Supporting Information for

Non-spherical microparticle shape in Antarctica during the last glacial period affects dust volume-related measurements

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2. Table S1

Table S1. Coincidence analysis results for r, r^2, and p-value for each run during the two time periods with the highest Abakus offset from the CC (Figure 2).

	Coincidence Test	R	R^2	p-value
Heinrich Stadial 1 (16-18ka)	5.1-6.4µm: <5.1 µm	-4.63×10^{-3}	2.14×10^{-5}	0.84
	3.2-6.4 µm: <3.2 µm	3.28×10^{-2}	1.08×10^{-3}	0.15
LGM (18-27ka)	5.1-6.4µm: <5.1 µm	-5.18×10^{-3}	2.69×10^{-5}	0.63
	3.2-6.4 µm: <3.2 µm	3.15×10^{-2}	9.91×10^{-4}	<0.01

2. Figures S1 to S10

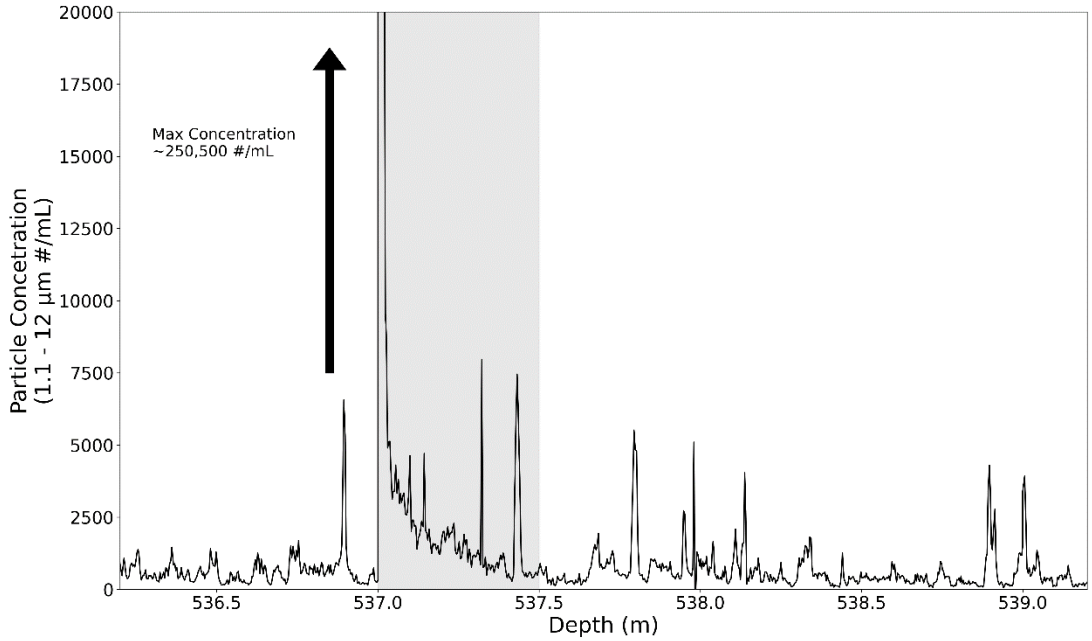


Figure S1. Estisol-140 style particle contamination highlighted in grey. Peak concentration is about 250,500 particles/mL Peak particle concentration is followed by a log scale decrease down core back to background concentration for the figure 523 ± 452 (536.2 – 539.2; standard error of the mean).

