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Highly supercooled riming and unusual triple-frequency radar signatures over McMurdo Station, Antarctica

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This supplementary material provides the joint histograms of radar multifrequency observations during the period with large $DWR_{Ka,W}$ on the 4th of January 2016 at McMurdo station, as in Figure 9 of the main manuscript. However, in the figures of this supplementary material, the superimposed lines correspond to the parameters forward modeled with different electromagnetic-microphysical EM-MIC models: SSRGA-LS15-B1kgm2 in Figure S1 and TMAT-M18-r0.4 in Figure S2.

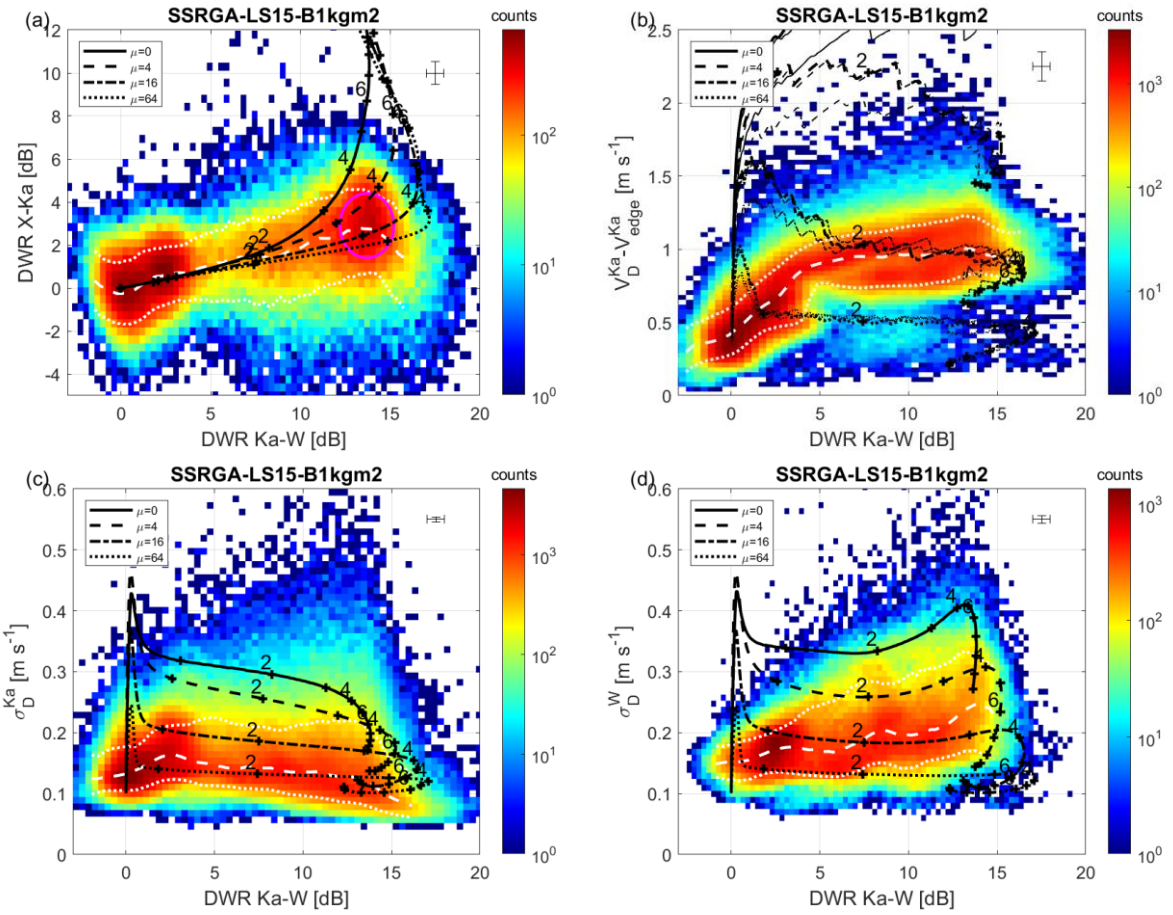

Figure S1: Two-dimensional histograms of observed (a) $DWR_{X,Ka}$, (b) difference between Ka-band Doppler velocity and Doppler spectra slow edge v_D^{Ka}-$v_{D,slowedge}^{Ka}$, (c) Ka-band spectral width σ_D^{Ka} and (d) W-band spectral width σ_D^{W} as function of observed $DWR_{Ka,W}$. The superimposed white dashed line (dotted lines) shows the median (10th and 90th percentiles) of the histogram for the $DWR_{Ka,W}$ bins containing at least 500 points. The superimposed black lines represent the corresponding parameters forward modeled with the SSRGA for a gamma distribution of aggregates of dendrites with various μ (see the legends in the plots), a mean mass diameter comprised between $0 < D_m < 10$ mm (each marker corresponding to 1 mm step) and simulated using an equivalent liquid water path of 1 kg/m². In panel (b), different line widths correspond to calculations of fall velocities using various hydrodynamic models.

