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## Statistical Methods - Motivation

- At higher frequencies (Ka/W-band), heavy attenuation can cause loss of signal and negatively bias estimates of total rainfall
- Statistical methods potentially provide the capability to estimate the mean space-time rainfall or rain rate distribution even when we are unable to sample the full Rain Rate distribution

## Statistical Methods - Objectives

- Assess fractional-area and distribution methods applied to the Ku- and Ka-band DPR data
- Compare with the sample mean Rain Rate at Ku-band where each FOV is corrected for attenuation

## Filtering Attenuated Data

To test the methods, we assume that we cannot accurately correct for attenuation; instead we filter the data that are most affected by it

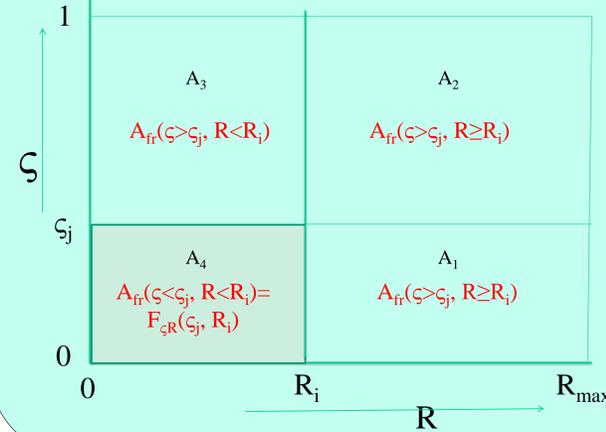
One such filtering function is the quantity  $\zeta$  from the Hirschfeld-Bordan equation, where

$$Z_{HB}(r) = Z_m(r) / [1 - \zeta(r)]^{1/\beta}$$

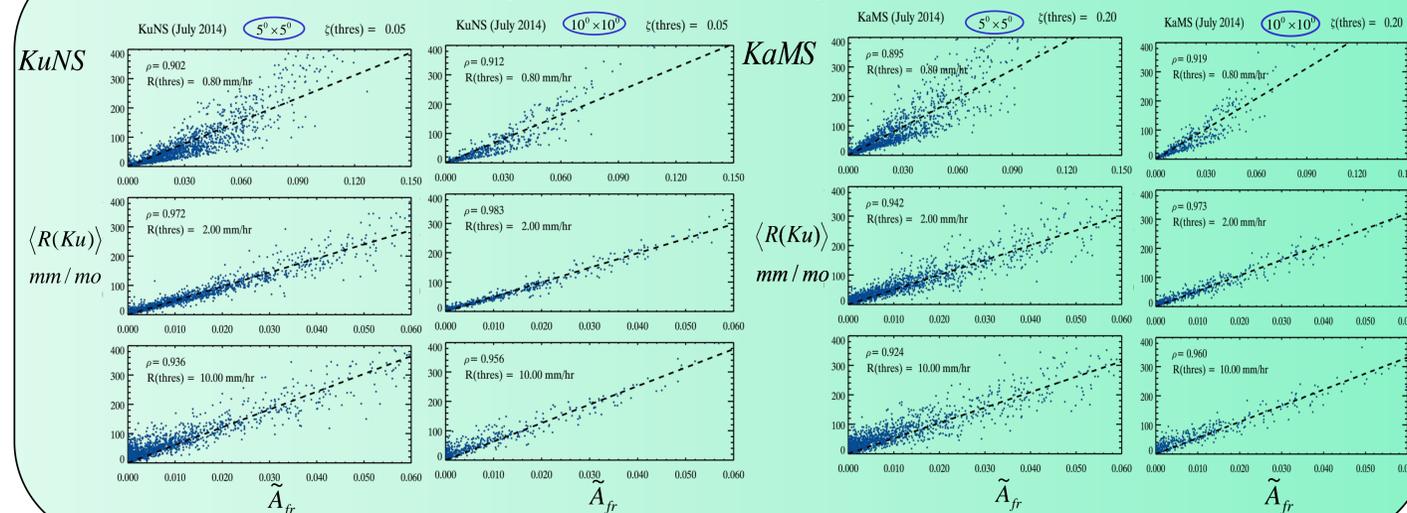
$$\zeta(r) = 0.2 \ln(10) \beta \int_0^r \alpha(s) Z_m^\beta ds$$

