

# In situ validation of cloud radar-based retrievals of ice hydrometeor shapes

Oliktok Point AMF3 facility (October 2016)

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## AMF3 Scanning ARM Cloud Radar (SACR2) at Oliktok Point

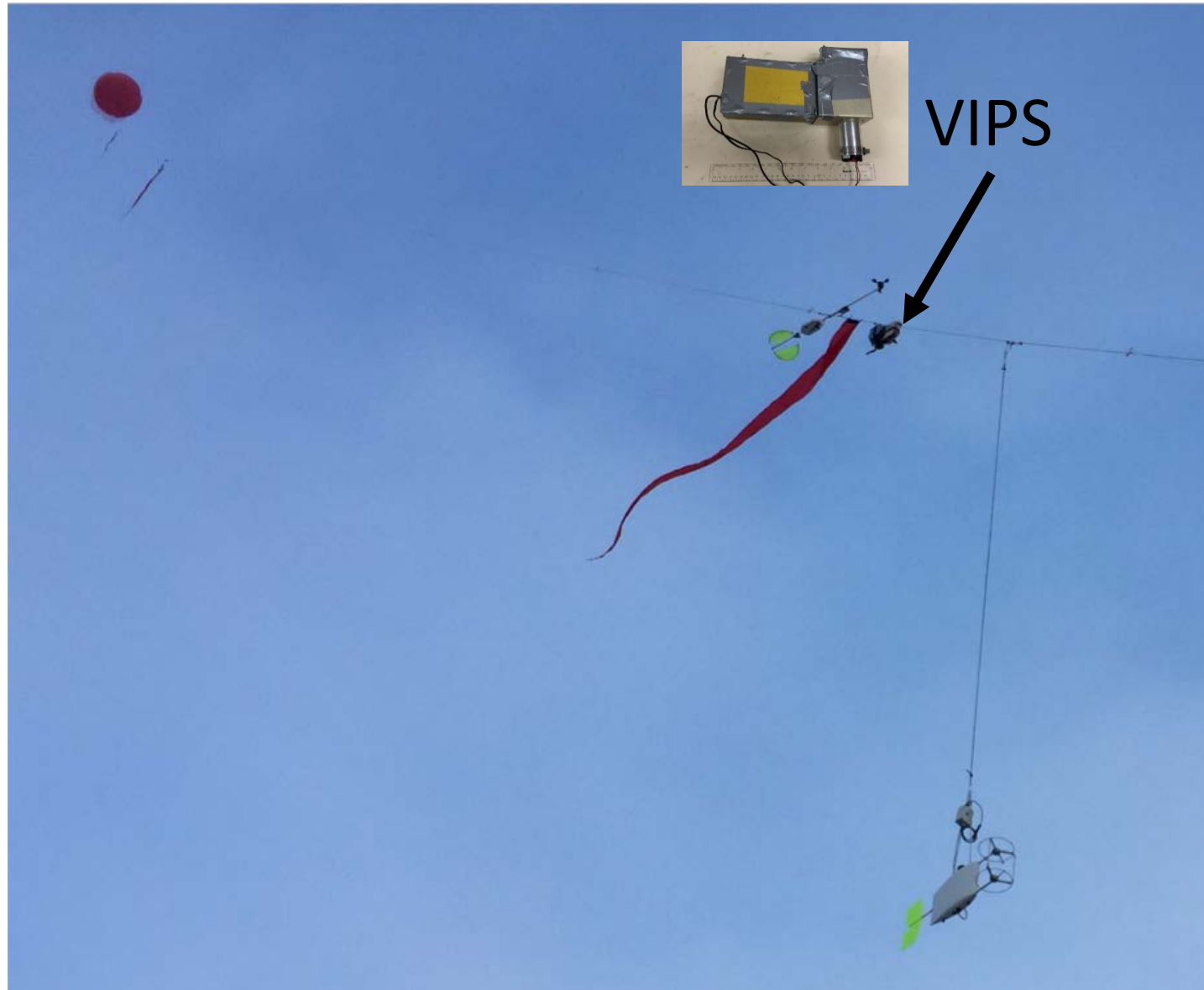
A fully polarimetric dual-frequency ( $K_a$  and W bands) SACR-2 was deployed at the AMF3 facility (Oliktok Point, AK)

