## Effects of crop growth and development on regional climate: A case study over East Asian monsoon area

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In this study, the CERES phenological growth and development functions were implemented into the regional climate model, RegCM3 to give a model denoted as RegCM3 CERES. This model was used to represent interactions between regional climate and crop growth processes. The effects of crop growth and development processes on regional climate were then studied based on two 20-year simulations over the East Asian monsoon area conducted using the original regional climate model RegCM3, and the coupled RegCM3\_CERES model. The numerical experiments revealed that incorporating the crop growth and development processes into the regional climate model reduced the root mean squared error of the simulated precipitation by 2.2%-10.7% over north China, and the simulated temperature by 5.5%-30.9% over the monsoon region in eastern China. Comparison of the simulated results obtained using RegCM3 CERES and RegCM3 showed that the most significant changes associated with crop modeling were the changes in leaf area index which in turn modify the aspects of surface energy and water partitions and lead to moderate changes in surface temperature and, to some extent, rainfall. Further analysis revealed that a robust representation of seasonal changes in plant growth and developmental processes in the regional climate model changed the surface heat and moisture fluxes by modifying the vegetation characteristics, and that these differences in simulated surface fluxes resulted in different structures of the boundary layer and ultimately affected the convection. The variations in leaf area index and fractional vegetation cover changed the distribution of evapotranspiration and heat fluxes, which led to anomalies in geopotential height, and consequently influenced the overlying atmospheric circulation. These changes would result in redistribution of the water and energy through advection.