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Photoacoustic Water Vapor Detector for Airborne Measurements

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Water belongs to the most important trace gases of the atmosphere. In form of clouds it is by far the most effective greenhouse gas, together with ozone it is the main source of tropospheric OH radicals, and it plays an important role in transporting latent heat from low to high altitudes. For studying atmospheric chemistry and the dynamics in the upper troposphere and lower stratosphere by using aircraft, it is a basic necessity to have a hygrometer on board. The typical water mixing ratios in this area are 4 to 1000 ppmv.

In spite of its paramount importance, there is a need for new fast and robust detectors for high sensitive, selective water vapor detection with wide dynamic range and capability of long-term unattended operation under varying environmental conditions.

We have developed a DFB diode laser based photoacoustic water vapor detector for airborne operation. In this presentation it is proven that the detector characteristics fulfills all the above mentioned requirements of atmospheric applications.

We demonstrate the high sensitivity of the detector and its wide dynamic range (from 0.2 ppm up to a few thousand ppm). It is also shown that the detector measures the water vapor in interference-free mode, so the components existing in the atmosphere do not affects the detector measurement accuracy. Experiments are presented, which prove that the varying environmental conditions (e.g. temperature and gas pressure) do not disturb significantly the sensitivity of the detector.

The described photoacoustic water vapor detector is utilized on-board a commercial

aircraft (Airbus A340-600 of Lufthansa) within the project CARIBIC since May 2005. First results are presented.

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