Supplements

Robin Ekelund[1] and Patrick Eriksson[1]

[1]Department of Space, Earth and Environment, Chalmers University of Technology, Gothenburg, Sweden.

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1 2 mm data, omitted parameters

Fig. 1, 2, 3 and 4 found here, correspond to Fig. 4, 6, 7 and 8 in the main article, respectively. They display parameters of the main 2 mm aggregate data, that was discussed, but not shown in the main article.

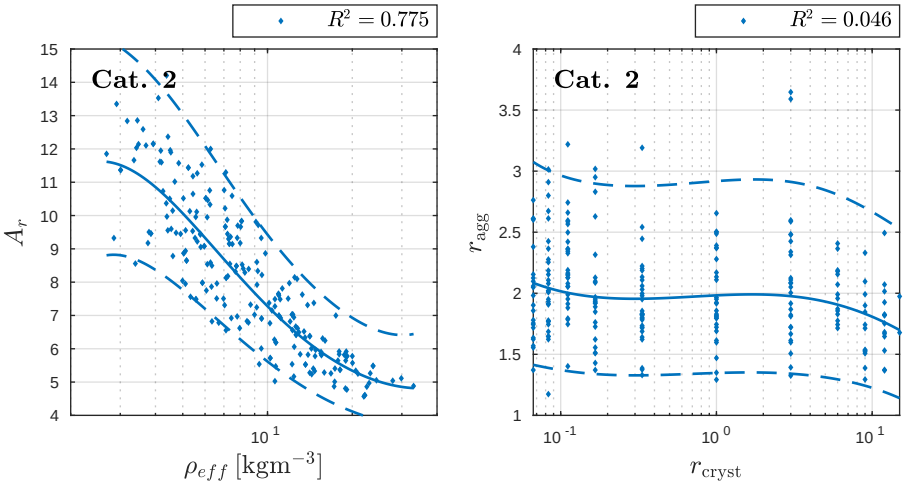

Figure 1: Aggregate parameters of category 2 shape data. (Left) Aerodynamic area ratio A_r as a function of particle effective density ρ_{eff}, using category 2 data. (Right) Aggregate aspect ratio r_{agg} as a function of crystal axis ratio r_{cryst}, using category 2 data. Lines represents cubic fits.

