Improved Resolution and Accuracy of Temperature Retrievals from GPS Occultations

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GPS occultations provide global active limb-sounding measurements of the atmosphere under all-weather conditions whereby high vertical resolution profiles of atmospheric refractivity, density, pressure, and temperature (or water vapor) are derived. Sub-Kelvin temperature profiles at sub-kilometer vertical resolution are achievable in the upper troposphere and the stratosphere. The current inversion method is limited by Fresnel diffraction to a vertical resolution of 1–1.5 km. However, more recent techniques bypass this limit by properly taking into account the diffraction effects in the observed signal. These methods can resolve fine-scale vertical structures in the atmosphere. We show that with the higher vertical resolution, the occultations capture sharper tropopause structures with colder temperature minima than the global analyses, thus setting different constraints on the stratospheric-tropospheric exchange of water vapor. By comparing CHAMP and SAC-C occultation events that are temporally and spatially co-located, the resolution, precision, and accuracy of these temperature retrievals are demonstrated.

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