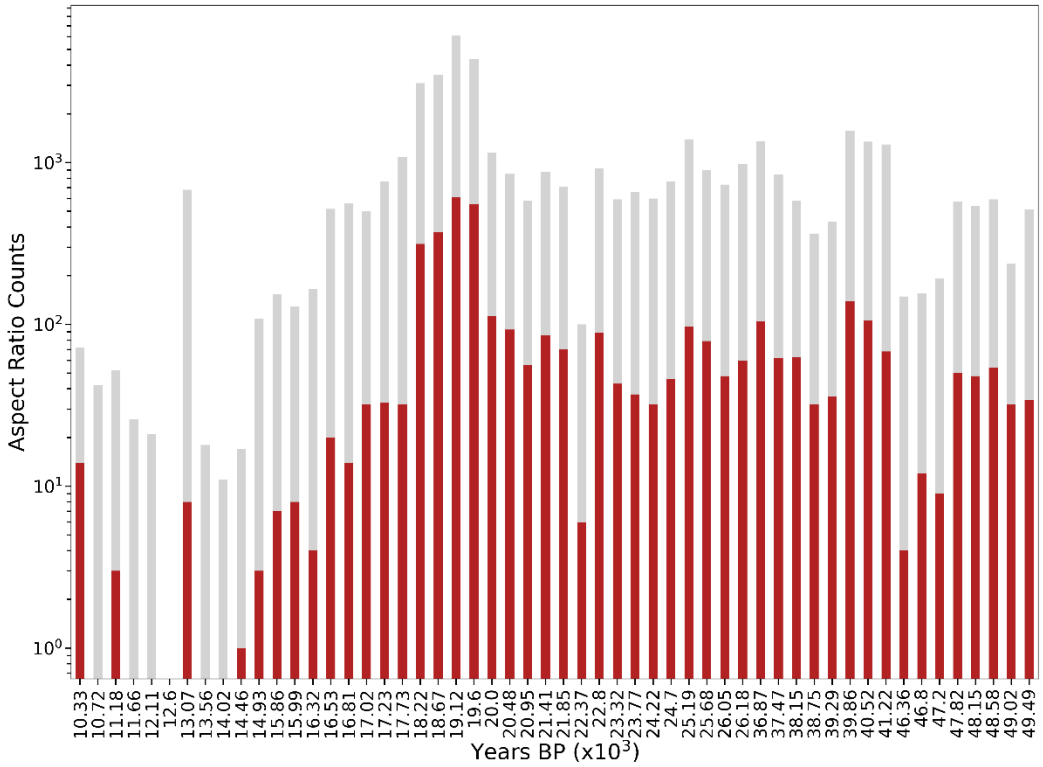


Figure S2. Particle counts per sample measured via DPI FlowCAM. Between 15 – 10 ka, there were low and inconsistent coarse particle counts in the DPI samples. Red colors are coarse (5.1 – 6.4 µm) particle counts and grey bars are total particle counts.

Figure S3. Subset of particle images captured from ~17.2 ka using FlowCAM.

