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](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


Vertical velocity (w) time series

(1) local parcel model

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

Curve: Cauchy distribution

\[ \frac{1}{\pi} \frac{\gamma}{\gamma^2 + (S - \langle S \rangle)^2} \]

(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

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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

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

$T_b$: Cloud base temperature

$T_b_{sat}$: Satellite-retrieved cloud base temperature

$T_b_{ceilometer}$: Cloud base temperature by ceilometer

$\Delta T$: 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
Using dual-Doppler techniques, we are deriving vertical winds for different MC3E cases from the network of DOE radars around the SGP and KVNX. 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)

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