Supplement of Atmos. Chem. Phys. Discuss., 15, 35313–35381, 2015
http://www.atmos-chem-phys-discuss.net/15/35313/2015/
doi:10.5194/acpd-15-35313-2015-supplement

Atmospheric Chemistry and Physics Discussions

Supplement of

Modeling the reactive halogen plume from Ambrym volcano and its impact on the troposphere with the CCATT-BRAMS mesoscale model

L. Jourdain et al.

Correspondence to: L. Jourdain (line.jourdain@cnrs-orleans.fr)

Supplementary material:

1. Sensitivity study to the height of the plume

Knowledge of the injection altitude of volcanic emissions is critical to study the transport, the chemical evolution and the deposition of theses emissions. We performed an additional simulation (S1_HighT_alt) in which emissions are injected at 2000 m into a grid-box of about 200-300 m depth. This higher plume altitude estimate was suggested by Bani et al. (2012) but is based only on visual estimations which are known to be rather uncertain.

Figure 1S shows that the SO_2 columns are less well simulated by the model in the S1_HighT_alt than in the S1_HighT simulation. The plume seems to be transported too much towards the east relative to the observations. As a result, the simulation S1_HighT_alt underestimates the observation by 44 % for SO_2 (compared to 2% for S1_HighT). The correlation between simulated and observed SO_2 is also reduced, 0.37 (compared to 0.61 for S1_HighT). This difference with S1_HighT is likely due to stronger and more north-westerly winds at 2000 m acting to decrease SO_2 columns. BrO columns are similarly underestimated by 83% in S1_HighT_alt (compared to 40% for the standard simulation S1_HighT), mostly due to the fact that total bromine is reduced for the same reason as for SO_2 by the shift in direction of plume transport (Figure 2S).

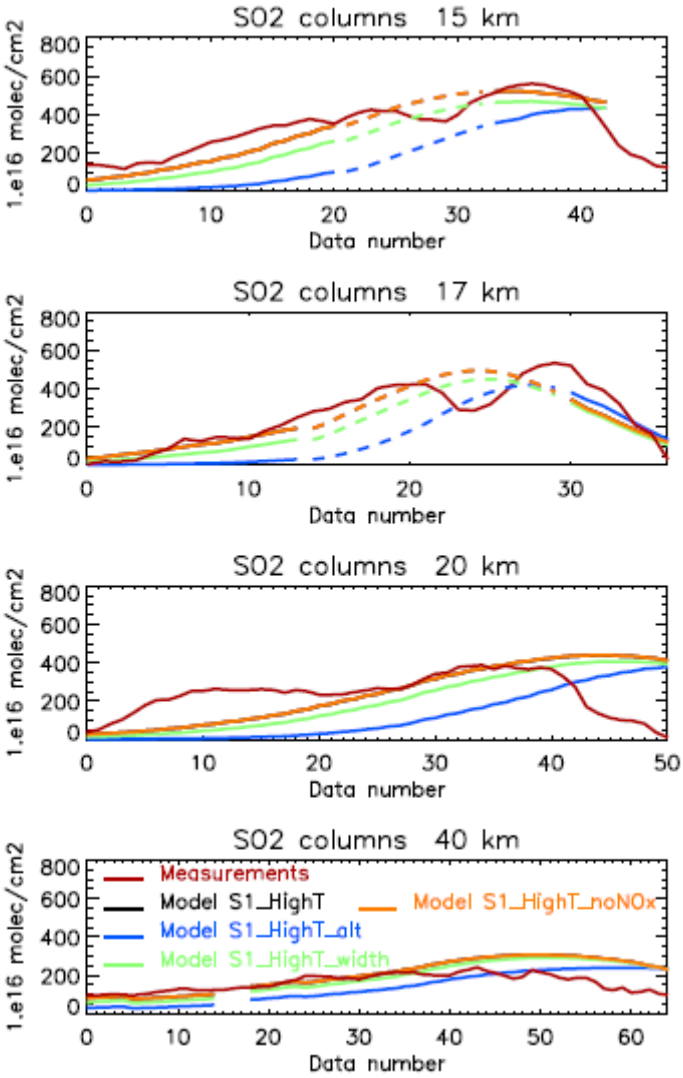


Figure 1S: Comparison between SO_2 columns observed by Bani et al. (2009) (red line) and simulated by the model for S1_HighT (black line) and for the sensitivity simulations: S1_HighT_alt (blue line), S1_HighT_width (green line), S1_HighT_noNOx (orange line). Note that black and orange lines are on top of each other (superimposed). The method of comparison is the same than Figure 3.

