Examination of “Yamase” events using d4PDF climate ensemble simulations.

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“Yamase”, are defined as cold, northeasterly winds periodically observed in Hokkaido and Tohoku region of northern Japan. Because Yamase conditions are most pronounced during the summer, prolonged events can and have resulted in substantial damages to rice crops, especially during the ripening phase (late-July to mid-August). During the strong Yamase year of 1993, the eastern Tohoku region experienced nearly a 70% deficit in rice yield. In 2003, the same region experienced a 35% deficit, despite the expanded use of cultivators such as “Hitomebore”, which were implemented to withstand lower temperatures. With projected average temperature increases in northeastern Japan ranging anywhere from 2.8 –5.0 ˚C at the end of the 21st century, agricultural practices will need to adapt in order to mitigate the impacts of a warmer climate. However, it is equally important that events such as Yamase be taken into consideration when climate change information is provided to stakeholders and policy makers.

This study aims to evaluate the ability climate models have in replicating Yamase events seen in observations, their changes in the future climate, and how regionally downscaled models provide important physical characteristics not captured at coarser resolutions. To accomplish this, we use large member ensemble of global (GCMs) and regional climate models (RCMs) from the Meteorological Research Institute (MRI), as part of the “database for Policy Decision-making for Future climate change (d4PDF)”. GCM results come from MRI-AGCM3.2, resolved at 60km horizontal resolutions, while RCM results come from the NHRCM, which is regionally downscaled to a horizontal resolution of 20km. For scenario climates, global mean surface air temperature is prescribed to be either 2K or 4K warmer than the pre-industrial climate, equivalent to emission scenarios from the Representative Concentration Pathways, RCP4.5 and RCP8.5, respectively. The performance of these models is evaluated using observational data from AMeDAS, and from the JRA55 and ERA-interim reanalysis datasets.

d4PDF models general reproduce well the environmental characteristics of Yamase events seen in observations. This consists of an enhancement of Okhotsk high and the weakening of the western Pacific high, easterly/northeasterly surface winds near the eastern Tohoku region, and negative temperature anomalies across eastern Japan, especially near the coastline. These characteristics remain relatively unchanged in future climates, as well as the frequency of Yamase events. The lack of substantial differences between current and future Yamase events highlights the importance not to neglect such events and will be the focus of this talk.

Keywords: Yamase, d4PDF, Climate change

