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Interactive comment on "A new site: ground-based FTIR XCO$_2$, XCH$_4$ and XCO measurements at Xianghe, China" *by* Yang Yang et al.

Anonymous Referee #2

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General comments

The manuscript "A new site: ground-based FTIR XCO2, XCH4 and XCO measurements at Xianghe, China" by Yang et. al. describes a data set of total column dry air mole fractions of carbon dioxide, methane and carbon monoxide derived from near infrared, solar absorption Fourier transform spectroscopy using methods similar to those of the Total Carbon Column Observing Network (TCCON). The described dataset covers a year of measurements and therefore captures a single seasonal cycle.

The manuscript follows a logical narrative, but in some areas would benefit from additional copy editing.

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Data of this type, from an urban area of China, are likely to be of value to the satellite and model validation communities and I would encourage the publication of this manuscript subject to a number of clarifications and modifications as detailed below.

Specific comments

Reference is made to TCCON throughout the manuscript, however it is not made explicitly clear that the Xianghe site is not currently affiliated to TCCON. This should be stated from the start including what steps are required for the site to become affiliated with TCCON if that is the objective. Additionally, statements such as "this study shows that the Xianghe data comply with the TCCON specifications" at page 12 line 30 are considered quite strong and possibly misleading as, for example, the TCCON requirement for an in-situ validation is not covered in this work. Care should also be taken when making comparison to the TCCON accuracy/precision requirements, throughout the manuscript reference is made to "the 0.8 ppm (SZA less than 80 °) retrieval accuracy of TCCON XCO2." (e.g. at P4 L23), this is actually the target for site-to-site biases within the TCCON. The actual single instrument/site precision target for TCCON is 0.1% i.e. 0.4 ppm for XCO2.

Precision estimates within the manuscript are based on the standard deviations of daily retrievals of each of the species. This may result in an overly pessimistic estimate as the daily means are potentially influenced by a number of factors such as a diurnal cycle, the influence of local sources in such a heavily urbanised area and a residual airmass dependence of the retrievals as pressure broadening is not accounted for in the GGG2014 spectroscopy. Better and more representative results may be obtained by limiting the windows over which standard deviations are calculated to a smaller range of solar zenith angles or shorter periods.

In sub-section 2.2 it would also be useful to present some example plots of ME and PE as a function of OPD, and as PE can have a maximum value at an OPD other than the maximum, consider presenting a time series of maximum PE. Also, LINEFIT 14.5 can

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be used in a number of modes, it should be explicit which mode is used.

The sub-section on signal-to-noise ratio would benefit from a discussion about how SNR is calculated as there are a number of possible methods. Making this explicit would make it easier to make comparisons between sites.

In the paragraph describing satellite missions that can be validated by this type of measurement in the introduction, GOSAT is notable by its absence, and as one of the first satellites dedicated to measuring greenhouse gases probably deserves to be mentioned.

Ongoing measurements of this type are likely to be of interest to a number of users and so a statement about whether future measurements will be added to the referenced dataset, or the TCCON archive if the site should become affiliated to the network, would be useful.

Technical corrections

P2 L4-8 Whilst not strictly necessary, it would be useful to provide more context by comparing the current values to their pre-industrial levels and/or stating the current rate of increase.

P2 L10 Provide the radiative forcing of CO_2 as a comparison.

P2 L13-14 Try to clarify the distinction that is being made here, i.e. are the two main types of measurement in-situ and remote sensing, or ground-based and satellite?

P3 L1-2 Inclusion of the sentence "To increase the precision of the retrievals, the spectra are cloud filtered based on the separate direct solar irradiation measurements." fragments the description of the manuscript outline, considering removing it.

P3 L33 After "NIR InGaAs" insert spectra or measurements.

P3 L26 - P4 L7 These two paragraphs highlight the importance of consistent represen-

tation of scalars and their vectors e.g. m and meters are both used and sometimes there is a space between the scalar and vector and sometimes not.

P5 Eq.1 Appears to have been inserted at the wrong point in the manuscript.

P5 L16 Please give details of these sensors, particularly the type and precision/accuracy of the pressure sensor which is very important for the accuracy of trace gas retrievals.

P5 L20 Does the first "a priori partial column" refer to the tropospheric component? This should be made more explicit.

P6 L10 Consider using affected instead of infected.

P9 Eq.4 The vector **l** is not defined.

P11 L8, L14 and L31 The Landgraf et al references do not contain a year.

Table 2. AC+DC mode column, it would be expected that additional filtering would result in a lower value for SNR+SI (row c) than for SNR (row b) on its own. This doesn't appear to be the case.

Interactive comment on Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2019-172, 2019.