

Applying local drop size distributions to estimate rainfall from commercial microwave links in the tropics

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MOTIVATION

- Commercial Microwave Links (CMLs) can be used to estimate rainfall based on signal attenuation
- Rainfall rate (R) and specific attenuation (k) can be related to each other through a power law with regression coefficients a and b :

$$R = 6 \times 10^{-4} \pi \int_0^{\infty} v(D) D^3 N(D) dD$$
$$k = \frac{10^{-2}}{\ln(10)} \int_0^{\infty} Q_{ext}(D) N(D) dD$$

$\left. \begin{array}{l} R = 6 \times 10^{-4} \pi \int_0^{\infty} v(D) D^3 N(D) dD \\ k = \frac{10^{-2}}{\ln(10)} \int_0^{\infty} Q_{ext}(D) N(D) dD \end{array} \right\} R = ak^b$

- Commonly a globally fixed parameter set of a and b values is used, recommended by the International Telecommunication Union (ITU).
- Alternatively, regression coefficients derived from drop size distributions $N(D)$ can be used.
- Here we compare regression coefficients of Rwandan DSDs with DSDs from the Netherlands and ITU coefficients. **(How much) can this improve CML rainfall estimates?**

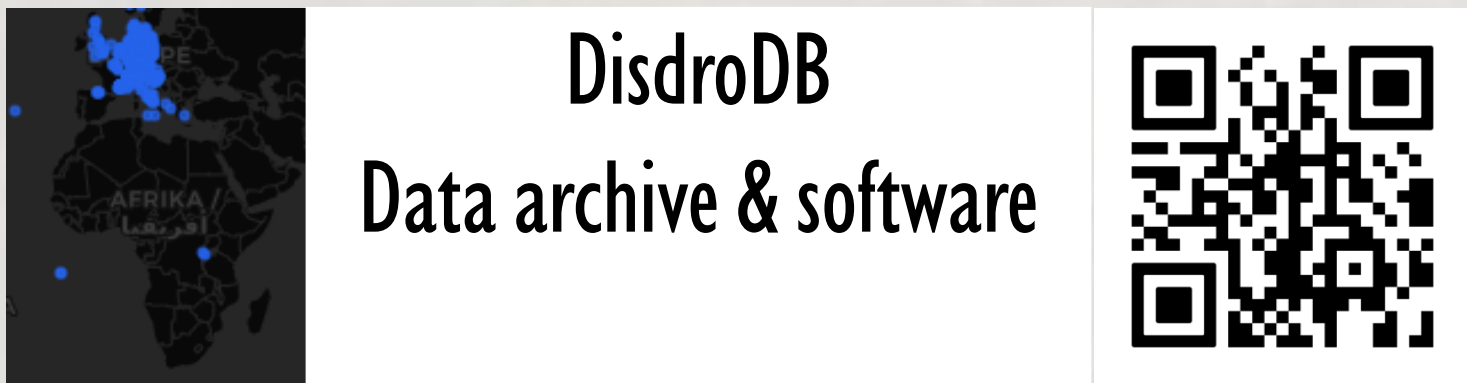
DATA COLLECTION

- Two Thies disdrometers were installed at Meteo Rwanda monitoring stations **Gitega** and **Busogo**
- Collection period: **1 Sept. 2025 – ongoing**
- Data collection software DisdroDL: 1 minute DSDs saved daily to NetCDF file.

