

**On-board Water Vapor Measurements by a  
Photoacoustic Laser Spectrometer (WaSul-Hygro),  
a Capacitive and a Chilled Mirror Sensor, Comparison and Validation**

**PHALCON  
An Eufar Transnational Access project**

**Dates of the campaign:**

From 29 September 2007 until 08 October 2007.

**Participants:**

Dr. Árpád Mohácsi and Dr. Zoltán Bozóki (University of Szeged)

**Aircraft:**

Enviscope-Partenavia

**Instrumentation:**

WaSul-Hygro diode laser based photoacoustic water vapor concentration measuring instrument (courtesy of Hilase Ltd.)

Meteolabor Dew Point Mirror TP3-ST

VAISALA HMP 230 with modified sensor assembly (in Rosemount housing)

MOZAIC – VAISALA HMP230 in Rosemount housing

**Scientific objective:**

The main goal of the project was to test the WaSul-Hygro — diode laser based photoacoustic water vapor concentration monitoring instrument, which was already successfully applied for UT/LS measurements on-board a commercial aircraft within the project CARIBIC since May 2005 — in measurements at lower altitudes, and compare its performance with other hygrometers.

**List of flights performed:**

04.10.2007: start 15:59 end 16:42

05.10.2007: start 11:46 end 12:51

05.10.2007: start 14:15 end 16:00

06.10.2007: start 11:22 end 13:33

06.10.2007: start 14:47 end 16:31

07.10.2007: start 14:24 end 16:55

**The Partenavia aircraft:**



*Figure 1. The Partenavia aircraft of the Enviscope GmbH.*

**The WaSul-Hygro instrument:**



*Figure 2. The WaSul-Hygro instrument before installation on the aircraft.*



Figure 3. The WaSul-Hygro instrument on-board of the Partenavia

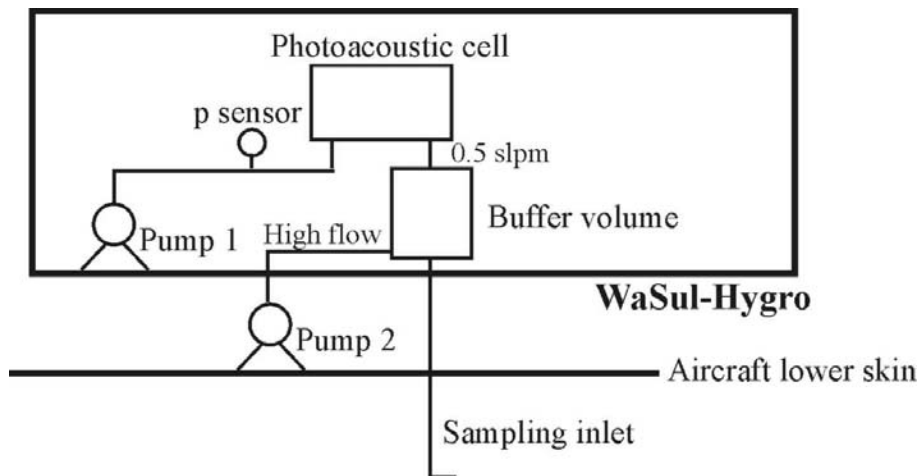


Figure 4. Schematics of the gas handling for the WaSul-Hygro

**Measurement results:**

On the following Figures the measurement results flight-by-flight can be seen. The following abbreviations were used:

MV-TP: Water vapor mixing ratio calculated from Meteolabor Dew Point Mirror TP3-ST

MV-MA: Water vapor mixing ratio calculated from VAISALA HMP 230 with modified sensor assembly (in Rosemount housing)

