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Climate of the Past Discussions

Interactive comment on "Natural variability and anthropogenic effects in a Central Mediterranean core" *by* S. Alessio et al.

Anonymous Referee #2

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General comments

The manuscript presents an analysis of the low frequency variations of δ18O from a highly-resolved oxygen isotopic ratio from a 2200-years sediment core in the Mediterranean Gulf of Taranto, Ionian Sea. Assuming from a previous work (Taricco et al., 2009) that the δ18O variations account for temperature changes during the last two millennia, the authors estimate the contribution of natural variability to the increase of temperature during the industrial era. An auto-regressive method and a neural network model are applied in order to segregate the natural and anthropogenic contributions. The main assumption is that the natural variability during the pre-industrial period serves to estimate what fraction of temperature variability can be attributed to human influences. Thus, they consider that the anthropogenic effect is the difference between

the temperature proxy in the interval 1840-1979 and the portion of variability estimated by calibrating the auto-regressive/neural network models using only pre-industrial data (prior to 1840).

There are however some aspects in this assumption and in the methodology that might need to be revised prior to accept the conclusions they present in the manuscript. Such aspects that are detailed in the Specific comments below may affect the quantification of the anthropogenic contribution they provide (i.e., 60% of the recent temperature increase is due solely to anthropogenic effects) and are related to the extent to which the natural variability during the pre-industrial period is reproduced by the models employed in this work. Although the authors present an exhaustive explanation about technical details in the methodology, the latter is from my point of view, unbalanced with the effort devoted to the discussion about how the models reproduce the natural variability background during the last 2000 years that would be the basis to admit the segregation of natural and human factors they present.

Specific comments

i.The manuscript reads "The comparison between the forecast and the actual δ18O signal during the Industrial Era allows one to quantify what percentage of the modern δ18O decrease can be attributed to natural vs. anthropogenic causes". The main objection to this assumption is that it is conditional to a reasonable reproduction of the natural variability during the pre-industrial time. To assess this issue, the authors could show both, proxy record and full estimated series not only for the prediction period but also from the beginning of the record (188 B.C. to 1840) to allow for an evaluation on how reliable is the the estimation of the low frequency natural variability. Some measure of the uncertainty might be suitable as well. My belief is that it is important to show it because if the variability during this period is not properly reproduced by the models or there is a very large range on uncertainty associated, how reliable are then the conclusions met by the authors regarding the portion of anthropogenic variability during 1840-1979?

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ii.Aligned with the previous comment, the auto-regressive models might be adequate for reproducing the main harmonics within the series and it can be assumed that some spectral components could be suitably estimated from the proxy data. However, as the authors point out (for instance in Page 3 where they state that "all prediction methods work better on clean, noise-free signals"), the regressive models find difficulties to reproduce the full range of variance within the original series. Therefore, the question comes whether using all spectral components (i.e., the full series including higher-frequency variability) would significantly vary their results in terms of how the variability during the pre-industrial time is reproduced. When the full series is used, the internal variability, which is a component of the natural variability, may play a significant role. If models can not reproduce this part of the spectral variance it can not be ruled out that the 'forecasted' variability is under-or overestimated, adding considerable uncertainty to the quantification of anthropogenic effects provided in the manuscript. Maybe authors can argue that long term trends might not be affected by internal variability. However there are studies that suggest that some processes pertaining for instance to the convective time-scales, like some cloud-radiation feedbacks, are crucial to understand centennial tendencies (Zhou et al., 2006) or, in general, that superimposed to the long-term trends, decadal variability may play a significant role in the increase of temperatures (Schelensinger and Ramankutty, 1994). Could the authors discuss or show how the results change if the case, when the full spectral variance is considered in the models?

iii.The calibration/validation process might be handled with caution identically. The authors employ a large effort in describing the process of validation. However still some questions remain. The performance of the models can significantly change depending on the period selected for calibration. For instance, the range of variance from which the regressive models would learn is not the same if the selected period is 188 B.C.-200 A.D. or if it is the period comprised between 200-500 A.D. Perhaps I did not properly understood what the sliding-window testing process does, but my feeling is that this fact of changing the period of calibration/validation is not fully addressed within the

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method the authors use. In any case, the description of the testing method is somehow obscure for the reader. In addition, when they alternatively use a longer learning period, the validation one becomes very short so that it can not be fairly compared with the performance of the sliding-window case. Maybe the authors can discuss in the manuscript what would be the effect of considering different calibration periods or clarify the description of their method.

These three points discussed above attempt to highlight that the degree of uncertainty in the "forecast" of natural variability during 1840-1979 A.D. can be large affecting the quantification or the assignment of weights to the different forcings responsible for the recent temperature increase. So the authors should more carefully discuss and illustrate these aspects.

iv.In the Mediterranean area there are previous works, like Silenzi et al., 2004, Montagna et al., 2008, Piva et al., 2008 or Sisma-Ventura et al., 2009, based on low-resolution sediment cores that could however be interesting to mention at least to place the work in its regional context. Nor this document nor the previous paper by Taricco et al., 2009 cites or refers to any of these studies. Some feedback on Mediterranean temperature-related proxies would be suitable here.

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