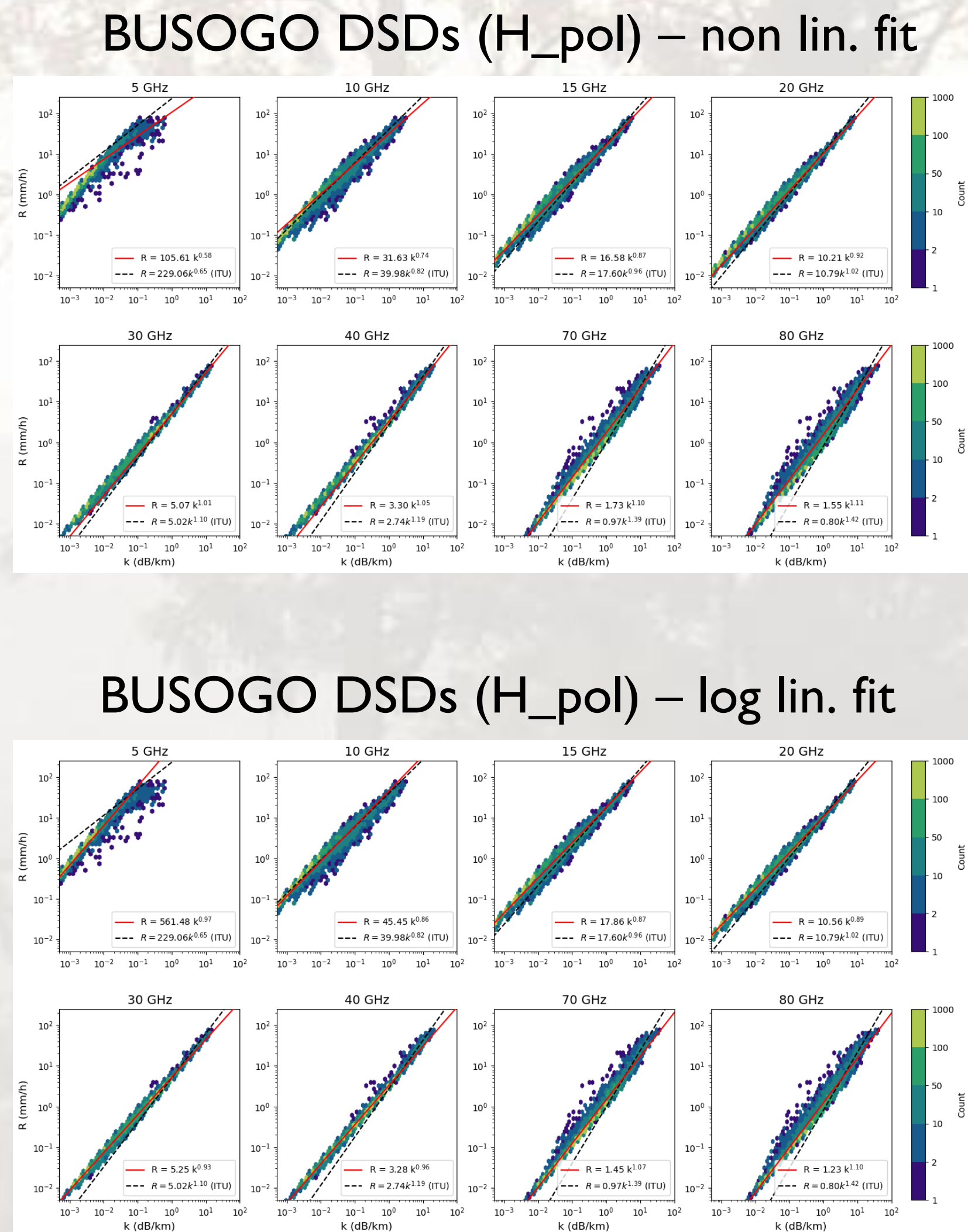