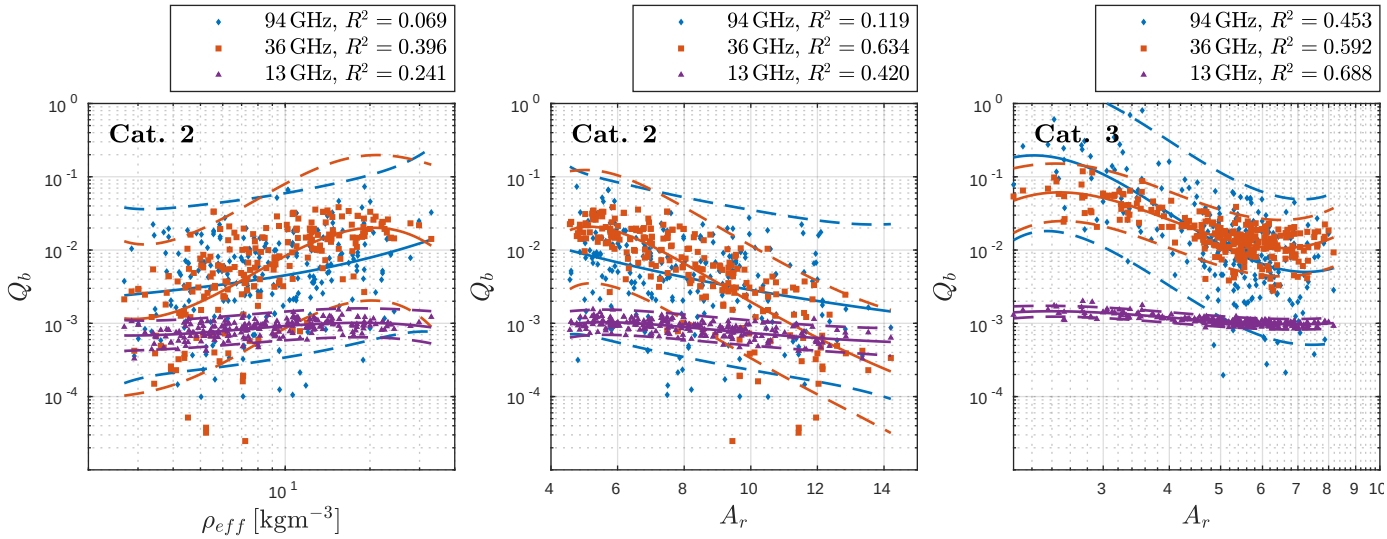

Figure 2: Back-scattering efficiencies Q_b as a function of different parameters, at 13.4, 35.6 and 94.1 GHz. The temperature is 230 K. (Left) Q_b as a function of particle effective density ρ_{eff}, using category 2 data. (Middle) Q_b as a function of function of aerodynamic area ratio A_{r}, using category 2 data. (Right) Q_b as a function of aerodynamic area ratio A_{r}, using category 3 data.

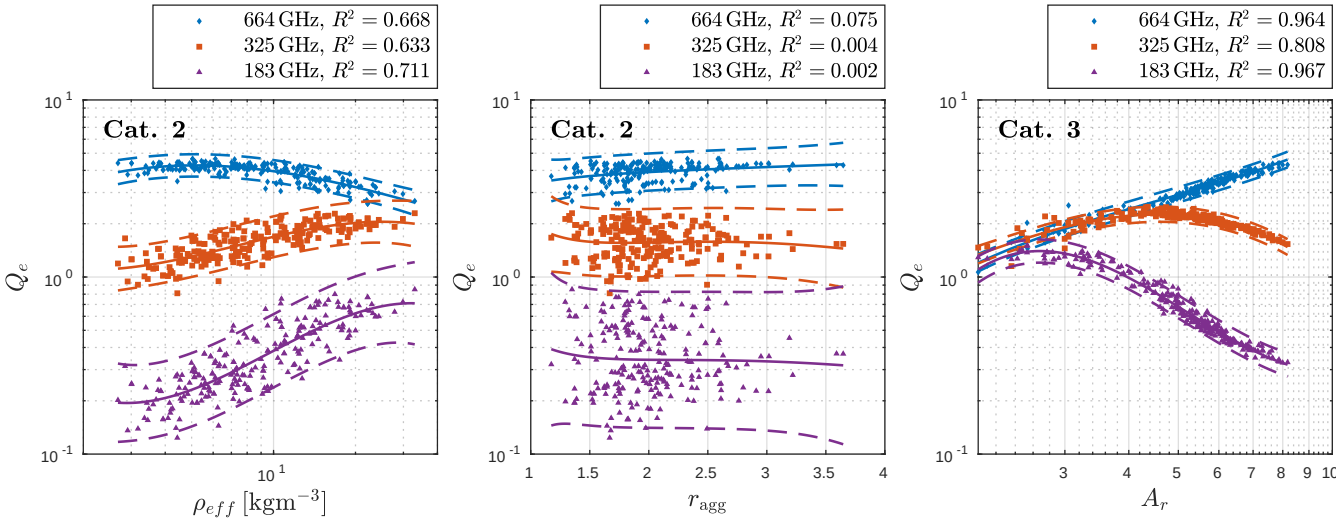

Figure 3: Extinction efficiencies Q_e as a function of different parameters, at 183.31, 325.15 and 664.00 GHz. The temperature is 230 K. (Left) Q_e as a function of particle effective density ρ_{eff}, using category 2 data. (Middle) Q_e as a function of aggregate aspect ratio r_{agg}, using category 2 data. (Right) Q_e as a function of aerodynamic area ratio A_{r}, using category 3 data. In contrast to corresponding figures in the main text, particles at 0.5 mm are included instead of 2 mm.

