Oral | Symbol A (Atmospheric, Ocean, and Environmental Sciences) | A-AS Atmospheric Sciences, Meteorology & Atmospheric Environment

[A-AS21_30AM1]Stratospheric Processes And their Role in Climate

Convener:*Kazuyuki Miyazaki(Research Institute for Global Change, JAMSTEC), Masakazu Taguchi(Aichi University of Education), Yoshio Kawatani(Japan Agency for Marine-Earth Science and Technology), Kaoru Sato(Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo), Chair:Yoshio Kawatani(Japan Agency for Marine-Earth Science and Technology)
Wed. Apr 30, 2014 9:00 AM - 10:45 AM 313 (3F)
The Stratospheric Processes And their Role in Climate (SPARC) is one of the major projects of the World Climate Research Programme (WCRP), and is characterized by its focus on chemical and dynamical coupling based on both observations and modeling. In this session, we welcome presentations on various processes in the troposphere to the mesosphere.

10:30 AM - 10:45 AM

[AAS21-P05_PG]Interannual variations of stratospheric water vapor in microwave limb sounding observations and climate model simulation

3-min talk in an oral session
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Keywords:quasi-biennial oscillation

Using the almost decade-long record of water vapor (H2O) measurements now available from the Microwave Limb Sounder (MLS) instrument on the NASA AURA satellite, the time-height structure of interannual variations in H2O content are investigated. The interannual anomalies display upward propagation below about 10 hPa in a manner analogous to the seasonal tape recorder, but at higher levels the anomalies in H2O appear to propagate downward. An explanation for this effect is sought by examining stratospheric water vapor in simulations of a fine horizontal and vertical resolution (T106L72) version of the MIROC-AGCM. This model is notable for its rather realistic simulation of the quasi-biennial oscillation (QBO) in the tropical stratosphere. The interannual anomlies in simulated stratospheric H2O display a similar propagation as seen in the MLS data. Further analysis shows that the upward propagation in the lower stratosphere is related to the mean advection of interannual water content anomalies induced by the QBO at the tropopause, while the downward propagation is due to the advection of the mean vertical gradient of water content by QBO's interannual fluctuations in the vertical wind. This conclusion is supported by additional experiments run with a modified MIROC that had a significantly different the mean vertical H2O gradient in the middle and upper stratosphere. Also analyzed are global warming simulations in both the MIROC model and in several other global models included in the recent Coupled Model Intercomparison Project 5 (CMIP5). The upward propagating interannual H2O variations are projected to become weaker in all these models because of a weakened QBO amplitude in the lowermost stratosphere.