EGU22-1065, updated on 05 Oct 2022
https://doi.org/10.5194/egusphere-egu22-1065
EGU General Assembly 2022

Skilful US Soy-yield forecasts at pre-sowing lead-times

Sem Vijverberg[1], Dim Coumou[1,2], and Raed Hamed[1]
[1]Vrije Universiteit Amsterdam, Institute for Environmental Studies (IVM), Water & Climate Risk, Utrecht, Netherlands (sem.vijverberg@vu.nl)
[2]Royal Netherlands Meteorological Institute (KNMI), De Bilt, the Netherlands

Soy harvest failure events can severely impact farmers, insurance companies and raise global prices. Reliable seasonal forecasts of mis-harvests would allow stakeholders to prepare and take appropriate early action. However, especially for farmers, the reliability and lead-time of current prediction systems provide insufficient information to justify for within-season adaptation measures. Recent innovations increased our ability to generate reliable statistical seasonal forecasts. Here, we combine these innovations to predict the 1-3 poor soy harvest years in eastern US. We first use a clustering algorithm to spatially aggregate crop producing regions within the eastern US that are particularly sensitive to hot-dry weather conditions. Next, we use observational climate variables (sea surface temperature (SST) and soil moisture) to extract precursor timeseries at multiple lags. This allows the machine learning model to learn the low-frequency evolution, which carries important information for predictability. A selection based on causal inference allows for physically interpretable precursors. We show that the robust selected predictors are associated with the evolution of the horseshoe Pacific SST pattern, in line with previous research. We use the state of the horseshoe Pacific to identify years with enhanced predictability. We achieve very high forecast skill of poor harvests events, even 3 months prior to sowing, using a strict one-step-ahead train-test splitting. Over the last 25 years, 90% of the predicted events in February were correct. When operational, this forecast would enable farmers (and insurance/trading companies) to make informed decisions on adaption measures, e.g., selecting more drought-resistant cultivars, invest in insurance, change planting management.