Reply to reviewer #2 for on egusphere-2025-1982 "Warmer growing seasons improve cereal yields in Northern Europe only with increasing precipitation"

The reviewer's comments appear in black, our response in blue. Line numbers refer to the original submission.

This paper explores the meteorological drivers of observed variability in crop yields in Sweden, investigating statistical relationships between key weather / climate indices and the yields of the four most commonly grown crops in the country over 55 years (1965-2020). Given the common assertion that anthropogenic climate change is beneficial for crops in higher latitudes, the conclusion that the potential benefits of warming may be limited by lack of increased precipitation is a very important one. There are also a number of extremely useful insights in the manuscript regarding the relative explanatory power of different variables, so overall I am supportive of this work.

We thank the reviewer for their positive feedbacks and further comments that are helping us to improve the manuscript. As detailed below, in a revised manuscript, we will discuss the lengthening of the growing season, which however does not impact our conclusions. We will also mention the effect of increasing CO_2 concentrations.

I note that the manuscript has already received a review from a referee and also a community review, to which the authors have already responded. Here I will focus on two additional points that appear to have been overlooked, which I recommend are addressed in a revised manuscript.

1. As the authors note, climate change is expected to increase the length of the growing season, and indeed this has already happened. eg. in southern Sweden, the meteorologically-defined growing season length has been starting earlier by between 2 and 4 days per decade between 1950 and 2022 (Miś and Tomczyk, 2025 https://doi.org/10.1007/s00704-025-05382-6). So, over the period analysed in the current study, the growing season may have lengthened by over 20 days in some places. However, the authors conduct their analysis using an average growing season length over the study period. Is there a risk that the results may have been affected by including events or averaging periods outside of the growing season in the earlier part of the study period but excluding some within the growing season in the later part? This seems particularly pertinent in the context of the authors remark at lines 317-320: "We surmise this low performance is in part due to the infrequent occurrence of short-term potentially damaging conditions (e.g., few occurrences of days with average temperatures above 25 °C, or frost during sensitive developmental stages)". I would be reassured if the authors could demonstrate that their conclusions are not sensitive to the use of an average growing season length over a period when the length has changed by a non-trivial amount.

This is a valid point. In our dataset, the growing season length increases by approximately 10 days on average over the study period, the result of the advancement of the sowing date and a smaller advancement of the maturity date, as determined by the growing degree (GDD) model (**Figure 1**).

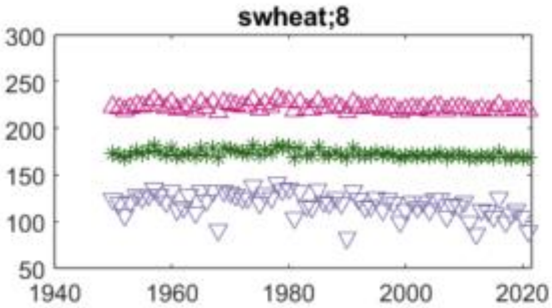

Figure 1: Example of time series of the day of the year (y-axis) corresponding to sowing (purple down-pointing triangles), flowering date (green stars) and maturity (pink triangles pointing upwards) for spring wheat in Kalmar County, in south-east of Sweden.

Motivated by the reviewer's concern, we tested the sensitivity of our results to the use of year and county-specific growing seasons, and hence length, instead of a fixed county-specific average, in determining the climatic indices. This had no meaningful effect on the number of extreme events identified or the average conditions or the resulting conclusions.

2. The authors do not mention the potential impact of rising atmospheric CO2 concentrations on photosynthesis, transpiration and yield - see, for example, Rezaie et al (2023 https://doi.org/10.1038/s43017-023-00491-0) for a recent review. If this is already having an influence then it will be included within the continuous variable representing the combined effects of time elapsed in since 1965 (as described in lines 197-200) so I don't think it will alter the findings regarding the relative importance of the different meteorological drivers during the period of observations. However, given the potential non-linear effects of CO2 effects in the future, especially in how they may affect crop responses to drought and high temperatures, the existence of these influences and their implications should be highlighted as an outstanding uncertainty in relation to the results here. Eg. it should be mentioned in line 199 alongside climate change and technological improvements, and also discussed in section 4.4 (Implications under climate change).

We agree with the reviewer that explicitly mentioning the role of atmospheric CO_2 concentration is helpful for a more complete description of conditions. However, as recognized by the reviewer, the role of the increase in CO_2 concentration cannot be disentangled by that of other trends, for example technological improvements. We will thus mention the physiological effects of CO_2 increase, referring to Rezaei et al. (2023) in L**70**, and explicitly mention that this is conflated with other changes in time in the coefficient of time in **L410** where we discussed implications under climate change. We note that all plotted results pertain to an intermediate time point (the year 1992, an intermediate year within the study period) and hence implicitly an intermediate atmospheric CO_2 concentration, among other changes occurred in the 55 years considered.