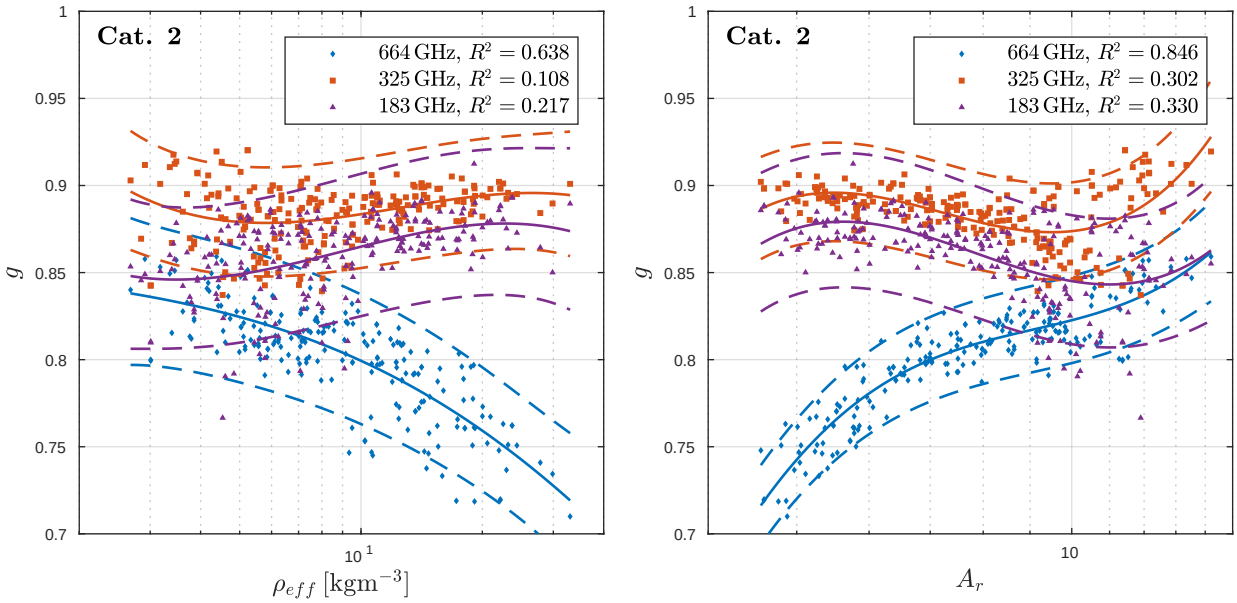

Figure 4: Asymmetry parameter g as a function of different parameters, at 183.31, 325.15 and 664.00 GHz, and a temperature of 230 K. (Left) g as a function of particle effective density ρ_{eff}, using category 2 data. (Right) g as a function of aerodynamic area ratio A_{r}, using category 2 data.

2 500 mm data

Fig. 5, 6, 7 and 8 found here, corresponds Fig. 4, 6, 7 and 8 of the main article, respectively. The difference is that all data have D_{veq} equal to 0.5 mm (as opposed to 2 mm as in the article).

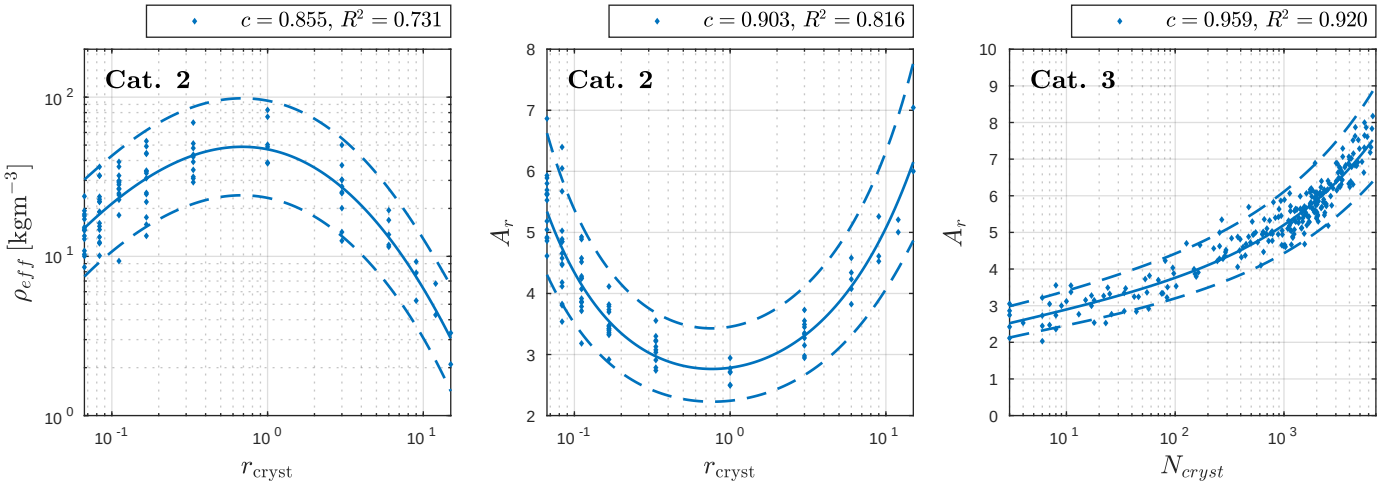

Figure 5: Aggregate parameters of category 2 and 3 shape data. (Left) Particle effective density ρ_{eff} as a function of crystal axis ratio r_{cryst}, using category 2 data. (Middle) Aerodynamic area ratio A_{r} as a function of r_{cryst}, using category 2 data. (Right) Aerodynamic area ratio A_{r} as a function of the number of constituent crystals N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 0.5 mm are included instead of 2 mm.

