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Using short-term ensemble weather forecast to evaluate outcomes of irrigation

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Irrigation water is an expensive and limited resource. Previous studies show that irrigation scheduling can boost efficiency by 20-60%, while improving water productivity by at least 10%. In practice, scheduling decisions are often needed several days prior to an irrigation event, so a key aspect of irrigation scheduling is the accurate prediction of crop water use and soil water status ahead of time. This prediction relies on several key inputs such as soil water, weather and crop conditions. Since each input can be subject to its own uncertainty, it is important to understand how these uncertainties impact soil water prediction and subsequent irrigation scheduling decisions.

This study aims to evaluate the outcomes of alternative irrigation scheduling decisions under uncertainty, with a focus on the uncertainties arising from short-term weather forecast. To achieve this, we performed a model-based study to simulate crop root-zone soil water content, in which we comprehensively explored different combinations of ensemble short-term rainfall forecast and alternative decisions of irrigation scheduling. This modelling produced an ensemble of soil water contents to enable quantification of risks of over- and under-irrigation; these ensemble estimates were summarized to inform optimal timing of next irrigation event to minimize both the risks of stressing crop and wasting water. With inclusion of other sources of uncertainty (e.g. soil water observation, crop factor), this approach shows good potential to be extended to a comprehensive framework to support practical irrigation decision-making for farmers.