



Supplement of

Exploiting airborne far-infrared measurements to optimise an ice cloud retrieval

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S1 Estimating the Cloud Effective Radius

Figure S1 shows the particle size distributions derived from the Cloud 2-DS in O’Shea et al. (2016) and the bimodal Gaussian distributions that have been fitted to them. The fittings were performed using the non-linear least squares method. The relative standard deviation of each fitted parameter for each particle size distribution (Table S1) was used to calculate the uncertainty in the cloud effective radius.

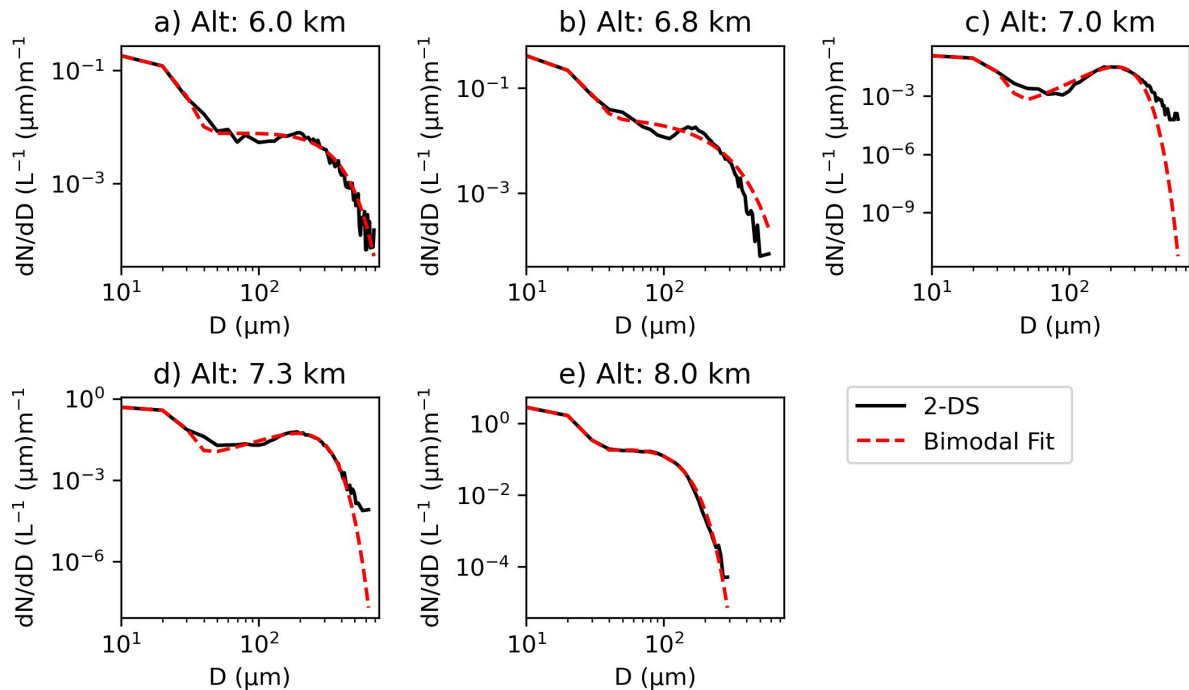


Figure S1. The (black) particle size distributions measured by a Cloud 2-DS probe during the B895 flight on 13 March 2015 that were successfully fitted with a bimodal Gaussian distribution.

Altitude (km)	A_1	μ_1	σ_1	A_2	μ_2	σ_2
6.0	3	3	0.8	50	10	6
6.8	40	7	5	100	40	100
7.0	2	4	2	0.7	2	2
7.3	2	3	1	2	4	3
8.0	0.8	1	0.3	4	3	1

Table S1. The relative standard deviation (%) in each parameter fitted in the bimodal Gaussian: $f(x) = A_1 \exp\left[\frac{-(x-\mu_1)^2}{2\sigma_1^2}\right] + A_2 \exp\left[\frac{-(x-\mu_2)^2}{2\sigma_2^2}\right]$ corresponding to the red dashed curves in Figure S1.

S2 Creating the FORUM-aircraft Observations

Figure S2 shows the residuals between the LBLDIS simulation of the TAFTS observation during the B895 flight that has had the FORUM apodisation directly applied and been made to look like TAFTS first. This is the same data plotted in Figure 4a in the main paper, but using a smaller scale for the TAFTS residuals.

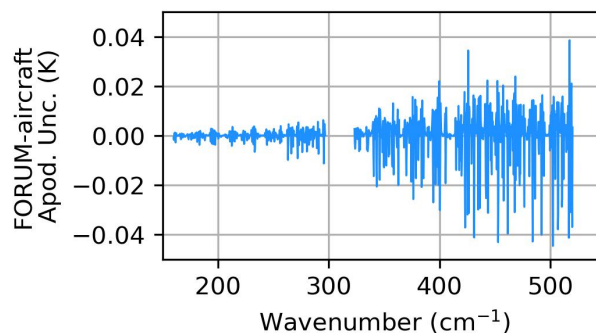


Figure S2. The brightness temperature (BT) residual between the LBLDIS simulation of the TAFTS observations during the B895 flight that has had the FORUM apodisation directly applied and been made to look like TAFTS first (FORUM-aircraft simulation) as outlined in Section 2.3.2 in the main text. This is the same data as plotted in Figure 4a in the main text, but with a smaller scale.

10 References

O'Shea, S. J., Choulaton, T. W., Lloyd, G., Crosier, J., Bower, K. N., Gallagher, M., Abel, S. J., Cotton, R. J., Brown, P. R. A., Fugal, J. P., Schlenczek, O., Borrmann, S., and Pickering, J. C.: Airborne observations of the microphysical structure of two contrasting cirrus clouds, *Journal of Geophysical Research.-Atmos*, p. 13510–13536, <https://doi.org/10.1002/2016JD025278>, 2016.