

Geosci. Model Dev. Discuss., community comment CC1
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Comment on gmd-2022-222

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Community comment on "DynQual v1.0: A high-resolution global surface water quality model" by Edward R. Jones et al., Geosci. Model Dev. Discuss.,
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This manuscript developed a global water quality model DynQual V1.0 and interpreted its results for TDS, BOD, and FC. Overall this manuscript is well-written with good-quality figures. Model results regarding the spatial patterns of concentration and temporal trends by region and economic development are interesting. However, there are some concerns about the model evaluation.

(1) there seems no description of model calibration. How was the calibration done for the global water quality model? Is it a simultaneous calibration for both hydrology (discharge) and water quality (Tw, TDS, BOD, FC), or a two-step calibration strategy with discharge calibrated first followed by water quality calibration? Since the author mentioned that discharge was very important for model results (Supplement, Line 295), I would assume the discharge has to be well-calibrated before modeling water quality.

(2) The model evaluation that is very important to the model development paper seems underdeveloped. It is essential to evaluate the model performance before the model result interpretation. For example, it is ideal to evaluate model performance whenever data are available. For example, there are 27,238 stations with TDS data in the Supplement. Perhaps the author could do the following evaluation regarding 1) spatial pattern of mean concentration (e.g., model mean vs. data mean from the station with high data availability); 2) temporal dynamics regarding seasonal fluctuations and long-term trends (e.g., Fig 11, add data points to the temporal trend plots to evaluate if the model could reproduce the long-term trends)

(3) what is a good nRMSE value? It would be beneficiary to add the Nash–Sutcliffe model efficiency coefficient (NSE) which is a widely used dimensionless metric in hydrology and water quality literature.

(4) this manuscript in general lack literature discussion or comparison in terms of model performance (e.g., Figure 3), for example, what is other water quality model performance in terms of nRMSE? There might be few global scale water quality models. But I guess it could be useful to add a few comparisons with other watershed-scale water quality models.

(5) Line 200, can the decay coefficient be specified by the user?

(6) Line 220, is it a constant background concentration or a time-varying background

concentration through each timestep?

(7) what was the computational time to run for 1-year simulation?

(8) Supplement Line 295, does it mean reaction is underestimated compared to discharge (dilution)?

(9) Supplement Line 300, what is high data availability, and how many data points during 1980-2019?

(10) Supplement Line 305, Figure S3 (b, c) what are the nRMSE and NSE values for these two rivers? It seems that the model overestimated a lot for peaks