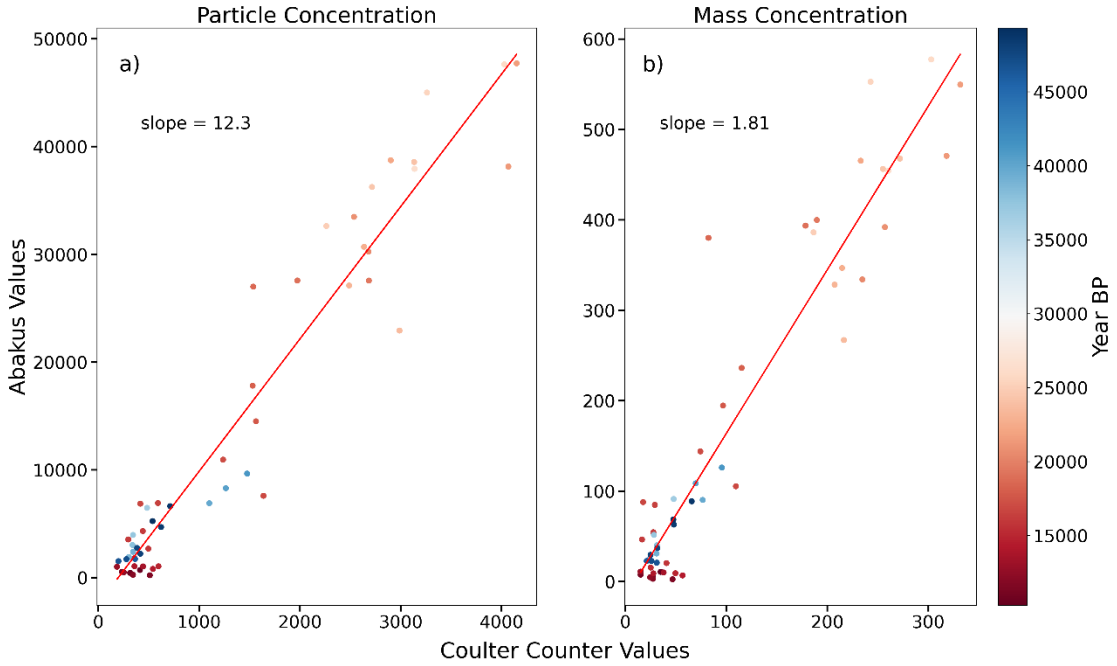


Figure S4. Scatterplots showing Abakus and Coulter Counter particle data from 54 periods analyzed: S4a) number concentration (r-value = 0.96, p-value < 0.01) and S4b) mass concentrations (r-value = 0.95, p-value < 0.01).

