

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1  
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## Comment on hess-2021-572

Anonymous Referee #1

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Referee comment on "The importance of non-stationary multiannual periodicities in the North Atlantic Oscillation index for forecasting water resource drought" by William Rust et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-572-RC1>, 2022

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This paper investigates the relationship between multiannual periodicities in the NAO and water resource drought in the non-stationary context and the potential of incorporating multiannual NAO periodicities to improve water resource forecasting and projection system. The paper is well-written and the idea is interesting.

I have a few concerns regarding the method and presentation. 1) The record length looks like around 40 years on average, is it relatively short for periodicity analysis? 2) Many of the stations are located in heavily urbanized regions, which means they may have significant artificial influence such as ground and surface water abstraction, effluent return, river regulation, and impounding reservoir (introduce another layer of uncertainty on the top of observation uncertainty). By including or excluding these stations might give very different results. 3) It might be better to integrate the results section and discussion section since they are closely interlinked.

In addition, I have the following comments:

L2 (& L73-76): in the title, water resource extremes could be interpreted as flood AND drought, however, the paper only addressed drought. The title does not correctly reflect the contents of the paper.

L16: 'particularly in Europe'? – this also applies to other regions as indicated in many literatures.

L159-161: might consider the UKBN dataset – a subset of NRFA stations that were considered near-natural with minimal human influence?

Harrigan, S., Hannaford, J., Muchan, K., & Marsh, T. J. (2018). Designation and trend analysis of the updated UK Benchmark Network of river flow stations: the UKBN2 dataset. *Hydrology Research*, 49(2), 552-567.

OR might use Factors Affecting Runoff (F.A.R.) codes published on the NRFA website to exclude stations that have huge human influence?

<https://nrfa.ceh.ac.uk/content/catchment-summary-information>

L168: the available period for NAOI is 1899-2021?

L201: do you mean Eq.1 here? Please check the equation numbers throughout the paper.

L232: what wavelet power can tell? Please clarify.

L242: punctuation mark is missing.

L367: it's not clear why 7.5-year periodicity is selected here, though the reason was provided in section 5, could consider refining the paper structure.

L429 & 435: 'F' is not shown in Figures 2 and 3, and 'E' is not visible in Figure 3.

L594: could you please justify why choose the summer season?

L669: are there any limitations of the work worth acknowledging?

L699: CORD means Cranfield Online Research Data? Please provide the expanded form.