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Application of 15 years of global atmospheric water vapor column observations from GOME-1/2 and SCIAMACHY for climate studies

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From UV/vis satellite instruments like GOME-1, SCIAMACHY and GOME-2 the total water vapor vertical column (column precipitable water) can be retrieved. One important advantage of these observations is that they can be retrieved both over land and ocean. In contrast to observations in the thermal IR they have high sensitivity even close to the surface, where typically the highest water vapor concentrations occur. Major limitations of these measurements are the rather coarse spatial resolution (ranging from 30x60km^2 to 320 x 40km^2) and the relatively high uncertainties, which are largely due to cloud effects.
Since the launch of the first instrument (GOME-1) in April 1995 water vapor measurements were continuously performed by GOME-1 and its successors SCIAMACHY and GOME-2. The time series between these sensors have large overlap periods. Thus, the combined observations of the three satellite instruments constitute a unique data set extending now over more than 15 years (1995-2011). This time period not only covers a strong ENSO event (1997/98) but also a time span of strong temperature increase due to climate change. We determine temporal trends (and their spatial distribution) of the atmospheric water vapor column over this period and relate them to simultaneous changes of the surface temperatures. The relationship between the atmospheric water vapor column and the surface temperature is also investigated based on the correlation of monthly anomalies and the effects of the 1997/98 ENSO event.