Atmos. Chem. Phys. Discuss., 5, S205–S207, 2005
www.atmos-chem-phys.org/acpd/5/S205/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evidence for long-lived polar vortex air in the mid-latitude summer stratosphere from in situ laser diode CH_4 and H_2O measurements" *by* G. Durry and A. Hauchecorne

Anonymous Referee #2

Received and published: 22 March 2005

This paper examines the origin of some remarkable laminar structures observed in balloon-borne profiles of stratospheric long-lived tracers (CH4, H2O) during the summer 2000. The soundings were taken in mid latitudes. By comparing with winter, high-latitude profiles obtained during previous campaigns, the authors demonstrate that the anomalously low (high) CH4 (H2O) laminae can be interpreted as "fossil" remnants of vortex air, long after the break-up of the polar vortex in the spring. In addition, the authors used a high-resolution advection model, and ran a simulation from the spring into the summer 2000. The transported, PV-tracer shows flat, pancake-like structures that are analogous to the ones observed.

The paper is well written, concise and to the point. There have been few observations of trace species in the summer stratosphere, and few studies of tracer transport. The paper is well suited for publication in ACP. I have only comment, for the discussion section.

Main comment for the Discussion section: Orsolini (GRL, 1998, cited) found a different behaviour in the tracers between the lower stratosphere (below 20km), and the mid stratosphere (above 20 km). In the lower altitudes, the vortex remnants are rapidly mixed through the action of synoptic-scale eddies penetrating into the stratosphere, and are meridionally bounded by the sub-tropical jet (see Konopka et al., ACP 2003, below). In the westward flow regime (typically above 20km), long-lived "fossil" remnants can be found. The June 2000 observations do indeed show CH4 laminae in the right altitude range. The authors could comment on whether this behaviour is found in their MIMOSA simulation (i.e. more rapid mixing and little evidence for long-lived remnants below 20km). The meridional cross-section on Fig.5 seems to indicate that this could be the case, but a horizontal map in the lower stratosphere could be added.

These summer laminar CH4 structures are found in 2000, but not in other years (figure 1). While it is not expected that a local balloon-borne sounding would sample such structures each time, the authors could perhaps address this issue of inter-annual variability in their model simulations, if they have run simulations for other years than 2000.

Minor: Fig 3 : panel labels a,b,c,d are missing Fig 4 : white circle at Gap is not visible Authors should clarify that the model is run, independently on the isentropic surfaces, if I am not mistaken, and is not a 3D model. This technique for reconstructing high-resolution tracer profiles by carrying separate, isentropic simulations was first used by Orsolini (QJRMS, 1995) and by Newman (JGR, 1996, cited).

The authors could note that some aspects of the ozone chemistry in the remnants of the polar vortex in the spring 2000 has been addressed by : P. Konopka, et al., "Dynamics and chemistry of vortex remnants in late Arctic spring 1997 and 2000: Simulations with

ACPD

5, S205–S207, 2005

the Chemical Lagrangian Model of the Stratosphere (CLaMS)", Atmos. Chem. Phys. Discuss., 3, 1051-1080, 2003.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1241, 2005.