

# **Integrated Use of Satellite and Non-Satellite Measurements to Study the Control Mechanisms of Upper Tropospheric Humidity**

## **Expression of Commitment to COST 723**

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Water vapor is a key constituents of the Earth's atmosphere. It turns out of increasing importance in atmospheric research to have much better knowledge about the water vapor concentration in the upper troposphere (UT) and the processes controlling it in order to increase the diagnostic and prognostic strength of numerical model simulations of chemistry, weather and climate of the atmosphere. Through the integrated use of satellite and non-satellite (ground based, aircraft, and balloon) observations it is our intention to investigate the large scale distribution of upper tropospheric humidity (UTH) and the processes controlling it, aiming to increase the diagnostic and prognostic strength of numerical model simulations of chemistry, weather and climate of the atmosphere.

We developed a concept to investigate whether UTH content is controlled by dynamics (convection) and/or by thermodynamics (i.e. sea surface temperature) through the synergistic use of MOZAIC (=Measurement of Ozone and Water Vapor by Airbus In Service Aircraft)-UTH observations with satellite data of sea surface and cloud top temperatures. The concept had been applied successfully to the equatorial Atlantic region. It is now the intention to extend the investigations more globally. Therefore a two-step approach of assimilation of data from different platforms (satellite and non-satellite) will be followed:

### **1. Contribution to WG 1:**

Development and synthesis of an integrated data set of UTH-observations with the best global coverage through the use of the MOZAIC passenger aircraft platform, providing accurate and quality assessed in-situ UTH-measurements, to validate/calibrate water vapor channels of different satellite instruments (e.g. SCIAMACHY, MIPAS, SAGE-III). Further, it is envisaged in how far UTH-measurements made with the new generation of radio weather sondes are of sufficient quality to use in addition.

### **2. Contribution to WG 3:**

Development of strategies to investigate the control mechanisms of UTH through the synergistic use of the integrated data set of UTH-observations together with synoptical

observations of surface temperature and thermodynamic properties of the atmosphere (air temperature, cloud characteristics etc.) made by satellite platforms (e.g. METEOSAT, AVHRR, ENVISAT).

### **Expertise in field of water vapour and ozone measurements and analysis**

Proposer, Herman G.J. Smit, has more than 20 years of experience in atmospheric research. This includes particularly the measurements of ozone and water vapour in the troposphere and stratosphere, participation in several field and ship campaigns, and data interpretation including numerical modelling. He has conducted several projects focusing on the relation between water vapor and ozone with respect to study transport processes versus chemistry, particularly in tropical motion systems. Since 1993 he is the PI of the water vapour measurements of the MOZAIC programme.

#### Publications:

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Smit, H.G.J., W. Sträter, M. Helten, D. Kley, Environmental simulation facility to calibrate airborne ozone and humidity sensors, *Berichte des Forschungszentrums Jülich*, **3796**, ISBN 0944-2952, Jülich, 2000.

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Smit, H.G.J., S. Nawrath, D. Kley and M. Helten, Control mechanisms of water vapor in the upper troposphere: Large scale subsidence in regions of tropical Cb-convection, Final report of EUROTRAC-II sub-project TROPOSAT, in press, 2003