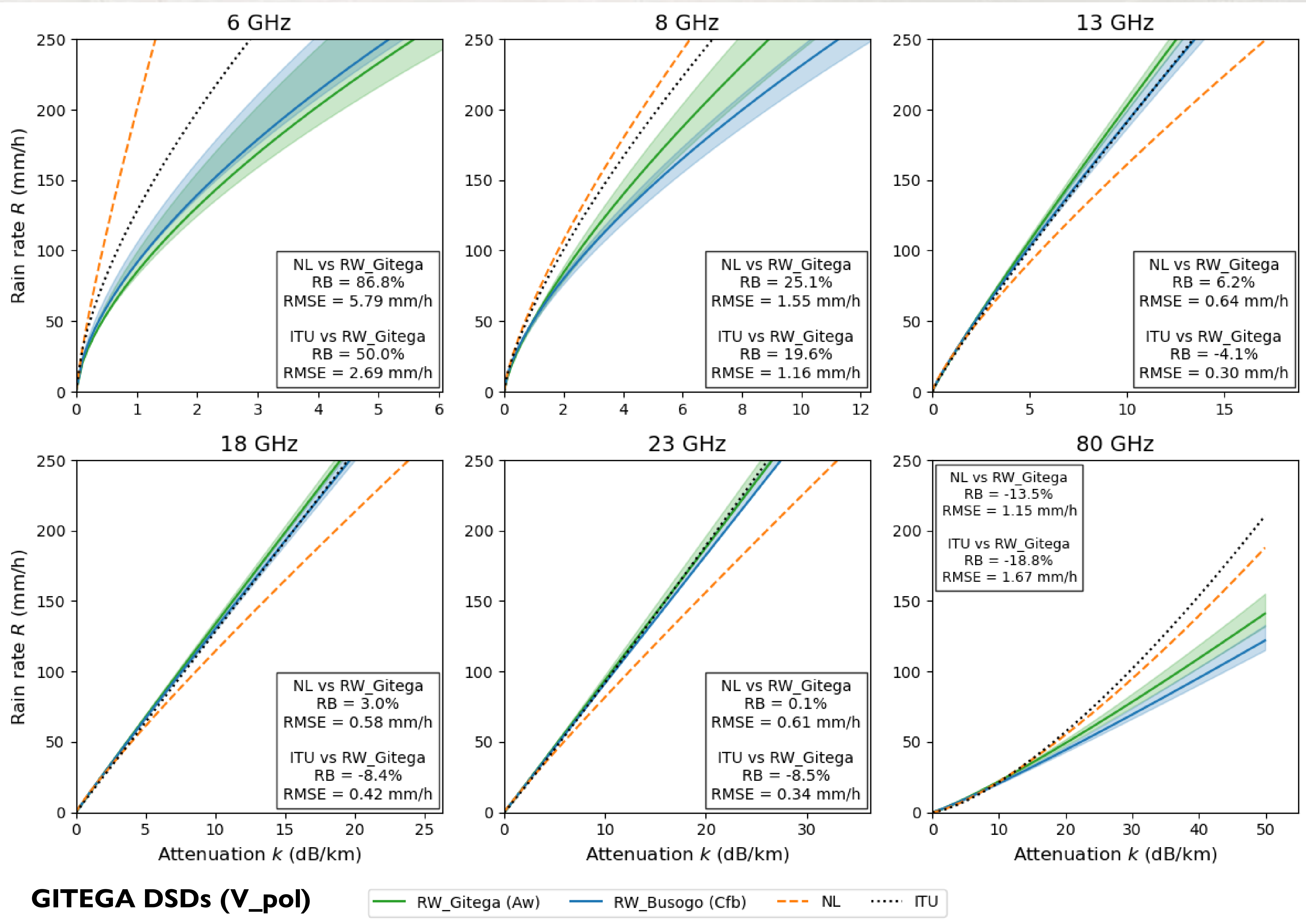


