X-Band Polarimetric Radar Measurements of Rainfall in KAMP

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Provide high resolution rain rate and DSD retrievals from combination of polarimetric and Doppler radar data.

Investigate radar/radiometer rain retrieval techniques and quantify their error characteristics through physical validation.
XPOL System Overview

- 9.3 GHz H/V transmission at 50 KW peak power;
- NCAR’s transmitter/receiver system;
- 0.9 deg beam width; variable pulse length (60-400 m); 110 km max range

Measurement noise

Zdr calibration
XPOL System Overview

TOGA and WSR cal. assessment from PR

XPOL cal. ass. from TOGA

TOGA vs. XPOW
Bias=0.05 dB; STD=5.8; Cor=0.75
XPOL Data & Rain Products

Raw data (~25 GB)
→
Filtered & compressed data (~2.5 GB) → Data archive & V.1 data reading code
→
Φdp unfolding and filtering: Ψdp → V.2 data reading code (March 02)
→
Zh/Zdr attenuation correction & microphysical retrievals for selected cases (09/19; 09/26-28) → Rain rate and DSD products archive
Parameterizations derived from DSD data:

\[ \frac{b}{a} = (1 + 0.05\beta) - \beta \cdot D \]

\[ A_h = \gamma(\beta) \cdot K_{dp} \]

\[ A_h = a \cdot N_w^{1-b} \cdot Z_h^b \]

\[ A_{dp} = c \cdot N_w^{1-d} \cdot K_{dp}^d \]

\[ D_0 = e \cdot \{Z_{DR} + A_{dp}\}^f \]

\[ R = g \cdot N_w^{1-h} \cdot Z_e^h \]
Example cases for Sept. 19th @18:50 UTC

Zh (dBZ)

1.0°

4.5°

8.5°

Zdr (dB)

1.0°

4.5°

8.5°
Example cases for Sept. 19th @ 18:50 UTC
Comparison with DSD data from other experiments
Assessment of rain rate estimates

Polarimetric Algorithm:

$Kdp < 0.5: \frac{R}{Ah} = f(Zdn)$ & $Kdp > 0.5: R = f(Kdp)$

Instantaneous radar rain rate (mm/h)

Standard ZR: $R = f(Zh)$

Instantaneous radar rain rate (mm/h)

Rain rate from 1-minute DSD data (mm/h)

Radar rain rate (mm/h)

Ray case A

Ray case B

Ray case C

Ray case D

Radar range (km)
Use the Sept. 19th XPOL rain rate and DSD products with coincident airborne observations to investigate combined radar/radiometer retrievals.

For other storm cases (e.g., Sept. 27-28) in KAMP use coincident XPOL and dual-Doppler TOGA/SMART-R observations to do combined microphysics-kinematics tropical ocean precipitation studies.