

Interactive comment on “Climate signatures of grape harvest dates” by M. Krieger et al.

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Comment 2.1: The present manuscript fails to provide genuinely new findings neither for the climate reconstruction community nor for phenological modellers. Here and there, promising hints are reported but get lost between a pile of non-significant correlation results. The dominant signal of early summer temperature in GHD has been repeatedly shown in many studies as correctly stated by Reviewer #1. A systematic statistical (correlation) analysis of the GHD with a variety of climate variables would be very helpful. The authors did collect a large number of gridded data set but they only show a selection of results than seems rather arbitrary. E.g. none of the results from the comparisons with Luterbacher et al (2002), Luterbacher et al (2004) and Pauling et al (2006) before 1900 are shown.

Reply: Our manuscript provides for a first time a systematic analysis of the relation of

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GHD and climate fields. For the known spring/summer temperature relationship our field correlation gives additional information, compared to the relationship detected in the local time series in the literature before. The spatial scale of climate variability at the region of the GHD is relevant for climate reconstructions. A new important result is the decadal influence of winter temperature on the GHD which might also explain the variations in the summer-GHD relationship. Via the winter temperature, the GHD is connected to atmospheric circulation (with some projection onto NAO). We agree with the reviewer that important findings get lost in the present manuscript because the shown results are not focussed enough on our main results. Therefore, we shortened the discussion of the spring/summer relationship and omitted insignificant correlation results. As suggested by the reviewer, we include the comparison to Luterbacher before 1900, as this demonstrates the consistency of the Luterbacher and the GHD data set. Please see also the general comment to all reviewers.

Comment 2.2: Furthermore a very recent debate raised the most important questions in phenological research (Körner und Basler, Science 327, 1461-1462 (2010); Chuine et al. Science 329, 277-e (2010)), namely the role of light, forcing temperatures but also chilling temperatures and their impact on the phenology of different plant species in a changing climate. The present manuscript little contributes to this discussion except the statistical findings that winter temperatures impact GHD at the decadal time scale.

Reply: The focus of the present paper is the empirical relationship between climate and the GHD. While phenological research, for example the two studies proposed by the reviewer, provide the mechanistic understanding of the link of local environmental variables and the GHD as climate proxy, it is complementary to the empirical relationship discussed in this study.

Comment 2.3: Finally, GHD represent a documentary proxy record of biological origin. In consequence, the authors should check each correlation not only for its significance but also for its plausibility. It would be biologically very interesting to describe the process that leads to a winter temperature impact on GHD when vines are in dormancy.

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Reply: We agree with the Reviewer that a plausibility check is important to support and verify the statistical results. We therefore discussed a potential reason for the winter relationship in 1535L10: "An explanation for this relationship could be that the vine adapts to the climatic conditions in winter in the medium term. For example, its development starts earlier after several mild winters." With our finding, we hope to foster new research on phenological reasons for the winter influence.

Comment 2.4: The paper would strongly benefit from the following suggestion. "1. Add significance test to every correlation reported."

Reply: Already in the presented version, we performed statistical significance tests for every correlation analysis (described in page 1528-1529). For field correlations, the local significance was tested and the respective areas were marked in the figures; In the running correlation analysis, the significance of the potential non-stationarities was tested using the Monte Carlo approach from Sterl et al.,(2007). We considered the effect of filtering prior to the analysis, and analysed the autocorrelation of the GHD series to test if a correction of the effective degrees of freedom is necessary. In the revised version, we will additionally mark the significance of the correlation values in the running correlation analysis, and add the p-value to all correlation values in the text.

Comment 2.5: "2.Only map significant correlation instead of using stipple marking."

Reply: We will improve the distinction between significant and non-significant areas in the revised version

Comment 2.6: "3. Include systematic presentation of running correlations between GHD and all climate variables including significance thresholds. "

Reply: We agree with the reviewer that running correlations are helpful to understand the stability of relationships. But we will only show them if they provide crucial information to keep the manuscript focused. The significance thresholds will be added. However, a more important measure of the significance is testing the stationarity of the

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relationship (Sterl et al., 2007). This test was applied to all running correlation analyses.

Comment 2.7: "4. Consider omitting all analyses that include lagged years."

Reply: We showed the lagged correlations to motivate the analysis of the filtered GHD series. We will omit them in the revised version.

Comment 2.8: "5. Use common "instrumental period" 1901–2000. Presently some analyses include data until 2002 or 2003 depending on the availability of the climate data set. However, be aware that 2003 shows the most extreme GH date of the last half millennium."

Reply: We agree with the reviewer on this point. In the revised version, we will use 1901-2002 as instrumental period as all of our data cover this time range. However, the results are not influenced by this change in the analysis.

Specific comments:

Comment 2.9: "Is it really true to say "of"? Should it not rather say "Climate signatures in grape harvest date series" or "Climate signatures from grape harvest dates" ;'

Reply: We would like to thank the reviewer for this comment. The title will be changed in the revised version.

Comment 2.10: "1526L20:add reference(s)."

Reply: Reference will be added (Jones, P., and M. Mann (2004), Climate over past millennia, Rev. Geophys, 42(2), 1–42).

