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Discussions

Interactive comment on "Processing of water level derived from water pressure data at the Time Series Station Spiekeroog" *by* L. Holinde et al.

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Review: General comments : This is solid work, and giving access to this data is of great value for a number of purposes. The illustrations are good, providing great examples of the processing steps without detailing the whole series which would have been too much. That being said, I think the whole paper would be better if both the TSS Spiekeroog and its environment were more detailed. We want to know more on how the station fits together with other water level stations (there is one in Neuharlingersiel of which data is used, but aren't there more? And is Neuharlingersiel a similar TSS station?) We also would want to know what instrument is used in TSS Spiekeroog. What kind of maintenance operations are conducted are also of major interest. And on the general environment, what is the tidal regime in this spot (tide range?). We have

some indication on storm surges in the region, but no info on the frequency, severity and impact on the coast (and on the TSS station itself!)

Reply: Thank you for your helpful comments. We will be adding meta data concerning the Time Series Station and the measurements.

Review: On the whole, the purpose of processing this time series that way is not so clear... In my opinion, having access to a long time series of water level has 3 main goals : - one is the identification of storm surges : that's the only point that is addressed in the paper, but for that you don't need to fill gaps, and you probably want to be extra careful with the removal of outliers... - another one would be to better know the tide in order to make tidal predictions, but for that, you wouldn't EVER want to fill gaps with interpolated data! - last but not least would be to identify trends, such as Sea Level rise, but that is justly crossed out because trends are subtracted to the series... So basically, the point of all this should be explained.

Reply: The filling of gaps is not needed for the identification of storm surges or certain tidal analysis (e.g. t_tide). But using simpler methods (e.g. FFT) requires a continuous time series and therefore we have filled the gaps. Even using t_tide for an analysis small differences are calculated for the used frequencies.

Review: Abstract: It should be clarified that the result of the processing of the 10 year-time series leads to a final time series of "only" 7 years. As it is written, you expect to get 10 years of data, and you don't.

Reply: Yes, we will clarify this.

Review: 2 - Methods : It seems to me that steps 3 and 4 are basically the interpolation of missing data. Step 3 should in fact be a sub-step of Step 4.

Reply: Yes, they could be combined because both steps are essential for the interpolation. But step 3 includes and generates some additional information and we wanted to separate this from the interpolation part. In addition, we will add more information

concerning the calculation of the supporting points.

Review: 2.1. Subtraction of a trend : Sensor drift is presented at the end of the first paragraph as a long term trend, and the next line says that "... in this work the long term trend is not addressed". This is a bit confusing because the whole purpose of this step is to correct the data from sensor drift.

Reply: We will clarify this. We wanted to emphasize that long term changes due to climate change are important/essential for this time series and we therefore subtracted a linear trend.

Review: 2.2 Removal of outliers : The method used seems to be robust. All the more so that a "visual check" is made in the data in order to make sure no outlier has been missed. This is basic control but it should always be done (and is so rarely done...), so congrats on that! I failed to see though why sensor maintenance would account for outliers. Maintenance could result in "steps" in the data of course, but Step 1 (subtraction of a trend for each section) would have gotten rid of those, wouldn't they? The 0.25m/10min threshold could have been be compared to the tidal rate at Spring Tides in order to get an idea.

Reply: Outliers can be a result of maintenance because when sensors are unplugged wrong signals can be received from the measurement systems and saved as data. The mean tidal range is about 2.5 m.

Review: 5) 2.3 Calculation of supporting points : I imagine no other measurements station was available apart from Neuharlingersiel?

Reply: There is one more measurement station nearby but the data are currently not accessible

Review: 2.5. Quality control. Storm surge magnitudes are given by the BSH, but there is no mention on how far off the coast these values are still valid. I couldn't find anything on the BSH website, but I don't speak German, that's maybe why.

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Reply: The values given on the BSH page are for the North Sea Coast, in Emden, Bremen and Hamburg. As far as we know there are storm surge magnitudes available for offshore measurements.

Review: 4.1 Discussion on subtraction of a trend. Is the comparison between a trend observed in 8 months and the fact that "the water level is increasing" relevant? I don't think so...

Reply: It is relevant as a reason why can subtract the trend because the trend is going against measured and observed trends at other station the German Bight.

Review: 4.3 Calculating of supporting points The only hypothesis given for the 20 min time lag compared to the 5 min "official" tidal time lag (i.e. the one given by the BSH) only accounts for a maximum of 5 minutes. It is one of the point given in the conclusion (and rightly so!), but the interrogation should be present in this paragraph as well. Even if there is no other obvious reason, it should be noted that this point needs further investigation.

Reply: We will improve this and also add the possible importance of shallow water constitutes for the tidal signal.

Review: 5. Conclusion The conclusion is very good. Some points raised here should have been developed in the above paragraphs. I agree with the last sentence : yes a radar tide gauge would probably be much more efficient on this particular station. And it would probably be less expensive to maintain, as no part is under the water.

Reply: Thank you. Many points will be improved through the helpful comments in the three reviews. A radar tide gauge has been added in 2013 and it will certainly improve our observations and data quality for future years.

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