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Interactive comment on “Using high frequency water quality data to assess sampling strategies for the EU Water Framework Directive” by R. A. Skeffington et al.

Anonymous Referee #1

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General comments

This manuscript addresses the consequences of different sampling strategies in relation to classifying the ecological and chemical status of rivers as stated by the Water Framework Directives (WFD). High frequency data of four different parameters (dissolved phosphorus, dissolved oxygen, PH and water temperature) were analysed for four different rivers. Based on the data new sub-series were constructed, to simulate different sampling frequencies and sampling strategies. It was found that both sampling frequencies and strategies can highly influence the process of assigning the streams to the appropriate WFD classes.

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The manuscript addresses some very important issues regarding the challenge of balancing sampling frequency and strategy with the desired precision and representativeness as well as the cost of obtaining them. Generally the manuscript is well written and clearly structured, and only minor corrections are suggested below. Hence, it is found that the manuscript addresses main scientific questions relevant for HESS, and that the paper is of general interest for the readership of HESS, specifically relevant for the discussion of monitoring strategies in surface waters to assist EU directives.

Specific comments

In the paper you address the sampling frequencies where you are simulating 1000 years with your data, which gives a very good data set for conducting the analysis of sampling frequency and strategy. However, the analysis of the temporal aspect is also interesting, and it could have been interesting to see some duration curves as well. For instance, how many "years" (simulated re-sampled series) are needed before the mean values seen for TP in fig. 2 are obtained? (assuming steady conditions represented by the limited years of data). This is of interest in terms of classifying streams, as not only sampling frequency but also the length of the period measured plays a role for obtaining a representative picture of the status of the stream. I do recognize that it would extend the focus of this paper, and I find the paper comprehensive enough by just focusing on the sampling strategies. However, this possibility/issue could briefly be mentioned in the discussion.

P. 1280, line 14: You write "to one of 3 or 4 WFD classes", do you mean that the water body is classified to belong to 3-4 different classes dependent on the sampling strategy? Could you please rephrase the sentence.

P. 1282, line 6: Could you please replace "a lot of" with a more formal phrase?

P. 1283, line 6-7. I would prefer that the last sentence is deleted or maybe better, rewritten to be more specific, leaving out for instance the words "some" and "at least".

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P. 1288, l. 7: You already defined CI, so no need to repeat it.

P. 1288, l. 12-13: I assume mean TP, rather than P?

P. 1288, l. 12-13: I find it confusing the way you refer to the CI, could you maybe just write the interval itself, it is not necessary to specify the difference between max and min in the CI.

P. 1288, l. 17-20. I do not find it clear what is meant. I assume you are still referring to temperature, since we just saw that for instance for TP it makes a huge difference to the possible WFD going from monthly to weekly sampling? I suggest that you rephrase this paragraph.

P. 1289, line 3: You refer to a period of 5 years, but it is not completely clear, how this data series of 5 years has been created? I assume it is by letting for instance sampling every Monday represent "one year", and so on, giving you five datasets. However, it is not clear from the text. Could you please specify this, so that is becomes clear.

P. 1289, line 7-9: I am not convinced that I understand what is meant in this paragraph. As I understand it, you show the range of yearly average values in your figures 2 – 5. What do you then mean by "the range of measured concentrations"? Do you refer to the different yearly averages based on your constructed data series, or do you refer to the variability in concentrations during the year (the original dataset)? You refer to fig. 2-5 for the reader to see where "the range of measured concentrations crosses one or more WFD class boundaries", but as I understand it, it is not the "range of measured concentrations", but the calculated yearly averages you refer to, or do I misunderstand? Could you please clarify this in the text.

P. 1289, line 12: You refer to the mean of all yearly averages of monthly and weekly sampled values, right? If yes, could you then clarify this in the text to avoid misunderstandings?

P. 1289, line 20: Again, I suppose you refer to the yearly mean of the monthly con-

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centrations, right? I would prefer that you wrote: “yearly mean of monthly samples”. I suggest that this is specified throughout the manuscript, to avoid misunderstandings. Also in the figure captions, it could be specified that it is yearly means, percentiles and confidence intervals.

P. 1289, line 23: What does “appropriate” refer to? The mean value of all measured data over entire measuring period, or? Please clarify in the text.

P. 1291, line 22-23: Could you rephrase this sentence, as the correct value for a measured concentration must obviously be the value that is measured (if correctly measured)?

P 1295, line 19: You write “biases the means upwards by about 0.0 to 0.2 degrees Celsius”, could you rephrase, for instance: “biases the means upwards by up to 0.2 degrees Celsius”, (0.0 is not an upwards bias).

P 1295, line 20. Is 0.2 degrees Celsius a significant change? I guess that depends on the measurement precision as well? Could you please comment on this?

P. 1296, line 12: What is meant by “all cases”? Is it referring to the diurnal variability? Please specify this in the text.

P. 1297, line 5: “most likely” would be appropriate to add to the last sentence.

P. 1309, figure 6: You show this informative probability plot only for dissolved oxygen. Is there a specific reason why you did not do the same for phosphorus? I think it could be interesting to have phosphorus plotted in the same way. Technical corrections

P. 1281, line 1: Write river in plural. P. 1286, line 8: Word missing between “means” and “these”? P. 1288, line 26: replace “in” with “of”, delete “of” before “being”. P. 1295, line 10: Please delete “totally” or replace with more formal word. Figure 3: Add comma after “Mean”. Figure 4: Could the different limits between WFD classes be mentioned in the figure caption? Figure 5: Add comma after “Mean”.

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