

Vertical Velocity Focus Group

Breakout Session - 2014 ASR PI meeting

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1. ANL
2. PNNL

VVFG -- Mission Statement

"The mission of the ASR Vertical Velocity FG is to use ARM measurements to improve the understanding of the connection between cloud-microphysics and cloud-scale dynamics and provide observational target (VV products) suitable to evaluate LES, cloud resolving and aspects of large-scale model parameterizations"

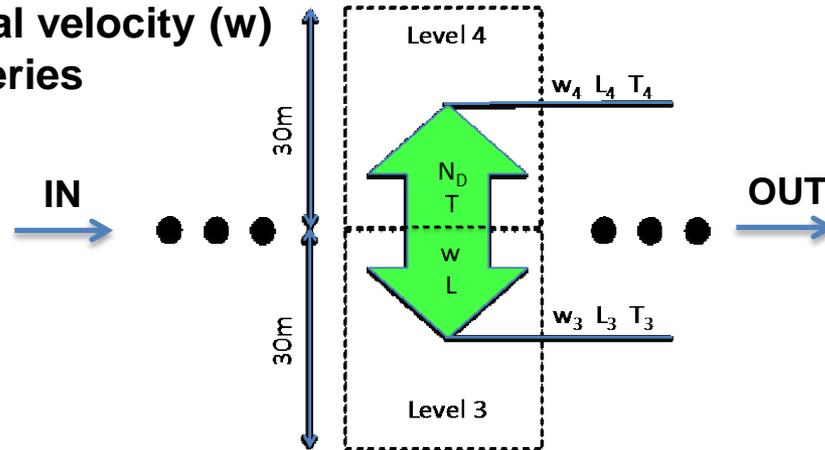
VVFG Webpage

- <http://asr.science.energy.gov/science/working-groups/focus-groups/vvfg>
- Mission Statement etc.
- Past presentations and discussion summaries.
- Publications
- Data Products

