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Three-dimensional radiative transfer effects on airborne and ground-based trace gas remote sensing

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S1 Additional Figures

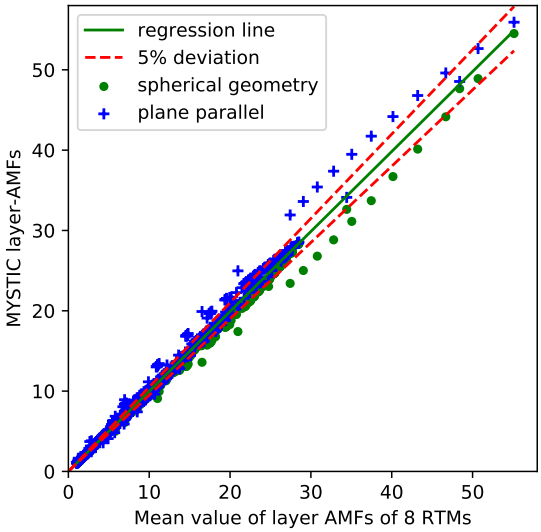

Figure S1. Scatter plot of MYSTIC layer AMFs computed with spherical (green dots) and plane parallel geometries (blue dots) against the model mean from Wagner et al. (2007) for 67 scenarios with 17 layers (1139 points). The solid green line is the regression fit to all points of both spherical and plane parallel geometries.

