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Ozone (O₃) risks to rice yields under warming climate using O₃-FACE observations

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Ozone (O_3) threatens food security by reducing rice yields, a staple food for half of the world's population. While numerical research has shown the negative impact of O_3 on rice through mathematical methods and crop models, existing global assessments have not incorporated data from rice-specific Free Air Concentration Enrichment (FACE) experiments into the mechanical models that simulate the interactions among crop phenology, physiology, and O_3 . FACE experiments are novel field experiments with O_3 distributed directly to the crops in the field. This provides a realistic environment for studying how rice responds to O_3 and is well-suited for evaluating its impact.

To perform this study, we use the calibrated JULES-crop model based on data from O_3 -FACE experiments, to simulate the effects of O_3 on rice. We investigate the response of rice under various shared socio-economic pathways (SSPs) as part of CMIP6. These SSPs represent a range of potential future anthropogenic emissions and different climate projections, from scenarios of regional conflict to those of global cooperation. By assessing the effects of O_3 on rice under these future scenarios, we gain valuable insights into pathways that could mitigate damage to food security. This research provides a critical foundation for policymakers facing the dual challenges of air pollution and climate change.