

On Observations of Maximum Hailstone Size

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Maximum Hailstone Size

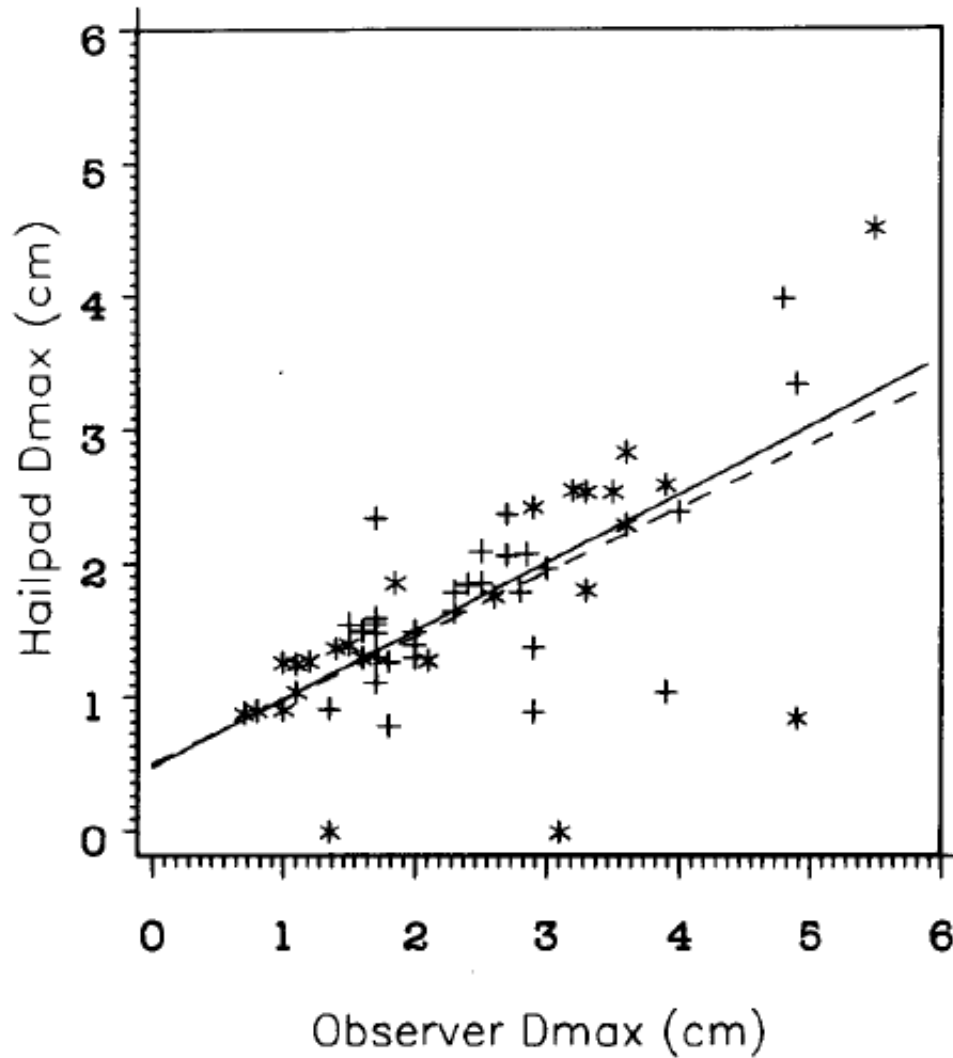
- Variable used in evaluating hail suppression experiments
- NEXRAD product (MESH)
- Forecast variable

Fundamental Problem

D_{\max} is not an observable quantity.

The observed value depends upon the sample size.