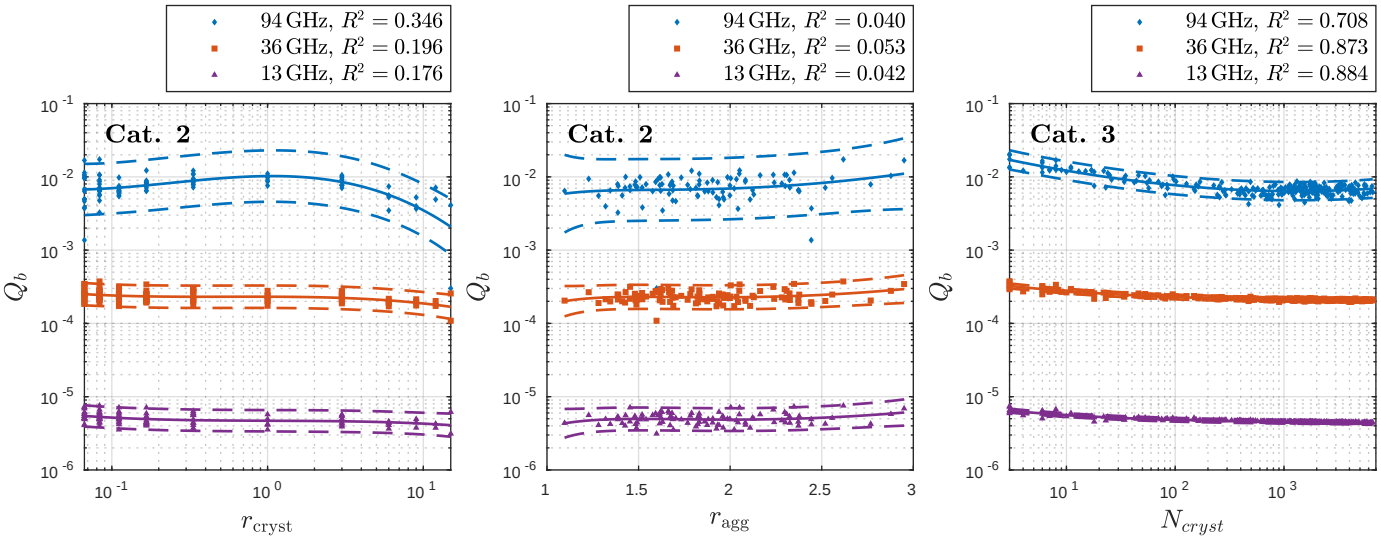

Figure 6: Back-scattering efficiencies Q_b as a function of different parameters, at 13.4, 35.6 and 94.1 GHz. The temperature is 230 K. (Left) Q_b as a function of crystal axis ratio r_{cryst}, using category 2 data. (Middle) Q_b as a function of aggregate aspect ratio r_{agg}, using category 2 data. (Right) Q_b as a function the crystal number N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 0.5 mm are included instead of 2 mm.

