Geophysical Research Abstracts
Vol. 18, EGU2016-4272, 2016
EGU General Assembly 2016

Is there a solar signal in lower stratospheric water vapour?

Tobias Schieferdecker, Stefan Lossow, Gabriele Stiller, and Thomas von Clarmann

Karlsruhe Institute of Technology, Institut für Meteorologie und Klimaforschung (IMK-ASF), Karlsruhe, Germany (gabriele.stiller@kit.edu)

A merged time series of stratospheric water vapour built from the Halogen Occultation Instrument (HALOE) and the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) data between 60 deg S and 60 deg N and 15 to 30 km, and covering the years 1992 to 2012, was analysed by multivariate linear regression, including an 11-year solar cycle proxy. Lower stratospheric water vapour was found to reveal a phase-shifted anti-correlation with the solar cycle, with lowest water vapour after solar maximum. The phase shift is composed of an inherent constant time lag of about 2 years and a second component following the stratospheric age of air. The amplitudes of the water vapour response are largest close to the tropical tropopause (up to 0.35 ppmv) and decrease with altitude and latitude. Including the solar cycle proxy in the regression results in linear trends of water vapour being negative over the full altitude/latitude range, while without the solar proxy, positive water vapour trends in the lower stratosphere were found. We conclude from these results that a solar signal seems to be generated at the tropical tropopause which is most likely imprinted on the stratospheric water vapour abundances and transported to higher altitudes and latitudes via the Brewer–Dobson circulation. Hence it is concluded that the tropical tropopause temperature at the final dehydration point of air may also be governed to some degree by the solar cycle. The negative water vapour trends obtained when considering the solar cycle impact on water vapour abundances can possibly solve the "water vapour conundrum" of increasing stratospheric water vapour abundances despite constant or even decreasing tropopause temperatures.