SACR-2 measures:  $Z_e$ ,  $V_D$ , LDR,  $Z_{DR}$ ,  $\rho_{hv}$ , (CDR can be calculated from the measured variables)



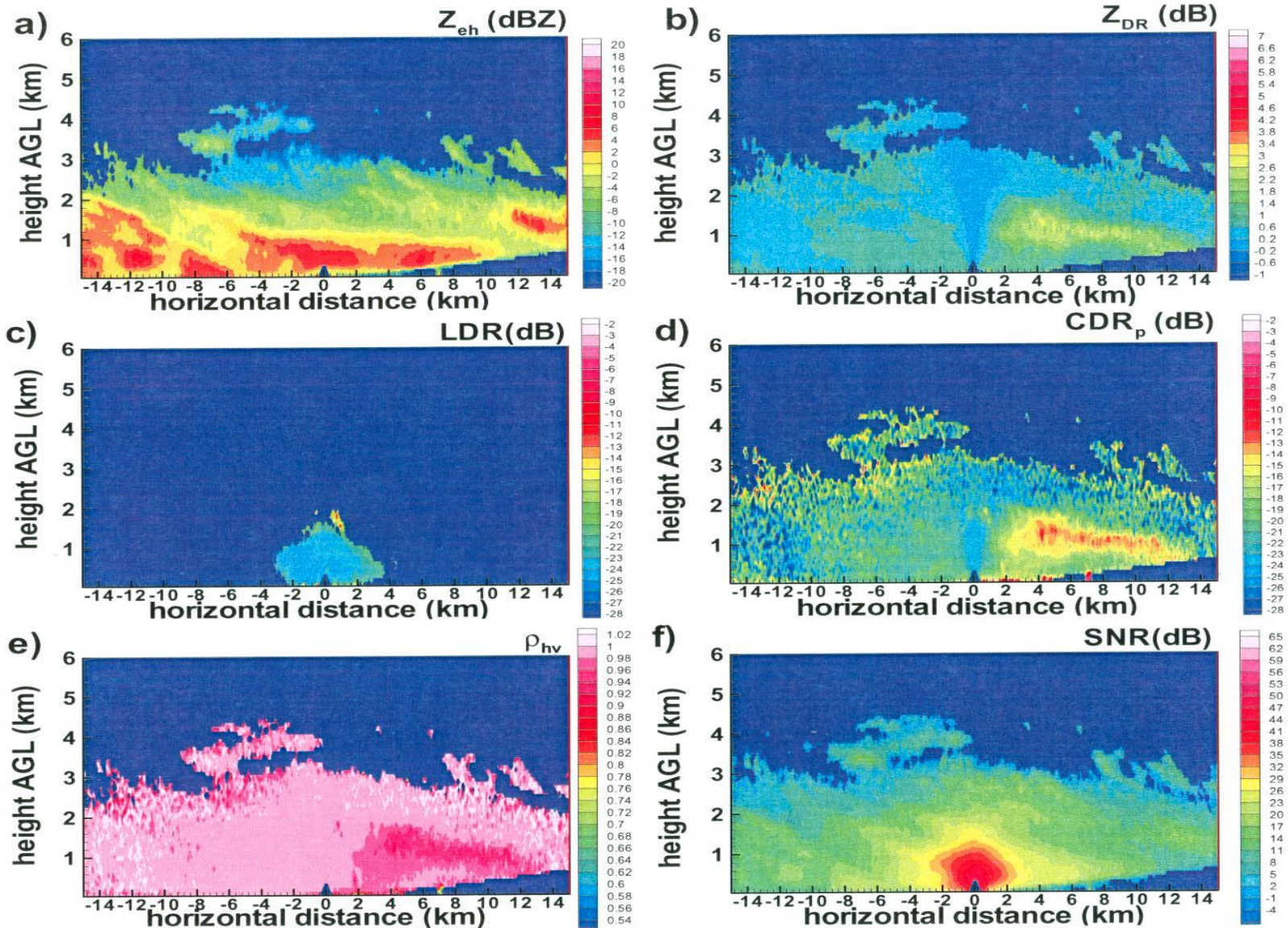
A remote sensing method to infer ice hydrometeor shapes from SACR2 measurements

