REFERENCE

V. Phogat, J.W. Cox, J. Šimůnek (2018) Identifying the future water and salinity risks to irrigated viticulture in the Murray-Darling Basin, South Australia, Agricultural Water Management, 201, 107-117.