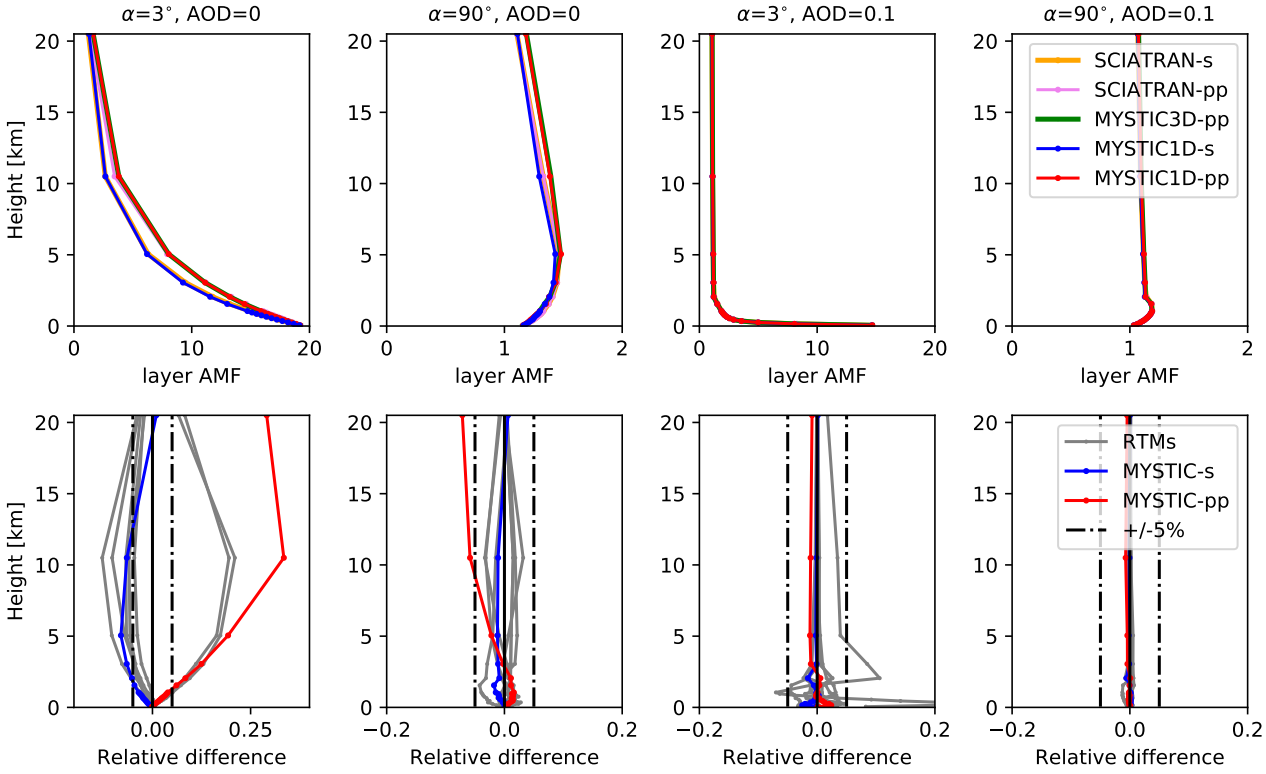

Figure S2. Upper row: AMF profiles for MYSTIC 1D spherical geometry (blue), 1D plane parallel geometry (red) and 3D plane parallel geometry (green) for two selected elevation angles of 3° and 90°, a SZA of 20°, with and without aerosol for radiation at 577 nm. Corresponding profiles computed with the SCIATRAN RTM are shown for comparison. Lower row: Profile of relative differences of MYSTIC results in spherical (blue) and plane parallel geometry (red) from the mean AMF profile of Wagner et al. (2007). The relative differences of the individual RMTs used in Wagner et al. (2007) are also shown for comparison.

