

Hydrol. Earth Syst. Sci. Discuss., author comment AC4
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Reply on RC4

Leah A. Jackson-Blake et al.

Author comment on "Seasonal forecasting of lake water quality and algal bloom risk using a continuous Gaussian Bayesian network" by Leah A. Jackson-Blake et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-621-AC4>, 2022

Relating to the first point in RC4:

- We think it is perfectly reasonable to consider weather variables when developing the forecasting model. Seasonal climate forecasting is a well-established research discipline. While it is clearly not possible to accurately predict wind speeds on a specific day several months in advance, seasonal climate forecasts (like long term climate forecasts) attempt to simulate physically plausible realisations of the future based on current trends and boundary forcings.
- In the context of predicting terciles, seasonal models exhibit significant skill for wind speed variables in certain places and times of year (e.g. Soret et al., 2019, Crespi et al., 2021), including our case study site. It therefore is not an understatement to say wind speed forecasting (for terciles) "isn't quite there yet".
- One of the original aims of the study was to see whether the latest seasonal forecasting data products could be used to support water management. As it turned out, we found that including weather variables in the model did not improve predictive performance compared to just using water quality data from the previous season, so this aim became irrelevant and was not mentioned in the paper. However, had weather variables been found to be important predictors of lake water quality, we would have investigated the skill loss associated with replacing observed weather data with seasonal climate hindcasts.
- You suggest we consider 6-month-ahead phosphorus forecasts. The TP node in the GBN is just this - a simple 6-month-ahead model of lake phosphorus concentration. If you instead meant phosphorus forecasts for incoming streamflow, we didn't find any relationship between river TP concentrations or loads and lake water quality. We can mention this.

These points are only briefly touched upon in the current manuscript. If we are invited to revise the paper, we would provide a better background to our motivations for developing the forecasting tool, and to our choice of variables to include in the exploratory feature analysis as it was something which raised some confusion with Reviewer #1 too.

Relating to the second point, we have now calculated 95% confidence intervals on the fitted GBN coefficients. This functionality isn't offered as standard within e.g. BNLearn (and I doubt it is in other BN packages), so is a bit of a fiddle, but does provide useful extra information. Otherwise, we don't think we should go too much into the pros and cons of BNs in this paper, as these have been discussed extensively elsewhere. The main

aims are instead to demonstrate a simple alternative to discrete BNs for environmental modelling, as well as exploring seasonal water quality forecasting.