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Sub-seasonal temperature variability in the tropical upper troposphere and lower stratosphere observed with GPS radio occultation

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We investigate sub-seasonal temperature variability in the tropical upper troposphere and lower stratosphere (UTLS) region using daily gridded fields of GPS radio occultation measurements. The unprecedented vertical resolution (from about 100 m in the troposphere to about 1.5 km in the stratosphere) and high accuracy and precision (0.7 K to 1 K between 8 km and 25 km) make these data ideal for characterizing temperature oscillations with short vertical wavelengths. Long-term behavior of sub-seasonal temperature variability is investigated using the entire RO record from January 2002 to December 2014 (13 years of data).
Transient sub-seasonal waves including eastward-propagating Kelvin waves (isolated with space-time spectral analysis) dominate large-scale zonal temperature variability in the tropical tropopause region and in the lower stratosphere. Above 20 km, Kelvin waves are strongly modulated by the quasi-biennial oscillation (QBO). Enhanced wave activity can be found during the westerly shear phase of the QBO.
In the tropical tropopause region, however, sub-seasonal waves are highly transient in time. Several peaks of Kelvin-wave activity coincide with short-term fluctuations in tropospheric deep convection, but other episodes are not evidently related. Also, there are no obvious relationships with zonal winds or stability fields near the tropical tropopause. Further investigations of convective forcing and atmospheric background conditions along the waves' trajectories are needed to better understand sub-seasonal temperature variability near the tropopause.

For more details, see
Scherllin-Pirscher, B., Randel, W. J., and Kim, J.: Tropical temperature variability and Kelvin-wave activity in the UTLS from GPS RO measurements, Atmos. Chem. Phys., 17, 793–806, doi:10.5194/acp-17-793-2017, 2017.
http://www.atmos-chem-phys.net/17/793/2017/acp-17-793-2017.html