

Interactive comment on “Study of the regional CO₂ mole fractions filtering approach at a WMO/GAW regional station in China” by S. X. Fang et al.

S. X. Fang et al.

fangsx@cams.cma.gov.cn

Received and published: 19 October 2015

Yes. The identification of atmospheric CO₂ observation data which is minimally influenced by very local emissions/removals is essential for the study of regional CO₂ characteristics and variations of sources/sinks strength. A lot of studies reported the observed CO₂ records using one of the approaches as summarized in the introduction. In our study, using the atmospheric CO₂ record at LAN as a sample, we compared the results from four different data filtering approaches. The main propose of this study is not to report the CO₂ record at LAN or a new method. The novelty of it is to find the suitability of such data filtering methods on the observation records at the regional

C3347

stations like LAN, and then to conclude the “most favorable” method which could be used at the other regional stations. Sorry we made a mistake in the “ABSTRACT”. The growth rate is calculated based on the records from 2009 to 2011. We corrected it in the revised manuscript.

Specific comments:

There are 4 different filtering technique discussed in this paper. This is not conclusive that which technique will be suitable for a particular location. Especially if some station acquire night time data how the applicability of these filtering techniques might alter. If one wants to apply all the 4 technique whether the result will be representable for a regional station.

Reply: Thanks for the comments. We discussed the suitability of the four approaches in section 4 as follows: “. . .However, it cannot be concluded that the other three methods are not suitable for the CO₂ data selection. For example, the four methods were also applied to process the observed CO₂ record at Mt. Waliguan station (100°54'E, 36°17'N, 3816 m asl) in China without excluding the nighttime data. As this station is a WMO/GAW global site and is located in a remote area, we found there were no distinct differences between the filtered CO₂ mole fractions, including the seasonal cycles, annual growth rates, background mole fractions (data not shown), and the results agreed very well with the background information in northern hemisphere. In this study, we selected daytime data only for the four approaches to exclude the influences of very local sources/sinks (e.g. vegetation). However, for sites without strong local sources/sinks and indistinct diurnal CO₂ variations, the nighttime data may also represent regional events and can be used. Atmospheric black carbon is mainly from fossil combustion and biomass burning, Thus the BC method may be applied at some remote sites to identify the anthropogenic influence on the observed CO₂ records. The theory of REBS assumes that the background signal varies very slowly relative to contributions of the regional signal. The results in this study prove that the REBS is not suitable for the CO₂ data filtering at regional stations like LAN. Instead, it may be applied at some

C3348

remote stations like Mt. Waliguan. The AUX can be applied at sites where the atmospheric CH₄ and CO₂ are subjected to the same sources, and it can also be applied at some remote stations. Moreover, due to the different characteristics and source/sink regimes of various gas species, the suitability of a particular filtering method may even differ when looking at different trace gases at the same sampling site. This needs to be studied separately.”

Minor comments:

1. Section 7058: 1. Line 20- add reference for “filters based on specific traces gases.....”

Reply: Agreed. We added references as: “(Brunke et al., 2004; Tsutsumi et al., 2006; Zanis et al., 2007)”

2. 2. Line 25- add reference for “Meteorological filters.....”

Reply: Agreed. We added references as: “(Artuso et al., 2009; Chmura et al., 2008; Collaud Coen et al., 2011; Zellweger et al., 2003)”

3. 3. What do you mean by Weather statistics?

Reply: Sorry for the misleading. We changed the phases to “weather conditions”. Some studies use it as an indicator (sunny, rainy conditions. . .) to filter the observed results.

4. 4. The line “Ths method e.g. consider various.....” is too lengthy and not clear, please split the line.

Reply: Agreed. We re-wrote the sentences as: “considers various factors such as the local wind speed, wind direction, boundary layer height, information on the atmospheric stability, solar input, or weather condition and others. Sometimes it further considers the diurnal CO₂ variation as it can be closely linked to the above parameters (Zhou et al., 2005). . .”

C3349

5. Section 7060 1. Why Fang et al., 2014 paper filtering technique gave different results from Pu et al., 2014?

Reply: Fang et al., 2014 used a meteorological filter, but Pu et al., 2014 used a different filtering approach (black carbon). We also analyzed the causes for the higher value from Pu et al., 2014 in section 4.

6. Section 7061 1. Please mention the altitude of the “small hill”

Reply: Agreed. We added the altitude of the small hill as “. . .(160 m asl). . .”.

7. Section 7064 1. Auxillary Tracer— The data filtration technique for poor CO₂-CH₄ correlation is not clear.

Reply: Agreed. we re-wrote the sentence as: “. . .especially for the data points which were away from the linear fit in Fig. 3. To reduce this influence, we arbitrarily defined the standard deviations (1σ) in respective seasons as outliers. If the absolute difference between the current CO₂ data point and the linear fit result was larger than 1σ , the data point was considered as local representative. . .”.

8. Section 7066 1. Why the CO₂ increasing trend is not seen in the BC method filtered data.

Reply: The long-term CO₂ trend in the BC method (polynomial part of the curve fitting function) decreases from February in 2011 (data not shown), which opposites to the variations of total CO₂ emissions (or black carbon) from fossil fuel in China with increasing value of 0.15 P g C in 2009 - 2010 period and 0.21 P g C in 2010 – 2011 period (CDIAC, 2015). As the BC method uses a fixed black carbon concentration (5000 ng m⁻³ in this study) as threshold to filter the CO₂ record, a large proportion of high regional CO₂ mole fractions in 2011 may be flagged as local events, and consequently, a decreasing long-term trend was acquired. This also proves that the BC method will induce bias on the CO₂ data filter at LAN.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 7057, 2015.

C3350