

SPARC water vapour initiative



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Towards a new Assessment?

SPARC Report No. 2, 2000
 WCRP – 113, WMO/TD - No. 1043

Topics:

- Instrumentation and data sets
- Data quality
- Distribution and variability of water vapour in the UTLS

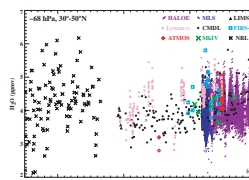
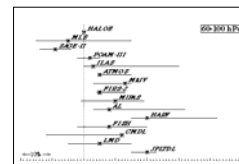
Key findings:

- Increase of stratospheric H₂O since 1950, 1%/y
- Reasons for the increase quantitatively not understood
- Long-term changes of UTH difficult to assess

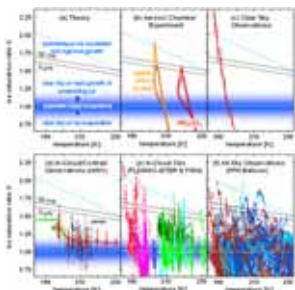
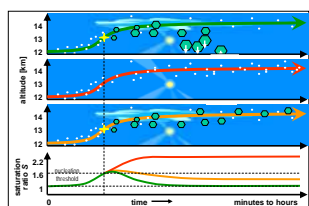
The new SPARC Water Vapour Initiative
 SPARC Newsletter No. 30, 2008

Why now?

- New instruments and new/continued data sets
- New data/instrument quality approaches
- Stratospheric trend has changed
- A new topic: The supersaturation 'puzzle'
- Improved knowledge about processes
- Improved tools for impact studies and prediction



Clear air + in-cloud supersaturation



How good are the data?

- Water vapour
- Temperature

Potential out-of-cloud effects

- Lack of preexisting aerosol
- Low mass accommodation of H₂O on aerosol
- Formation of glasses
- Surface nucleation
- Underestimated vapour pressure of supercooled water

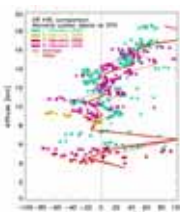
Potential in-cloud effects

- Control by ice nuclei
- Mesoscale temperature fluctuations
- Subresolution patchiness
- HNO₃ deposition on ice, forming NAT
- Low mass accommodation of H₂O on ice
- Cubic ice

Data quality

In-situ, advanced hygrometers for low mixing ratios

- discrepancy in-field data
- laboratory intercomparison (AquaVIT 2007)
- assessment of absolute errors, not only relative discrepancies



Satellite and other remote sensing

- long records: synthesised data sets of different instruments
- assessment of the ability to measure H₂O at the tropopause

UTH data

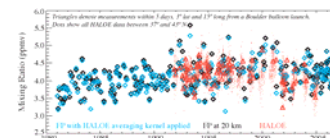
- operational satellites
- radiosondes
- in-service aircraft programmes (as MOZAIC/IAGOS)
- quality assessment (e.g. GRUAM)

Temperature

UTS water vapour changes

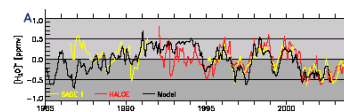
Observation of long-term changes of UTS water vapour

- Update and continuation of SPARC H₂O data base
- Stop of increase of stratospheric H₂O after 2000
- Improved capabilities to investigate UTH compared to 2000?



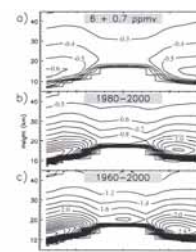
Processes causing changes of H₂O in the UTS

- tropopause temperature
- CH₄ increase
- tropical entry and BD circulation
- SST, climate change



Climate impact and future changes

- Radiative forcing by changing UTS water vapour
- Chemical impact (e.g. ozone layer)
- Prediction of future changes



Peter et al., When dry air is too humid, Science, 314, 2006.
 Peter et al., Upper tropospheric humidity, A report on an international workshop
 SPARC Newsletter 30, 2008

Kick-off meeting
 Wednesday, September 3, 2008
 1400 – 1730