



SPARC Workshop SHARP2016

The influence of the Asian summer Monsoon, ENSO, and the QBO on the boreal summer UTLS temperatures, water vapour and ozone mixing ratios

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Transport processes and pathways related to the Asian summer monsoon (ASM), in particular the dynamics of the Asian monsoon anticyclone (AMA), can have an impact on the composition of the UTLS. Here, we assess the ability of chemistry climate models (CCMs) to reproduce the main characteristics and variability of water vapour, ozone and temperatures in the UTLS during the boreal summer in comparison to MIPAS satellite observations and ERA-Interim re-analyses. Using a multiple linear regression model the main influencing factors, i. e. the strength of the ASM, the QBO, and ENSO are separated. The results of the regression analysis show for ERA-Interim and the CCMs enhanced water vapour and reduced ozone mixing ratios within the AMA for stronger ASM seasons. The regression results for the CCMs further confirm earlier studies which emphasize the importance of the Tibetan Plateau/ southern slope of the Himalayas as the main source region for water vapour to the AMA in the UTLS. The results suggest that water vapour is transported towards higher latitudes at the north-eastern edge of the AMA, rather than transported towards low equatorial latitudes to be fed into the tropical pipe.