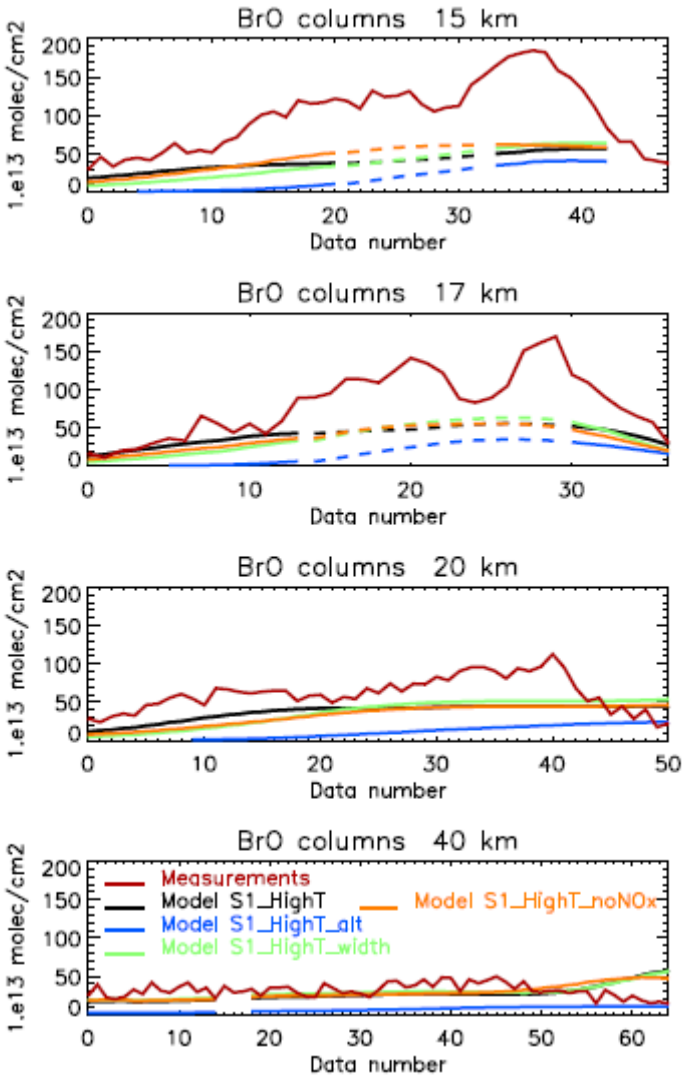
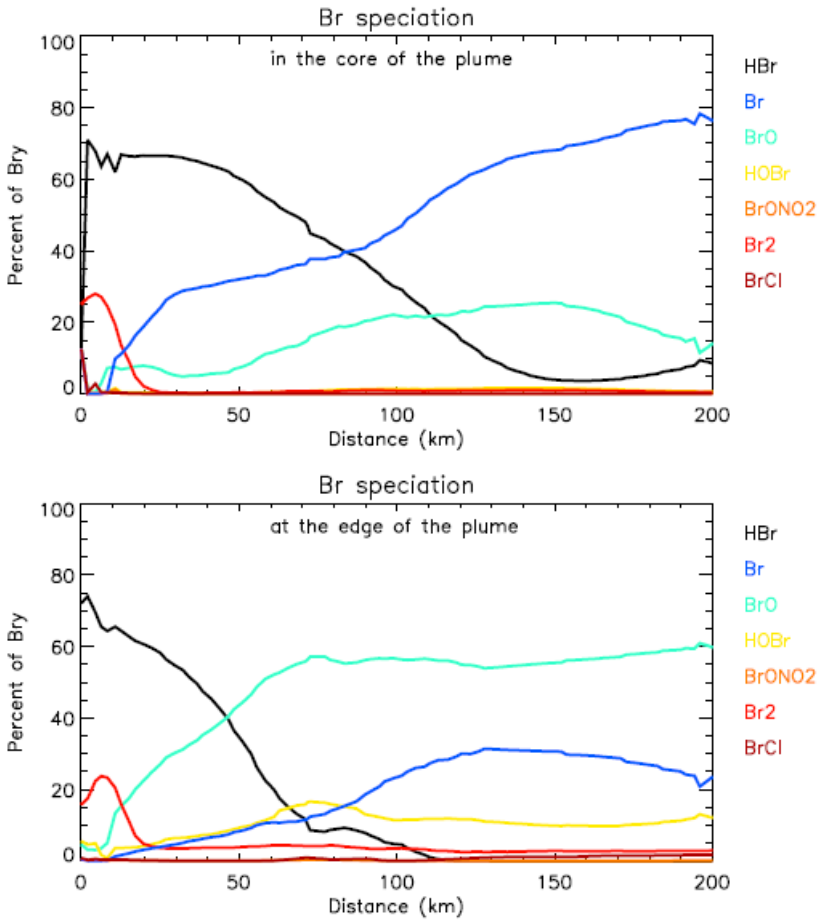