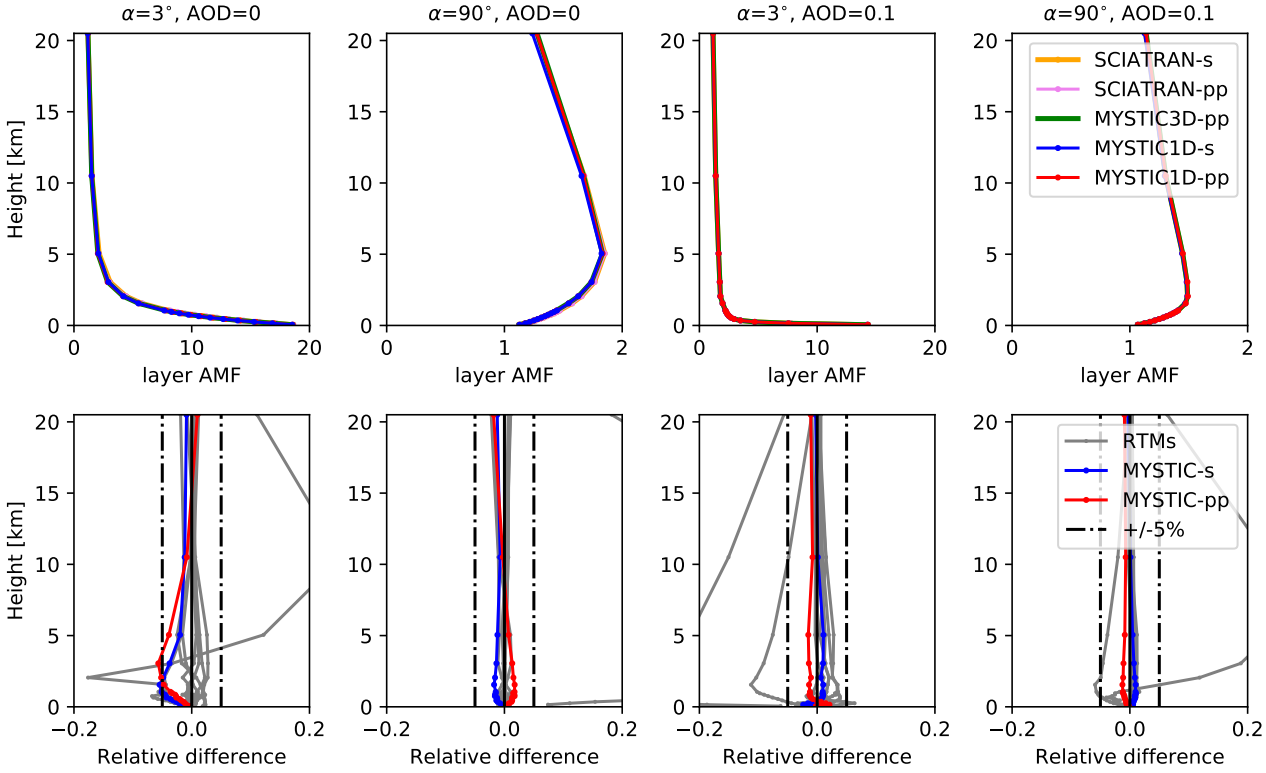

Figure S3. Upper row: AMF profiles for MYSTIC 1D spherical geometry (blue), 1D plane parallel geometry (red) and 3D plane parallel geometry (green) for two selected elevation angles of 3° and 90°, a SZA of 20°, with and without aerosol for radiation at 360 nm. Corresponding profiles computed with the SCIATRAN RTM are shown for comparison. Lower row: Profile of relative differences of MYSTIC results in spherical (blue) and plane parallel geometry (red) from the mean AMF profile of Wagner et al. (2007). The relative differences of the individual RMTs used in Wagner et al. (2007) are also shown for comparison.

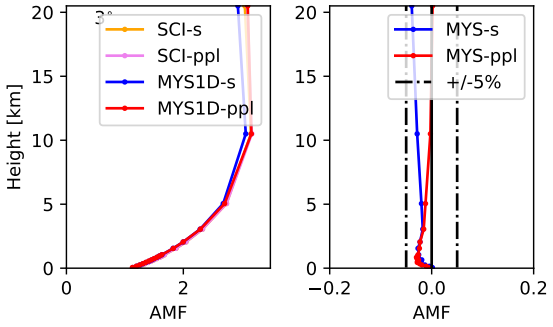

Figure S4. Left: AMF profiles for 440 nm for MYSTIC 1D - plane parallel geometry (red), MYSTIC 1D - spherical geometry (blue) SCIATRAN - plane parallel geometry (pink) and SCIATRAN - spherical geometry (orange) for an instrument viewing angle of 90° (zenith view), a solar zenith angle of 70° and without aerosol. Right: AMF relative difference profile for a relative difference of MYSTIC spherical (blue) and plane parallel (red) to SCIATRAN spherical and plane parallel, respectively.

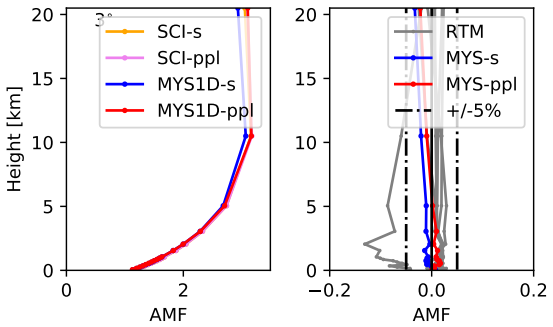

Figure S5. Left: AMF profiles for 440 nm for MYSTIC 1D - plane parallel geometry (red), MYSTIC 1D - spherical geometry (blue) SCIATRAN - plane parallel geometry (pink) and SCIATRAN - spherical geometry (orange) for an instrument viewing angle of 90° (zenith view), a solar zenith angle of 70° and without aerosol. Right: AMF relative difference profile for a relative difference of the individual models to the models mean from the models from Wagner et al. (2007).