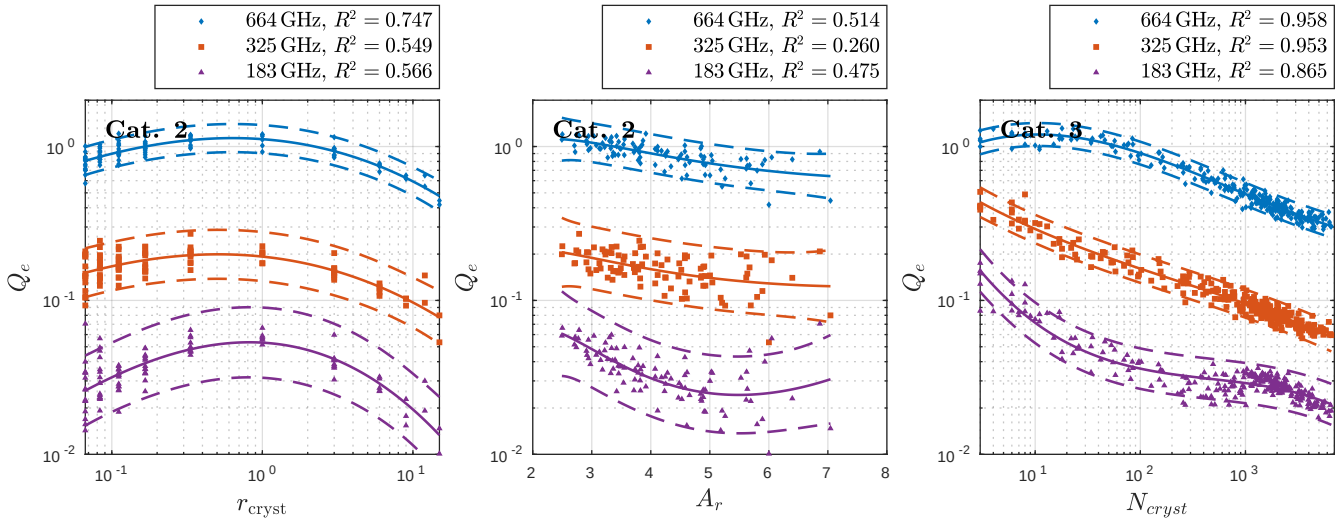

Figure 7: Extinction efficiencies Q_e as a function of different parameters, at 183.31, 325.15 and 664.00 GHz. The temperature is 230 K. (Left) Q_e as a function of crystal axis ratio r_{cryst}, using category 2 data. (Middle) Q_e as a function of aerodynamic area ratio A_{r}, using category 2 data. (Right) Q_e as a function of the constituent crystal number N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 0.5 mm are included instead of 2 mm.

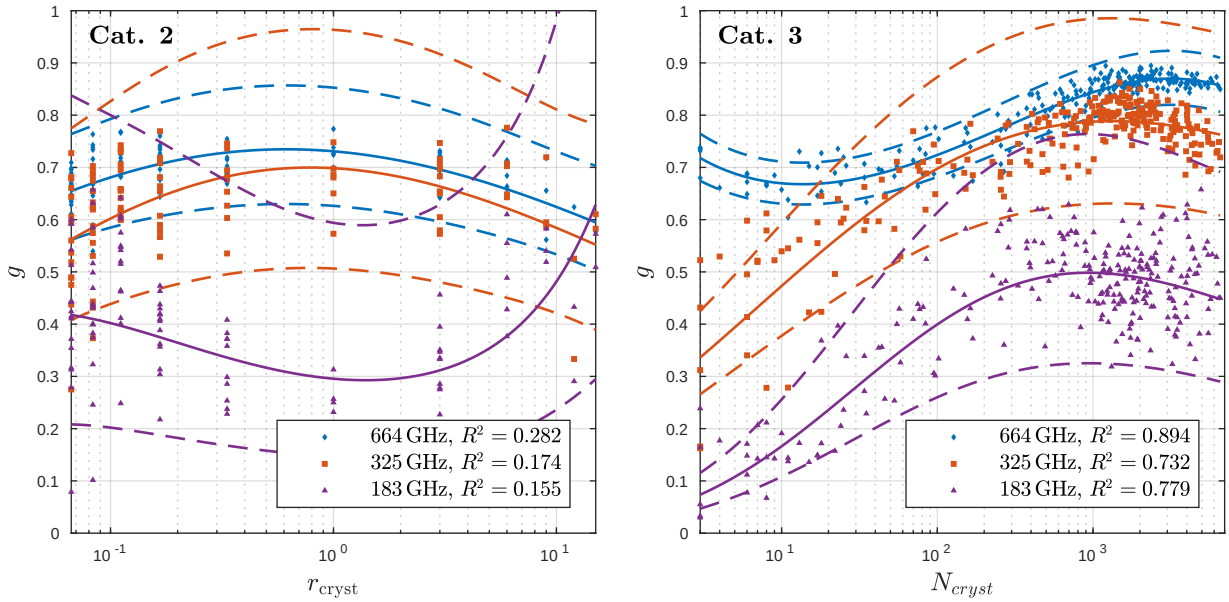

Figure 8: Asymmetry parameter g as a function of different parameters, at 183.31, 325.15 and 664.00 GHz, and a temperature of 230 K. (Left) g as a function of crystal axis ratio r_{cryst}, using category 2 data. (Right) g as a function of the crystal number N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 0.5 mm are included instead of 2 mm.

