# Spectral processing techniques for measuring Doppler velocity of rainfall from a low-earth orbiting satellite

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**ABSTRACT**

The utility of a spaceborne Doppler precipitation radar for gathering necessary information about physics and microphysics of atmospheric events has been recognized since the early 80's. Recently, the radar technology has advanced to the point that such a spaceborne Doppler precipitation radar can be implemented. In conjunction, recent research studies have highlighted the important impact of Non-Uniform Beam Filling (NUBF) on mean Doppler velocity measurements: in fact, the bias introduced by NUBF on mean Doppler velocity estimates can be greater than the standard deviation of the estimated velocity because of the noisy nature of the weather signal. Furthermore, it was proved that such a bias is dependent on the along-track reflectivity profile within the IFOV.

In this work a sampling strategy and a signal processing technique are proposed to overcome the aforementioned NUBF-induced errors. The sampling strategy is based on the oversampling in the along-track direction in order to retrieve information about the reflectivity pattern at the sub-beam scale. The proposed processing technique, named Combined Frequency-Time (CFT) technique, exploits the time series of spectra at fixed range to resolve the NUBF induced bias. The results and the evaluation of performances achievable by means of CFT, were obtained by applying a 3D spaceborne Doppler radar simulator to a 3D dataset of reflectivity and mean Doppler velocity measured through the NASA/JPL airborne Doppler radar ARMAR.

The radar system considered here is a nadir-looking, Ku band radar. It is shown how the error on mean Doppler velocity estimates can be reduced by means of CFT to the level predicted for such a radar system in the case of uniformly filled resolution volume.

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