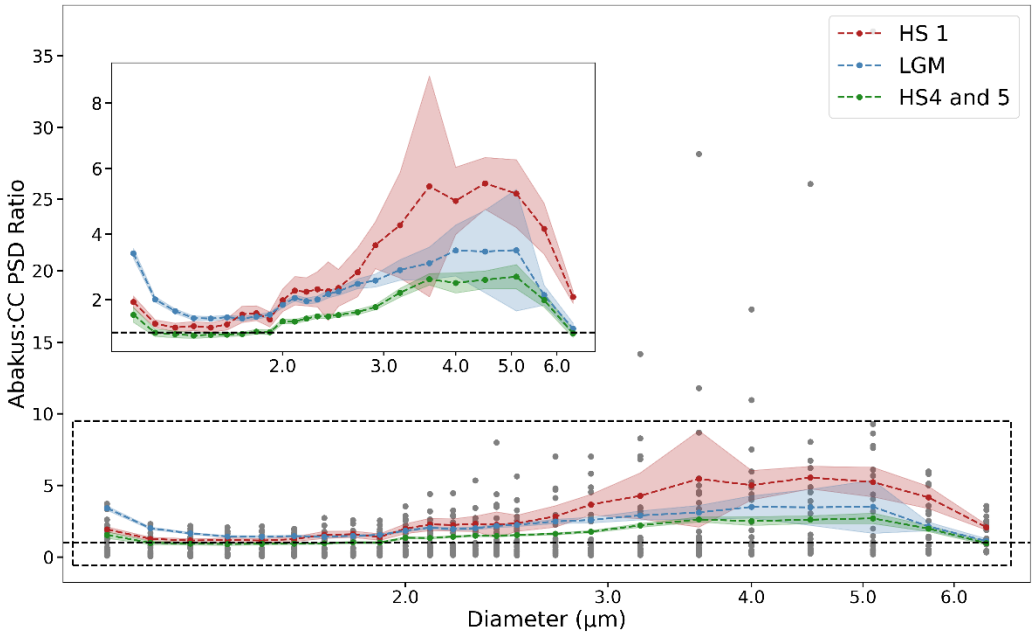
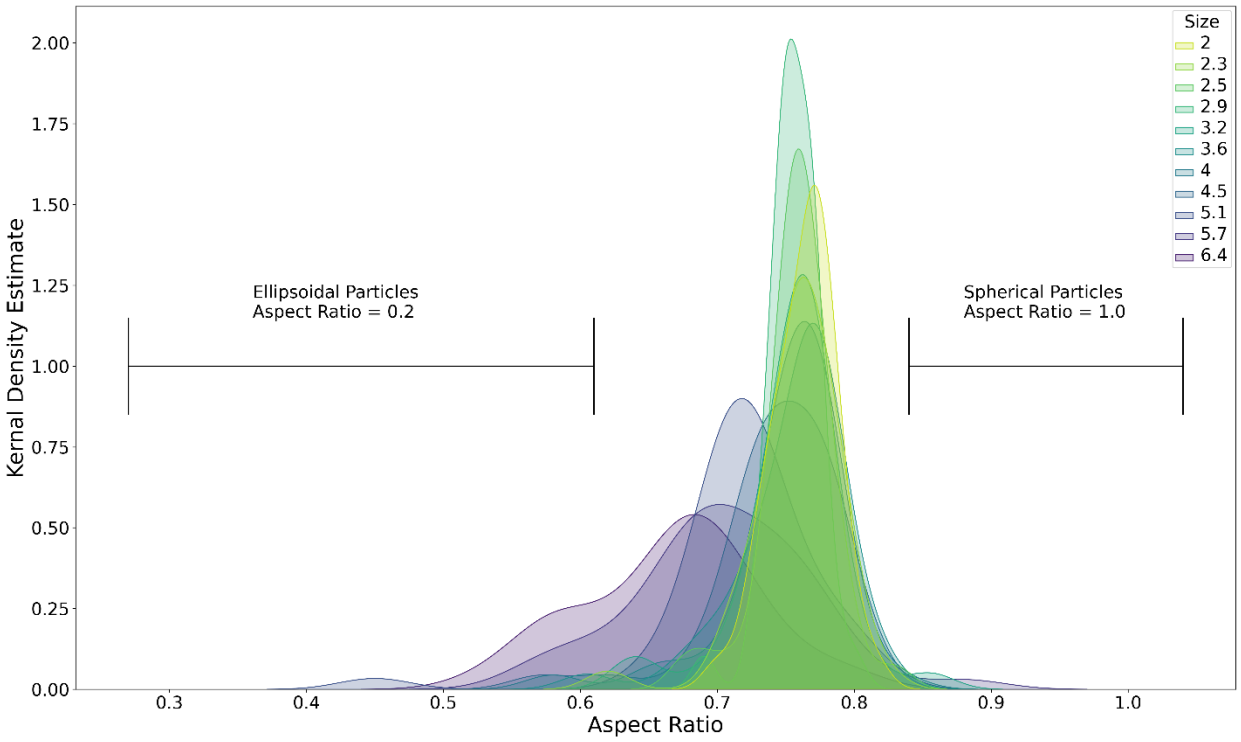


Figure S5. Particle size distribution ratios from the Abakus and Coulter Counter samples during HS 1 (18 – 16 ka; red), LGM (27 – 18 ka; blue), and HS 4 and 5 (42 – 36 ka; 50 – 46 ka; green). Colored regions represent one standard error of the mean for each time period. Inset is outlined by dashed box and highlights averaged ratio variability across bin sizes.



55 **Figure S6. Abakus bin size-averaged and interpolated aspect ratio measurements determined using a FlowCAM.**

