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## Future storylines of the 2012 soybean failure event

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Weather events are a common cause for crop failures all over the world. Whilst extreme weather conditions may cause extreme impacts, the most common type of failure-inducing weather events are compounded. For these cases, explaining which conditions triggered a failure event is a complex task, as the links connecting climate and crop yield can be multiple and non-linear. On top of that, the climate change is likely to perturb the interface between climate and agriculture, possibly altering the occurrences or the drivers of crop failures, or generating new types of extreme impacts. In this context, the goal of this study is to demonstrate how global warming can affect the climate-crop connection. For that, we use a storyline approach and focus on an observed failure event, the extreme low soybean production during the 2012 season in hotspots regions, such as the Midwest US, Brazil and Argentina. The scale of this event drove the global soybean prices to the highest values ever recorded. We set out to quantify the change in occurrence of similar events in a warmer scenario. The storylines allow for event attribution, where a given impact can be examined and its causes disentangled. Here, four hotspots of soybean production are examined to contemplate the local consequences of climate change. The study is divided in two parts. We first link climatic features with soybean yields. For each hotspot region, a random forest classifier model is used to establish which meteorological variables are most important and how they are correlated with low soybean yields. With the model trained, we identify the climatic conditions that lead to the 2012 event. Second, we explore the influence of global warming on crop failures. Three large ensembles of simulated weather are obtained from the EC-Earth global climate model, one relating to the present-day period (including the 2012 event) and two relating to future periods with different levels of future warming. We apply the random forest model to these data, and obtain failure statistics for both present and future conditions, isolating the influence of climate change on the soybean failure.