Aura Microwave Limb Sounder observations of the polar middle atmosphere: Dynamics and transport of CO and water vapor
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The vertical structure and evolution of the wintertime annular modes are studied using six years of geopotential height (GPH), carbon monoxide (CO) and water vapor (H2O) data from Aura Microwave Limb Sounder (MLS). The Northern Hemisphere annular mode (NAM) and the Southern Hemisphere annular mode (SAM) reveal a strong coupling of the dynamics in the stratosphere and mesosphere between 316 hPa (~9 km) and 0.002 hPa (~90 km). CO is a good tracer throughout the middle atmosphere, while variable vertical gradients of H2O limit the regions where it is useful as a dynamical tracer. The maximum of the CO NAM and SAM (CNAM and CSAM) indices is used to monitor and characterize the evolution of wintertime polar dynamics as a function of time and height. The CNAM analysis reveals reformation of a stronger mesospheric polar vortex after significant stratospheric sudden warmings (SSWs) in 2006, 2009, and 2010. There is a significant anti-correlation between the mesospheric and stratospheric CNAM indices during 2005-2010 winters, supporting the hypothesis of mesosphere-stratosphere coupling through planetary-gravity wave interactions.