3 1 mm data

Fig. 9, 10, 11 and 12 found here, corresponds Fig. 4, 6, 7 and 8 of the main article, respectively. The difference is that all data have D_{veq} equal to 1 mm (as opposed to 2 mm as in the article).

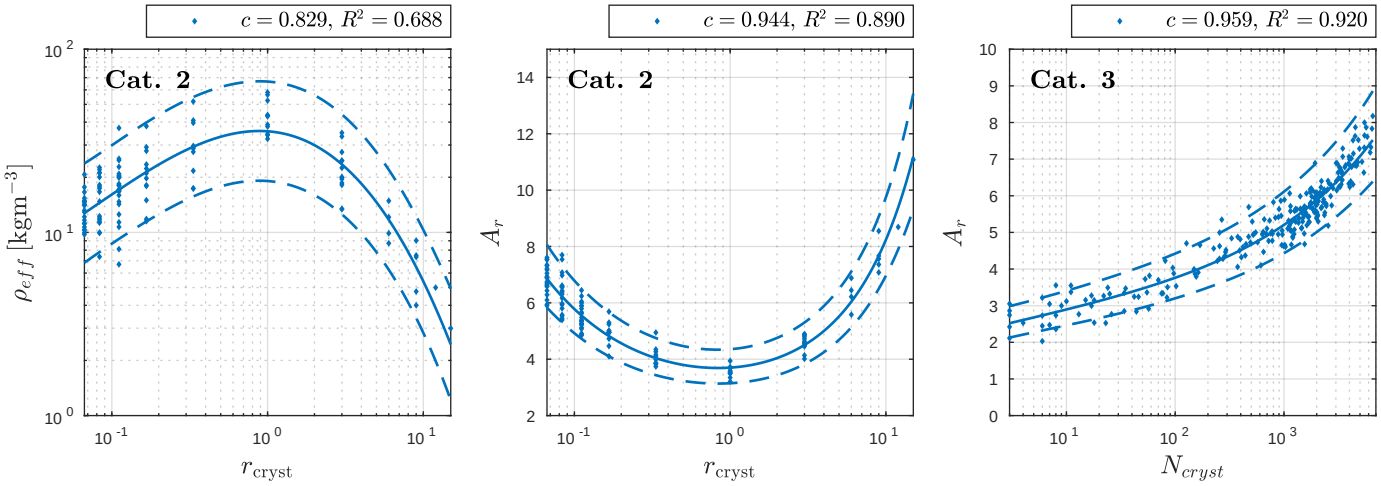

Figure 9: Aggregate parameters of category 2 and 3 shape data. (Left) Particle effective density ρ_{eff} as a function of crystal axis ratio r_{cryst}, using category 2 data. (Middle) Aerodynamic area ratio A_{r} as a function of r_{cryst}, using category 2 data. (Right) Aerodynamic area ratio A_{r} as a function of the number of constituent crystals N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 1 mm are included instead of 2 mm.

