Session: B10 Oral presentation

Fully integrated assessments of the interactions between crops and climate

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Cropland and pastures presently occupy approximately 40% of Earth's ice-free land surface and therefore are an important part of a key component in the Earth system. To date, representation of agro-ecosystems within climate models has been by proxy; grass plant functional types have been used to represent the biogeochemical and biophysical feedbacks to the atmosphere. While many crop species are biologically "grasses" the use of natural grasslands to represent crops is unsatisfactory when one considers the differences between crops and grasslands due to growth rates, physiology and morphology and, crucially, the managed aspect of croplands. The Joint UK Land Environment Simulator (JULES), which is based upon the land surface scheme within the Unified Model of the UK Met Office, was developed to include a parameterisation of croplands. Several crop functional types were identified based on differences in important crop traits such as photosynthetic pathway and photoperiod sensitivity. A generic parameterisation of crop growth and development based on traditional crop modelling approaches was added to JULES with variations in parameter values representing the different crop functional types. The coupling of JULES with the atmospheric component of the Unified Model allows for the examination of the two-way interactions of crops with climate; i.e. how climate variations affect crop production, and how crop production affects climate. Understanding how climate change will affect crop production is crucially important for society, in order to achieve global food security. However, such impact assessments are typically conducted in an offline manner where the outputs of climate models are used to drive crop impact models. Such approaches do not consider the impact of croplands on the environment and, therefore, may omit important feedbacks which will alter the response of crops to climate change. The development of JULES_crop enables the determination of the importance of this omission for crop impact assessments.