Biogeosciences Discuss., 8, C3187–C3189, 2011
www.biogeosciences-discuss.net/8/C3187/2011/

Biogeosciences Discussions

Interactive comment on "The imprint of surface fluxes and transport on variations in total column carbon dioxide" *by* G. Keppel-Aleks et al.

Anonymous Referee #1

Received and published: 19 September 2011

In this manuscript, the authors attempt to reveal the relationship between total column CO2, and surface fluxes and transport using ground based total column CO2 data from Total Carbon Column Observing Network (TCCON) observatories, and eddy covariance flux data, and free troposphere [CO2] data from aircraft. The total column CO2 data were also used to compare with atmosphere transport modelling results and concluded that boreal growing season NEE (between 45–65°N) is underestimated by ∼40% in CASA. I suggest the authors considering the following in revising this manuscript.

(1) The section title of 3.1 is 'diurnal variations' of observed, and the authors claimed that they are small (during the summer growing season is ∼2 ppm) and influenced by a large spatial footprint. This may also a factor for the authors to 'use daily mean

CO2 model output" to compare with observed. However, the authors need to answer a question first: Can you quantify the diurnal variation of based on the measurements? Figure 4 does not provide enough information to do so as the observations only cover part of each day. From another angle, 2 ppm is also a significant variation to consider as it represents the total column, not the thin boundary-layer as 2 ppm change in the atmospheric CO2 concentration means ∼1Pg C flux in the surface.

(2) In Fig.5, the authors compared the NEE calculated from drawdown in the total column and NEE inferred from eddy covariance measurements at Park Falls, Wisconsin. Clearly, the correlations at daily (a) and weekly (b) time steps are so poor that it hardly to infer reliable fluxes from them. At the monthly (c) time steps the NEE calculated from drawdown in the total column overestimates the sink comparing with the NEE inferred from eddy covariance measurements (EC-NEE). This means using total column measurement may overestimate surface sink if EC-NEE is right. What is the implication of this relationship to your finding that 'boreal growing season NEE (between 45–65°N) is underestimated by ∼40% in CASA'?

(3) A daily version of AM2 was used in the study. 1) Daily AM2, however, cannot reproduce the CO2 concentration at the time, and solar zenith angle (SVZ) that the observation is made. 2) The authors calculated the daily mean of the observed in order to match the daily AM2 output, but <CO2> is only observed in certain time of day. 3) Monthly mean solar zenith angles (SVZ) for TCCON sites are shown in Fig 8, and these mean SVZs were used to convert the daily mean CO2 model output from AM2 into <CO2>. As the relationship with SZA is nonlinear, using mean SZA could lead more uncertainties.

(4) Uncertainties of the observations, the model and the relationship obtained in this manuscript should be further concerned. As it is not easy to evaluate the uncertainty of the model (AM2), you may first quantify the influence of the observation uncertainties. An uncertainty of 0.8 ppm, for example, in observation from one site could inversely bring how much uncertainty in surface flux in different regions is a critical question to

BGD

8, C3187–C3189, 2011

answer.

(5) As the authors used observations from 5 TCCON sites, a pretty small observation set, and all the adjustments (Fig 12) are made seemingly to fit only observations at Park Falls, one of these sites. Considering this and the uncertainties from observation, modelling, it is still hard for readers to evaluate the conclusions from this manuscript.

Interactive comment on Biogeosciences Discuss., 8, 7475, 2011.