Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-238-RC1, 2017

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Exploratory studies into seasonal flow forecasting potential for large lakes" *by* Kevin Sene et al.

K. Engeland (Referee)

koe@nve.no

Received and published: 22 June 2017

The title explains well the content of the paper: "Exploratory studies into seasonal flow forecasting potential for large lakes". I think the paper is interesting and provide some useful insights and conclusions.

First a general comment on the evaluation of model performance in this study. When assessing forecasting skill, the benchmark that is used as a reference for assessing skill should be given. If there is a strong seasonality in lake outflows, maybe a monthly climatology would be a better benchmark than a long term average. See e.g. Bettina Schaefli and Hoshin V. Gupta (2007) for choosing benchmark in catchments with a strong seasonality in runoff. Another performance measure that could be used is

anomaly correlation coefficient.

The paper is, in general, well written, but some parts of the manuscript could benefit from more clarity in the presentation. I will give some suggestions below.

Introduction

The introduction is rather brief, and it could be useful to refer to both operational systems and research papers describing approaches that are used for seasonal forecasting of lake levels or outflow. E.g. for the great lakes in US/Canada there is an operational seasonal forecasting service: https://www.glerl.noaa.gov/data/wlevels/levels.html#modelsAndForecasts. In particular if there are other studies on forecasting the water levels in lake Victoria and Malawi could be useful. One recent example is Mulumpwa et al. (2017). I also think the introduction could better reflect the content of the paper, in particular the use of different circulation indices as a predictors for forecasting water levels. Maybe small parts of the data section could be moved to the introduction. In the end of the introduction I miss some clearly stated aims or objectives.

Case Studies

Often it is challenging to estimate outflows based on time series of lake levels since the results might be very sensitive to quality of water level observations. In particular for large lakes where one mm water level represents a large volume, using this approach for daily values, results in a lot of noise. It helps to use weekly or monthly values as in this study.

I miss a more specific description of the data: What is the time resolution of water level and outflow data you used?

Methodology

It would be useful if you in the methods section explains more explicitly the combination of models that yare used, i.e. how is the net inflow model combined with the lake

response model. Further on, how are the regression and ARMA models are used, i.e. is the the residuals of the lake response model the dependent variable?

Results

The previous comment on telling what is used as dependent variable in the regression and the ARMA modelling is important when presenting results on lines 12-16 on page 15. Section 3.2 "Net inflow estimates" is maybe not very precise. As I understand, you want to use this model as a simple forecasting model where forecasted precipitation is used to drive the model. Would "Net inflow forecasting" be a better sub-title?

Discussion

Many of the great lakes are located in areas with a seasonal snov cover. In the introduction seasonal forecasting in snow dominated catchments is mentioned, but it could be useful to speculate on seasonal forecasting for catchments with large lakes and seasonal snow cover.

Figures

Figure 2: could change the scale of the y-axis to be between 0.5 and 1.5

Figure 4: It is difficult to see the observations (the dots). It also seems like the 95% confidence intervals are too wide since all observations are well inside this interval. Please comment.

Figure 5: It is difficult to see the difference between the lines.

Equations

Equation 1 and 2: I have some questions about dimensions in these equations. On the left hand side, dh/dt has the dimension length/time, so then N should also have the same dimension. Then "depth per unit area of lake surface" is confusing. I suggest to use "Volume flux per unit area of lake surface". In Equation 2 I miss a Δt. Either should (i) the fluxes P, E, Qc and Q0 be integrated over the time interval Δt in order to

become water depths, or (ii) Δh be divided by Δt in order to become a flux. If the latter alternative is used, it could be useful to state that all P, E, Qc , Q0 are average fluxes over the time interval Δt.

Equation 7 and 8: it could be useful to avoid using a and b here since these symbols are already used in Equation 3.

Equation 7: What is n and yt?

Equation 9: It is is difficult to understand this equation. What is A and B? previously A was used for lake surface area.

Equation 12: This equation is not necessary.

References:

Bettina Schaefli and Hoshin V. Gupta (2007) Do Nash values have value? Hydrol. Process. 21, 2075–2080 (2007) DOI: 10.1002/hyp.6825

M. Mulumpwa, W. W. L. Jere, M. Lazaro, A. H. N. Mtethiwa n(2017) World Academy of Science, Engineering and Technology, International Journal of Environmental and Ecological Engineering Vol:4, No:3, 2017 Forecasting Lake Malawi Water Level Fluctuations Using Stochastic Models

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-238, 2017.