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Investigating coupled crop-climate interactions using a crop-climate model.

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Both the rate of crop growth and development are sensitive to the environment. Specifically, the rate of crop development is determined largely by temperature while the process important for growth are influenced by the atmospheric humidity, temperature and CO_2 concentration as well as the available water in the soil. Therefore, the productivity of croplands at seasonal to longer timescales is vulnerable to variations in weather and climate, respectively.

Impacts assessments of food security under present and future climates are commonly based upon offline coupling of seasonal forecasts or climate change projections with dynamic crop growth models. These studies, thereby, ignore the possibility that the crop, as part of the land surface, may itself have an impact on its atmospheric environment; i.e. temperature, humidity and possibly precipitation. To address this omission a coupled crop-climate model has been developed which includes parameterizations both of the affects of weather on crop growth, development and yield, and the impacts of the changing land surface characteristics on the atmosphere.

This study firstly introduces the coupled crop-climate model, illustrating its potential to study crop-climate interactions. Secondly, by comparing climate simulations produced with a growing and prescribed crop, the role of interactively growing crops in determining climate variability has been assessed. For parts of the semi-arid Tropics, growing crops enhance the influence of soil moisture on surface evaporation and climate variability. Additionally, the dynamic response of growing crops appears to

extend this influence to months following the initial soil moisture anomaly, persisting the strengthened land-atmosphere feedback.