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Atmospheric Measurement Techniques Discussions

Interactive comment on "Performance of a geostationary mission, geoCARB, to measure CO_2, CH_4 and CO column-averaged concentrations" *by* I. N. Polonsky et al.

Anonymous Referee #1

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Interactive comment on the manuscript "Performance of a geostationary mission, geoCARB, to measure CO2, CH4 and CO column-averaged concentrations" by I. Polonsky et al.

The manuscript "Performance of a geostationary mission, geoCARB, to measure CO2, CH4 and CO column-averaged concentrations" contains important new material and it covers the topics appropriate for Atmospheric Measurement Techniques. The authors investigate accuracy/precision of the GeoCARB instrument, which is proposed to measure column averaged concentrations of atmospheric carbon dioxide, methane and carbon monoxide from geostationary orbit. They have demonstrated the possibility

to meet target accuracy requirements for baseline GeoCARB configuration as well as for less expensive descope options. Most of the results were obtained by the inversion of the numerically simulated GeoCARB spectral radiance. The simulations were performed on the basis of the OCO simulator (previously developed by the authors) that was adopted for GeoCARB mission. Acceptability of the descope option was also investigated using actual GOSAT observations over Lamont TCCON site. Special attention was paid to the estimation of the power plant emissions. Along with analytical estimates of required number of plume observations, the authors performed end-to-end simulations and retrievals of emission values for different types of plants. Both signal simulations and retrievals are performed at a high level providing realistic estimates of target instrument performance. Presented methodology and numerical results may be helpful for the performance investigations of the similar satellite missions. The manuscript is well structured and written; the abstract clearly summarizes the main results. I recommend the manuscript publication provided some minor comments would be considered (at least in the interactive comments).

1) The authors analyzed accuracy/precision of the descope option (not using strong CO2 band) by retrieving actual GOSAT spectra taken around the TCCON (Lamont) site: the table 6, figures 11 and 12. First, the units for XCO2 in the table should be corrected to ppm. Next, some comments regarding accuracy/precision of baseline option would be useful: does precision (standard deviation) of 0.36 ppm agree with L2 algorithm validation results? Are these impressive accuracy/precision characteristics mostly "Lamont-specific"? Otherwise it is not clear why so modest requirements (2.5 ppm for CO2) are set for the next satellite mission and next retrieval algorithm versions.

2) More detailed explanation of the eq. 5 would be helpful. The term "enhancement" is rather obscure. In fact, this equation determines "CO2 vertical column [g/m2] at and downwind of the point source" (e.g., Bovensmann et.al. "A remote sensing technique for global monitoring of power plant CO2 emissions from space and related applications, Atmos. Meas. Tech., 2010). I would also recommend to describe how the

scaling (from [g/m2] to [ppm]) was performed in the presented equations.

3) Since bias and standard deviation of XCO2 are presented either in [ppm] or in %, these units should be explicitly shown in figures and tables (e.g., Fig. 8).

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 9397, 2013.