Effects of aerosols on shallow cumuli sampled during RACORO

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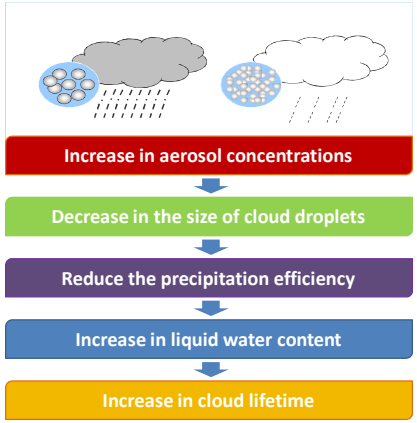
1. Introduction

❖ **Classical Second aerosol indirect effect (Albrecht, 1989)**



2. Field Experiment: RACORO

❖ **Routine AAF Clouds with Low Optical Water Depths (CLOWD) Optical Radiative Observations (RACORO)**

- ✓**Where**: in the vicinity of the ACRF SGP site, OK
- ✓**When**: from January to June 2009
- ✓**What**: Routine measurements of aerosol, cloud , and radiative properties
- ✓**Data**: 260 hours flight time
  => 85 hours of shallow cumuli conditions
  => 2,337 cumuli sampled

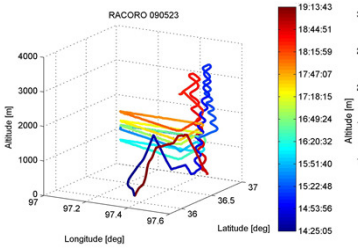


Fig 1. Typical flight pattern flown by CIRPAS Twin Otter during RACORO.

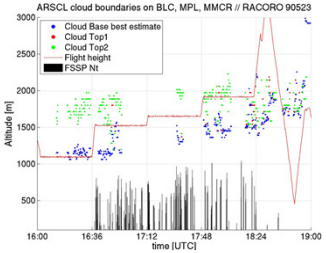


Fig 2. Cloud top and base heights estimated by ARSCL, overlapped with FSSP measurement.

3. RACORO Cumulus Statistics

❖ **Schematic plot: How to define individual cloud**

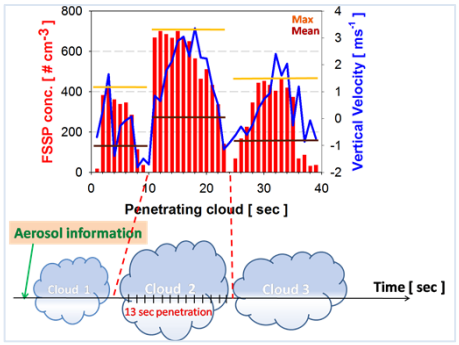


Fig 3. Schematic plot of RACORO cloud criteria.

❖**Cloud Macro- / Micro- physical properties Statistics**

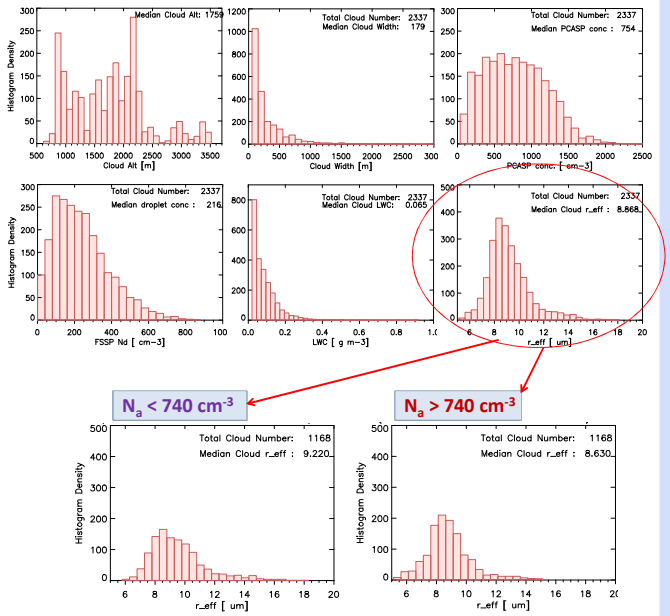


Fig 4. Histograms of mean properties of the cumuli .

4. Aerosol – Cloud Interactions

❖ As aerosol concentration (PCASP) increases, LWC decreases.

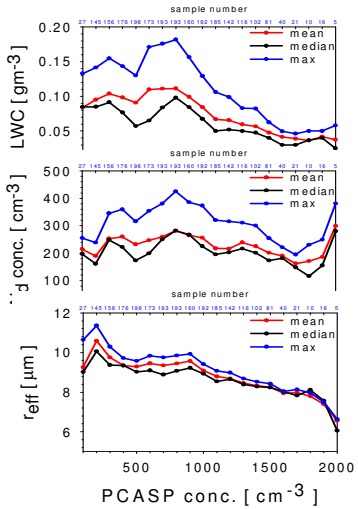


Fig 5. The cloud averaged Nd, LWC, and reff as a function of PCASP concentration.

❖ Vertical velocity inside clouds can answer this.

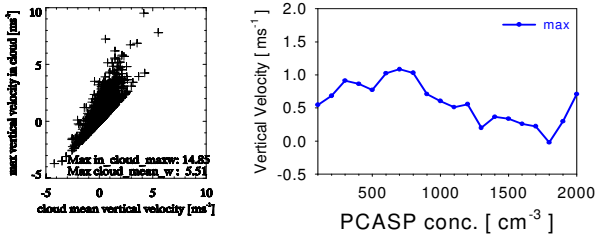


Fig 6. (a) comparison of cloud mean updraft and max updraft in cloud, (b) vertical velocity as a function of PCASP conc.

5. Conclusion

- ✓ LWC decreases as PCASP concentration increases, different from classical 2nd indirect effect.
- ✓ Decrease in LWC explained by decrease in vertical velocity inside clouds as PCASP concentration increases.
- ✓ R_{eff} decreases as PCASP concentration increases.