$$k = \alpha Z^\beta; P(r) = C |K|^2 Z_m(r) / r^2$$

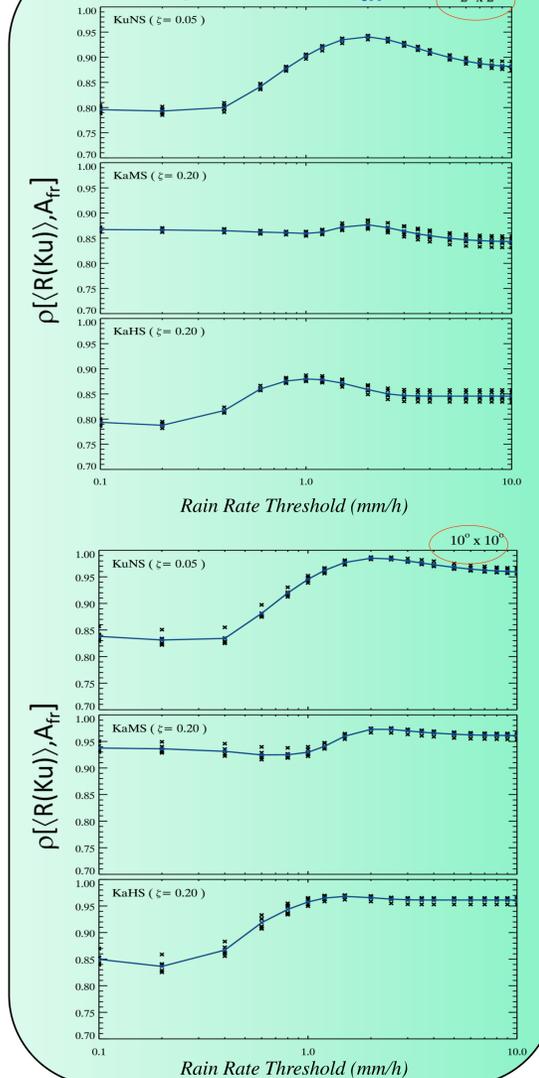
## Modified Fractional Area above a Rain Rate Threshold



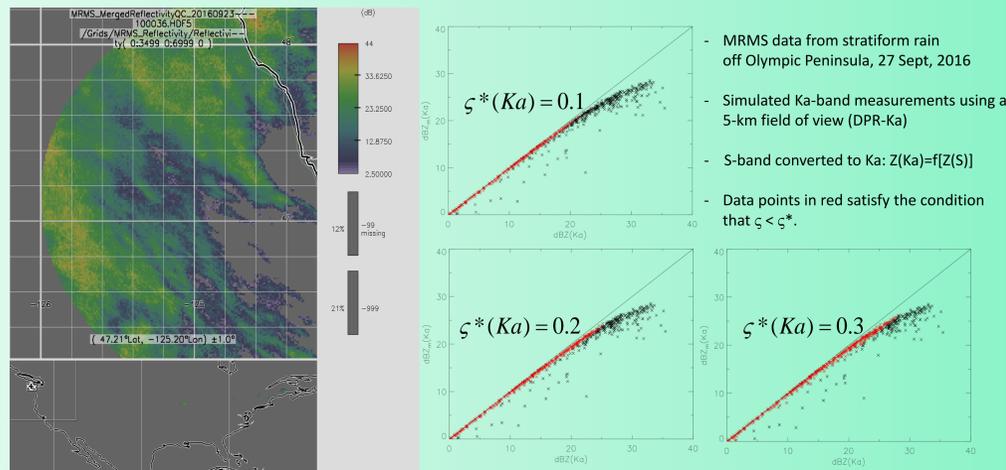
## Scatter Plots of Sample-Mean Monthly Rainfall vs 'Fractional Area'



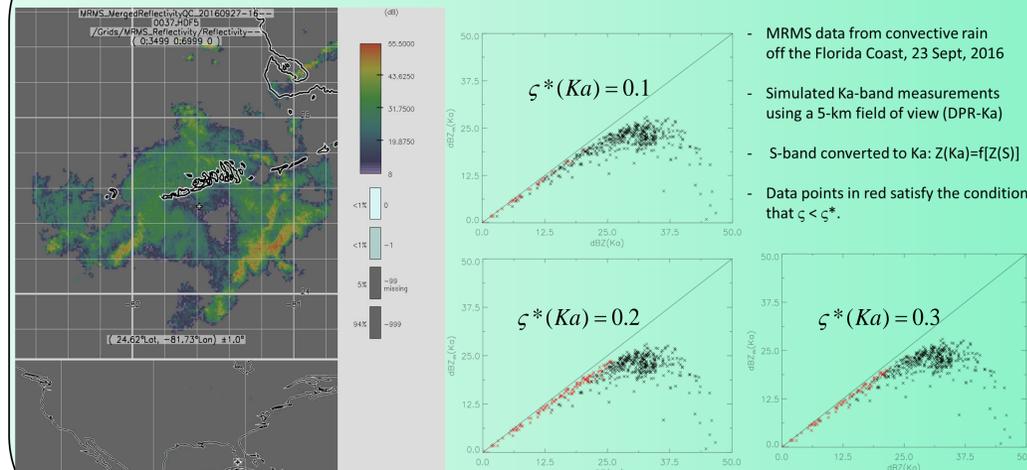
## $\rho$ versus $R_{th}$



## Stratiform Rain Rate Example of Filtering



## Convective Rain Rate Example of Filtering



## Statistical Methods – Summary

- Signal loss for higher frequency radars produces negatively biased rainfall estimates
- Statistical methods can mitigate the problem
- However, good retrieval accuracy requires fairly large space-time regions
- Space-time requirements probably can be made less demanding if attenuation-correction is applied at each FOV, when the signal exists, before application of these methods