Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-234-AC3, 2019

Hydrology and Earth System Sciences
Discussions
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EGU

Interactive comment on "Upgraded global mapping information for earth system modelling: an application to surface water depth at ECMWF" *by* Margarita Choulga et al.

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Received and published: 8 August 2019

Interactive comment on "Upgraded global mapping information for earth system modelling: an application to surface water depth at ECMWF" by Margarita Choulga et al.

Thank you for the positive evaluation and useful comments. Below you will find our detailed responses to your comments.

- The abstract could be reviewed to make it easier for any kind of readers to understand what is this work about and what is addressed and expected. The abstract here started with many previous results which make it not easy to understand it.

Printer-friendly version

Discussion paper

We propose to rewrite the Abstract in a following way: “Water bodies influence local weather and climate, especially in lake-rich areas. The FLake (Fresh-water Lake model) parametrization is employed in the Integrated Forecast System (IFS) of the European Centre for Medium-range Weather Forecasts (ECMWF) model which is used operationally to produce global weather predictions. Lake depth and lake fraction are the main driving parameters in the FLake parametrization. The lake parameter fields for IFS should be global and realistic, because FLake runs over all the grid boxes, and then only lake-related results are used further. In this study new datasets and methods for generating lake fraction and lake depth fields for IFS are proposed. The data include the new version of the Global Lake Database (GLDBv3) which contains depth estimates for unstudied lakes based on a geological approach, the General Bathymetric Chart of the Oceans and the Global Surface Water Explorer dataset which contains information on the spatial and temporal variability of surface water. The first new method suggested is a two-step lake fraction calculation; the first step is at 1 km grid resolution and the second is at the resolution of other grids in the IFS system. The second new method involves the use of a novel algorithm for ocean and inland water separation. This new algorithm may be used by anyone in the environmental modelling community. To assess the impact of using these innovations, in-situ measurements of lake depth, lake water surface temperature and ice formation/disappearance dates for 27 lakes collected by the Finnish Environment Institute were used. A set of offline experiments, driven by atmospheric forcing from the ECMWF ERA5 Reanalysis were carried out using the IFS HTESSEL land surface model. In terms of lake depth, the new dataset shows a much lower mean absolute error, bias and error standard deviation compared to the reference set-up. In terms of lake water surface temperature, the mean absolute error is reduced by 13.4 %, the bias by 12.5 % and the error standard deviation by 20.3 %. Seasonal verification of the mixed layer depth temperature and ice formation/disappearance dates revealed a cold bias in the meteorological forcing from ERA5. Spring, summer and autumn verification scores confirm an overall reduction in the surface water temperature errors. For winter, no statistically significant change in

the ice formation/disappearance date errors was detected.”.

- The paper is well structured and all information references are well cited.

- A lot of data are engaged and comparisons with other models and validation are present. Obtaining accurate and timely lake surface water temperature analyses from remote sensing remains difficult. Data gaps, cloud contamination, variations in temperature atmospheric profiles and moisture, and a lack of in situ observations provide challenges for satellite-derived surface water temperature for climatological analysis or input into geophysical models. The authors used different sources of data including Reanalysis to test the operational and new lake depths. The seasonal and annual variations may need further assessment mainly if the authors got time-series data. The upscaling or downscaling of satellite resolution is always a challenge but it is well addressed in this work.

Currently we are gathering satellite-based data of surface water temperature for several hundred lakes all over the globe to have a more detailed analysis of seasonal and annual lake surface water temperature variations and ice formation. We mention the importance of the remote sensing data for lakes in the Discussion section: “. . . it would be useful to compare model results with measurements from the other countries and climate zones as IFS is a global forecasting system. For that, data from remote sensing could be beneficial, although they contain gaps and cloud contamination problems.”.

- I congratulate the authors for such rich and rigorous paper, which will definitely add to the knowledge of the scientific committee in this field.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-234/hess-2019-234-AC3-supplement.zip

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