Comment 2.11: 1526L24: reformulate "GHD can be possibly used for temperature reconstructions": it was done so successfully plenty of times.

Reply: We will reformulate this sentence in the revised version.

Comment 2.12: 1527L21/22: Schleip et al. (2008) not only performed time series

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analysis but also used Bayesian regression to analyse temperature impacts of single months. They found that autumn (October) and summer (June) temperatures of the previous year do leave an impact on the GHD. Consider these findings also for the discussion section.

Reply: Schleip et al., calculated coherence factors between the temperature of single months and the GHD time series based on the changepoint distributions of the temperature and phenological time series. This is very different to our direct regression approach, in which the interannual variability also provides information about the GHD-climate relationship. While their method does not rely on a linear relationship between climate and phenology, it ignores the information contained in the interannual variability of climate and GHD. However, the difference of the time series between the seasons and the years preceding the GHD and the same year, are strongest on the interannual time scale. Further, in their study, an impact of the previous year on the GHD was not found in the Burgundy region. We therefore did not discuss their result in our manuscript.

Comment 2.13: 1527L24: define "instrumental period" here.

Reply: The instrumental period will be defined in the revised version (in our case 1901 to 2002).

Comment 2.14: 1527L24: why italics for "climatic"? How would you separate other impacts from the GHD series? Also: viticultural practices have dramatically changed GHDs during the 20th century to meet the needs of the consumers.

Reply: We used italics for climatic as the study is focused on the climatic impacts on the GHD. This does not imply that there are no other influences. We will reformulate this sentence to avoid misunderstandings. Viticultural practices are discussed in the reply to 2.16.

Comment 2.15: 1527 last paragraph: what is the hypothesis of the study? Except

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doing a bunch of correlation maps and running correlations and see what happens.

Reply: Our study is an extension of previous studies which established a local relationship between summer temperature and GHD, and a weak relationship between GHD and NAO. By using field correlations, we systematically analyse the climate-GHD relationships. We show that the summer-GHD relationship is consistent with the temperature reconstruction from the pre-instrumental period. We further detect an influence of the winter temperature on the decadal time-scale, and argue that a strengthened relationship between summer and winter temperatures in the last decades led to the increase in the GHD-summer temperature correlation. We agree with the reviewer that the selection of the shown results can be improved. As mentioned before, we will focus on the main results in the revised manuscript; please see the comment to all reviewers.

Comment 2.16: 1528L11/12: very courageous statement and assumption. Viticultural and (world) market forces have also dramatically changed during the "instrumental period"

Reply: In the revised version, we will formulate this statement more carefully. Changes in viticulture practice possibly have an influence on the GHD. On the other hand there are a few arguments that the viticulture practice has not changed dramatically: Garcia de Cortazar-Atauri et al (2010) pointed out that maturity definitions found in historical documents are close to modern definitions and the alcohol content of 19th century wines is not very different to modern wines. Changes in the cultivated varieties can also have a strong influence on the GHD. But in the Burgundy region the cultivated varieties has been the same for the last six centuries (Garcia de Cortazar-Atauri et al., 2010)

Comment 2.17: Data section: define "instrumental period"; include NAO definition as you discuss NAO later on. Method section: include the definition of the temperature index for France that is used later.

Reply: In the revised version the definitions of the instrumental period, the temperature

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index and the NAO will be included in the data section.

Comment 2.18: 1529L8: "certain"? which ones! Result section: use the same period for "instrumental period" for all data sets. This section is very confusing.

Reply: In the revised version we will use the same instrumental period (1901-2002) for all data sets.

Comment 2.19: 1530L4/5: where do you show this? Otherwise add references.

Reply: The statement "not shown" is missing. We correlated every single month with the GHD series and obtained significant correlations for the month from April to August.

Comment 2.20: 1531L6-20: move to introduction, data and method sections, respectively. Here are only results.

Reply: Following the suggestion of the reviewer we will describe the idea of comparing the AAT with the GHD correlation to differentiate between direct and indirect impacts on the GHD in the method section.

Comment 2.21: 1532L3ff: why the split in 1948/1949? Include in method section.

Reply: The split of the time section is motivated by the fact that the running correlation is positive up to 1947 and negative after 1948. However, in the revised version, we will omit the figures of the splitted timeperiods as they are ambiguous and not focussed on our main results.

Comment 2.22: 1537/38: some conclusions are not supported by any results.

Reply: It is not clear to us to which specific conclusions the reviewer is refereeing to. In the revised version, we will ensure that all conclusions are supported by the main text.

Comment 2.23: Fig1: very confusing and unnecessary change of time scale. Maybe add an inset.

Reply: We would like to thank the reviewer for this advice. We will add an inset in the

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revised version.

Comment 2.24: Fig3b: add significance of each correlation accounting for autocorrelative effects.

Reply: In the revised version, we will add the significance level to all figures showing running correlation analyses. However, a more important measure of the significance is testing the stationarity of the relationship (Sterl et al., 2007). This test was applied to all running correlation analyses. We did not account for the autocorrelation of the residuals as the autocorrelation of the GHD series is very small ($R(\text{lag}1)=0.12$) and the time series shows a nearly white frequency spectrum. (1528L27)

Interactive comment on Clim. Past Discuss., 6, 1525, 2010.

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