Atmos. Meas. Tech. Discuss., 8, C1970–C1973, 2015
www.atmos-meas-tech-discuss.net/8/C1970/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparative measurements of water vapor fluxes over a tall forest using open- and closed-path eddy covariance system" *by* J. B. Wu et al.

Anonymous Referee #2

Received and published: 13 July 2015

This paper presents a comparison of water vapor flux measurements made by open and closed-path sensors above a deciduous forest in China. As the author's point out there is a paucity of comparisons to enable good quantification of measurement uncertainty and bias by different water vapor senors. This paper will provide a useful service to the community and valuable data. However there are some additional points and analyses that need to be considered in order to make this intercomparison as fair and useful as it can be.

page 4715; line 20, The description of calibration procedure is incomplete. What is the balance gas for the CO2 standard? Note that nitrogen rather than air introduces a bias

because the spectral characteristic of air and N2 are different. What if anything is done to check the calibration for water vapor? This is critical to assure that none of the bias between the two sensors comes from difference in calibration.

Pg 4718,Line 14; The comparison in figure 1 is not at all convincing that the two analyzers are in agreement. A longer set of data is needed to show that they are in overall agreement. Comparing the mean values from each analyzer by plotting one against the other to confirm that there is not a bias or offset between the two should be the first step. In comparing the high frequency, which analyzer provides the true signal? It would help to show temperature or CO2 in order to demonstrate whether the high frequency variability in the open path sensor is real atmospheric variation or instrument noise. Secondly, use spectral analysis to more conclusively demonstrate the point that the closed path sensor is attenuating some signal.

Page 4719, first paragraph You need to note that long lag and dependency on RH is a problem with the inlet tubing and perhaps a function of the material used, or an accumulation of foreign material on the surface. Different tubing materials (such as teflon), or having fresh clean tubing may give different results. The problem with lags is not inherent to the instrument, though it is unavoidable to some extent when there is an inlet. Nevertheless, a useful methods comparison should assess how well the problem can be corrected by choice of tubing material.

Page 4719, line 19. Once you have demonstrated that a fixed lag time is inappropriate no further comparison should be made between the open path and closed path data calculated with a fixed lag. Please make it clear at this point in the text that fixed lags are not used in any of the subsequent analysis. There also needs to be some discussion around this point about what corrections have been made for loss of high frequencies. An important question to answer is whether or not the data from close path sensor can be adequately corrected using the best available data processing tools.

Section 3.5. There is no need to separately compare the results for water exchange

and latent energy. The underlying measurement is water vapor flux. Conversion to energy flux is made using the heat of vaporization that is the same for both data sets

Page 4721, line 17. I do not think it is correct to state that the Fluxnet community generally accepts that Open path sensors need less maintenance. Each of them have different needs and present different issues that are more or less important depending on the site characteristics. This paper should just focus on presenting the comparison between the two analyzers and the question of how large is the difference after applying the best data processing approaches to each.

Line 23. Data rejection because of failing integral turbulence and stationarity tests ought to apply to both analyzers equally if it is function of the local site's turbulence structure. Unless you are suggesting that the closed path sensor fails this test, but the open path does not, then it is not a drawback of the sensor. If the number of points rejected by these tests for the two sensors are different, you need to give some explanation of why. Compare the amount of data that are retained by each after the turbulence and stationarity are excluded. It is a valid point to mention that rainy conditions may cause significant data loss from the closed path, but please include a fair analysis of whether this can be adequately corrected by choosing better inlet material and accounting for the changing lags and difference in tube attenuation. Furthermore, in computing water or energy balances, how much water vapor flux actually occurs during rain events and when humidity is near 100%. Surely the rainfall itself transports more than the water vapor, and at 100% RH there is little gradient to support evaporation.

Page 4723. As noted above, I don't think additional examination of the results based on a fixed lag time are warranted. It is clearly not correct, so shouldn't be used. The difference between optimized lag and maximum covariance needs to be further explored. How do you know which is right? If the maximum covariance within a broad window is truly computing unreasonable lag times you should demonstrate this by saving the lags that the maximum covariance method identifies and compare them to the optimized lag method. In addition, it would be helpful to contrast the patterns for water vapor fluxes

by comparing them to the results for the more inert tracer CO2.

Finally, the points made in this paper about tube attenuation being a significant problem for the close path sensor would be better made by showing spectra and cospectra for the open and closed path water vapor data. Is there indeed a noticeable loss of cospectral power at high frequency?

The intercomparison presented in the manuscript is not clear enough about how the known corrections for loss of high frequency variations are applied to each data set. One of the most important questions to answer is whether or not the data from closed-path water vapor analyzers can be adequately corrected if the data are processed properly.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4711, 2015.