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Atmospheric Measurement Techniques Discussions

Interactive comment on "A remote sensing technique for global monitoring of power plant CO_2 emissions from space and related applications" *by* H. Bovensmann et al.

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Answers to the comments of anonymous Referee 1 to Bovensmann et al., "A remote sensing technique for global monitoring of power plant CO2 emissions from space and related applications".

In the referees opening remarks it is writen that the proposed satellite has a spectral dispersion which is significantly lower than OCO. The spectral dispersion of two of the three bands, namely the 760 nm O2-A-band channel and the 2000 nm strong CO2 band channel, is however quite similar as OCO. Only the spectral dispersion of the weak CO2 and CH4 bands around 1600 nm is significantly lower (this is because a

larger spectral range is covered to also measure methane). As the 1600 nm spectral region is quite transparent this channel does not provide very much information on atmospheric scatterers (aerosols and clouds), even at high spatial resolution. Very high resolution is therefore not needed for this channel. The overall information content on aerosols and clouds is similar as for OCO.

According to the referee the manuscript needs significant editing. The referee suggests to significantly shorten the manuscript. Unfortunately the referee is not providing very much details as "I do not have sufficient time". If the manuscript is too long the review obviously suffers from the opposite as it is quite short. Nevertheless, we will aim at generating an improved revised version of the manuscript and will aim at removing unnecessary text.

In addition the referee lists three specific concerns. Our reply is as follows:

1. The referee expresses its concern that the conversion of the measured concentrations into fluxes is not adequately described. In the revised version of the manuscript we will present a more detailed analysis especially related to the question of how systematic errors of the wind field propagate into errors of the derived fluxes.

2. To address the second concern we will present in the revised version of the manuscript a more detailed analysis of how clouds and aerosols in the plume affect the accuracy of the retrieved concentrations. The referee is right that even for clear sky situtations there typically will be a plume of, e.g., condensed water vapor, near the power plant. This plume will however be optically thick typically only within a few hundred meters along the prevailing wind direction. This plume needs to be identified. This can be achieved by analysing the CO2, O2, and CH4 column retrievals (due to the shielding effect of the cloud all columns should be lower than the average columns in the surrounding of the power plant). In addition it is planned to equip the satellite with a Cloud and Aerosol Imager (CAI) to provide (even) higher spatial resolution measurements (similar as the CAI onboard GOSAT; an initial specification of the CarbonSat

CAI is given on the CarbonSat website http://www.iup.uni-bremen.de/carbonsat). It is expected that typically 1 or at maximum 2 of the 2x2 km2 ground pixels is affected by a significantly optially thick power plant plume (note that the CO_2 plume will typically be much longer as shown in Fig.1 of our manuscript). If an optically thick cloud is identified, the affected ground pixels have to be flagged and excluded from the analysis. This will typically result in only a moderate degradation of the uncertainty of the inferred fluxes as the flux error depends only weakly on the number of used ground pixels (approximately square root dependence). In the revised paper we present a detailed investigation of this and will provide a quantitative error estimate.

3. To address the third concern we will present in the revised version of the manuscript a detailed analysis concerning the impact of (different) vertical gradients of CO_2 and CH_4 in the boundary layer.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 55, 2010.