# NCAR Video Ice Particle Sampler (VIPS) attached to a tethered balloon



# Oliktok Point, 21 October 2016 case study

$K_a$ -band SACR HRHI at az=135°, 00:22 UTC

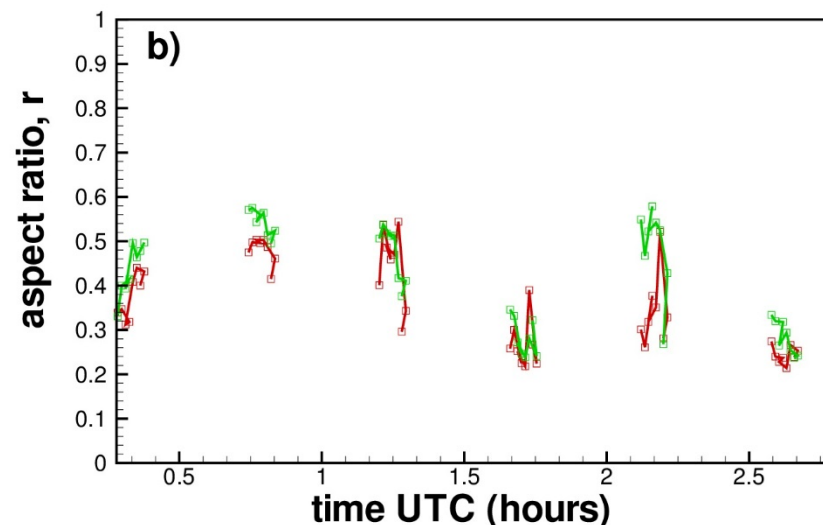
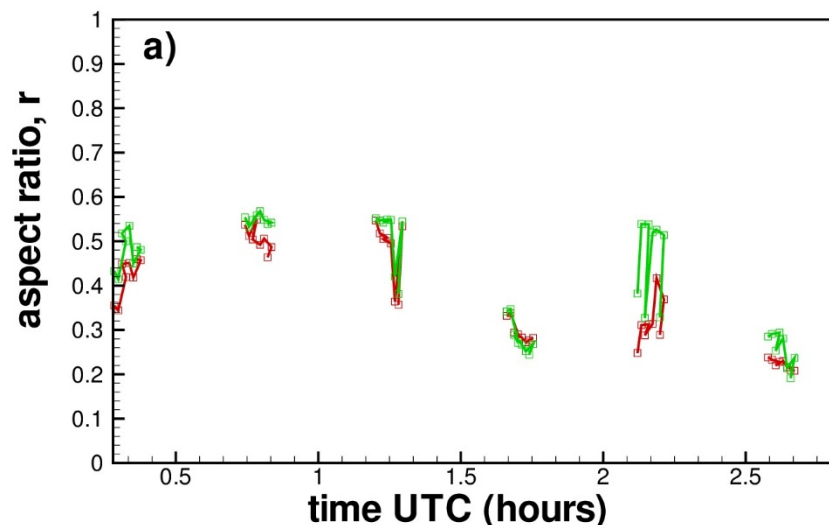