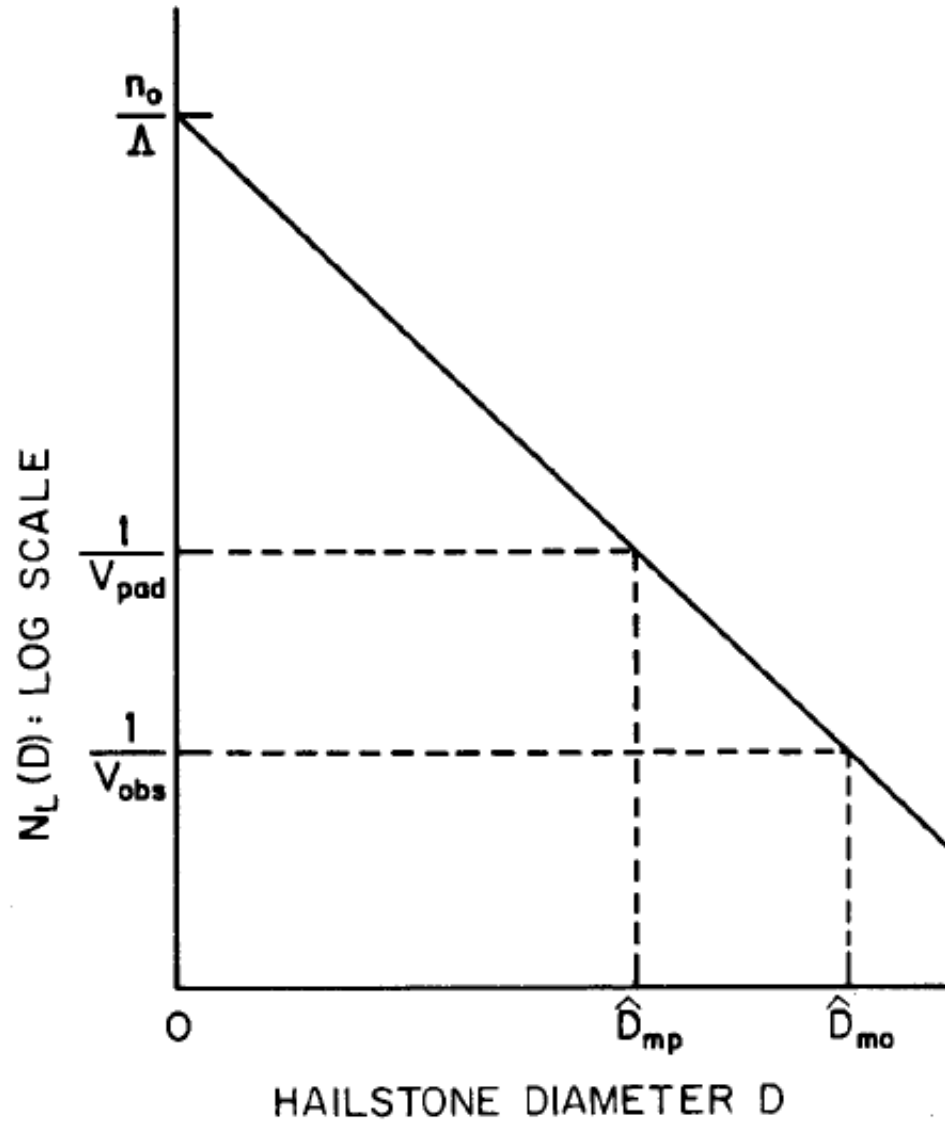
From Grossversuch IV



Gedanken Experiment

- Consider two hailpads side by side
- Now add a third hailpad
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Heuristic Explanation

