



## On the connection between stratospheric water vapour changes and widespread severe denitrification in the Arctic

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Water vapour is one of the most important greenhouse gases and plays a key role in the chemistry of the upper troposphere and lower stratosphere (UT/LS). Any changes in atmospheric water vapour bring important implications for the global climate. Long-term ground-based and satellite measurements indicate an increase of stratospheric water vapour abundance by an average of 1 ppmv during the last 30 years (1980-2010). Increases in stratospheric water vapour cool the stratosphere but warm the troposphere. Both the cooling of the stratosphere and the increase in water vapour enhance the potential for the formation of polar stratospheric clouds. More than a decade ago it already was suggested that a cooling of stratospheric temperatures by 1 K or an increase of 1 ppmv of stratospheric water vapor could promote denitrification, the permanent removal of nitrogen species from the stratosphere by solid polar stratospheric cloud particles. In fact, during the two recent Arctic winter 2009/2010 and 2010/2011 the strongest denitrification in the recent decade was measured by Odin/SMR. In the latter winter denitrification lead also to severe ozone depletion with similar extensions as the Antarctic "ozone hole". In this study, the correlation between observed water vapour trends and the recent temperature evolution in the Arctic together with trace gas measurements and PSC observations are considered to investigate a possible connection between the increase in stratospheric water vapour and polar stratospheric cloud formation/denitrification.