# Inferring shape parameters of atmospheric ice particles expressed as aspect ratios, $r$ , from SACR2 measurements

21 October 2016

0.5 km altitude

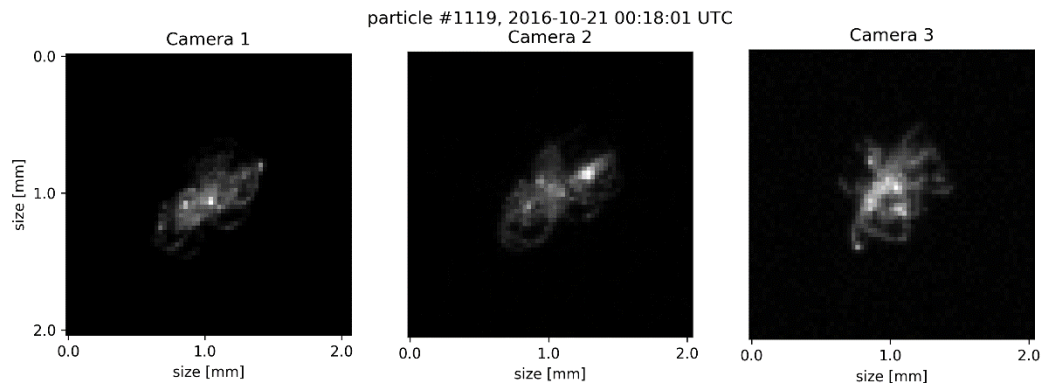
0.3 km altitude



red: from  $CDR_p$

green: from  $Z_{DR}$

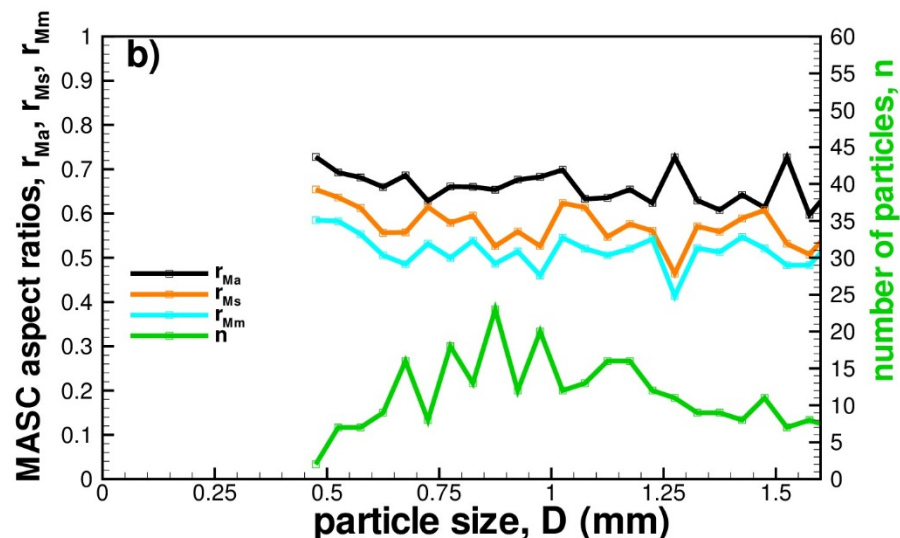
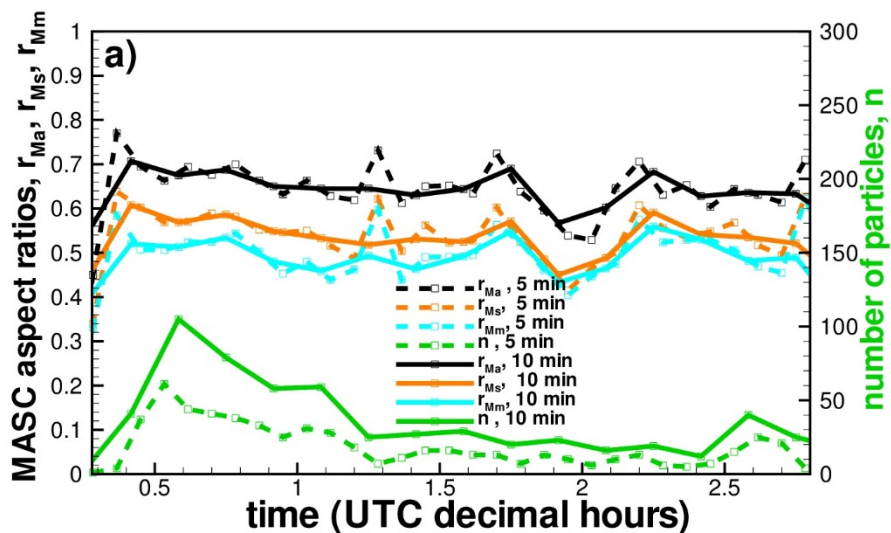
# Ground-based MASC estimates of particle aspect ratios (21 October 2016)



$$r_{Ma} = \langle r_{M0} + r_{M1} + r_{M2} \rangle / 3$$

$$r_{Ms} = \langle \min(r_{M0}, r_{M1}, r_{M2}) \rangle$$

$$r_{Mm} = \langle \min(D_0 r_{M0}, D_1 r_{M1}, D_2 r_{M2}) / \max(D_0, D_1, D_2) \rangle$$