Figure 2S: Comparison between BrO columns observed by Bani et al. (2009) (red line) and simulated by the model for S1_HighT (black line) and for the sensitivity simulations: S1_HighT_alt (blue line), S1_HighT_width (green line), S1_HighT_noNOx (orange line). The method of comparison is the same than Figure 3.



43

44 **Figure 3S:** Br speciation along the plume (in the core and at the edge) in the simulation
45 S1_HighT_noNO_x and the grid 2 km x 2 km the 12th of January 2005 at 06 UT. The Br
46 speciation has been calculated as the percent of Bry (Bry= HBr + $2Br_2$ + BrCl+ Br + BrO +
47 HOBr + $BrONO_2$). Distance is calculated from the middle of the gridbox containing Marum
48 and Benbow

49

50

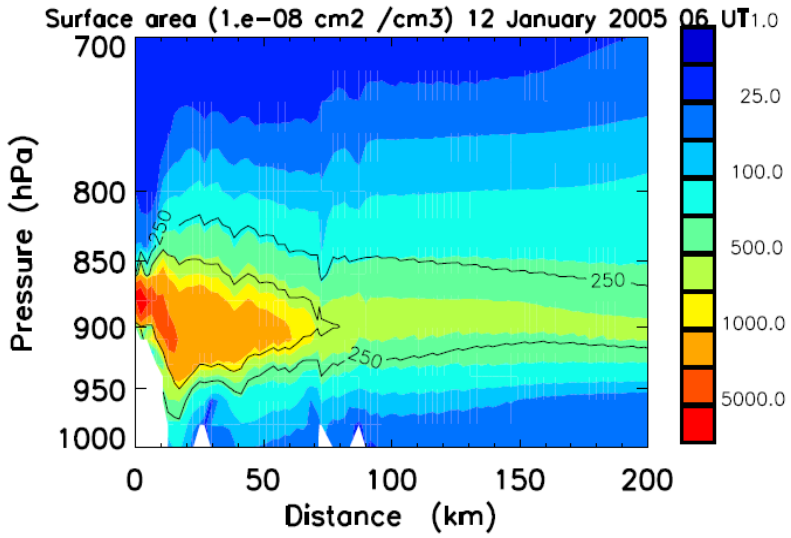


Figure 4S: Distance-Pressure cross section of the aerosol surface area density (μm^{-2} /cm^3) in the plume of Ambrym on the 12th January 2005 in the simulation S1_HighT.