
Spectral Invariance Principles Observed in Spectral Radiation Measurements of the Transition Zone

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The transition zone between cloudy and clear air has a major impact on determination of aerosol direct and indirect forcing, because the determination demands a precise separation between aerosol and cloud, and yet the separation using remote sensing techniques is always ambiguous. This zone is also a region of strong aerosol-cloud interactions but hard to measure, because most research aircraft, satellites and ground-based instruments have insufficient spatial and temporal resolution to resolve the transition. One-second-resolution zenith radiance measurements from the Atmospheric Radiation Measurement program's shortwave spectrometer (SWS) provide a unique opportunity to analyze the transition zone. We apply our recently discovered spectrally invariant relationship in SWS observations to the transition zone measurements. We also discuss how to better understand clouds and aerosols interaction, and to better determine aerosol direct and indirect forcing by accounting for contributions in the transition zone.