Tropical cloud properties as a function of regime

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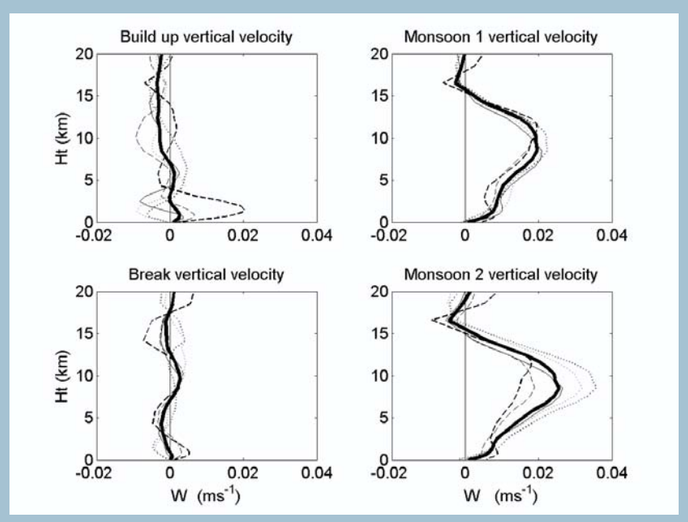
Regimes?

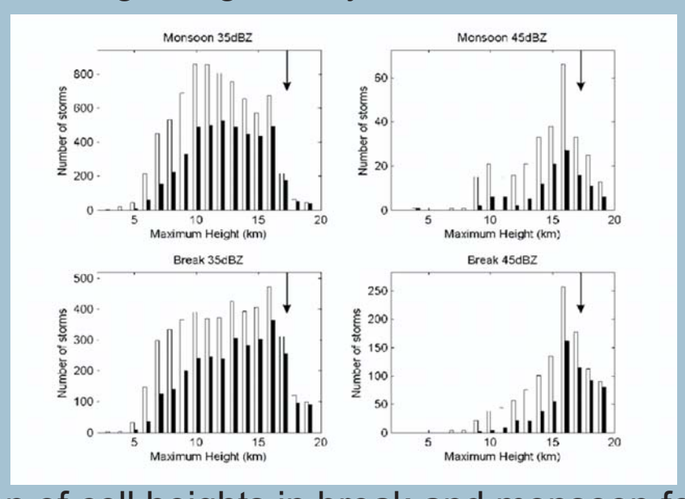
- We can define cloud regime in many ways, e.g. By sounding profiles, MJO phase, monsoon and break etc.
- How do does atmospheric conditions and resulting cloud properties vary?
- Here we look at cloud properties in monsoon versus "break" conditions in Darwin
- Past work shows monsoon clouds are oceanic in character and break has continental characteristics

Monsoon versus Break

- Different synoptic vertical velocity profiles
  - Changes convective inhibition, corresponding convective intensity (e.g. May and Ballinger, 2007)



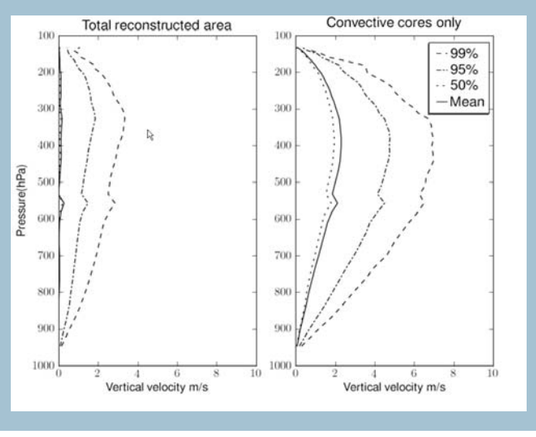
Results in different PDF's of maximum cell heights, convective vertical motion, lightning activity, etc



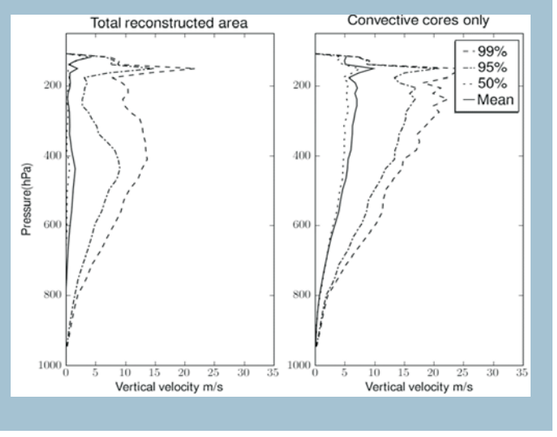
Distribution of cell heights in break and monsoon for "ordinary" 35 dBZ cells and the subset of intense cells (45 dB) after May and Ballinger 2007

