Dynamic INtegrated Gap-filling and partitioning for OzFlux (DINGO) response to reviewer comments

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Biogeosciences Discuss., doi:10.5194/bg-2016-188, 2016

The associate editor has given us food for thought and have asked us to consider his comment below.

While I agree that it includes both random and systematic I think that forcing to zero is an error because one one side you remove this systematic error only nighttime (daytime is still there and you don't see it) but also because you mask a problem and for a user this is negative. If I get a DINGO result where a site has total nighttime GPP of 5 gC or -5 gC I will get the important information that there could be a bias in the data. If you force to 0 this info is lost…

As it turns out the way that DINGO (and OzFlux QC) works the value of GPP naturally equates to zero at night time anyway and therefore there is no need to force to zero. So we have rewritten the paragraph as follows to explain that point:

"Once the Fc timeseries has been filtered for low u* values it is gap filled using ANN Fre model and the resultant output is labelled as 'Fc_ustar'. Next, the ANN model output trained using nightime data is then extrapolated to the daytime data to create a continuous timeseries of modelled Fre (Fre_NN) that is used to fill missing gaps in the nighttime data where data where either filtered out using the u* threshold or where missing. This creates a continuous time series of Fre (Fre_Con) that is a combination of valid observations and ANN model output. GPP is then calculated as the difference between Fc and Fre (GPP_Con) where our sign convention is negative is a net flux into ecosystem and positive away from it. GPP naturally equates to zero numerically at nighttime. This is because we use the u* filter to exclude low turbulence conditions at night and then assume that the remaining observations of Fc are valid measurements of Fre. Hence, when u* is above the threshold, Fc and Fre have the same values and since GPP = -Fc + Fre, this gives GPP = 0. In addition, using the modelled Fre from the ANN we predict Fre for those times at night when Fc is missing (through QA/QC or rejection by u* filter) and for the daytime. At night, when u* is below the threshold the ANN prediction replaces Fre and Fc (same value) and since again, GPP = -Fc + Fre, this gives GPP = 0. GPP is not forced to zero during the day and this can sometimes result in GPP being positive (biologically nonsense) particularly close to sunrise and sunset. Since GPP is the difference between measured Fc and estimated Fre, it incorporates random error that is superimposed on the measurements (and potentially also systematic error in the model), and may therefore be correspondingly higher or lower than the 'true' value. As a result, some GPP estimates may switch to positive sign when the signal:noise ratio is low (e.g. early morning / later afternoon). While these estimates are therefore unphysical, the effect of their removal is to filter the positive domain of the random error distribution, thereby converting random error to systematic error that leads to slightly higher GPP and therefore we do not force GPP to zero during the daytime."