# Examples of VIPS images of particles (21 October 2016)

period 1



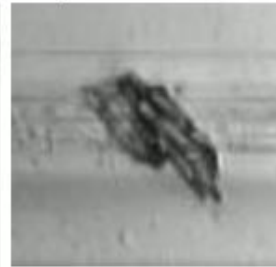
period 2



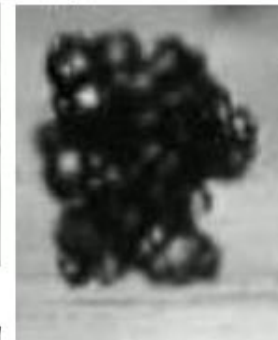
period 3



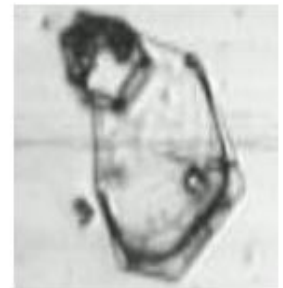
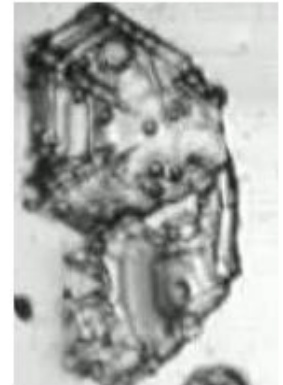
period 4



