Evaluation of five reanalysis products over France: implications for agro-climatic studies

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Agriculture is extremely vulnerable to climate change. Increase in air temperature alongside the more frequent extreme climate events are the main climate change's negative impacts influencing the yields, safety, and quality of crops. One approach to assess the impacts of climate change on agriculture is the use of agro-climatic indicators (AgcIs). AgcIs characterize plant-climate interactions and are practical and understandable for both farmers and decision makers.

Climate and climate change impact studies on crop require long samples of reliable past and future datasets describing both spatial and temporal variability. The lack of observed historical data with an appropriate temporal resolution (i.e., 30 years of continuous daily data) and a sufficient local precision (i.e., 1km) is a major concern. To overcome that, the reanalysis products (RPs) are often used as a potential reference data of observed climate in impact studies. However, RPs have some limitations as they contain some biases and uncertainties. In addition, the RPs’ evaluation is often conducted on climate indicators which raises questions about their suitability for agro-climatic indicators.

This work aims to evaluate the ability of five of the most used RPs to reproduce observed AgcIs for three specific crops (i.e., apple, corn, and vine) over France. The five RPs selected for this study are the SCOPE Climate, FYRE Climate, ERA5, ERA5 Land and the gridded dataset RFHR. They are compared to the SYNOP meteorological data provided by Météo-France, considered as a reference dataset from 1996 to 2021.

Our findings show a higher agreement between the five RPs and SYNOP for the temperature-based AgcIs than the precipitation-based AgcIs. RPs tend to overestimate the precipitation-based AgcIs. We also note that, for each RP, the discrepancies between the AgcIs and the reference SYNOP dataset do not depend on the geographical location or the crop. This study emphasizes the need to quantify uncertainty in climate data in climate variability and climate change impact studies on agriculture.