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Hydrology and Earth System Sciences
Discussions



# *Interactive comment on* "Kalman filter approach for estimating water level time series over inland water using multi-mission satellite altimetry" *by* C. Schwatke et al.

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The differences between the results from Ricko et al, 2012 and our paper can be explained by the different outlier rejections performed before the validation.

In Ricko et al. 2012, an outlier rejection and filtering of time series with respect to in-situ data was performed and is described in '3.2. Product Filtering': "First, data outliers in the three altimeter products were removed with respect to in situ gauge data as a reference (accepting good altimeter data within one standard deviation of the original gauge data). For the periods when gauge data are missing, outliers in the GRLM time

series were filtered out using the smoothed product version of the GRLM time series. For the other two altimeter products (LEGOS and ESA-DMU), these were filtered out with respect to the filtered GRLM product."

In contrast, we use the original time series from Hydroweb, GRLM and River & Lakes without any changes for the comparison with in-situ data. In our opinion, using the validation data set (in-situ) for outlier detection is sub-optimal. Moreover, when applying a outlier rejection by means of standard deviations a rejection level of 3sigma is recommended. We do not modify the external time series before the validation process and also do not use the in-situ data for a outlier detection of the DAHITI time series since we want to document the quality of the time series without further modification. This differences in the validation strategy cause our RMS values to be larger than those of Ricko.

In order to verify the DAHITI results and to check the dependence on time series length we re-downloaded the Hydroweb time series. The new comparisons (see table) show small improvements with respect to the old ones but the results are still much worse for Lake of the Woods and Lake Athabasca than the Ricko results meaning that there are still some outliers in the original Hydroweb time series.

We will discuss the differences to Ricko results in the revised version of the paper and point out the different outlier rejection strategies.

Moreover, we will try to improve the paper figures 7/8/9 and to display the different time series more clearly. At the moment part of the Hydroweb time series is hidden behind other data sets – probably we will shift the time series to each other in order to allow to distinct between them.

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| | (Schwatke et al.) RMS [m] / $R^2$ (old data) | (Schwatke et al.) RMS [m] / $R^2$ (new data) | (Ricko et al.) RMS [m] / R / $R^2$ |
|---|---|---|---|
| Erie - Cleveland | 0.094 / 0.91 | 0.090 / 0.92 | 0.10 / 0.95 / 0.90 |
| Ontario - Oswego | 0.067 / 0.94 | 0.066 / 0.95 | 0.06 / 0.98 / 0.96 |
| Michigan - Milwaukee | 0.100 / 0.95 | 0.088 / 0.96 | 0.11 / 0.98 / 0.96 |
| Huron - Harbor Beach | 0.075 / 0.97 | 0.077 / 0.97 | 0.08 / 0.99 / 0.98 |
| Superior - Marquette | 0.059 / 0.94 | 0.055 / 0.95 | 0.06 / 0.97 / 0.94 |
| Woods - Warroad | 0.333 / 0.60 | 0.323 / 0.51 | 0.27 / 0.81 / 0.65 |
| Athabasca - Crackingstone | 0.337 / 0.79 | 0.321 / 0.79 | 0.28 / 0.91 / 0.82 |

**Fig. 1.** Comparison between of RMS and $R^2$ between Schwatke et al. and Ricko et al. for Hydroweb



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