Mix/ppm: MOZAIC – VAISALA HMP230 in Rosemount housing

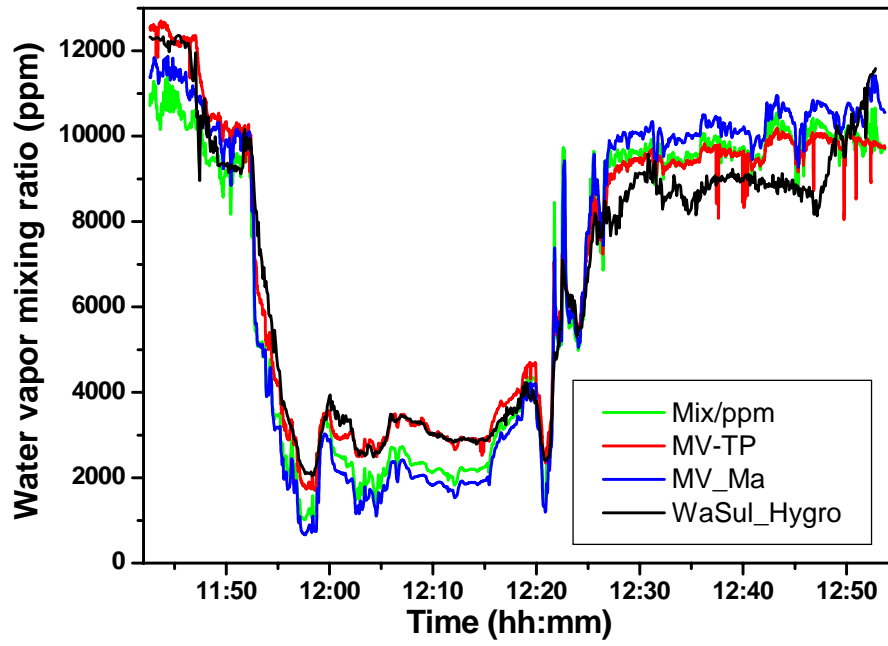


Figure 5. Measurement on 5<sup>th</sup> October.

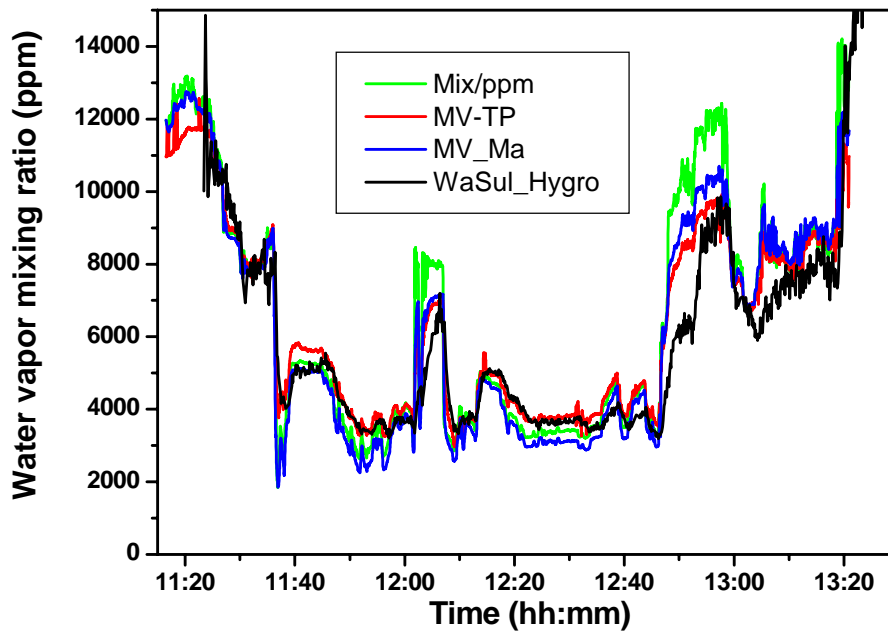


Figure 6. First flight on the 6<sup>th</sup> October.

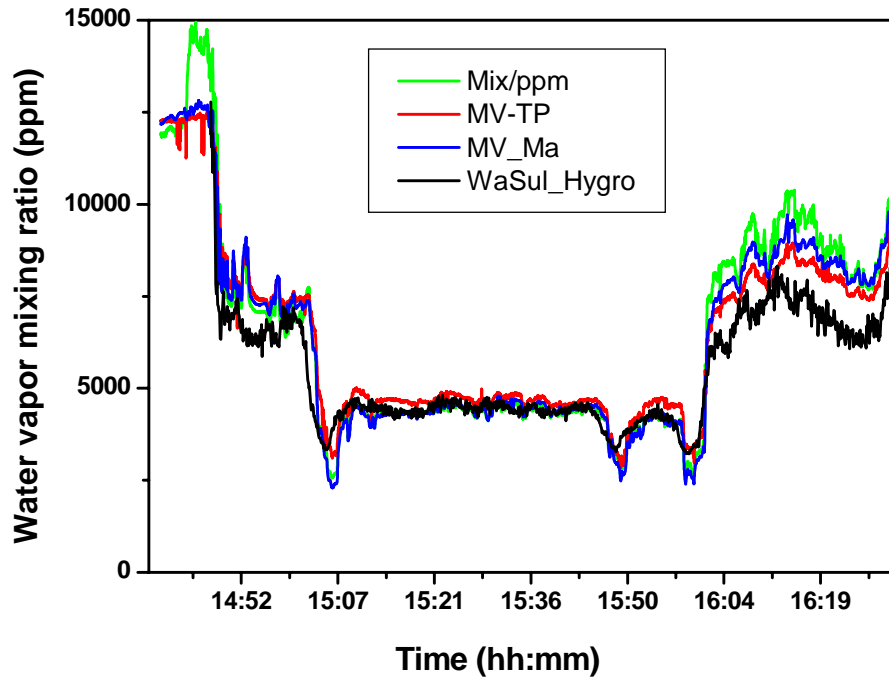


Figure 7. Second flight on the 6<sup>th</sup> October.

