Session: B10 Oral presentation

Quantifying the impact of more frequent and stronger extreme climatic events on global crop yield

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Climate and farming management practices are both key drivers of crop yield. While climate change is expected to affect the productivity of cropland in the future, the magnitude of the impact and the role of farmer adaptation's response remain highly uncertain. Indeed, the interactions between anthropogenic climate change, the socioeconomic system and the terrestrial biosphere are complex, involving multiple feedback processes and large uncertainties. Most of existing studies looking at the impact of climate change on food production at the global scale have considered only the effect of changes in mean climate variables on crop yield but very little work has been done to quantify the effect of changes in climate variability. However, from year to year, crop development and annual harvests are especially vulnerable to variation in extremes of temperature and precipitation, in particular to drought, heat and cold waves and torrential precipitation. Climate change is projected to increase the frequency and intensity of extreme climatic events. It is therefore of paramount importance to better assess the direct impact of these variations on annual yields worldwide in order to develop better farming management practices and adaptation strategies. Such projections will also inform land use decisions. Using the global crop yield model PEGASUS (Predicting Ecosystem Goods And Services Using Scenarios), we present a global scale study of the effect of more frequent and greater extreme temperature and precipitation patterns on crop yield. PEGASUS simulates global crop yield for maize, spring wheat and soybean and includes the effect of planting date decisions, choice of crop cultivars, irrigation and fertiliser application on yield. Higher or lower than expected temperature occurring during the growing season affects crop development and can have detrimental impact on final yield if those extreme events occur at a critical stage. Our analysis will quantify variations in yield due to changes in climate variability according to different scenarios of farming management adaptation options. For instance, farmers can cope with more severe and more frequent seasonal water stress by irrigating or by switching to a more drought-tolerant crop or cultivar type. In addition, PEGASUS will be linked to the Community Integrated Assessment System (CIAS) to be driven by future climate data resulting from the Representative Concentration Pathways (RCPs) scenarios of greenhouse gases emissions. With this study, we hope to improve global impact assessment of climate change on agriculture.