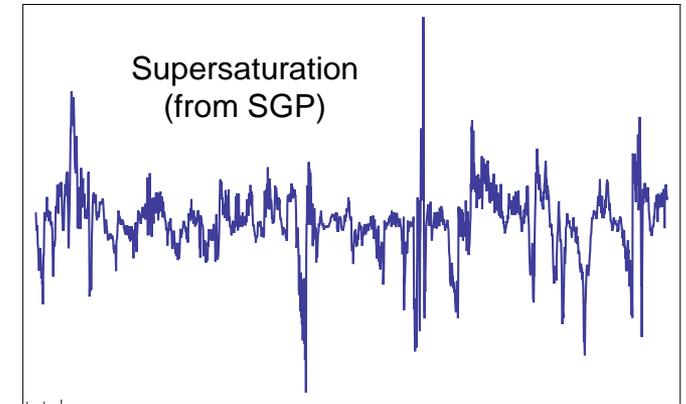
FLUCTUATIONS IN IN-CLOUD SUPERSATURATION AND DROPLET GROWTH

McGraw, Luke, and Kollias

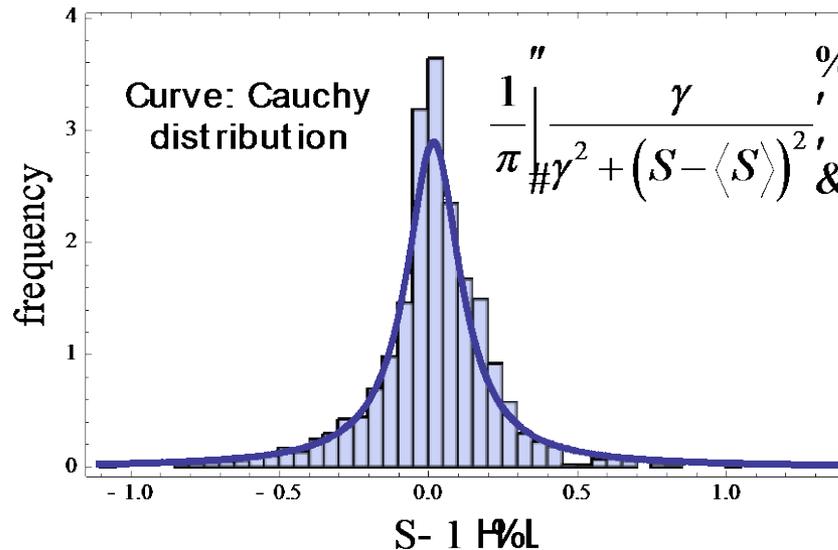
Vertical velocity (w)
time series



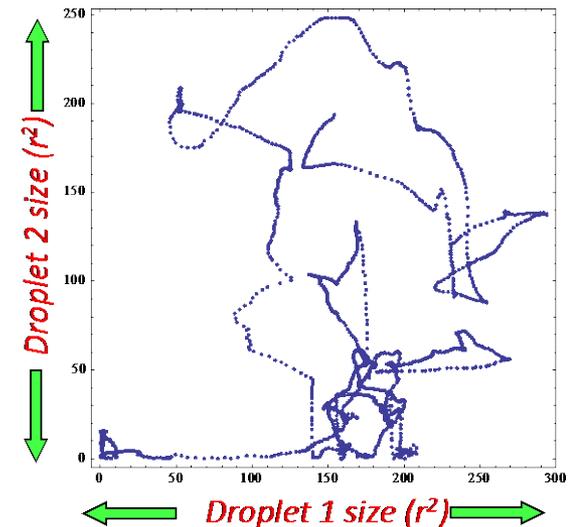
(1) local parcel model



(2) Time series of $S-1$ from time series of w



(3) PDFs: histogram shows binned values of supersaturation



(4) Simulated droplet growth trajectories

Satellite inference of thermals and cloud base updraft speeds based on retrieved surface and cloud base temperatures

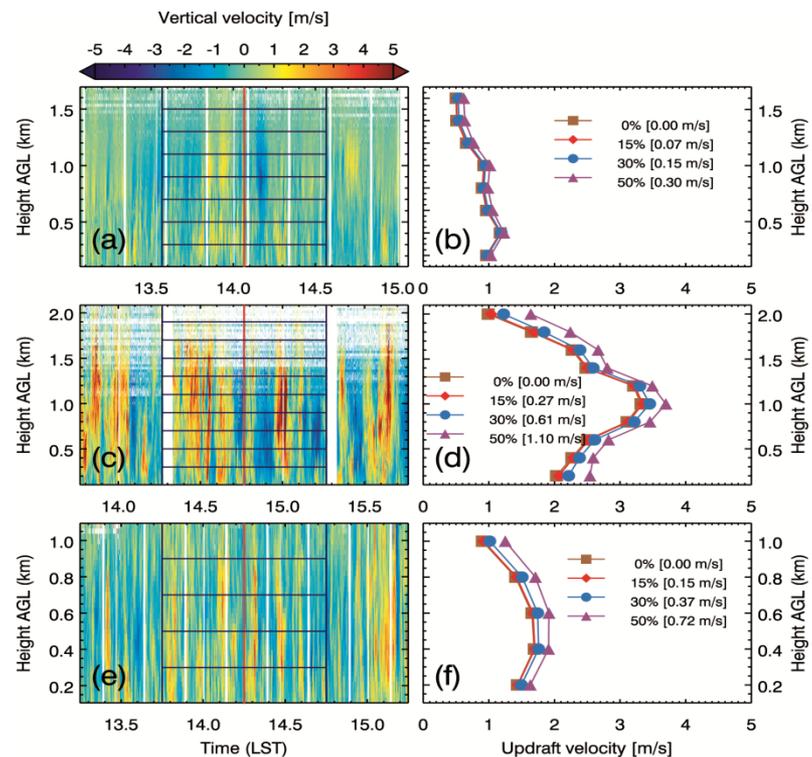
Youtong Zheng^{1,2}, Daniel Rosenfeld² and Zhanqing Li¹

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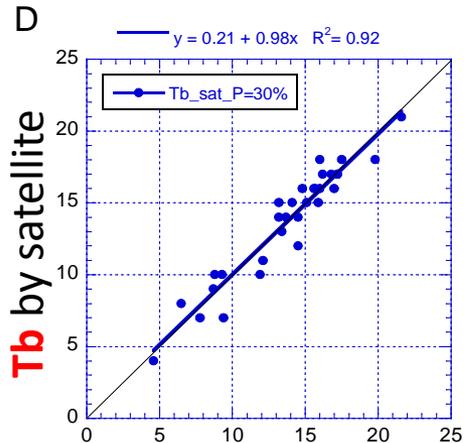
1. Calculating updraft speed (**W**) with Doppler lidar

$$W = \sum \frac{N_i W_i^2}{N_i W_i} |W_i > 0$$

N_i stands for the frequency of occurrence of **W_i**.



