FASTER-RACORO Experiments

RACORO
Routine
ARM Aerial Facility (AAF)
Clouds with Low Optical Water Depths (CLOWD)
Optical Radiative Observations

Website: http://acrf-campaign.arm.gov/racoro/

Supporting Documentation:
FASTER-RACORO White Paper Yangang sent to the FASTER Team
Wed Poster: RACORO Aircraft Data Case Study Development for FASTER
RACORO BAMS article (In press, Early online release)
Updated RACORO Data Guide (v2)
RACORO, and
What can it contribute to FASTER?

- 5-Month aircraft campaign over the SGP obtaining boundary layer, liquid-water cloud field statistics (Long legs, 2xProfiles)
  - **Microphysical properties**
    - LWC, Drop size distribution
  - **Aerosol properties**
    - CCN, Size distributions, Number concentrations
  - **Atmospheric state**
    - Temperature, Water vapor, Vertical velocity, Turbulence
  - **Radiative fluxes and Optical properties**
    - Cloud extinction, Reff, SW & LW fluxes

- **Other Data**
  - SGP Observations
    - Variational analysis
  - King Air Flights (HSRL, RSP)
  - Tomography IOP (Dong Huang)
  - EOS Overpasses
What We Have

77% in Sc & Cu

LWC > 0.01 gm⁻³
Overview of Proposed FASTER-RACORO Experiment Plan

Multi-Pronged Approach:

1. SCM and NWPs
   Examine the full RACORO period

2. High-resolution modeling (LES, CRM)
   Examine selected “golden” cases 1st, broaden as conditions allow

3. Observations (aircraft, surface, satellite)
   Data integration and model evaluation

4. Aerosol Data Assimilation
   Z. Li’s presentation (previous) and poster
Large-Scale Forcing

Variational analyses: Hrly RUC data constrained by SGP obs

- Standard domain: (280 km)$^2$, 25-mb vertical resolution up to 100 mb, Hourly
- Include surf. & upper-air met. fields, and large-scale advec of heat & moisture

Also considering:

- High-Res domain: (75 km)$^2$, 10-mb vertical resolution up to 100 mb, Hourly
- Finely-tuned forcings: That reproduce aspects of the thermo evolution
- Ensemble (perturbed) forcings
### Golden Cases Selected for 1st Reference

**Selection criteria:**
- Well sampled (instruments A-OK)
- Preferred (i.e., being picky)
  - Multi-day periods
  - And/or “archetype”
- Easier above-cloud radiation boundary conditions

### Primo Cases

<table>
<thead>
<tr>
<th>Cloud Type</th>
<th>When</th>
<th>What’s so special about it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>St &amp; Sc</td>
<td>April 19</td>
<td>Great transition case: St → Sc → Clear</td>
</tr>
<tr>
<td>St &amp; Sc</td>
<td>April 27-28</td>
<td>Best drizzle case: CCN drops 400 → 130 cm⁻³</td>
</tr>
<tr>
<td>St, Sc &amp; Cu</td>
<td>May 6-8</td>
<td>Range of conditions: St → Sc, St &amp; Cu, Sc</td>
</tr>
<tr>
<td>Cu, Cu &amp; Cu!</td>
<td>May 22-26</td>
<td>Great Cu period: W ~1 m s⁻¹, CCN 600 → 170 cm⁻³</td>
</tr>
<tr>
<td>St</td>
<td>May 27</td>
<td>Thick, weakly precipitating St: CCN low (280 cm⁻³)</td>
</tr>
<tr>
<td>Sc &amp; Cu</td>
<td>June 18-21</td>
<td>Exten’d period St &amp; Cu: CCN low (160-250 cm⁻³)</td>
</tr>
</tbody>
</table>
## Still Good Cases, but runners up

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<tr>
<th>Cloud Type</th>
<th>When</th>
<th>What’s so special about it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sc</td>
<td>March 20</td>
<td>Very optically thin Sc: Multi-level, CCN levels high (520 cm(^{-3}))</td>
</tr>
<tr>
<td>St &amp; Sc</td>
<td>June 3</td>
<td>Good St &amp; Sc case: Overcast to scattered Cu</td>
</tr>
<tr>
<td>Sc &amp; Cu</td>
<td>June 8-9</td>
<td>Highish CCN case (480 cm(^{-3})): Cu sampled best on 6/8</td>
</tr>
<tr>
<td>Cu</td>
<td>June 11</td>
<td>One of the lowest CCN cases (170 cm(^{-3})): W (\sim) 1 m s(^{-1}), and median LWC low (0.09 g m(^{-3}))</td>
</tr>
<tr>
<td>Sc &amp; Cu</td>
<td>June 22-26</td>
<td>CCN (\sim)triples during period (210 to 590 cm(^{-3})): Scattered Cu whose median LWC increases steadily during the period (0.09 to 0.15 g m(^{-3}))</td>
</tr>
</tbody>
</table>
Sensitivity of In-Situ Sampling – Implications to MWR LWPs

![Graph showing frequency distribution of average liquid-water content in gm⁻³. The graph includes two curves: one smooth and one stepwise, indicating different sampling implications.](image-url)