Geophysical Research Abstracts
Vol. 12, EGU2010-11774-2, 2010
EGU General Assembly 2010

LIF-instrument for Airborne and Ground-Based Measurement of OH and HO2 Radicals in the Troposphere.

Sebastian Broch, Mathias Bachner, Knut Dahlhoff, Frank Holland, Andreas Hofzumahaus, Peter Jansen, Andreas Meier, Dominik Raak, Jörg Wolters, and Andreas Wahner

Forschungszentrum Jülich GmbH, 52425 Jülich, Germany (s.broch@fz-juelich.de)

The radicals OH and HO2 (also named HOx) play an important role in the chemical degradation and transformation of most trace gases in the troposphere. The rate of these processes depends strongly on the magnitude of the radical concentrations. Due to their high reactivity, their concentrations are very low (sub pptv and pptv range) and exhibit a strong regional variability. Therefore exact measurement of HOx in different regions and at different altitudes in the troposphere are very important for the understanding and modelling of the self cleaning ability of the atmosphere.

Here, we present the technical concept and results of laboratory test measurements of a new, mobile instrument for measurement of OH and HO2 radicals based on the proven laser induced fluorescence (LIF) technique (Holland et al., 1995, 2003; Schlosser et al., 2007, 2009). The instrument is planned to be used for ground-based field measurements, for airborne application on a Zeppelin (h = 0-2 km) and on the new German research aircraft HALO (Gulfstream V, h = 0-15 km). The setup of the new instrument is modular to allow different configurations for different applications and all components are newly designed to reduce weight, size and power requirement.

For the implementation on HALO completely new air-inlet systems for OH and HO2 were developed at Forschungszentrum Jülich. The OH inlet is based on the shrouded-inlet design by Eisele et al. (1997). The design has been modified to reduce size and weight, and cope with the flight conditions and certification requirements of HALO. These are different than those for the original design, like higher speed, greater ceiling height and strength against bird strike. Compared to our ground-based measurement system, the aircraft inlet requires long inlet tubes which modify the detection sensitivity and possible interferences. Since the sensitivity of our instrument depends on ambient pressure, the OH inlet system is equipped with a calibration system, which allows calibration of the OH measuring channel during flight at different altitudes. Furthermore, both inlet systems allow heating of the inlet tubes and contain flight safety features like de-icing and bird strike resistance.

We present results of the characterisation of the new instrument especially with regard to the sensitivity achievable with the long inlet tubes and of laboratory testing of the OH “in-flight” calibration system.

Literature:
Holland et al., J. Atmos. Sci., 52, 3393, 1995
Holland et al., J. Geophys. Res., 108, 8246, 2003
Schlosser et al., J. Atmos. Chem., 56, 187, 2007
Schlosser et al., Atmos. Chem. Phys., 9, 7923, 2009
Eisele et al., J. Geophys. Res., 102, 27993, 1997