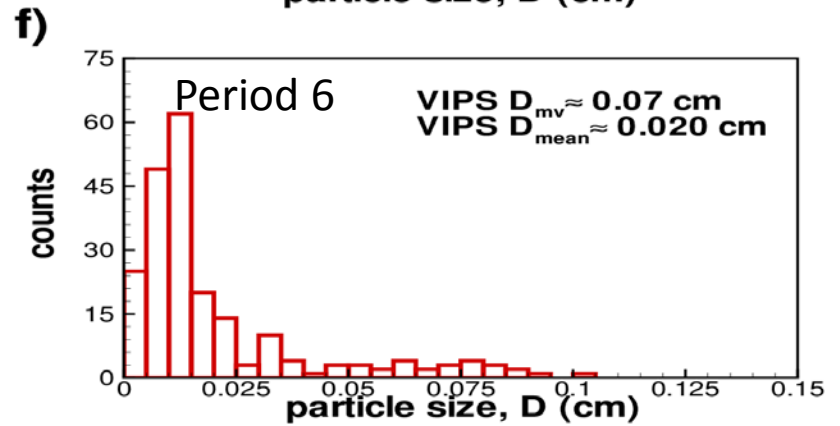
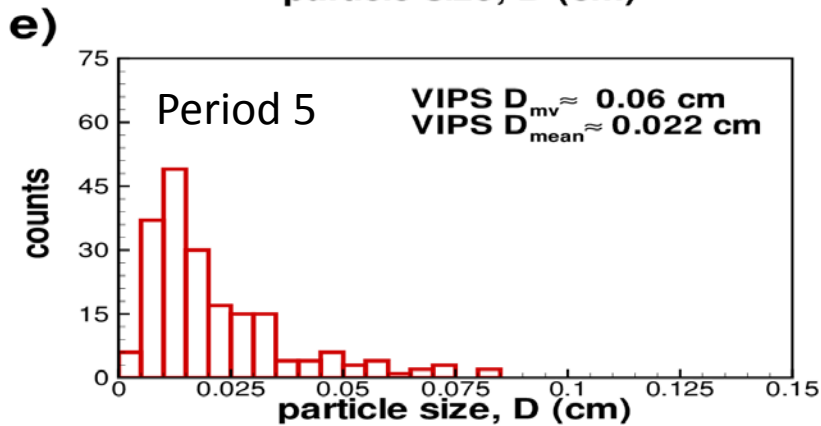
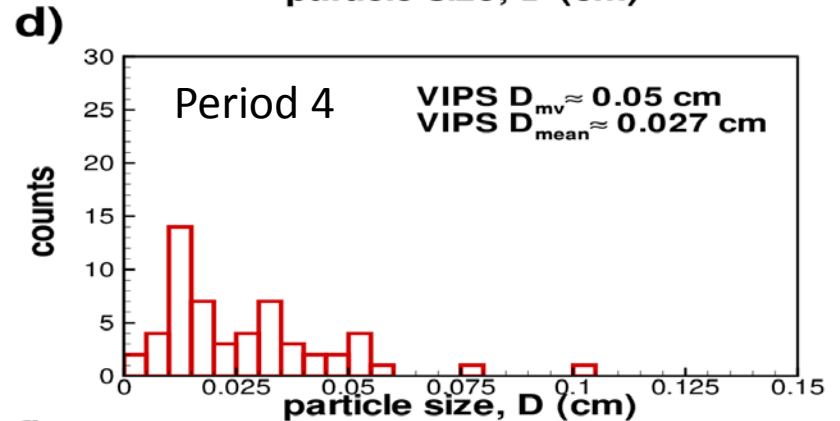
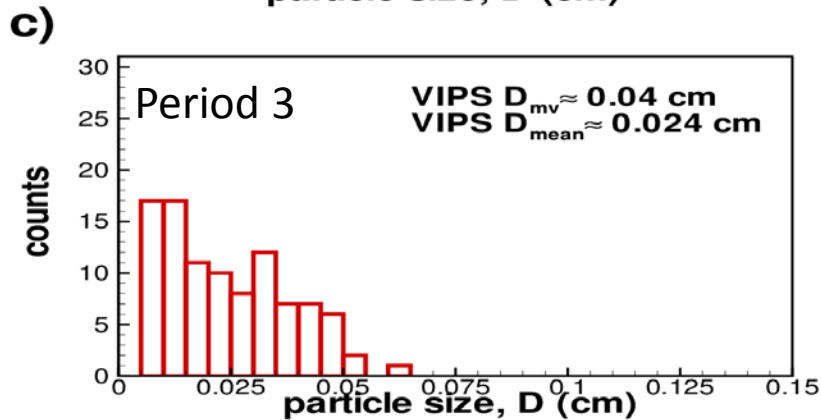
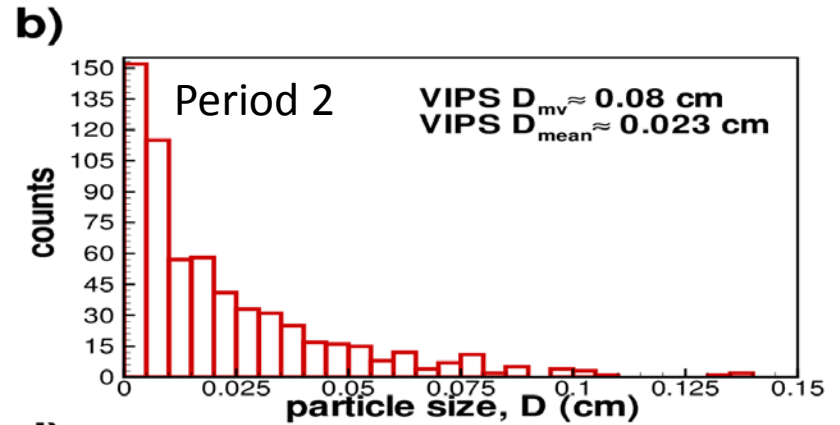
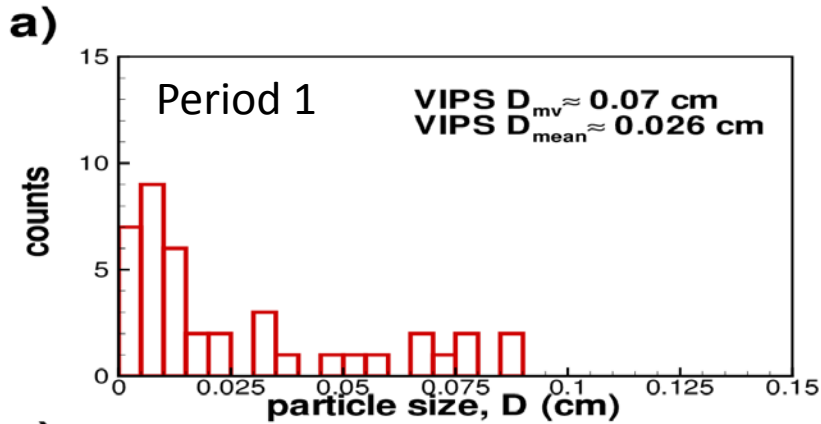
period 5