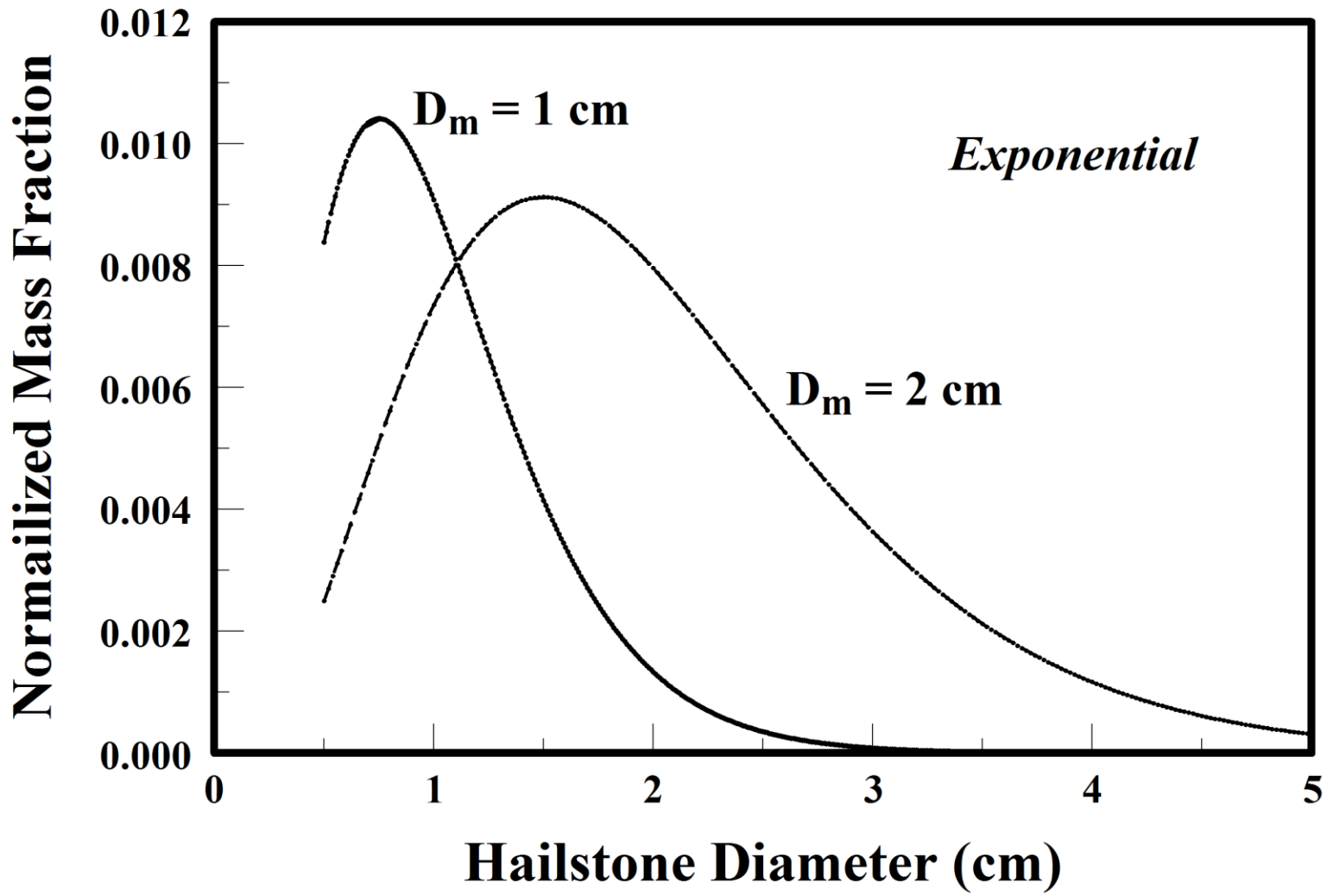


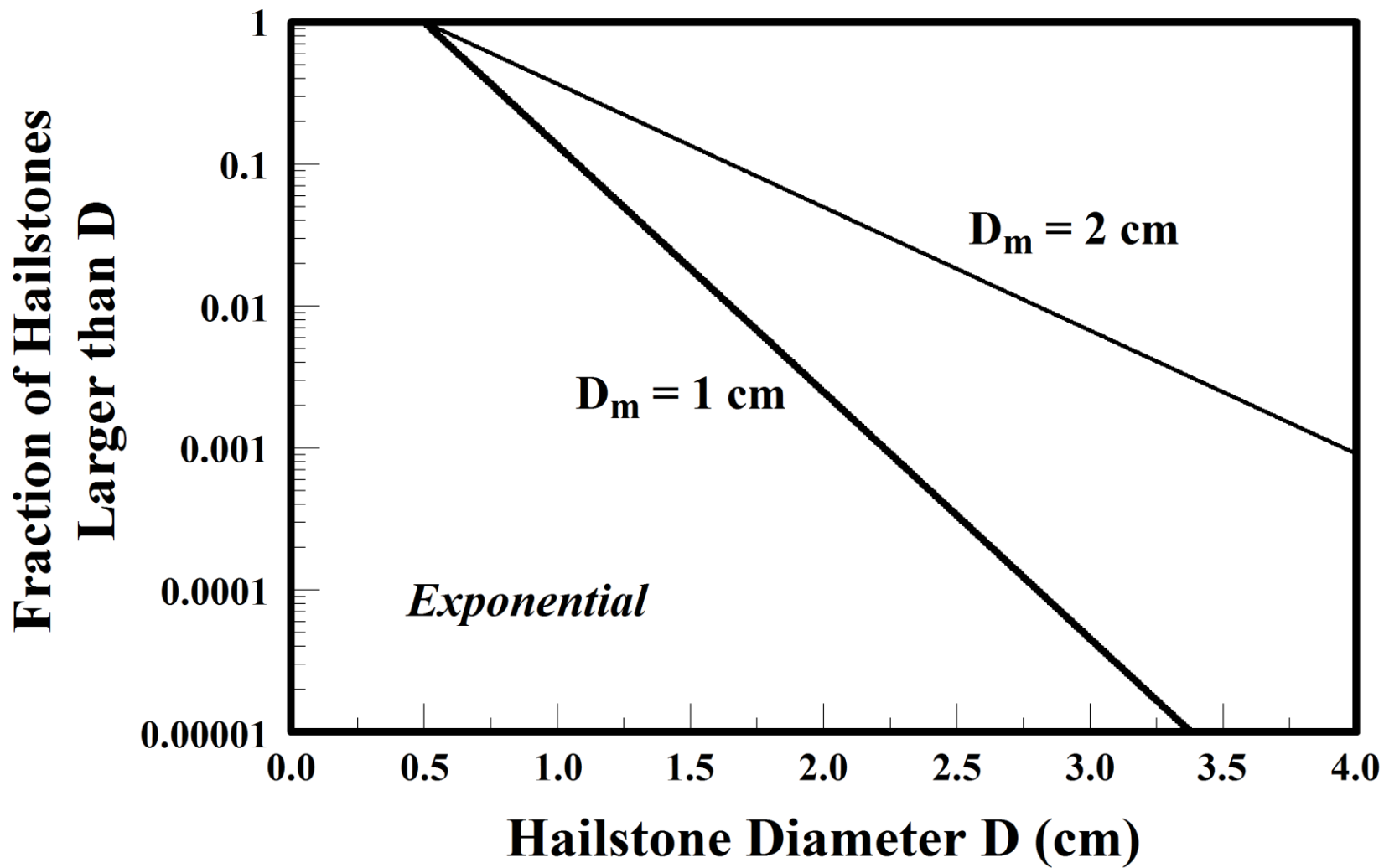
Exponential PSD

$$n(D) = n_0 \exp(-\Lambda D)$$

$$n_0 = \Lambda N_T; \Lambda = 4 / D_m$$