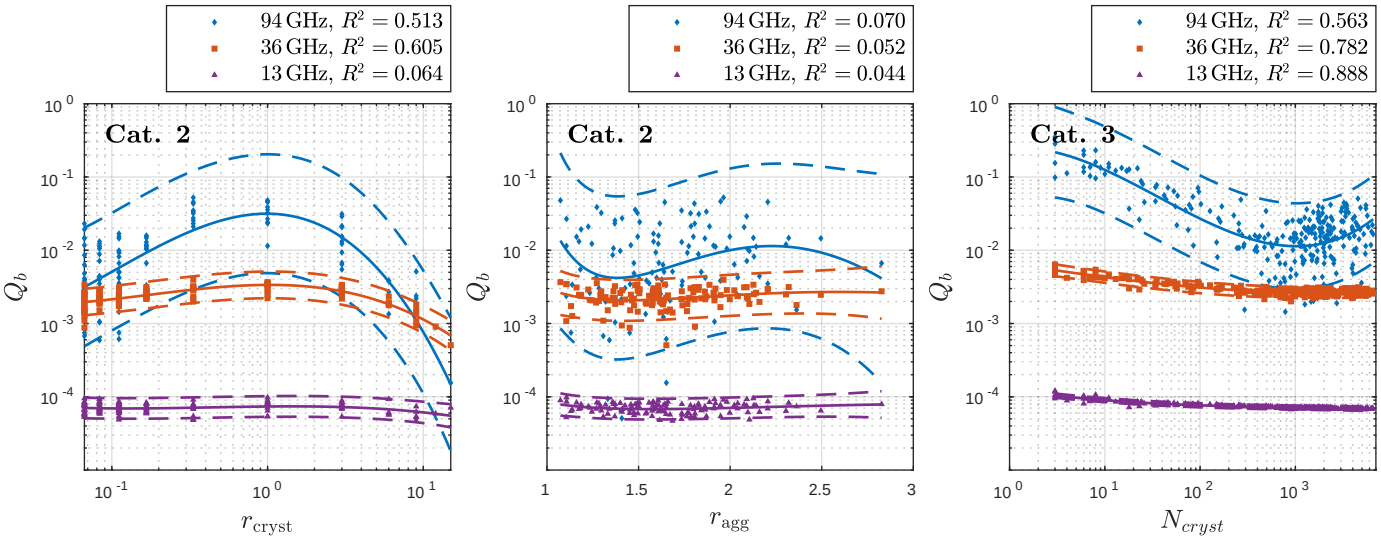

Figure 10: Back-scattering efficiencies Q_b as a function of different parameters, at 13.4, 35.6 and 94.1 GHz. The temperature is 230 K. (Left) Q_b as a function of crystal axis ratio r_{cryst}, using category 2 data. (Middle) Q_b as a function of aggregate aspect ratio r_{agg}, using category 2 data. (Right) Q_b as a function the crystal number N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 1 mm are included instead of 2 mm.

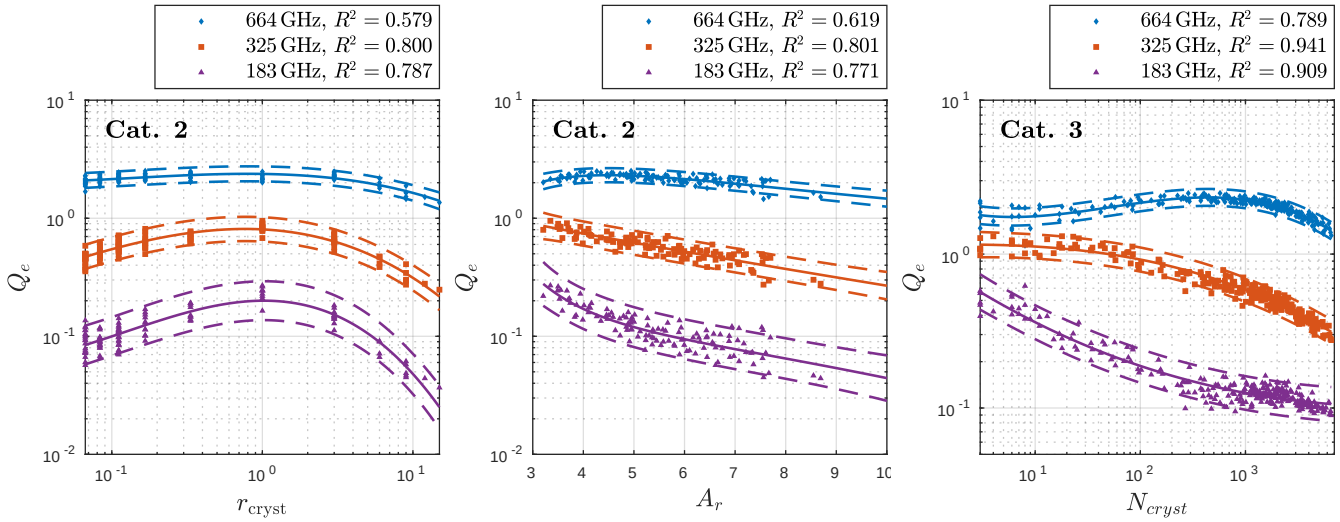

Figure 11: Extinction efficiencies Q_e as a function of different parameters, at 183.31, 325.15 and 664.00 GHz. The temperature is 230 K. (Left) Q_e as a function of crystal axis ratio r_{cryst}, using category 2 data. (Middle) Q_e as a function of aerodynamic area ratio A_{r}, using category 2 data. (Right) Q_e as a function of the constituent crystal number N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 1 mm are included instead of 2 mm.

