

## ***Interactive comment on “Population Growth–Land Use/Land Cover Transformations–Water Quality Nexus in Upper Ganga River Basin” by Anoop Kumar Shukla et al.***

**Anonymous Referee #3**

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The study aims at analysing population and land use changes in the Upper Ganga River basin and identifying the drivers associated to the spatio-temporal variations of water quality using a water quality index. To do so, a methodology that links remotely sensed land cover data to estimate changes in time and a water quality index derived from measured data in several points of the river. The scientific approach is valid but there is no reference to previous similar studies analysing land use-water quality index relationships (e.g. <https://doi.org/10.2989/16085914.2015.1077777>, doi:10.1016/j.proenv.2012.01.140, <https://www.ncbi.nlm.nih.gov/pubmed/27498508>) nor any justification of the scientific relevance and novelty of the study. In relation to the writing, some parts of the text should be moved to different sections specially

C1

from results to methods. There is too much repetition of information along the paper. English is understandable but should be revised (e.g. word confusion, articles, etc.). A few specific comments are detailed below:

Keywords - Population or demographic change should be included

Introduction - Paragraphs could be used to better organise the ideas in the text - Lines 76-86: many water quality indices are cited, but no comment about their validity, similarities (clusters), differences, etc. is made. - Why the OIP index is good compared to other? From the methods section, I see that it is only the average of individual indices of different pollutants. Should all pollutants have the same weight according to their impact on health, removal costs. . . ? Does the OIP propose more pollutants apart from those considered in the present study? If not, what would be the approach if there are other relevant pollutants in the studied region? - Objectives should be better organised and explained: o Not clear that it is not a continuous time analysis, but a 2 time slice analysis (2001 and 2012) with seasonal component. o Should the test of OIP as a valid index be principal in the study before it is used to extract conclusions?

Case study - Justify why the 7 selected pollutants are important and not others - Not sure if the data sources should be detailed after the methods section and be, therefore, better related to each methodological stage.

Methods - There is repetition of information. Try to avoid it by re-organising the text (section 4.1, remove details from the introduction and explain them only in this section) - Move table 1 to data section or to results, but it is not part of methods - The classification for OIP that relates the obtained values with an overall water quality status should be included in the methods section, like the IPI classification. The OIP classification is currently described in the results section (5.4.2). - Explanation about the link between LULC and water quality at the diverse stations is missing. I assume that the sub-catchments draining to the locations of the water quality stations are defined and this is used to relate the impact of spatial LULC change with water quality. I think it is

C2

worth including that as part of the methods section and also in Figure 2.

Results - No need to explain how to calculate a % change (lines 27-31). If you decide to include it anyway, it should be placed under the methods section - Figure 3 would be more useful if showing the results for the upper and lower reaches separately, instead of aggregated for the whole basin. It would support the statement in lines 20-21 which is not proved based on results - Table 4 and Figure 5 present the same results. Only one of them should be included in the paper to avoid repetition of information - Lines 95-99 should be moved to the methods section, including a description and reference about the Kappa statistics - The meaning of user's and producer's accuracy is not clear - Lines 124-158 could be moved to methods section as they describe the Mann-Kendal test - Best scenario to select representative months based on what? - In figures 6 and 7 it would be useful to depict the OPI thresholds as horizontal lines instead of as a legend - Some discussion about the conclusions and comparison with the current study should be included

Please also note the supplement to this comment:

<https://www.hydrol-earth-syst-sci-discuss.net/hess-2017-384/hess-2017-384-RC3-supplement.pdf>

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2017-384>, 2017.