period 6

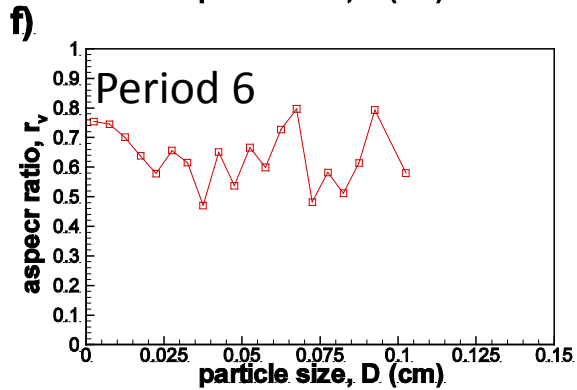
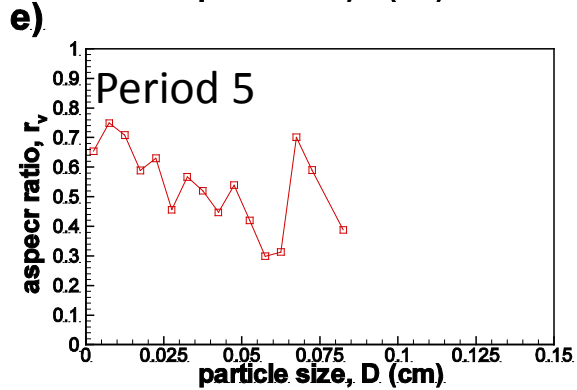
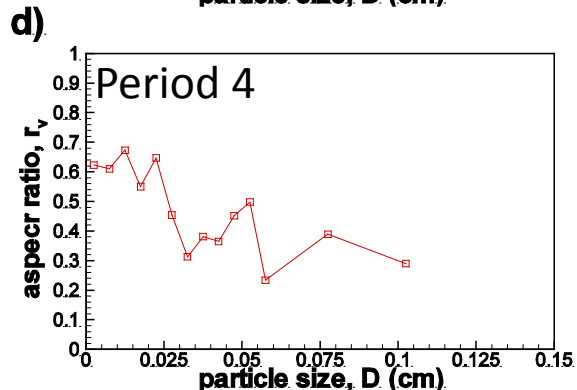
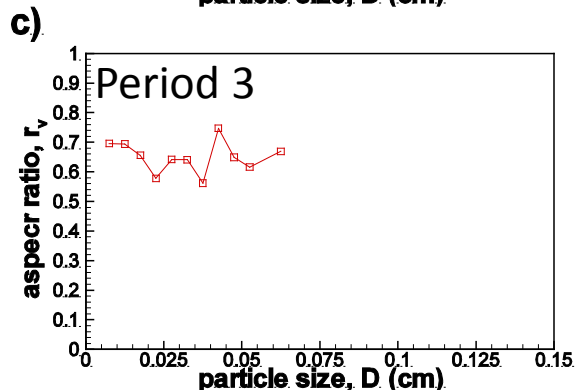
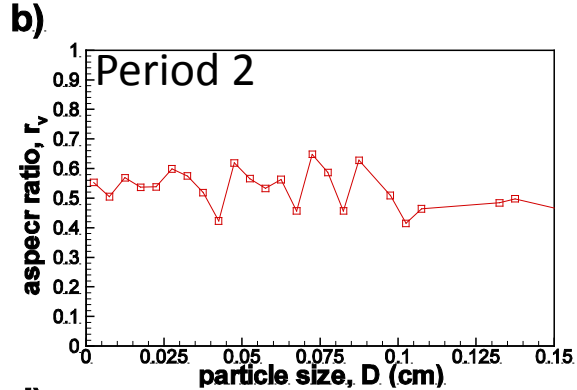
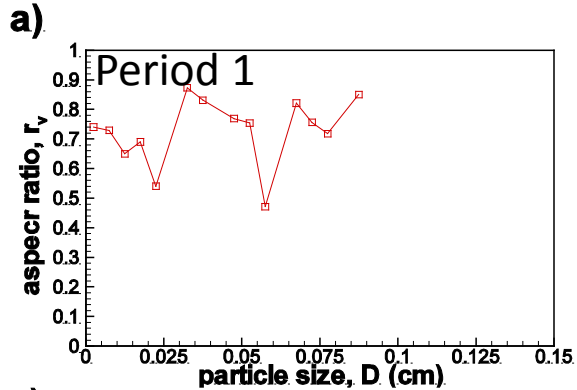