DATA PROCESSING

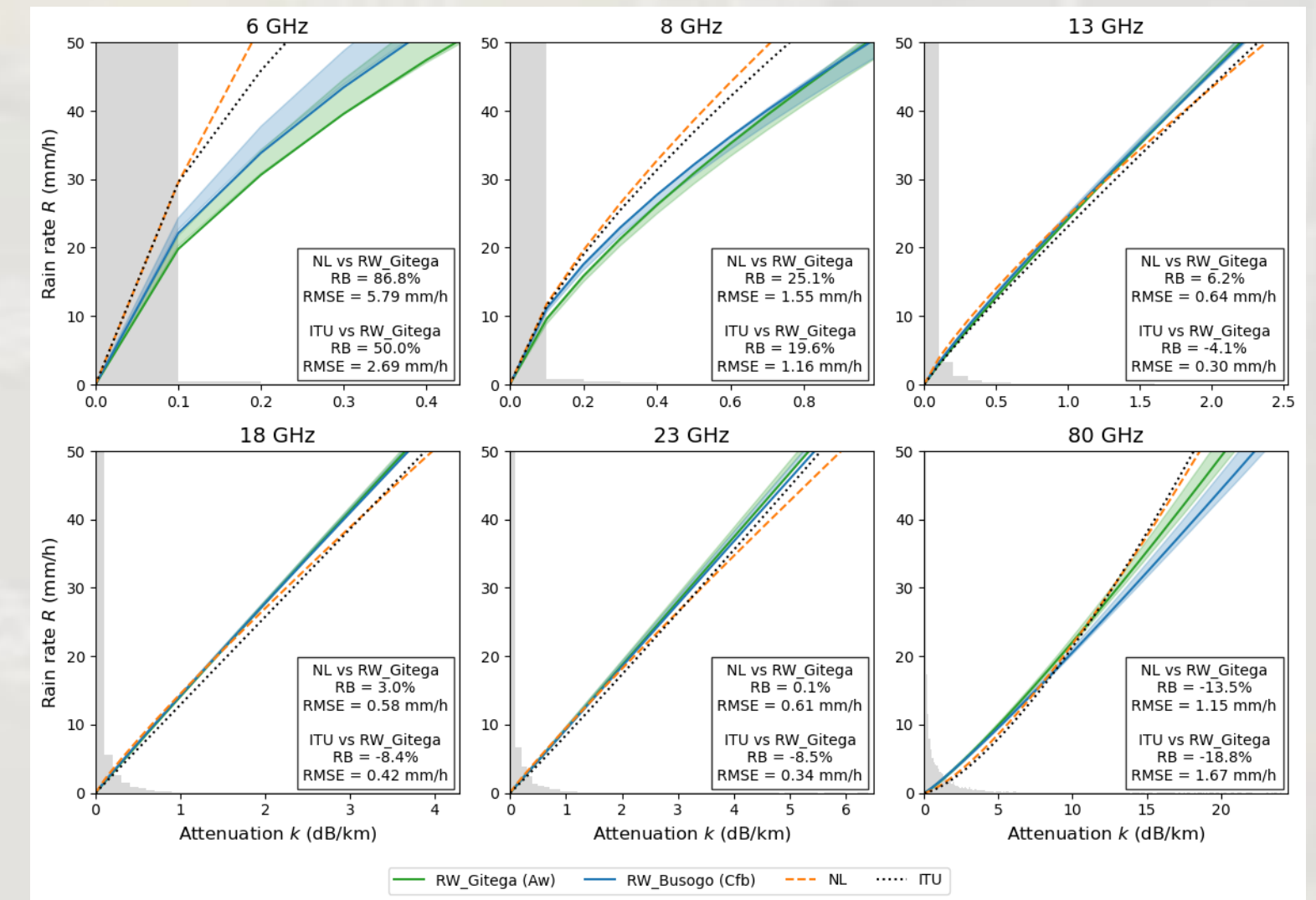
- Data processing from raw disdrometer data to attenuation quantities using **DisdroDB** software
 - Cleaning and standardization of raw data
 - Derivation of polarimetric (radar) variables through T-matrix simulations
- Non-linear least squares fit through drop size spectra to derive R - k power law relation



Local drop size distributions 
are necessary to improve rainfall estimation
with **sub-10 GHz CMLs** 
in the **tropics**.



Metrics are dominated by small values of k , based on positively skewed distribution of k -values in the background,



Frequency dependence of regression coefficients a and b

