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Possible causes for the observation of exceptionally high N2O mixing ratios in the tropical lower stratosphere

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A modified form of tracer-tracer correlations of N_2O and O_3 has been used as a tool for evaluation atmospheric photochemical models, like CTMs and CCMs. Thereby, the data is organized monthly for both hemispheres by partitioning the data into altitude (or potential temperature) bins and then averaged over a fixed interval of N_2O. In our recent model evaluation study where we applied satellite observations from the Odin-Sub Millimeter Radiometer (Odin/SMR) we found large differences between model simulation and Odin/SMR observations in the tropics. The N_2O averages we derived from Odin/SMR observations at potential temperature levels between 500 and 650 K were much higher than the N_2O values we derived from the model simulations. Further, these values are much higher than what up to now has been measured. Validation studies comparing Odin/SMR N_2O data with other data shows that the Odin/SMR N_2O data is of good quality. Further, checking the method we applied did also not reveal any errors. Since our data is averaged over bins of fixed N_2O we found that these bins contain a relatively low number of data points compared to the other bins. Furthermore, these values occur with a seasonal dependence showing a maximum in winter and a minimum in summer. Thus, since we cannot find an error in our analyses or in the Odin/SMR data, a scientific explanation could be that these high values are caused by local dynamical processes in the tropics, e.g. overshooting convection, that are not well represented in the model simulations. To test this hypothesis we will apply our method to other satellite data sets with a high coverage in the tropics as e.g., MLS, MIPAS-ENVSIAT or CRISTA. If these high values are also found in other satellite observations we additionally perform model simulations to track the process by which these high values are caused in the lower stratosphere.