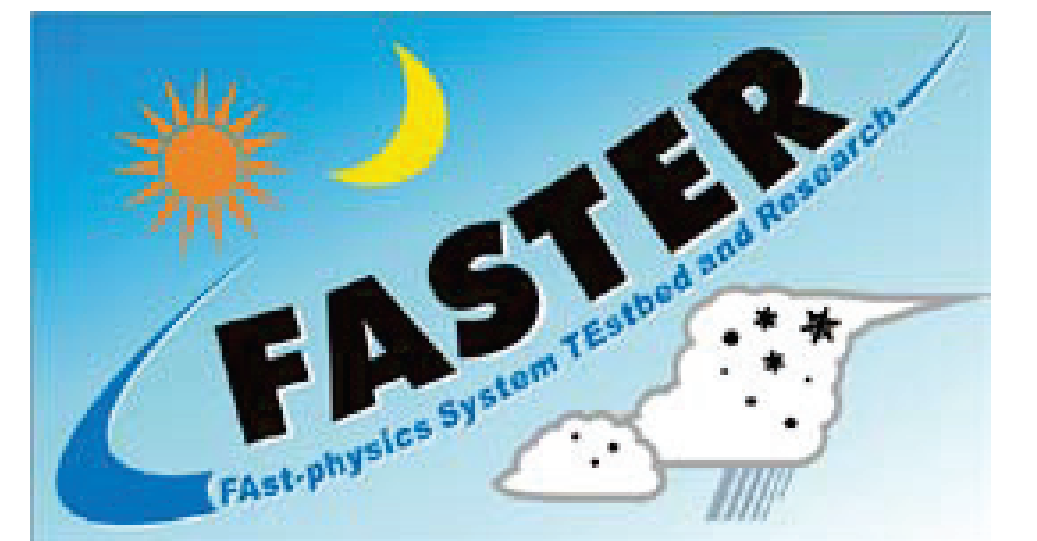


RACORO Aircraft Data Case Study Development for FASTER



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Summary

As part of the FAsT-physics System TESTbed and Research (FASTER) project, RACORO aircraft data are being used to construct case studies to assess and improve models of continental boundary-layer clouds.

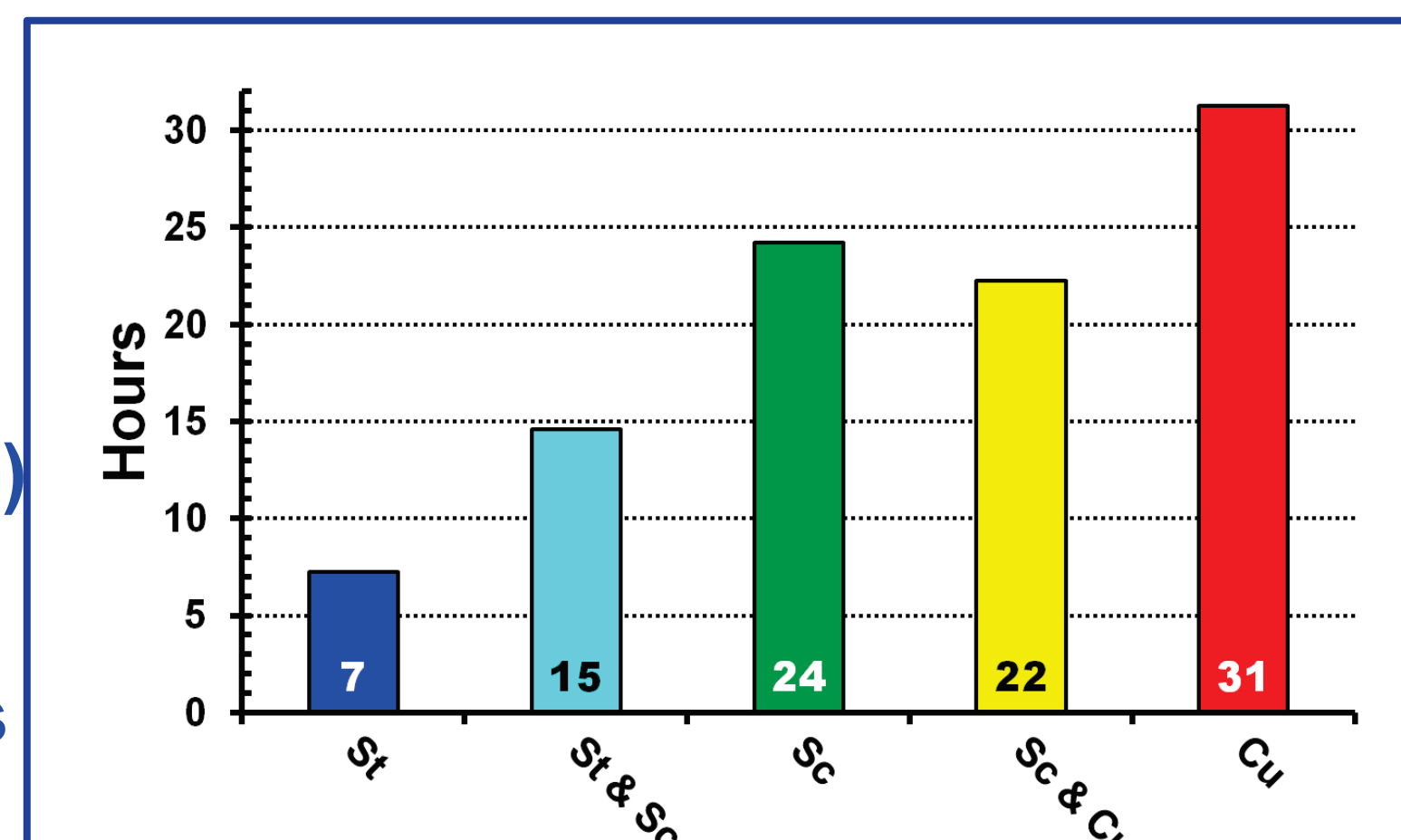


1. What is RACORO?

RACORO was a first-of-a-kind, extended-term cloud aircraft campaign conducted by the ARM Aerial Facility to obtain an *in-situ* characterization of boundary-layer clouds (Vogelmann et al., 2012).

