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Poster
CO2M will be the first satellite mission that is specifically designed to monitor CO2 emissions from anthropogenic sources. This increases the need of assessing the current capabilites and future needs for XCO2 validation at urban environments. In this work we carry out a joint validation of OCO-2 XCO2 and aerosols at locations that have both a TCCON and an AERONET ground-based measurement sites close to each other. More detailed analysis is carried out at stations that are at urban environments. The motivation of this work is to gain understanding of different validation approaches in urban, high aerosol load environments and to establish the current state of the art and gaps in both retrievals and validation.

There are currently 13 locations worldwide, where ground-based TCCON and AERONET site are located close (< 10 km) to each other and have overlapping data since 2014 for more than one month. Five of these locations can be considered as urban; CalTech, Karlsruhe, Nicosia, Paris, and XiangHe. Overall, at all of these joint stations the mean AERONET AOD at 760 nm is low and well below the current OCO-2 AOD threshold of 0.2, except at XiangHe where the mean AOD is 0.36. Comparison of OCO-2 AOD estimate against AERONET AOD shows good correlation (r=0.65) and low bias (<0.01) at the 13 locations. However, there are some single cases, mainly in XiangHe, where OCO-2 AOD is underestimated while AERONET indicates AOD values larger than 0.2. Analysis also shows that the mean XCO2 bias at the stations is relatively low (<= 1 ppm), even in XiangHe despite differing aerosol conditions. The comparisons also don’t show any systematic dependency between the XCO2 bias and AERONET AOD, or the OCO-2 AOD bias.

In the second part of the work more detailed analysis of OCO-2 XCO2, other retrieval parameters and aerosols is carried out in the vicinity of the urban stations. Aerosols’ spatial variability and the representativeness of the AERONET stations are analysed using MODIS Aqua AOD. For each five urban-type stations spatial correlation map between MODIS and AERONET AODs is established to obtain an estimate on how wide area the aerosol conditions obtained from AERONET can be considered representative. In addition, specific case studies are carried out, when single OCO-2 XCO2 soundings from one overpass are merged with MODIS AOD. This allows more dynamic investigation of various retrieval parameters along the flight direction, e.g. when the instrument pass over a clear AOD gradient. On a daily (single overpass) level there were no clear indication that the XCO2 bias would highly depend on prevailing AOD conditions, even though at some cases OCO-2 provided good quality XCO2 observations when AERONET and/or MODIS reported significantly higher AOD than the threshold. Next steps include more detailed analysis on the effect of aerosol vertical distribution.
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