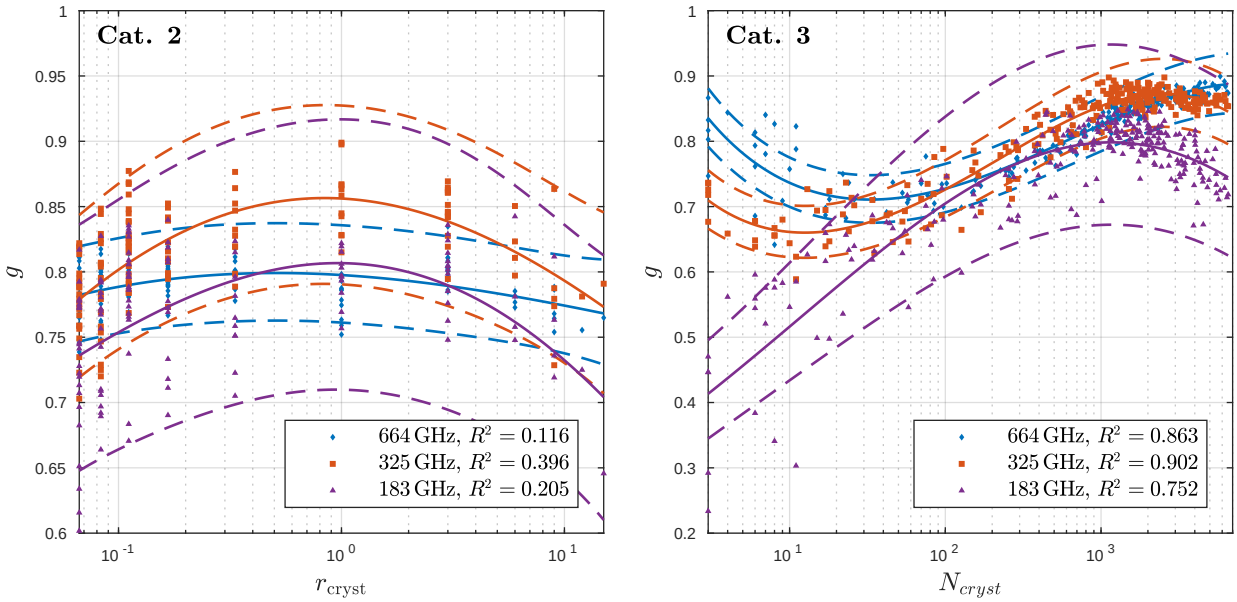

Figure 12: Asymmetry parameter g as a function of different parameters, at 183.31, 325.15 and 664.00 GHz, and a temperature of 230 K. (Left) g as a function of crystal axis ratio r_{cryst}, using category 2 data. (Right) g as a function of the crystal number N_{cryst}, using category 3 data. In contrast to corresponding figures in the main text, particles at 1 mm are included instead of 2 mm.

4 Alternative triple frequency signature plot

Fig. 13 corresponds to the top panel of Fig. 10 in the main article. The difference is that the particle size distribution is defined in $D_{\max}$, instead of D_{veq}.

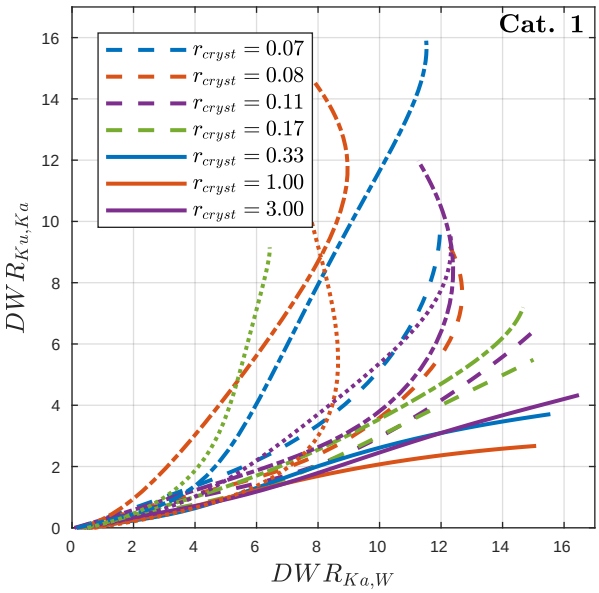

Figure 13: Triple frequency signatures using radar frequencies of 13.4 (K_u-band), 35.6 (K_a-band) and 94.1 GHz (W-band). Temperature is 230 K and an exponential PSD (using $D_{\max}$ as a size parameter instead) was assumed. Lines are divided into different r_{cryst}-values. (Top) Triple frequency signatures.