- It operated over the SGP from 22 January to 30 June 2009 (5 mos)
- 31 Cloud flights sampled mostly cumulus and stratocumulus
- The Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) Twin Otter aircraft measured: Cloud microphysics, Aerosol properties, Radiation, and Atmospheric state parameters

See the [updated RACORO Data Guide \(Vogelmann, 2012\)](#)



RACORO flight time per cloud type sampled. Time expressed at column base as a percentage of the 103 hrs of cloud sampling. 77% of cloud flight time was in Cu & Sc.

2. FASTER Case Study Selection/Development

SGP surface measurements support the aircraft-based case study development. We focus on the fair-weather boundary-layer clouds that dominated the RACORO period.



“Golden Cases” assessed using a 3-pronged approach:

1. Observations (aircraft, surface, satellite)
2. Single-Column Model (SCM) and Numerical Weather Prediction (NWP) simulations
3. High-resolution modeling (Large-Eddy Simulation, and Cloud Resolving Models)
 - SCMs and NWP models will examine the full RACORO period.
 - High-resolution models will focus on the selected “Golden Cases.”



Also may go beyond the “Golden Cases” to formulate idealized cloud test datasets.

See [data assimilation of the 3D aerosol fields supporting this effort \(Li et al. Poster\)](#)

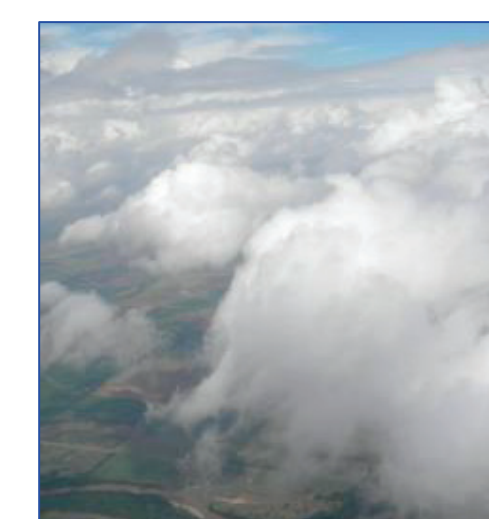
3. Large-Scale Forcing

Variational analyses use hourly RUC data constrained by SGP obs (Zhang & Lin, 1997; Zhang et al. 2001)

- Standard domain: (280 km)², 25-mb vertical resolution up to 100 mb, Hourly
- High resolution domain: (75 km)², 10-mb vertical resolution up to 100 mb, Hourly

Also considering:

- Fine-tuned forcings, which reproduce aspects of the thermodynamic evolution
- Ensemble (perturbed) forcings



4. “Golden Day” Candidates

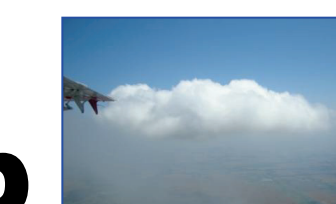
The following periods are promising candidates, which will be refined as we progress.

Primo Cases



Cloud Type	When	What's so special about it?
St & Sc	April 19	<u>Great transition case.</u> Solid post-frontal St deck breaks into Sc and eventually clears.
St & Sc	April 27-28	<u>Best precipitation/drizzle period of the program.</u> Lasting & wide-spread St/Sc. CCN drops considerably (400 to 130 cm ⁻³ [at 0.2% supersaturation]).
St, Sc & Cu	May 6-8	<u>Good range of conditions.</u> St deck breaks into Sc on 5/6, followed by St & Cu on 5/7, followed by Sc on 5/8.
Cu, Cu and Cu!	May 22-26	<u>Great Cu period.</u> Non-precipitating and weakly precipitating Cu followed by scattered Cu. Updrafts ~1 m s ⁻¹ . CCN decreases from high to low (600 to 170 cm ⁻³).
St	May 27	<u>Thick, weakly precipitating St.</u> CCN low (280 cm ⁻³).
Sc & Cu	June 18-21	<u>Extended period of St and Cu.</u> Moderate updrafts (0.5 m s ⁻¹) and low CCN (160-250 cm ⁻³).

Some Runners Up



Cloud Type	When	What's so special about it?
Sc	March 20	<u>Very optically thin Sc:</u> Multi-level with low updrafts (0.25 m s ⁻¹). CCN levels high (520 cm ⁻³).
St & Sc	June 3	<u>Good St & Sc case.</u> Overcast to scattered Cu.
Sc & Cu	June 8-9	<u>Highish CCN case (480 cm⁻³).</u> Cu sampled best on 6/8
Cu	June 11	<u>One of the lowest CCN cases (170 cm⁻³).</u> Updrafts about 1 m s ⁻¹ , and median LWC low (0.09 g m ⁻³).
Sc & Cu	June 22-26	<u>CCN almost triples during period (210 to 590 cm⁻³).</u> Scattered Cu whose median LWC increases steadily during the period (0.09 to 0.15 g m ⁻³).

Contact Information, References, & Acknowledgements

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