SPARC Water Vapour Initiative

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In the year 2000, SPARC published its Assessment of Upper Tropospheric and Stratospheric (UTS) Water Vapour (SPARC Report No. 2, WCRP-113, WMO/TD No. 1043), which was coordinated and edited by Dieter Kley, Jim M. Russell III and Celine Phillips. The key topic addressed in this report was the analysis and the assessment of the long-term changes of UTS water vapour, with an emphasis on the observed increase of water in the stratosphere. The report had a strong focus describing and comparing relevant data sets using *in situ* hygrometers and remote sensing instruments from laboratories all over the world in order to create a suitable data set, including historical data back to the 1940s. Data presented is the report are available at the SPARC data centre at **http://www.sparc.sunysb.edu/**. The distribution and variability of UTS water vapour, the relevant processes, and the impact of the increased water vapour on radiation, dynamics and chemistry were discussed. However, a quantitative explanation of the analysed changes was not possible in 2000.

Following the recommendations of this report, climatological measurement programmes have continued, new campaigns to investigate UTS water vapour have been carried out, new satellite observation programmes have been launched, and many model and laboratory studies have been made since 2000 to explain the observations and to identify previously unknown processes. Emerging from the new observations, an additional "puzzling" question became apparent in that unexpected high relative humidities were observed, largely in the cold tropopause region both inside and outside of clouds (see contribution by Peter, Krämer and Möhler, this issue). Data quality, in particular knowing the absolute accuracy and not simply the relative discrepancies between different sensors, has become a crucial issue if we are to assess these questions. These accuracy issues have lead to the need of cross validation of established and recently developed hygrometers, both in the field and in the laboratory.

In light of these developments, it seems timely to update the SPARC water vapour assessment of 2000. In particular, there is a need to summarise the relevant results over the past decade from various field experiments, laboratories and models in a comprehensive report or review publication. The major goal of such an exercise is to assess the value and the accuracy of recent measurements and to give new recommendations and guidelines for future research on UTS water vapour. The major topics to be addressed are:

1. **Data quality:** How reliable are *in situ* and remote sensing field data in terms of accuracy and precision?
2. **Clear air and in-cloud supersaturation:** Can the observations be explained within the framework of our current knowledge or do we need new theoretical concepts and new laboratory investigations, *e.g.* of ice growth at extreme temperatures?
3. **Recent observations of UTS water vapour changes:** Are these observations mutually consistent, do we understand them, and what are our abilities for future predictions?
4. **Impact on atmospheric chemistry and climate:** What are the implications of changing UTS water vapour for radiation, dynamics, chemistry, clouds and climate?

Therefore, the SPARC Scientific Steering Group proposed during its annual meeting in September 2007 to initiate a new water vapour initiative, which will be coordinated by Cornelius Schiller, Thomas Peter and Karen Rosenlof. A kick-off workshop for the community will be organised in 2008, preferably connected to the SPARC General Assembly in Bologna (August 31 – September 5, 2008). More detailed information will be provided soon to the community concerned with water vapour issues.