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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Airborne in-situ measurements of vertical, seasonal and latitudinaldistributions of carbon dioxide over Europe" *by* C. Gurk et al.

Anonymous Referee #3

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General

Airborne in-situ measurements of vertical, seasonal and latitudinal distributions of carbon dioxide over Europe, by C. Gurk et al., [ACPD, 8, 7315-7337, 2008] provides insight into the distribution of CO2 in the free troposphere and lowermost stratosphere along the western border of Europe from the subtropics to the Arctic during different seasons. The SPURT CO2 measurements complement those from CARIBIC whose trace gas profiles are often restricted to the vicinity of heavy-duty airports, and are thus not representative of the background atmosphere. The presentation of the CO2 observations within this manuscript is an invitation for modeling studies and retrieval algorithm

development/refinement; they also provide a historical context for future works. The paper merits publication in ACP after consideration of the points outlined below.

Specific The latter half of the Abstract states well known general trends of the CO2 seasonal cycle and vertical distribution characteristics. The paper would benefit by summarizing new findings as a result of the CO2 measurements conducted during SPURT e.g. model simulations support the observed altitude gradients of delta CO2 are likely due to STT (i.e. Figure 7) and/or observed latitudinal gradients given on 7321 L17-19

7316L19 The average rate of annual increase since 2000 is 2.0 ppm/year

7317L8 The list of airborne free tropospheric CO2 measurements cited is not comprehensive therefore suggest prefacing the publications cited with "for example"

7318 It is unclear whether your samples are dried upstream of the LI-COR or water vapor corrections are applied post-sampling utilizing the information from the LI-6262 water vapor channel. Please clarify this in the text.

7321L24 From Figure 3 it appears that the April 2003 data exhibit higher CO2 mixing ratios in the BL than those in February 2003 as stated. Please change the statement (in particular during February 2003) if this is indeed the case.

An explanation of how tropopause height is defined for this study is provided on page 7323 yet, the initial reference to tropopause height is introduced on page 7322L2-3 without explanation of how it was determined. Please define at the earliest mention.

Fischer et al. concluded that long-range transport of Asian air masses is identified as the dominant source of CO pollution over Europe in the free troposphere. Is this signature also apparent in the CO2 data? In Figure 3, the decrease in CO2 with altitude in spring at high northern latitudes may result from not only STT but also long-range transport. Suggest investigating instances in the mid-to-upper troposphere during spring where CO2 mixing ratios are lower than representative background and accompanied

ACPD

8, S5246–S5248, 2008

by elevated CO.

7323 Does the SPURT N2O data support the 2 PVU tropopause definition for your analysis as PV does not necessarily accurately represent the instantaneous tropopause?

7324 Find the discussion regarding station selection for a MBL reference rather vague. What stations are being invoked? Mention is made of longitudinally averaging the observations however, CO2 exhibits both latitudinal and longitudinal variability. To the best of my knowledge, GLOBALVIEW data are not direct observations rather simulations from direct measurements i.e. a GLOBALVIEW data product is derived from measurements but contains no actual data. Have actual data from the NOAA ESRL surface sites been considered in your analysis (e.g. AZR, MHD, ICE, STM, ZEP, PAL)? How the remote MBL background is determined is key to your findings.

Technical It would be beneficial to have a figure similar to that shown in Fischer et al. of the stop-over (refueling) locations with the home base in Hohn also illustrated rather than referring the reader to that paper. 7323L8-9 rephrase "including constant level flight legs and independent of the latitude of observation" for clarity. 7327L11 data presented in this paper are

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 7315, 2008.

ACPD

8, S5246–S5248, 2008

Interactive Comment