



Impact of climate change on agricultural economic losses in France: modelling drought and frost events in 2050 and their impact on agricultural yield loss rates

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The IPCC (2014) projections in terms on consequences on climate change in the future focus on long-term average trends on agricultural yields. These trends give information for decision makers on agricultural productivity, food security and agricultural land projections.

On the other hand, agricultural yields are strongly exposed to climatic events: field crops show high vulnerability for drought, flood events, less vulnerability for frost and hail while tree growers have strong vulnerability to hail and frost. The definition of an extreme event is different depending on the scale of study: at the individual farm scale, an extreme event can be defined as an extreme value of a climatic indicator (min temperature, lack of water) in a localized area: the farmlands; at the regional or national scale, an extreme events is defined as the combination of an extreme value of a climatic indicator and a large-scale spatial coverage (drought in 2003 and 2018, frost in 2012).

A crop insurance coverage is linked to the occurrence of a climatic hazard on the insured farmlands. Agricultural insurance and reinsurance industries are facing a lack of knowledge on the occurrence of extreme events in the future years. The agricultural yield projections do not take into account the climatic accidents and the volatility of the yields. Some studies (Ben-Ari et al., 2016) have shown these extreme events influence on yields.

This PhD research project (2018-2021), a partnership between Caisse Centrale de Réassurance (the French public reinsurance company), Meteo-France and Agrocampus Ouest, aims at defining climatic events indicators for drought and frost by studying their correlation with extreme values of historical yield losses (AGRESTE and RICA databases). Then, using ARPEGE-Climat simulations for the year 2050 according to the RCP 4.5 and RCP 8.5 scenarios (CCR and Meteo-France study in 2015 and 2018), the objective is to project these indicators in the future and to predict agricultural yield losses.

The first step of this study, presented in this paper, is to build two climatic indicators for drought and frost impact on respectively cereals and fruits in France, at different spatial and temporal scales. These indicators are integrated in a yield loss model and have been built on climatic data that can be projected in the future using ARPEGE results (precipitations, temperature and evaporation).

In parallel, a classification of the agricultural structures depending on their vulnerability to climatic risks will be done. This classification will allow to test different hypothesis of agricultural structures evolution for 2050 and propose an estimation of their financial exposure to climatic events in a near future.