Causes and implications of the unforeseen 2016 extreme yield loss in France’s breadbasket

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The 2016 wheat harvest in France suffered from an unforeseen and unprecedented production loss. At 5.4 tonnes ha\(^{-1}\), wheat yield was the lowest recorded since 1986 and 30% below the five-year average. Crop yield forecasting can be considered as near-real-time impact modelling, but unfortunately, none of the forecasting systems in place anticipated the extent of the impact. The 2015/2016 growing season was characterized by compounding warm autumn temperatures and abnormally wet conditions in the following spring. High rainfall and high temperatures leading to fungal diseases, soil water lodging and anoxia, low radiation affecting grain filling, and leaching of nitrogen from the root-zone have all been suggested as important factors ultimately leading to the yield loss. The use of binomial logistic regressions accounting for autumn and spring temperatures and precipitation, suggests that the odds of an extreme yield loss in 2016 was times 35 higher than expected. The challenge now is to further identify the variety of biotic and abiotic processes interacting at different timescales. Collecting relevant insights on the field or from trial experiments, and confronting these with statistical and biophysical crop modelling will be key to achieve this. Improved impact relevant indicators will need to be integrated into operational crop yield forecasting systems in preparation for future compound events.