EGU21-14740
https://doi.org/10.5194/egusphere-egu21-14740
EGU General Assembly 2021

Crop specific assessment of droughts in the growing season considering the spatiotemporal variability in phenology

Erik Tijdeman and Lucas Menzel
Professorship in Hydrology and Climatology, Institute of Geography, Heidelberg University, Heidelberg, Germany (erik.tijdeman@uni-heidelberg.de)

In the context of climate change, it is important to understand whether drought conditions over the growing season of agricultural crops have changed over the past decades. Common drought metrics used for such assessments compare hydrometeorological anomalies using a static time window. However, the growing season varies among crops as well as in space; driven by climatic differences, and time; driven by e.g. changes in climate or crop-genotypes. Focusing on Southwestern Germany, we aim to investigate how the ranking of drought years varies between crops as well as among static and spatiotemporally varying growing season scenarios. First, we derived annual information on the timing of different phenological phases of two crops, winter wheat and maize, resp. early and late covering, from observations available from the German Weather Services. We then interpolated the timing of these phenological phases to 1 km resolution grids covering all agricultural areas in the study region, using static and spatiotemporally varying interpolation scenarios. Following, we extracted climatological timeseries for all agricultural grid cells and used those to simulate the climatic water balance as well as soil moisture for each grid cell with the hydrological model TRAIN. Finally, we derived for each year different drought metrics, i.e. anomalies in precipitation, temperature, climatic water balance and minimum soil moisture, and correlated those with crop yield anomalies. Results revealed distinct differences in the start and end of the growing season among considered crops. Further, the timing of different phenological phases varied by over a month in both space and time. During the most prominent drought years (2003, 2015, 2018), the growing season of both crops was particularly dry, independent on whether a fixed or variable growing season was considered. On the other hand, there were also some crop specific drought years, e.g., 1991 for maize or 2008 for winter wheat. The difference in hydrometeorological anomalies derived for static and variable growing seasons mainly relates to differences in temperature, but also affected the ranking of some drought years according to other hydrometeorological variables. More apparent were differences between drought metrics, e.g. between the climatic water balance and minimum soil moisture. From these metrics, especially minimum soil moisture correlated well with maize yields, whereas correlations with winter wheat were generally weak for all metrics. To conclude, crop specific agricultural drought assessments could benefit from a crop-relevant growing season specific definition of drought.