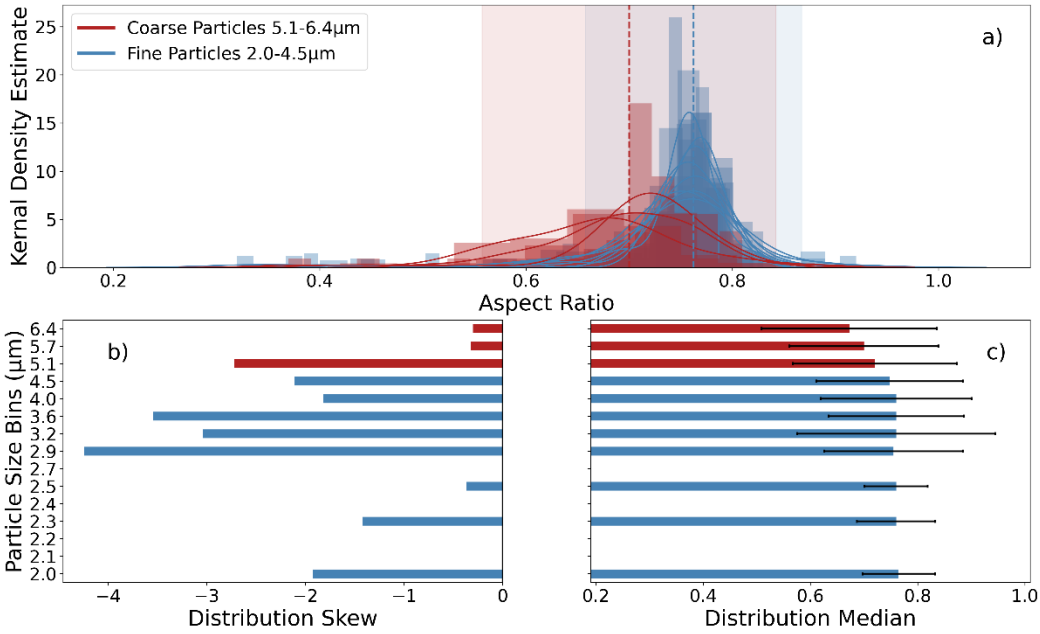


Figure S7a - c. S7a) Fine and coarse particle aspect ratio distributions with distribution skew and size bin median value with 2σ S.D. Regardless of particle size-bin, particle distribution statistics are leptokurtic and are skewed towards more elongated particles. Dotted lines and shading represent respective median values and standard deviation (2σ).

