

## **Bin DSD and dynamics retrievals in rain with the ARM Ka-W-band radars dual wavelength Doppler spectra**

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The US Department of Energy Atmospheric Radiation Measurement (ARM) program facilities host an unequalled number of active and passive collocated sensors. In this study, Doppler spectra measured by the collocated and beam-matched Ka-band (35-GHz) and W-band (94 GHz) are combined to retrieve bin drop size distribution (DSD) and dynamics (vertical wind and turbulence) profiles in light to moderate precipitation.

Against common expectations, millimetre wavelength cloud radars are well capable of quantifying precipitation via their attenuation signals with no needs of a very accurate radar calibration. Furthermore, their sensitivity to both cloud and precipitation make them a first choice instrument for the observation of the transition from clouds to precipitation since they provide a holistic view of the water cycle.

The presented technique focuses on rain retrievals from Ka and W-band spectra by exploiting the differences in their shape due to the Mie scattering by rain drops. It is an extension of the recently developed Doppler Spectra Ratio (DSR) technique to turbulent rain cases. Indeed, the turbulence is known to seriously widen radar spectra, hampering the retrieval of accurate DSDs. However, this technique permits to retrieve the turbulence widening thanks to the universality of the shape of the DSR after the deconvolution of the radar Doppler spectra. It will provide an unprecedented product combining bin DSD, turbulence and vertical wind which can serve as a reference for developing spaceborne radar retrievals and parameterisations at cloud resolving model scales.