Investigating the representativeness of CARIBIC data using model simulations of the model EMAC

Johannes Eckstein, Roland Ruhnke, Andreas Zahn, Marco Neumaier, and Ole Kirner

Karlsruhe Institute of Technology, Germany (johannes.eckstein@kit.edu)

CARIBIC (Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrumented Container), measuring about 100 atmospheric trace gases and aerosol parameters, has run since the year 2005 in its second stage, CARIBIC 2 (Brennikmeijer et al., ACP, 2007). The data for each species are sorted into bins of month and height relative to the tropopause (using measurements of ozone, following Sprung and Zahn, JGR, 2010). We question whether these plots stand for a climatological seasonal cycle, i.e. is the data taken by CARIBIC representative?

This question is tackled using model data. The model data is taken from a run of the general circulation model EMAC with a horizontal resolution of T42 (about 2.8 degrees) which includes an extensive interactive chemistry scheme. In order to compare the CARIBIC data to the model output, the latter is first interpolated linearly in time and space to the location of the aircraft. Since the pressure corresponding to different tropopause definitions is calculated by the model, a climatological seasonal cycle relative to the tropopause can be produced form the model data and compared to that using the CARIBIC data.

This study goes beyond only comparing measurement and model data. In addition, different random data sets are produced from the model data, namely along random paths flown at the speed of civil aircraft and completely random data. The model data along these random paths is compared to the model data along true CARIBIC paths using descriptive statistics. In a second step, a variance analysis following Rohrer and Berresheim, Nature, 2006, which has already been applied to aircraft measurements by Kunz et al., ACP, 2008, is performed for different height bins to investigate the spread of the data. The variance analysis together with the descriptive statistics give information on the representativeness of the data along the CARIBIC paths. The second aim of this study is then to link species lifetime and variability with the representativeness along CARIBIC paths.