2. Satellite-retrieved cloud base temperature



Tb: Cloud base temperature

Tb by ceilometer

3. Cloud base updraft estimation (**W_{cb}**)

• $y = 0.03x + 0.78$ $R = 0.10$
 ♦ $y = 0.16x + 0.48$ $R = 0.71$

DeltaT: Temperature difference between cloud base and cloud top.

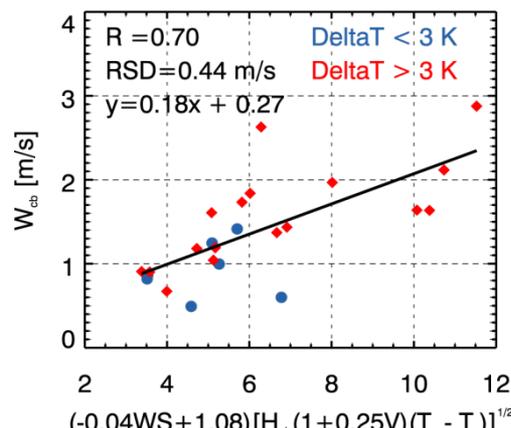
V: surface wind speed

T_s: surface skin temperature

T_a: 2-m air temperature

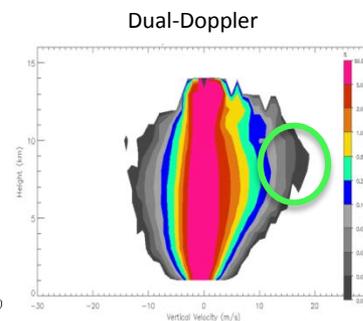
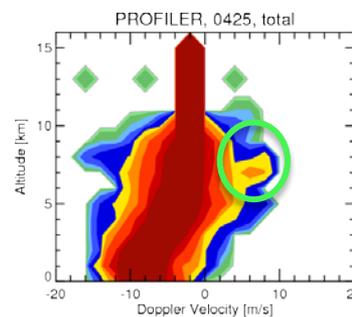
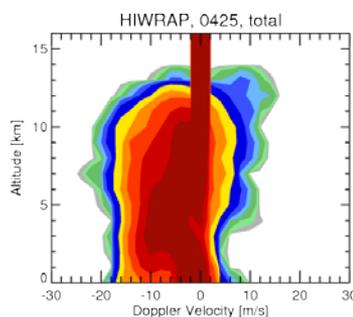
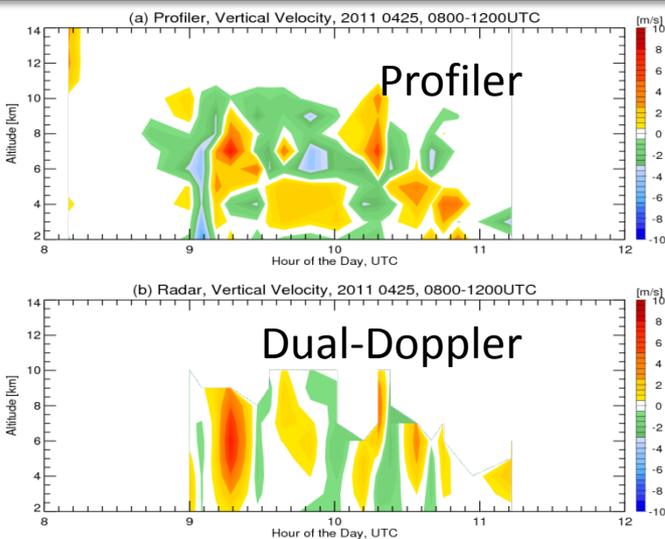
WS: vertical wind shear

H_{cb}: cloud base height



Comparison of vertical wind retrievals during MC3E

Using dual-Doppler techniques, we are deriving vertical winds for different MC3E cases from the network of DOE radars around the SGP and KVNK. As a way of 'validating' the retrievals and getting an estimate of error bars, we are comparing with other measurements of vertical winds, such as from the S-band profiler located at the SGP and the HIWRAP radar flying onboard the ER-2. We are comparing both statistics and timeseries for multiple cases.



