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QBO and ENSO indices from GPS Radio Occultation to describe atmospheric variability

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The GPS Radio Occultation (RO) satellite technique provides 15 years (since 2001) of high quality measurements with global coverage and high vertical resolution. These properties make RO a valuable dataset for the characterization of atmospheric variability.

Atmospheric variability arises from different physical processes and manifests itself on different time-scales. In this study, we focus on inter-annual atmospheric variability of the tropical troposphere and stratosphere, which mainly results from El Niño-Southern Oscillation (ENSO) and the Quasi Biennial Oscillation (QBO). To describe these modes of variability proxies (so called indices) are used.

The ENSO index is commonly computed from tropical sea surface temperature anomalies. For describing the QBO, usually wind speeds at the 30 hPa and/or 50 hPa levels are used. However, both atmospheric variability patterns change with height. Thus, when computing, e.g., height-resolved trends, it is essential to account for these height-varying variability patterns in order to properly remove their contributions.

We perform a principle component analysis of the RO temperature record from 2001 to 2016 to identify dominating variability modes. Then we use these principal component time series to provide vertically high resolved QBO and ENSO indices based on temperatures from RO.