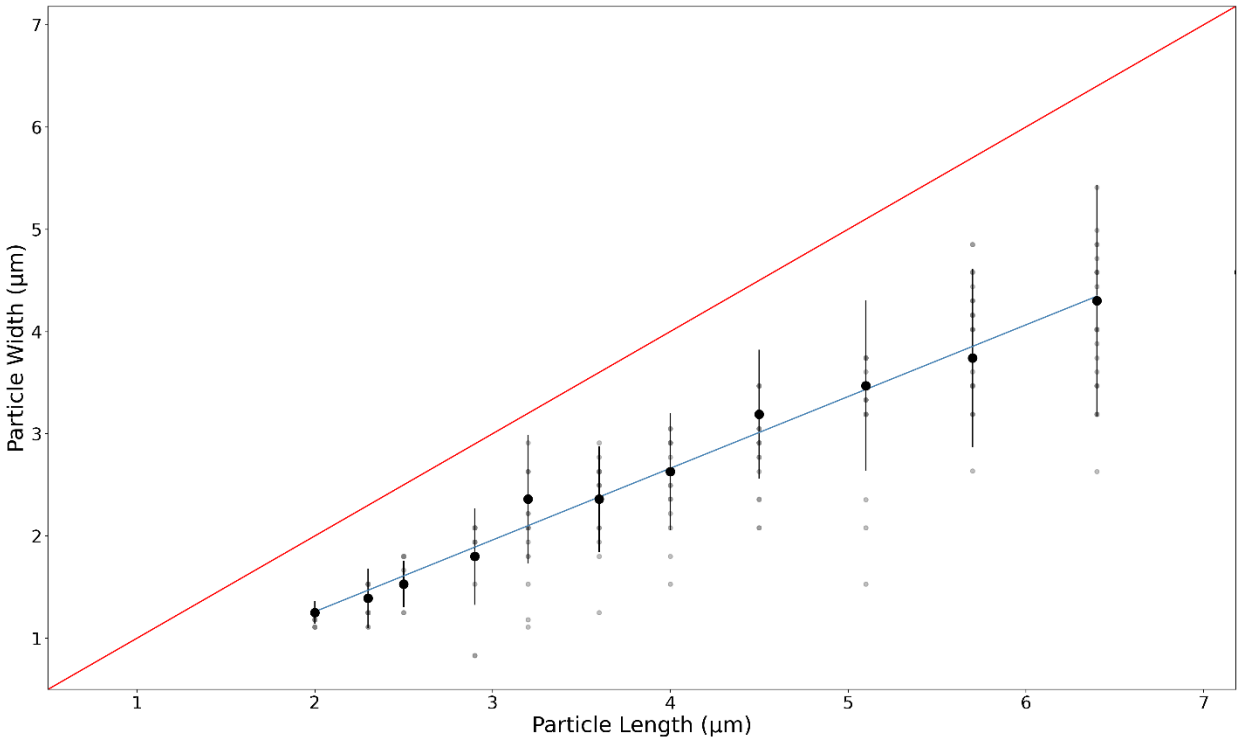


Figure S8: Averaged particle width measurements (µm; 2σ) by particle size information. Width measurements are not equal to length measurements (1:1 red line). The slope of the lines of best fit (blue) is 0.70, highlighting the incorrect assumption of non-equal particle dimensions.

