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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of ECMWF water vapour analyses by airborne differential absorption lidar measurements: a case study between Brasil and Europe" *by* H. Flentje et al.

H. Flentje et al.

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We thank the reviewer for his careful reading and his valuable suggestions which will be followed in the revised version of the paper. Some important points are risen which need more attention. We'd like to comment briefly on the main points:

- pp4409, l27 Vertical & horizontal averaging: We run short high resolution forecasts from the latest analysis available before each flight segment and wrote the model output for every hour at 0.25 degree resolution. Model profiles are interpolated linearly to the observation location, both in space (from 0.25 deg resolution) and time (between nearest 1 hour outputs). The length of the forecast varies from 0 to 8 hours from latest analysis, which is available 6-hourly. When a flight segment went from e. g. 17h

to 19h, I used the forecast starting from 12h for the whole segment to avoid jump in the middle of the segment associated with the new analysis. These short range forecasts should nevertheless provide almost the same accuracy as the analysis. For each model layer we get the pressures at top and bottom of the layer, layer mean temperature and layer mean humidity from which we can integrate the geometrical altitude, which is also measured be the lidar (based on aircraft GPS data). There is of course a small problem in that the model uses an average orography height over the gridbox, but this is reduced by averaging the lasers estimate of the surface height along track over the corresponding distance and putting model average ˜ laser average. Most of the tracks are over the ocean anyway.

- pp4410, l18 Concerning use and definition of the term hygropause: Indeed, we do not measure up to the hygropause but only up to ˜10 km, thus the term hygropause will be replaced by 'upper troposphere' (according to humidity). The use of the (somewhat sloppy) 100 ppmv hygropause-definition is obsolete anyway since this value does not enter the H2O comparison/discussion and the specific statements about the humidity gradients in the UT do not depend on a specific threshold value. The mixing ratio of 0.06 g/kg or 100 ppmv of water vapour to distinguish tropospheric from stratospheric influenced air was used because according to aircraft in situ water vapour measurements in the 'lowermost stratosphere' (e.g. during the POLINAT experiment described by Ovarlez et al, JGR, 104,16973 pp, 1999) the saturation mixing ratio at thermal tropopause levels occasionally ranges up to 120 ppmv, possibly due to convective injection from the troposphere or the mechanism proposed by Dessler (JGR, 100, 232676 pp, 1995 - i.e. freeze drying at mid-latitudes and subsequent isentropic transport to the tropics). Thus 120 ppbv (or roughly 100 ppmv) is an experimentally derived threshold for air masses to already show significant stratospheric characteristics. Thus we took this value. These observations are from mid-latitudes, though. But as noted above, this value actually is not required for our results.

- pp4411, l2 PBL top height over sea on10 March 2003: Thanks, yes the PBL top south

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of 25N is located around 1 km and is characterized by shallow convection. There is no radio sounding available over sea but for the layer between 1 and 3 km the laminar appearance of the aerosol in this altitude range suggests stable stratification.

- pp4411, l23 Gaussian fit of the difference distribution: We agree that only a part of the differences between model and observations are statistically distributed and can be described by a Gaussian. Most relevant deviations occur due to shortcomings in the initial state, parameterizations and model limitations and should be summarized by statistical quantities (mean/median for the bias, standard deviation for local deviations,Ě) and discussed with respect to the individual features in the difference 2-D-distributions and frequency distributions.

pp4412, l6: The maximum altitude of convection around 14 km was reported repeatedly by the pilots during the TROCCINOX campaign and it is deduced indirectly from the DIAL measurements which show that elevated humidity, mostly associated with convective outflow, only occurred at altitudes below 13-14 km. But as indeed these observations are far apart from the DIAL observations discussed in this paper, we will follow the suggestion to omit this comparison here.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 4405, 2007.