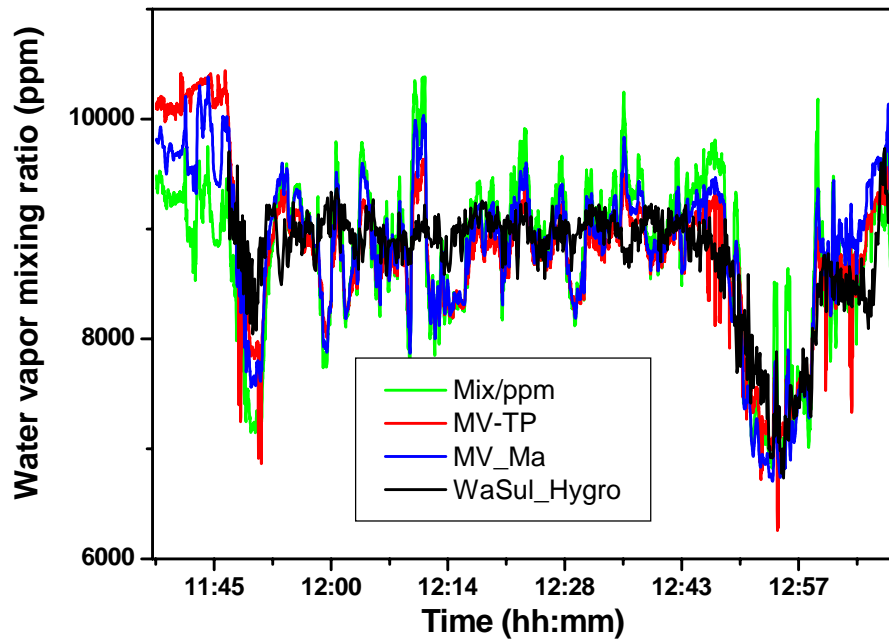


Figure 8. First flight on the 7<sup>th</sup> October.

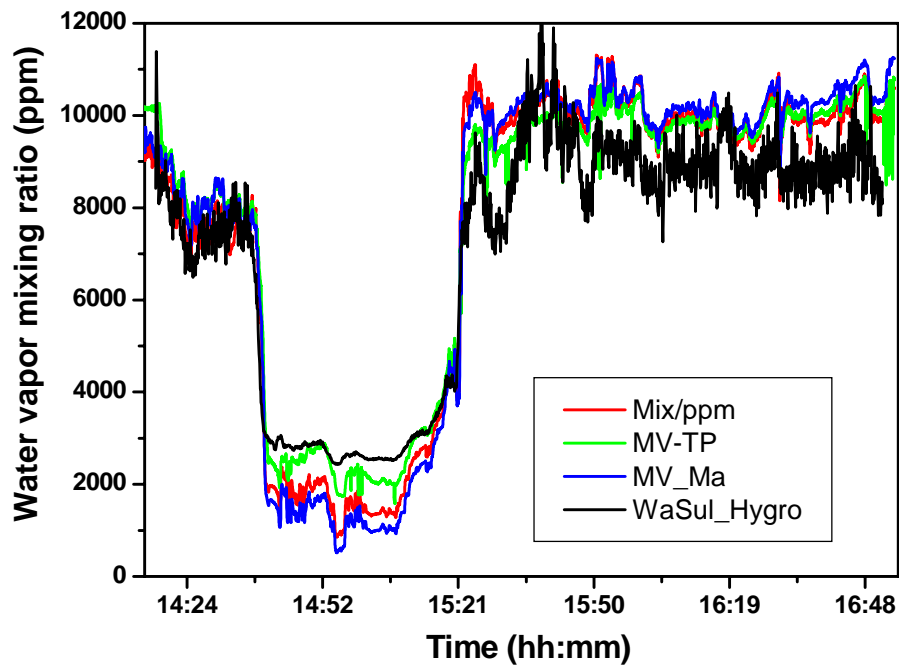


Figure 9. Second flight on the 7<sup>th</sup> October.

There was a good overall agreement between the readings of WaSul-Hygro instrument and other water vapor instruments on-board. The slight differences can be the consequence of the fact that the WaSul-Hygro instrument was sampled air from a different part around the aircraft than other instruments. WaSul-Hygro has a faster response time than the other instruments.

In conclusion, the PHALCON campaign proved that the WaSul-Hygro instrument is a valuable tool for lower altitude measurements too.

Dr. Zoltán Bozóki