$$n(D) = (4N_T / D_m) \exp(-4D / D_m)$$





Normalized Size Variable

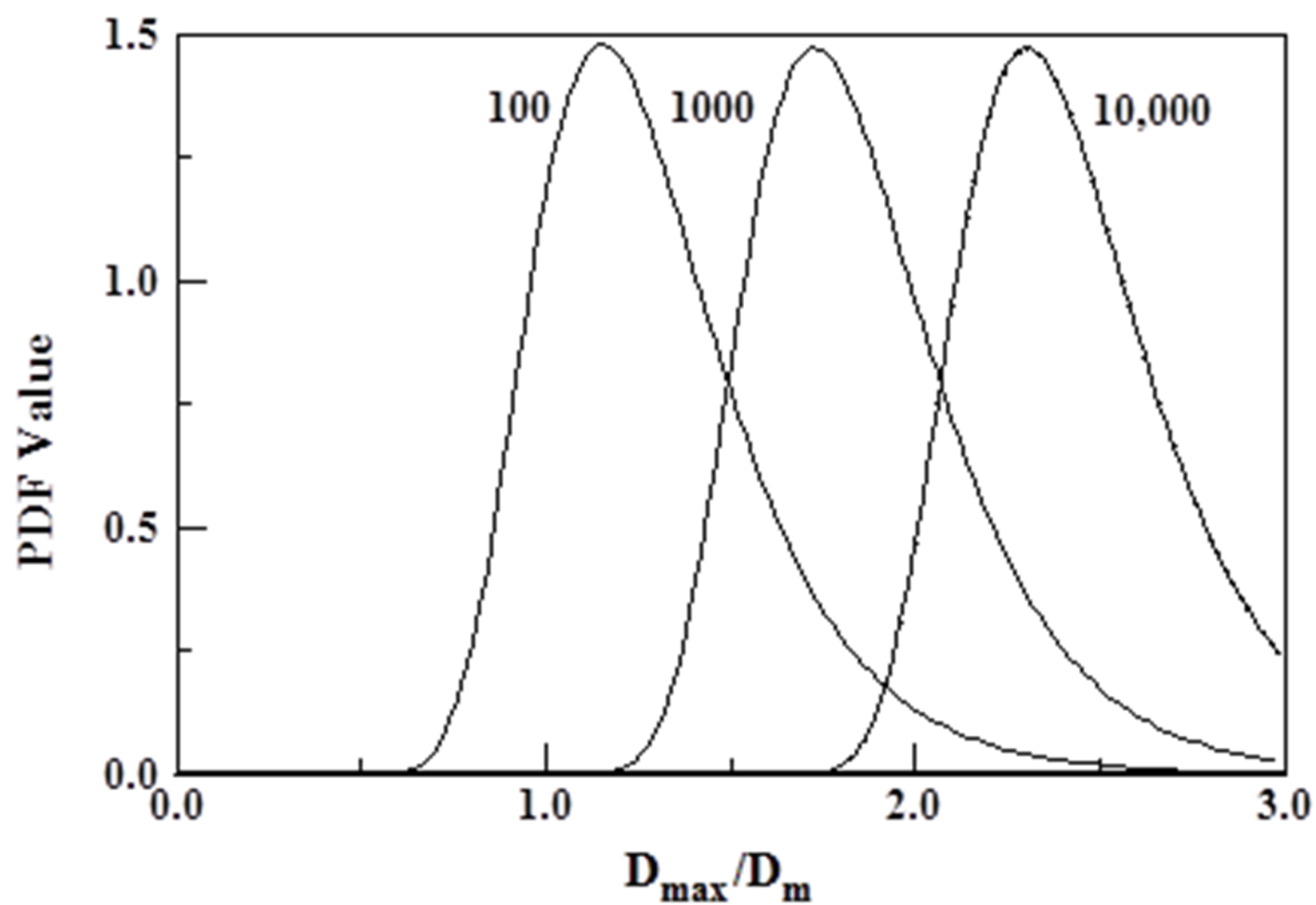
$$x = D / D_m$$

$$n(x) = N_T * 4 \exp(-4x)$$

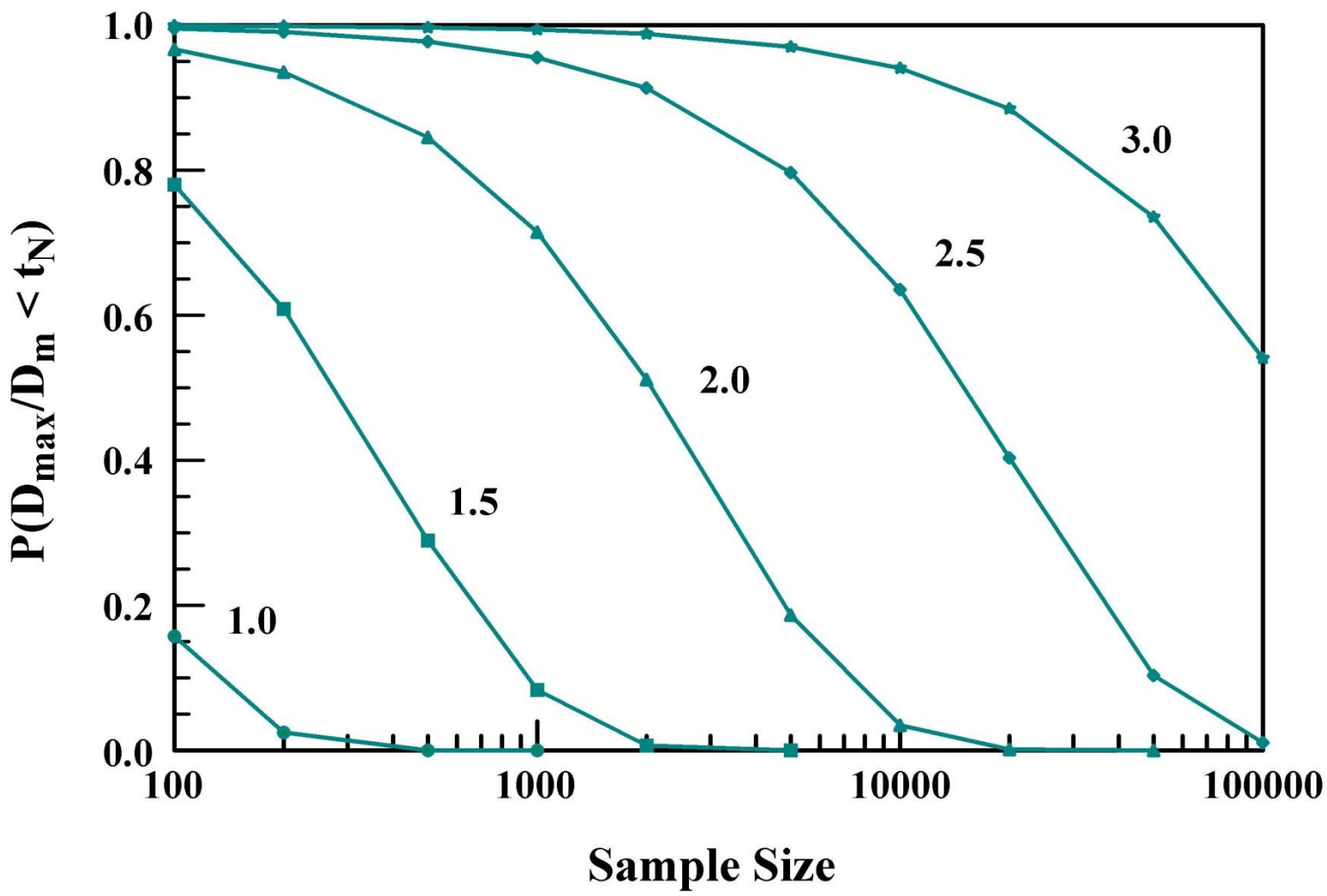
PDF of D_{\max}

$$p\left(\frac{D_{\max}}{D_m}\right) = 4 * SS * \exp\left(-4 \frac{D_{\max}}{D_m}\right) * \left\{1 - \exp\left(-4 \frac{D_{\max}}{D_m}\right)\right\}^{SS-1}$$

PDF of D_{\max} : Exponential DSD



$P(D_{\max}/D_m < t_N)$: Exponential DSD



Summary

- Maximum hailstone size is a random variable
- The observed value of which depends upon the sample size.