Atmos. Chem. Phys. Discuss., 13, C4044–C4045, 2013
www.atmos-chem-phys-discuss.net/13/C4044/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global carbon monoxide products from combined AIRS, TES and MLS measurements on A-train satellites" *by* J. X. Warner et al.

Anonymous Referee #3

Received and published: 21 June 2013

General comments

The manuscript describes a method to combine different sets of carbon monoxide (CO) observations using the Kalman filter equation. Unlike a data assimilation problem, the presented method doesn't use a numerical model to propagate the observational updates in space and time, but the data set with better spatial coverage is used as a background state. The aim of this method is to deliver a new global product combining the advantages of both data sets: better spatial resolution from one side, the AIRS CO retrievals, and better spectral resolution from the other, TES or MLS CO profiles. To my knowledge, this study is the only work applying a data assimilation algorithm to

different observations without a model. Whereas, the works on delivering combined observational products are already known.

The authors show that the combined product demonstrates improved sensitivities as compared to the AIRS-only retrievals, and improved coverage compared with the TES and MLS CO data. The combined product is validated against independent data sets. The advantage of using the combined product in a data assimilation work is not discussed.

The overall presentation of the results is clear and concise. The language is adequate and the use of graphics helps to understand the content.

Specific comments

Page 15412. Line 6: "However, as in the case of other nadir sounders,..." - I would recommend to add a reference here. The lines 15-20, a reference is missing as well.

Page 15414. Line 25: "...measurements taken within a short time period (15-30 min)." I suggest 1) to describe quantitatevly the background and observational state vector; and 2) to discuss if the localization of the error covariances is needed (to filter out small and noisy correlations at large distances).

Page 15415. Line 8: "The population of the profiles... is determined... by the observed variances..." This sentence is not clear to me. Line 17: a reference to (Kalman, 1960) is needed.

Page 15416. Line 1: "Since the variable amount..." It is not clear. Do you mean "the size of the observation vector $\mathbf{X}_0$"? Line 20. The power law equation is not correct.

Page 15417. Line 10: "the correlation lengths ... were chosen to match the measurement characteristics and sensitivities of AIRS and TES." Could you explain in more details how do you chose these length scales? Line 17: "This is based on previous knowledge and validation experience." I suggest to add a reference here.