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# *3D EFFECTS ON SPECTRALLY INVARIANT BEHAVIOR NEAR CLOUD EDGES: IMPLICATIONS FOR RETRIEVING AEROSOL AND CLOUD PROPERTIES IN THESE CHALLENGING REGIONS*

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## ABSTRACT

Fuzzy cloud edges, with the transition from cloudy to clear air spanning as little as 50 m to as much as several hundred meters, are the battleground where the fate of aerosol indirect forcing is decided. However, measuring aerosol and cloud properties near and within cloud edges from remotely sensed data remains problematic because the separation between cloudy and clear air is always ambiguous, and because effects of the 3D nature of clouds on measurements need to be considered. Recently, we discovered a surprising spectrally invariant behavior in zenith radiance spectra measured by the shortwave spectrometer of the Atmospheric Radiation Measurement (ARM) Climate Research Facility. The relationship suggests that the shortwave spectrum near cloud edges can be determined by a linear combination of zenith radiance spectra of the cloudy and clear regions. More importantly, 1D radiative transfer calculations show that the relationship is mainly determined by cloud properties and is insensitive to aerosol properties and the underlying surface type. Here, we will demonstrate how 3D effects may modulate the spectrally invariant relationships. We will also show the extent to which the general conclusions drawn from 1D calculations hold in 3D calculations, which will shed light on development of a new retrieval method that works for cloud edges.