**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "Balloon-borne limb measurements of the diurnal variation of UV/vis absorbing radicals – a case study on NO$_2$ and O$_3$" *by* L. Kritten et al.

Anonymous Referee #1

Received and published: 12 March 2010

This paper describes a new method for the retrieval of the diurnal variation of UV-vis absorbing species like O3, NO2, BrO, OClO from balloon-borne limb scattered light observations. This method, based on a Bayesian minimization technique, is applied to observational data obtained from a mini-DOAS instrument aboard balloon gondolas during flights around Teresina in Northern Brazil in June 2005. The inferred profiles have been successfully compared to in-situ ozone sondes and ENVISAT/SCIAMACHY limb observations, demonstrating the validity of the retrieval method presented here. The paper is well written and clearly structured. I recommend its publication in AMT after addressing the following comments:

Specific comments:

Page 433, line 20: Balloon flights are listed in Table 1 and not in Table 4. Can the new Bayesian minimization algorithm be applied to all flights listed in Table 1 ? If not, it should be mentioned somewhere in the Table which flights are useful for this study.

Page 435, line 25: It is not necessary to put again the list of UV/vis absorbers since this one appears already in the Introduction.

Page 437: You should mention somewhere how the choice of the reference spectrum is done in practice. You should also show a plot of the retrieved and modeled O3 DSCDs as a function of time since it is a paper dealing with NO2 and O3.

Page 439, line 8: Referring to Schofied et al. (2004) is not relevant here since they also retrieve the chemical variation as in the present study (chemical modeling in the forward model is only needed if the chemical variation of the absorbing radical is not retrieved but provided a priori).

Page 443, line 9: A reference or a short description for the Labmos model should appear.

Page 444, line 3: How do you calculate the number of degrees of freedom ? By using the trace of the averaging kernels ? Also according to the y-axis of Fig. 4, you have about 85 degrees of freedom. It seems to me to be an unrealistic large number.

Page 451, line 2: Do you have any explanation for this off-set of about 2km between SCIAMACHY and balloon NO2 profiles above the concentration maximum ?

Page 451, line 9: "…the balloon-borne retrieval takes into account the full range from 0 to 70 km". For me, this sentence is a bit misleading because according to Fig 9, the information content from the balloon retrieval is only significant in the 10-35 km altitude range.

Page 456, line 7: Are the Johnston's cross sections available somewhere (web link ?)

?

Technical corrections:

Page 435, line 26: According to my copy of the Platt and Stutz's book, the year of edition is 2008 and not 2006.

Page 438, line 20: Since it is the first time that 'RTM' is used, the meaning of this acronym should appear.

Page 450, line 8: 'Envisat' -> 'ENVISAT'

Page 457, line 24: 'NO-2' -> 'NO2'

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 431, 2010.