# VIPS estimates of PSDs (21 October 2016)

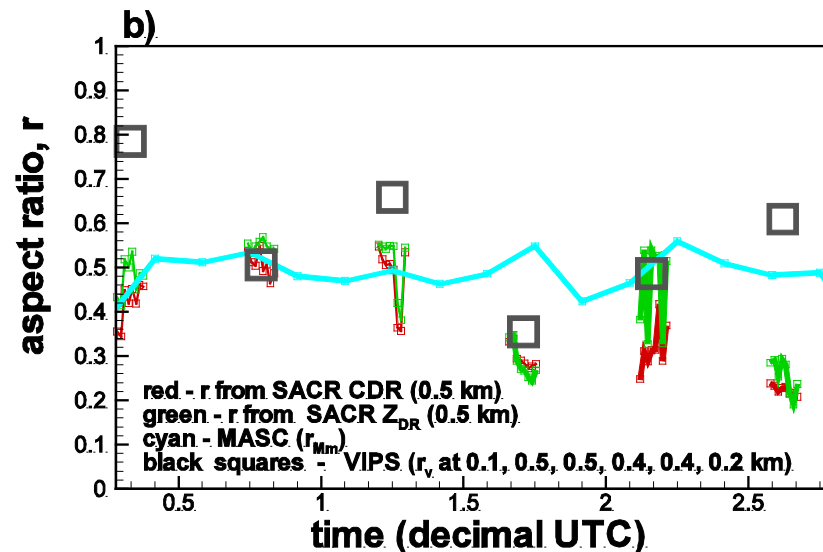
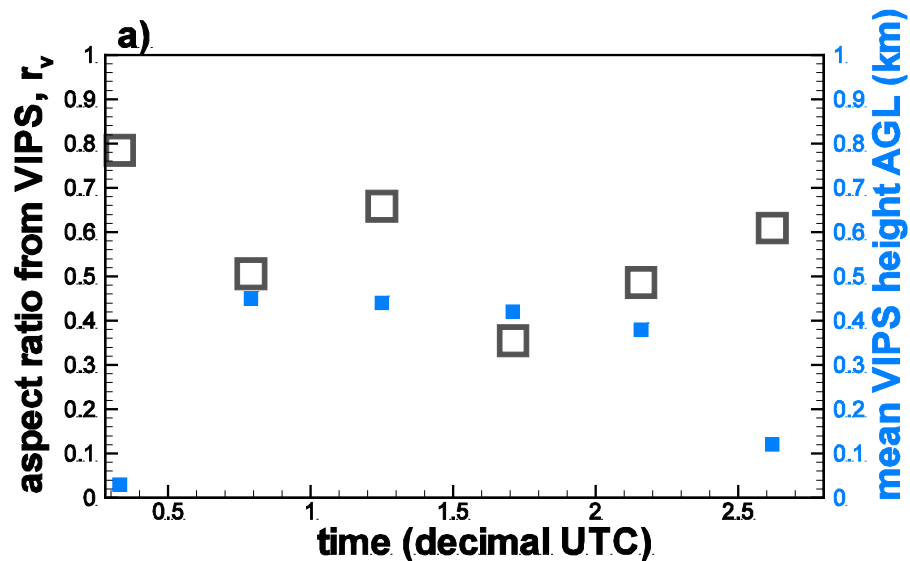




# VIPS estimates of aspect ratios as a function of particle size (21 Oct 2016)



Intercomparisons of particle aspect ratios from radar retrievals (green and red) at 0.3 km VIPS (black squares) at  $\sim$  TBS altitudes, and ground-based MASC data (cyan line)



More details: Matrosov et al. 2017, J. Atmos. Oceanic Technol.  
doi:10.1175/JTECH-D-17-0111.1

TBS is a convenient platform for deploying in situ microphysical probes allowing for close collocation of direct and remote (e.g., radar-based) estimates of cloud and precipitation microphysical parameters

It would be useful if ice microphysical probes are deployed during more ARM TBS flights