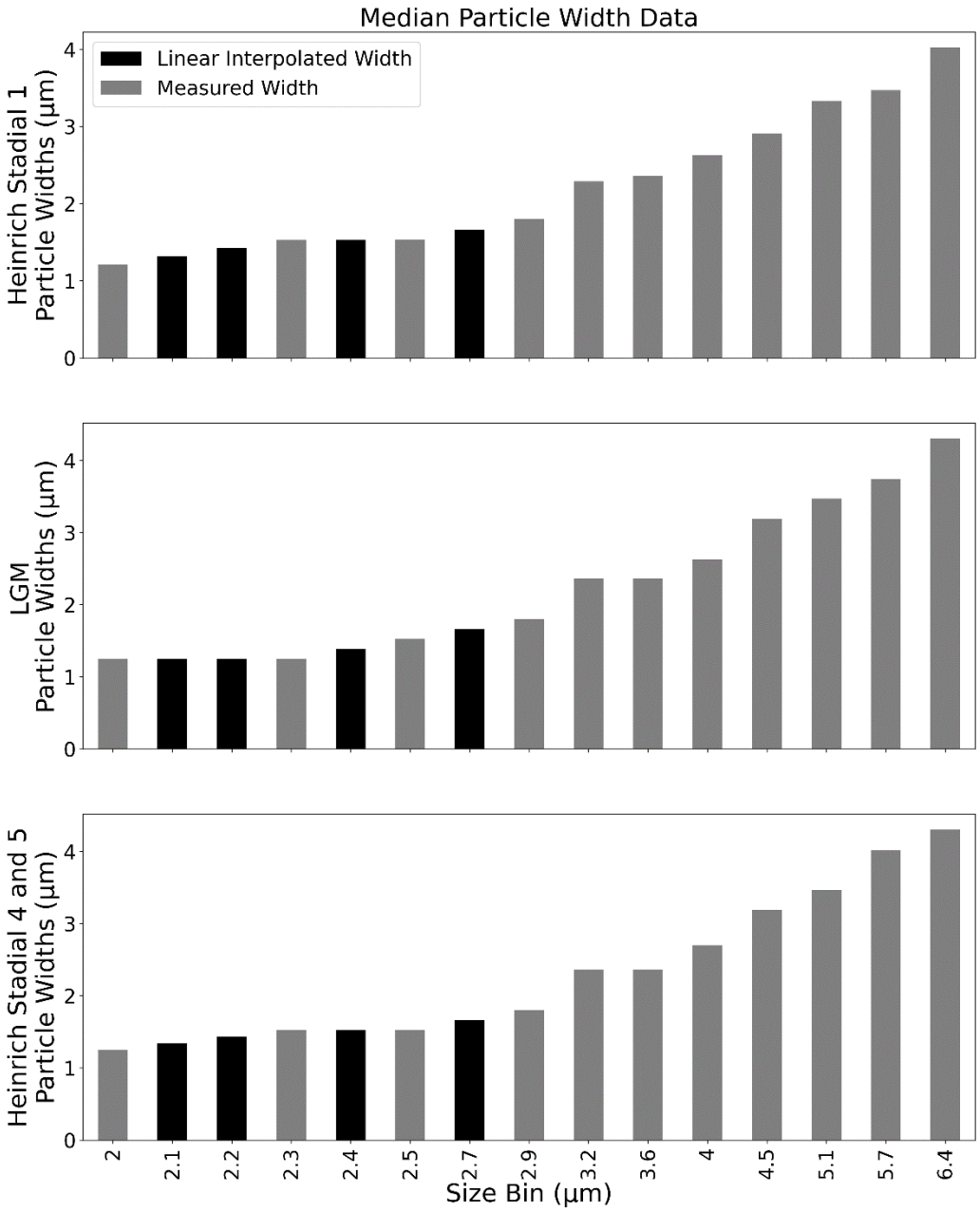

Median Particle Width Data
Linear Interpolated Width
Measured Width
Heinrich Stadial 1
Particle Widths (µm)
LGM
Particle Widths (µm)
Heinrich Stadial 4 and 5
Particle Widths (µm)
0
1
2
3
4
2
2.1
2.2
2.3
2.4
2.5
2.7
2.9
3.2
3.6
4
4.5
5.1
5.7
6.4
Size Bin (µm)

Figure S9: Differences in particle width measurements by Abakus bin size. Measurements in black have been derived from linear interpolation. Particle width measurements between neighboring bins are within the standard deviation of each other. Therefore, we calculate missing bin sizes using linear interpolation.

