Atmos. Meas. Tech. Discuss., 4, C1260–C1264, 2011
www.atmos-meas-tech-discuss.net/4/C1260/2011/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Information operator approach applied to the retrieval of the vertical distribution of atmospheric constituents from ground-based high-resolution FTIR measurements" *by* C. Senten et al.

Anonymous Referee #2

Received and published: 4 August 2011

General Comments

This paper describes the application of the information operator approach to the retrieval of vertical profiles from ground-based FTIR solar absorption spectra. This method is applied to spectra recorded at La Reunion, and the results are compared with the more widely used optimal estimation method, and with the Tikhonov regularization method. The information content, robustness of the retrievals, and error budgets for the three methods are assessed using four trace gases (O3, CH4, N2O, and CO;

only the first two are used in comparisons with the Tikhonov regularization method). The information operator approach is shown to provide somewhat better accuracy, stability, and sensitivity to the a priori profile than the other two methods, and slightly lower information content. This paper makes a useful contribution in the area of retrieval methods, and is of particular relevance to ground-based NDACC FTIR community. I recommend publication in AMT after the minor comments below are addressed.

Specific Comments

Page 3746, line 4: Briefly define the upper Hessenberg form.

Page 3749, para 2 and Table 1: Explain why different spectral resolutions (listed in Table 1) were used for the four gases.

Page 3752, line 13: Was the Tikhonov regularization method tuned to give the same DOFS as the other two methods?

Page 3754, line 13: Define the sense of the bias.

Page 3754, line 19: State which parameters are included in the forward model parameter error. Doesn't this include some of the other errors listed in this sentence (e.g., temperature, line intensity, pressure broadening, solar zenith angle, etc.)? Also on page 3755, lines 13-14, there appears to be redundancy in the list of errors.

Page 3756, line 4: Discuss possible reason(s) for the large systematic error for the CH4 partial columns retrieved using the TR method.

Page 3757, lines 5,6: Discuss briefly the results of the sensitivity tests to retrieval grid, e.g., what grids were tested and the magnitude of the sensitivity.

Page 3774, Figure 4: Why is the sensitivity for TR equal to unity for ozone?

Technical Corrections

Page 3740, line 11: frameWORK

Page 3740, line 21: change “as to” to “with respect to”

Page 3740, line 24: change “is” to “has been”

Page 3740, line 25: define FTIR

Page 3740, line 25: high-resolution; this is hyphenated in some places, e.g., the title – check throughout the manuscript and add hyphens where appropriate

Page 3741, line 5: frameWORK, define NDACC

Page 3741, line 8: knowledge gained

Page 3741, line 23: has led us to

Page 3742, line 3: above-mentioned

Page 3742, line 17: commonLY

Page 3742, lines 18, 21: delete comma after OEM and after achieved

Page 3745, line 22: define QR

Page 3746, line 11: replace “less” with “fewer”

Page 3746, line 25: that best represent the retrieval results.

Page 3747, line 4: in THE case of

Page 3747, line 18: commonLY

Page 3748, lines 17-18: These molecules were first mentioned in the Introduction (page 3741, line 11) – define the chemical symbols there.

Page 3748, line 22: the retrieval strategy used, and . . .

Page 3749, line 2: Before continuous operations . . .

Page 3749, line 3: change “have” to “had”

Page 3749, line 22: The a priori profile x_a, used, and its . . .

Page 3749, line: replace “where one can hardly get” with “for which it is difficult to get”

Page 3750, line 9: An overview . . .

Page 3750, line 12: criteria

Page 3750, line 23: systematic decrease

Page 3750, line 26: delete rather

Page 3751, lines 15,16: less oscillatory

Page 3752, line 28: and CH4, the TR retrievals are also shown . . .

Page 3753, line 2: they represent the complete dataset well, and . . .

Page 3756, line 10: define VMR here, not on page 3756, line 10

Page 3753, line 26: define VCA and PCA

Page 3755, line 13: forward model parameter error

Page 3755, line 22: columns is the systematic error unexpectedly . . .

Page 3756, line 8: change “onto” to “on”

Page 3756, line 10: move “obtained” after profiles

Page 3757, line 7: delete comma after S_a

Page 3758, line 15: allows the derivation of more . . .

Page 3758, line 16: for the atmospheric species investigated

Page 3758, line 26: What is meant by “the IOA applied onto the OEM”? Delete very.

Page 3762, Table 1: For CH4 variability, give the range of values used rather than “variable”. Should variability be better labeled as variance (diagonal elements of S_a),

or are these really the square roots of the diagonal elements?

Page 3771, Figure 1 caption: to the a priori profile used. Also for page 3882, Figure 11 caption.

Page 3772, Figure 2: The symbols (black circles, black squares, blue) are difficult to distinguish.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 3739, 2011.