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Global water vapor variations in the upper troposphere and lower stratosphere in a coupled stratosphere-troposphere-ocean model

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Stratosphere-Troposphere coupling in the Tropics is here examined; in particular the influence of the Quasi Biennial Oscillation (QBO) on the troposphere- stratosphere exchange, cold-point tropopause temperature and its variations, water vapour distribution and the representation of tropical clouds. Water vapor and ice are known to exert a key influence on the radiative and dynamical balance of the upper troposphere and lower stratosphere (UTLS). Recent research has demonstrated that observed variations of the global water vapor into the lower stratosphere are an important driver of decadal global surface climate change. Therefore, variations of the water vapor into the lower stratosphere can provide a source of decadal variability for the climate system. However, there is still a need to improve the representation of the UTLS water vapor distribution and its variations in climate models. The interannual and inter-decadal variability of the water vapor in the UTLS is examined in a long-term simulation performed with a coupled troposphere-stratosphere-ocean model and compared with global observational datasets. The model has a well-resolved stratosphere with a high vertical resolution and is fully coupled to a dynamical ocean model. The long-term pre-industrial simulation (more than 100 years) is not subject to external forcings and is therefore analysed for investigating the internally driven long-term variability in the global UTLS water vapor. The evaluation will focus on the impact of the ocean coupling, the high vertical resolution and the representation of the tropical stratospheric dynamics on the modeled UTLS water vapor distribution and its interannual to inter-decadal variability, the representation of the cold-point tropopause temperature and its variations, the representation of tropical clouds and their impact on the tropical tropospheric variability.