Different PDF's of vertical motion (after Collis et al, this meeting)

Monsoon



Break



Resulting Cloud Properties

- Expect different regimes to have different cloud processes, e.g. warm rain processes are more important in the monsoon, different upper tropospheric detrainment profiles and upper tropospheric moisture.
- Examine rain DSD using polarimetric radar
- Examine ice cloud properties using MMCR and MPL

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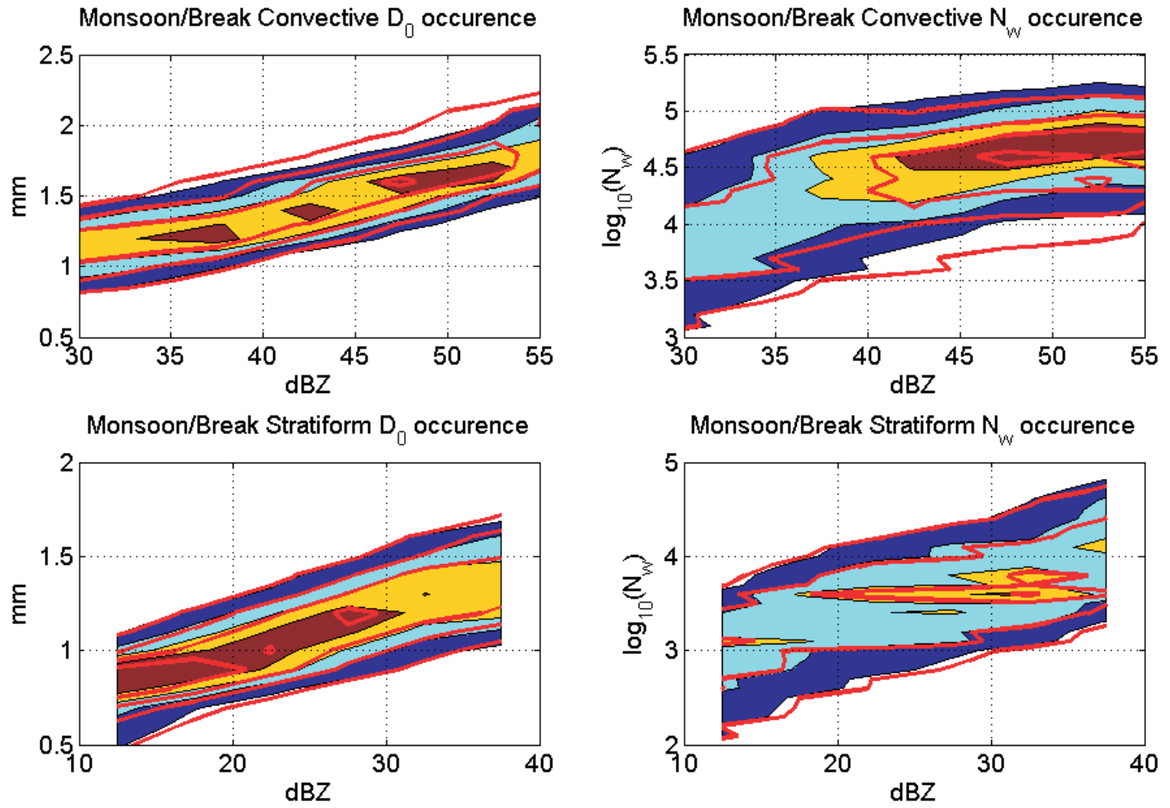
DSD variations

- Characterize rain DSD by median volume diameter (D_0) and intercept parameter (N_w) of a Gamma distribution
- In the convective part of clouds, break DSD's have consistently larger drops, lower N_w and a slightly broader distribution for a given reflectivity reflecting ice processes being more important for that regime.
- In stratiform (low vertical velocity) part of cloud, the physics is similar and have almost identical characteristics.



Conditional PDF's of D_0 and N_w as a function of reflectivity for monsoon (filled contours) and break periods (heavy solid contours)

Ice cloud properties

(no convective ice, 2006 - 2007)

break distribution is broader

Diurnal cycle

Monsoon clouds are more frequent, and on average thicker

Monsoon anvil clouds have a narrower distribution of microphysical properties compared to break anvils

Much more marked diurnal variation in anvil cloud occurrence during the break, consistent with diurnal variation of the parent convection.

Summary

We are documenting regime dependence of the large scale environment and the clear links to corresponding cloud properties.

There are clear implications for interpretation of remote sensing, validation of CRM's and GCM paramaterisations.