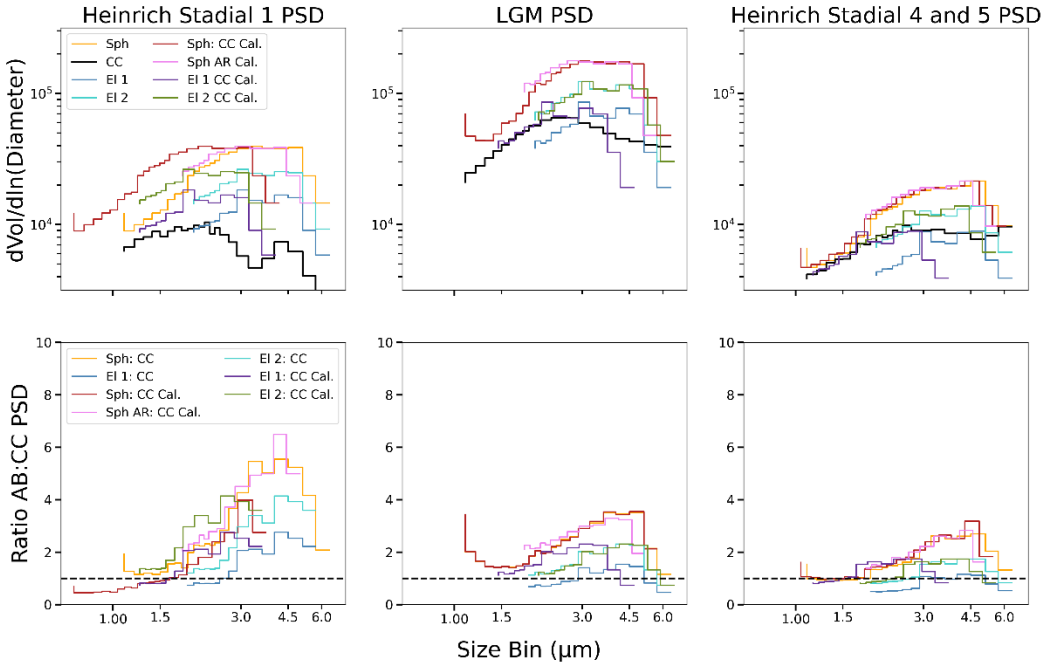


Figure S10: Comparison of Abakus volume and calibration schemes (Equations 1-3) and PSD_{CC}. Sph = AB sphere calculation, CC = CC calculation, El 1 = Ellipsoid 1 PSD calculation, El 2 = Ellipsoid 2 PSD calculation, Sph: CC Cal. = AB Spherical: CC calibration, Sph AR Cal. = Aspect Ratio calibration, El 1: CC Cal = Ellipsoid 1: CC calibration, El 2: CC Cal = Ellipsoid 2: CC calibration. The top panel compares the PSD_{Abakus} volume and calibration techniques to PSD_{CC} and the bottom panel is the ratio of each PSD_{Abakus} to the PSD_{CC} in different time periods. The dotted line represents a 1:1 value. There are clear temporal differences between each method used. Ellipsoid 1 and Ellipsoid 2 reduce the offset between spherical calculation and CC during the LGM and Heinrich Stadial 4 and 5.

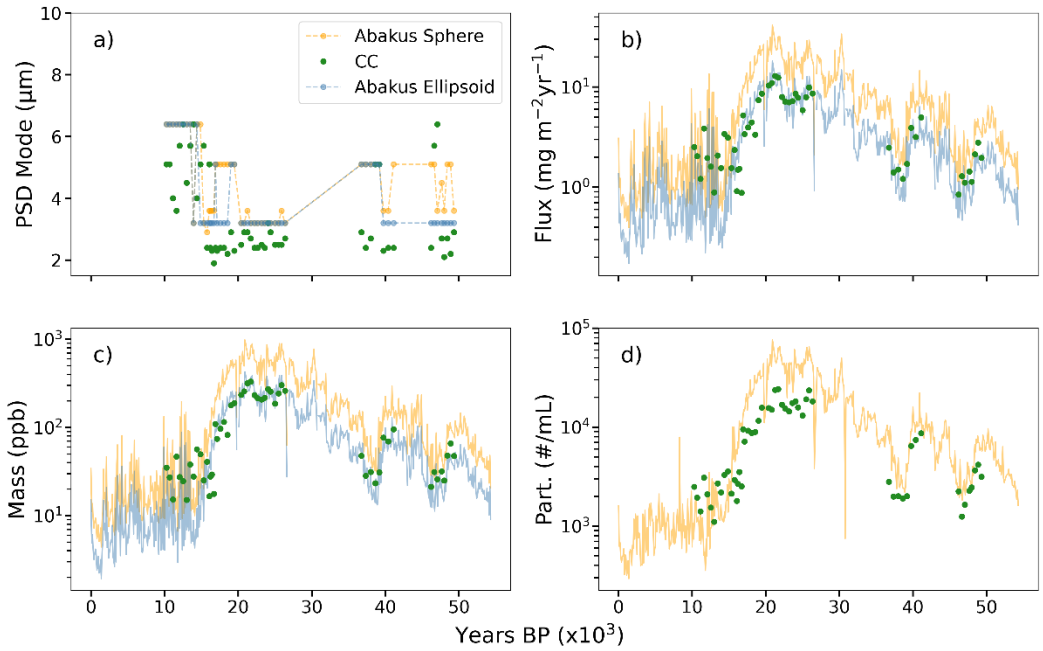


Figure S11a – d: 100-year resampled mean (11a – d) particle metrics. The resampled median values (Figure 5a – d) spanning 16 – 10 ka show discrepancy between the CC and Abakus samples, which the resampled mean values (11a – d) show a close correspondence between the two methodologies. We interpret the increased variability in the resampled mean values as an effect of Estisol-140. Because the natural concentration increases prior to 16 ka (i.e., during the LGM), we believe that any Estisol-140 contamination is mitigated by the naturally high dust concentration.