The Characteristics of RSDs before and after the Landing Typhoon Meranti

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Track of Meranti (2016)
LPA10 disdrometer

similar to the PARSIVEL disdrometer

64 drop sizes (0.1-30mm)
32 velocities (0.2-20m/s)
laser measurement area (63cm²)

Output data: raindrop size distribution (RSDs)
Quality-control

1. Remove:
   • Strong wind effects
   • Splashing
   • Margin fallers

Friedrich et al. (2013)
Quality-control

2. minimize instrument error (Battaglia et al, 2009)

\[
D = \begin{cases} 
D_d & (D_d \leq 1.00\text{mm}) \\
D_d \times (1.075 - 0.075D_d) & (1.00\text{mm} < D_d \leq 5.00\text{mm}) \\
0.7 \times D_d & (D_d > 5.0\text{mm}) 
\end{cases}
\]

where \( D \) is the equivalent sphere diameter and \( D_d \) is the diameter measured by disdrometer.
Characteristics of echo

- in the front side of outer rainband
• major rainband
residual cloud
Characteristics of RSDs
Gamma distribution:

\[ N(D) = N_0 D^\mu \exp(-\lambda D) \]

\( \mu \): shape  
\( \lambda \): slope  
\( N_0 \): Intercept, depend on \( \mu \)

Widely used in:  
cloud-model  
Dual polarization radar measure precipitation
Gamma distribution

\[ N(D) = N_0 D^\mu \exp(-\lambda D) \]

- **Weakness:** \( N_0 \) not independent

Normalized Gamma distribution (Bringi et al. (2003))

\[ N(D) = N_w \left( \frac{D}{D_m} \right)^\mu \exp\left[ -(4 + \lambda) \frac{D}{D_m} \right] \]

\( D_m \): mass mean diameter
\( N_w \) only depend on \( D_m \) and LWC

Normalized Gamma distribution described by \( \mu, N_w \) and \( D_m \)
Convection rain samples:

Oceanic convection:
- $D_m = 1.5 - 1.75 \text{ mm}$
- $\log_{10}(N_w) = 4 - 4.5$

Continental convection:
- $D_m = 2 - 2.75 \text{ mm}$
- $\log_{10}(N_w) = 3 - 3.5$

Stratiform rain samples:
- Approximate linear distribution

Oceanic convection:
- Tiny graupel or smaller rimed ice particles

Continental convection:
- Large dry snowflakes
In Meranti

- Stratiform (S1) → oceanic convective-stratiform mix clouds (S2) → oceanic convective (S3) → oceanic convective-stratiform mix clouds (S4-6) → stratiform (S7)
outcomes

From the front side of rainband to the central region then to the rear side or residual cloud of Typhoon Meranti:

• The top of radar echo and reflectivity both increased when the Meranti moving closely, and then decreased during its moving away.

• Meanwhile, the number concentration and spectrum width of RSDs also exhibited the same features as the top of radar echo and reflectivity.

• Moreover, the precipitations were produced by stratiform → oceanic convective-stratiform mix clouds → oceanic convective → oceanic convective-stratiform mix clouds → stratiform.
Thank you