- Profiler Doppler velocity shows a small peak in upward motion around 8 km, similar to the dual-Doppler CFAD
- HIWRAP may have a sampling bias (underestimate the strong updraft velocities)

Comparison of profiler (corrected for fall-speed using Giangrande et al. 2013) and dual-Doppler vertical wind timeseries for 25 April 2011 case

- Updrafts are approximately the same strength (6 ms^{-1})
- Downdrafts more intense in profiler (-4 ms^{-1}) compared to DD (-2 ms^{-1})
- Echoes may not have been topped during all times over the SGP leading to errors in DD

We are working on removing fall-speed from the profiler and HIWRAP at their native temporal resolution to compare with the dual-Doppler derived statistics, and from that quantifying an uncertainty in the dual-Doppler wind retrievals. We are analyzing five cases from MCE.

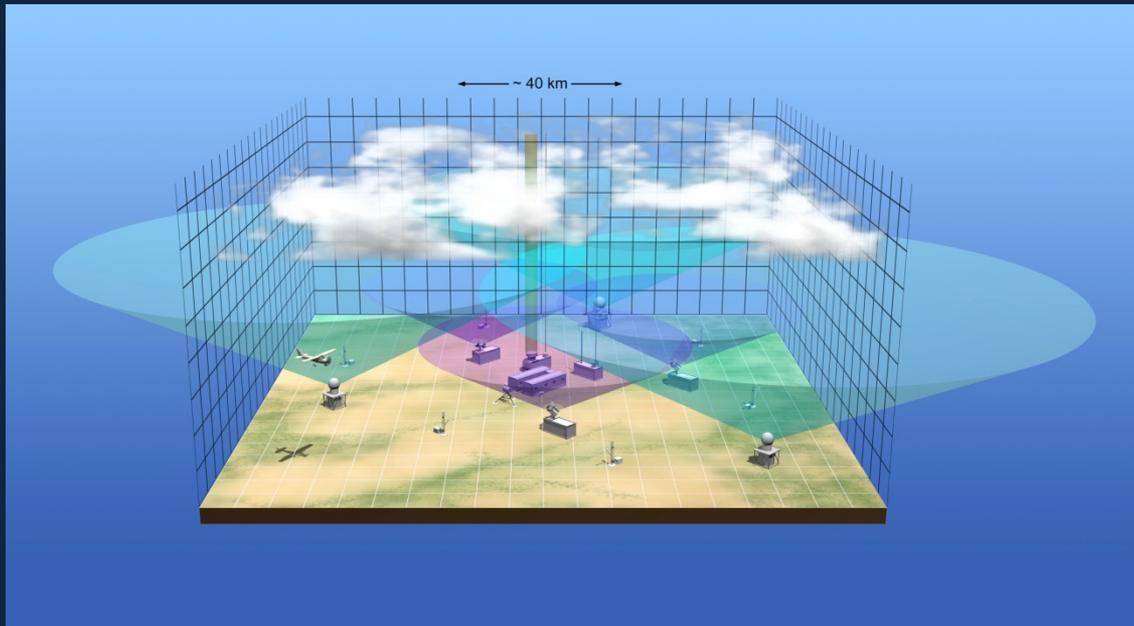
Presentations

Discussion Points

- Site used as a test-bed for Best Estimate Product
 - TCAP and/or SGP (1 year) for now
 - Geared towards ENA
- For the Best Estimate Product
 - List of variables
 - Resolution
 - Uncertainty characterization

Discussion Points

- Targeted science questions we should focus on in the future.
- Suggestions for the super-site to maximize vertical velocity observations.



Thanks