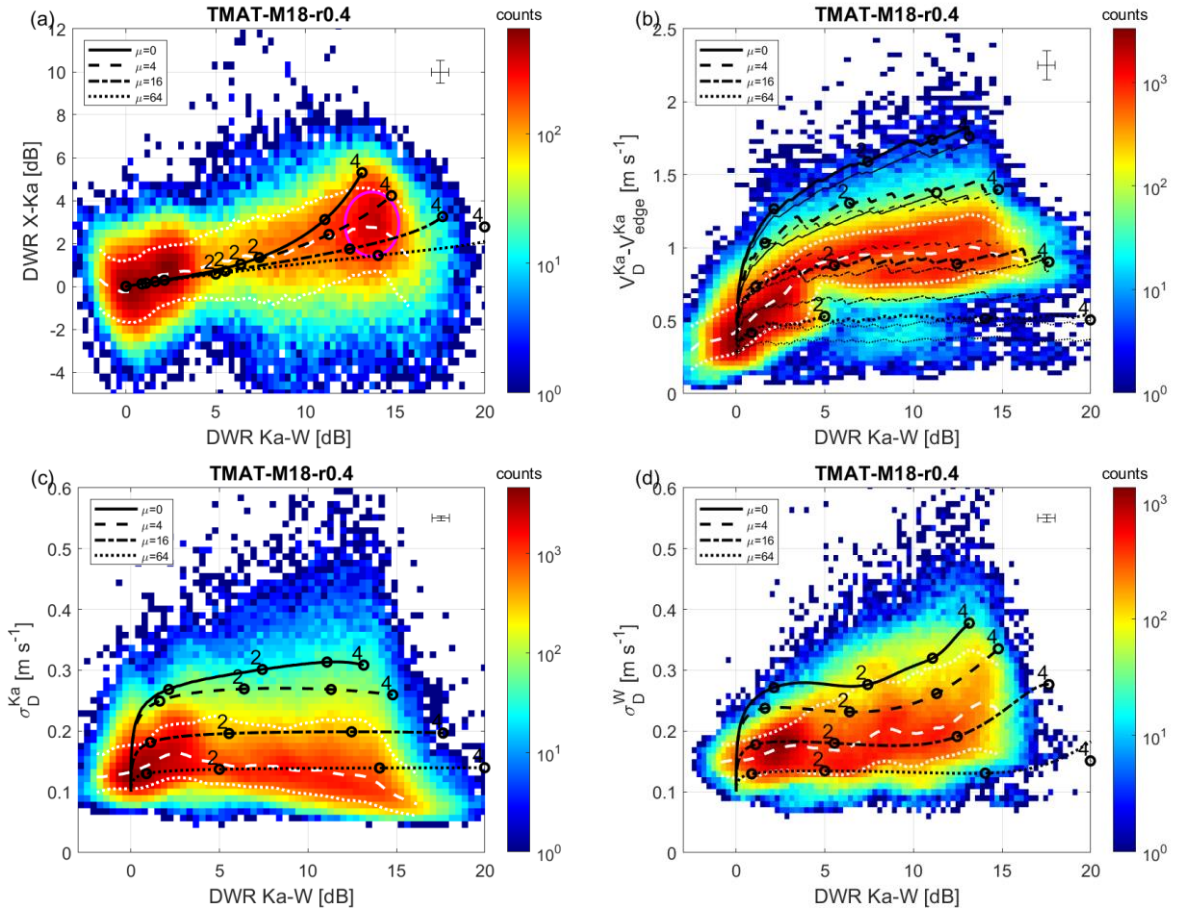

Figure S2: Two-dimensional histogram of observed (a) $DWR_{X,Ka}$, (b) difference between Ka-band Doppler velocity and Doppler spectra slow edge v_D^{Ka}-$v_{D,slowedge}^{Ka}$, (c) Ka-band spectral width σ_D^{Ka} and (d) W-band spectral width σ_D^{W} as function of observed $DWR_{Ka,W}$. The superimposed white dashed line (dotted lines) shows the median (10th and 90th percentiles) of the histogram for for the $DWR_{Ka,W}$ bins containing at least 500 points. The superimposed black lines represent the corresponding parameters forward modeled with the T-Matrix approximation for a gamma distribution of mixture of ice and air spheroids with various μ (see the legends in the plots), a mean mass diameter comprised between 0 < D_m < 4 mm (each marker corresponding to 1 mm step) and a density factor of 0.4. In panel (b), different line widths correspond to calculations of fall velocities using various hydrodynamic models.