Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2018-150-AC2, 2018

Atmospheric Measurement Techniques Discussions

Interactive comment on "Technical Note: Possible errors in flux measurements due to limited digitalization" *by* Thomas Foken et al.

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Received and published: 15 November 2018

Thank you very much for the helpful comments and that you agreed with our conclusion that the digitalization error of the sensor configuration used in the 1990s years for carbon flux measurements is negligible. This finding enables ecosystem trend analyses of carbon fluxes including data from the 1990s, which are not affected by the limited digitalization in a significant fashion . Our answers to the specific comments are (we changed the order):

d) Fluxes of water vapour and carbon dioxide are small if the fluctuations of the vertical wind velocity or those of the trace gas concentration or both are small. This follows from the eddy-covariance theory (see e.g. Foken et al. 2012a); the flux (covariance)

is a non-normalized correlation coefficient. Data with low wind fluctuations will not be used because of gap filling or/and data quality criteria based upon flow statistics such as friction velocity or non-dimensional flow statistics (Goulden et al. 1996, Foken and Wichura 1996, and all follow up papers). If the fluctuations of the concentration are too low and on the order of the resolution of the digitalization procedure (see Table 1) the signal is constant or changes only by a few digits and is therefore affected by the digitalization error. We will include this explanation in the paper. If the fluctuation is much larger than the digitalization step, the fluxes are not affected as shown in the paper.

b) From the statement in Section 3.1 and the explanation d) follows that the fluxes of other measurement sites are only affected for low fluxes (no turbulence, transition time, partly at night). These fluxes are mostly not affected by the ecosystem or with other words: The finding, that only low fluxes may be affected by low resolution digitalization can be generalized to other sites. The abundance of such situations differs among sites, but from the error magnitude in our analysis it is very unlikely, that other sites were significantly affected by the digitalization problem. On the other hand, most of these small fluxes are gap-filled and high-resolution raw-data data were rarely archived in the 1990s. Therefore only a simulation of the digitalization problem with recently collected data at sufficient resolution is a viable way of investigating this effect (see a). For these reasons and because of other error sources result in much larger uncertainties (see c) we conclude that our conclusion would not change.

c) The focus of our paper was only the digitalization error that was not yet discussed in the literature. For other errors there are many papers with exact error bands available, also from the first author (Foken et al. 2012a,b, Foken 2017 and many references within these publications). The magnitude of most flux corrections scale with the magnitude of the computed flux and hence in case of the flux error resulting from digitalization the correction is very small. The spike test of the original data is not relevant because the digitalization error does not generate spikes. Only the ogive test – made with the

original date – may be affected. However, the correction is within the error band for low fluxes (Charuchittipan et al. 2014). This test is not applied in standard flux calculations.

a) We used the standard eddy covariance processing software (see description in paper). The only modifications we administered was i) converting the 16-bit-data into data with 12-bit-digitalization by applying bin-averages according to the 12 bit resolution specified in Table 1 and ii) modifiying the sonic anemometer data to reproduce the digitalization error mimicking the error observed for the R2/R3 data. Therefore the 12-bit-calculations were not done with the original data but with data where we artificially introduced these errors, which we call here simulation. We will change the wording for a better understanding.

We have made some small language editions.

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-150, 2018.