

Home

Online Library ACP

- Recent Final Revised Papers
- Volumes and Issues**
- Special Issues
- Library Search
- Title and Author Search

Online Library ACPD

Alerts & RSS Feeds

General Information

Submission

Review

Production

Subscription

Comment on a Paper

Impact
Factor
4.865

ISI
indexed



Volumes and Issues Contents of Issue 3

Atmos. Chem. Phys., 3, 839-849, 2003
www.atmos-chem-phys.net/3/839/2003/
© Author(s) 2003. This work is licensed
under a Creative Commons License.

Dynamics and chemistry of vortex remnants in late Arctic spring 1997 and 2000: Simulations with the Chemical Lagrangian Model of the Stratosphere (CLaMS)

P. Konopka¹, J.-U. Grooß¹, S. Bausch¹, R. Müller¹, D. S. McKenna², O. Morgenstern³, and Y. Orsolini⁴

¹Institute for Stratospheric Chemistry (ICG-I), 52425 Jülich, Germany

²National Center for Atmospheric Research, Boulder, CO, USA

³Max-Planck-Institut für Meteorologie, Hamburg, Germany

⁴Norwegian Institute for Air Research (NILU), Kjeller, Norway

Abstract. High-resolution simulations of the chemical composition of the Arctic stratosphere during late spring 1997 and 2000 were performed with the Chemical Lagrangian Model of the Stratosphere (CLaMS). The simulations were performed for the entire northern hemisphere on two isentropic levels 450 K (~18 km) and 585 K (~24 km).

The spatial distribution and the lifetime of the vortex remnants formed after the vortex breakup in May 1997 display different behavior above and below 20 km. Above 20 km, vortex remnants propagate southward (up to 40°N) and are "frozen in" in the summer circulation without significant mixing. Below 20 km the southward propagation of the remnants is bounded by the subtropical jet. Their lifetime is shorter by a factor of 2 than that above 20 km, owing to significant stirring below this altitude. The behavior of vortex remnants formed in March 2000 is similar but, due to an earlier vortex breakup, dominated during the first 6 weeks after the vortex breakup by westerly winds, even above 20 km.

Vortex remnants formed in May 1997 are characterized by large mixing ratios of HCl indicating negligible, halogen-induced ozone loss. In contrast, mid-latitude ozone loss in late boreal spring 2000 is dominated, until mid-April, by halogen-induced ozone destruction within the vortex remnants, and subsequent transport of the ozone-depleted polar air masses (dilution) into the mid-latitudes. By varying the intensity of mixing in CLaMS, the impact of mixing on the formation of ClONO₂ and ozone depletion is investigated. We find that the photochemical decomposition of HNO₃ and not mixing with NO_x-rich mid-latitude air is the main source of NO_x within the vortex remnants in March and April 2000. Ozone depletion in the remnants is driven by ClO_x photolytically formed from ClONO₂. At the end of May 1997, the halogen-induced ozone deficit at 450 K poleward of 30°N amounts to ~12% with ~10% in the polar vortex and ~2% in well-isolated vortex remnants after the vortex breakup.

Final Revised Paper (PDF, 1478 KB) Discussion Paper (ACPD)

Citation: Konopka, P., Grooß, J.-U., Bausch, S., Müller, R., McKenna, D. S.,

Search ACP

Library Search

Author Search

News

- Sister Journals AMT & GMD
- Financial Support for Authors
- Journal Impact Factor
- Public Relations & Background Information

Recent Papers

01 | ACP, 11 Mar 2009:
Measurements of Pollution In
The Troposphere (MOPITT)
validation through 2006

02 | ACP, 11 Mar 2009:
Air-sea fluxes of biogenic
bromine from the tropical
and North Atlantic Ocean

03 | ACPD, 10 Mar 2009:
Characterization of organic
ambient aerosol during
MIRAGE 2006 on three
platforms

04 | ACPD, 10 Mar 2009:
Regional differences in

Morgenstern, O., and Orsolini, Y.: Dynamics and chemistry of vortex remnants in late Arctic spring 1997 and 2000: Simulations with the Chemical Lagrangian Model of the Stratosphere (CLaMS), Atmos. Chem. Phys., 3, 839-849, 2003. [Bibtex](#) [EndNote](#) [Reference Manager](#)