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Improvements in stratopause evolution and transport in advanced data assimilation systems

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Recent satellite data, including temperature and trace gas fields from the Aura Microwave Limb Sounder (MLS), and data assimilation system (DAS) products, are used to detail the evolution of the stratopause and transport in the stratopause region, focusing on the 2005/2006, 2008/2009 and 2009/2010 Arctic winters that had prolonged stratospheric major sudden warmings (and in 2009/2010, an unusual lower mesospheric mixing event). The CMAM-DAS and NOGAPS-ALPHA DAS provide better representations of the stratopause region than operational systems (e.g., ECMWF, GEOS-5). NOGAPS-ALPHA has a higher model top than operational systems, and assimilates MLS and SABER temperatures and MLS ozone and water vapor. The CMAM-DAS also has a high model top, and includes a more sophisticated non-orographic gravity-wave drag scheme than operational DAS. Results from these advanced DAS are compared with satellite data and operational DAS products to help elucidate factors that are important in improving DAS performance in the stratopause region.