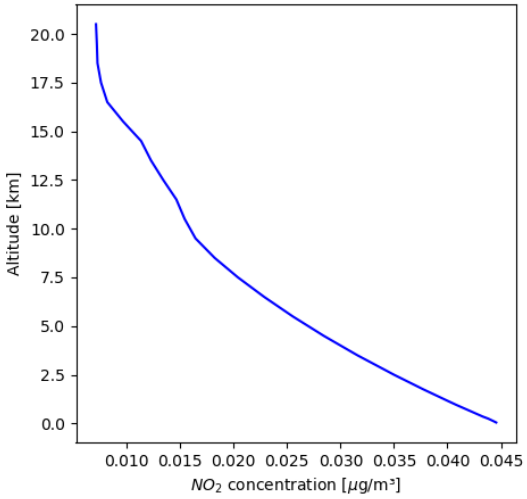

Figure S6. NO_2 background profile interpolated from the US standard atmosphere (United States Committee on Extension to the Standard Atmosphere, 1976).

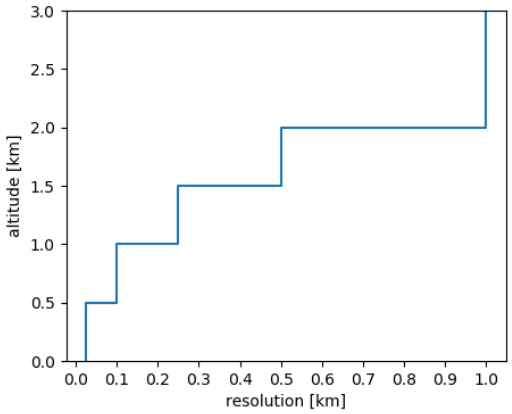

Figure S7. MYSTIC vertical resolution for layers between 0 and 3 km. Between 3 and 21 km the vertical resolution is 1 km

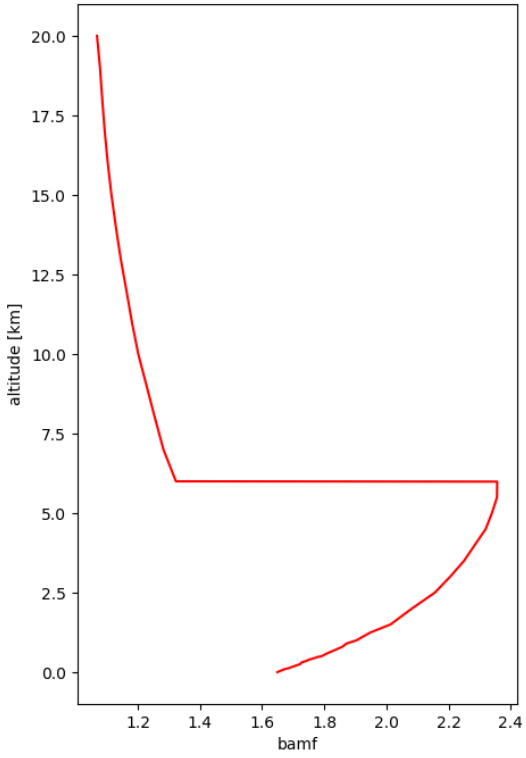

Figure S8. Horizontally integrated box AMFs for the airborne measurement scenario

References

United States Committee on Extension to the Standard Atmosphere: US Standard Atmosphere, vol. 76, National Oceanic and Atmospheric Administration, National Oceanic and Atmospheric Administration and United States, United States Air Force, Washington D.C. 1976, 1976.

Wagner, T., Burrows, J. P., Deutschmann, T., Dix, B., von Friedeburg, C., Frieß, U., Hendrick, F., Heue, K.-P., Irie, H., Iwabuchi, H., Kanaya, Y., Keller, J., McLinden, C. A., Oetjen, H., Palazzi, E., Petritoli, A., Platt, U., Postylyakov, O., Pukite, J., Richter, A., van Roozendael, M., Rozanov, A., Rozanov, V., Sinreich, R., Sanghavi, S., and Wittrock, F.: Comparison of box-air-mass-factors and radiances for Multiple-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) geometries calculated from different UV/visible radiative transfer models, Atmospheric Chemistry and Physics, 7, 1809–1833, 2007.