NOAA MCB LES: Aerosol Perturbation

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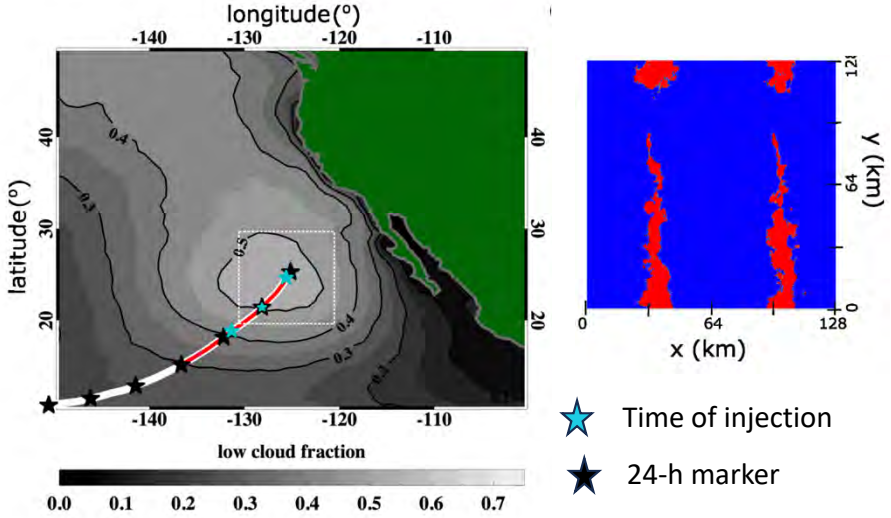
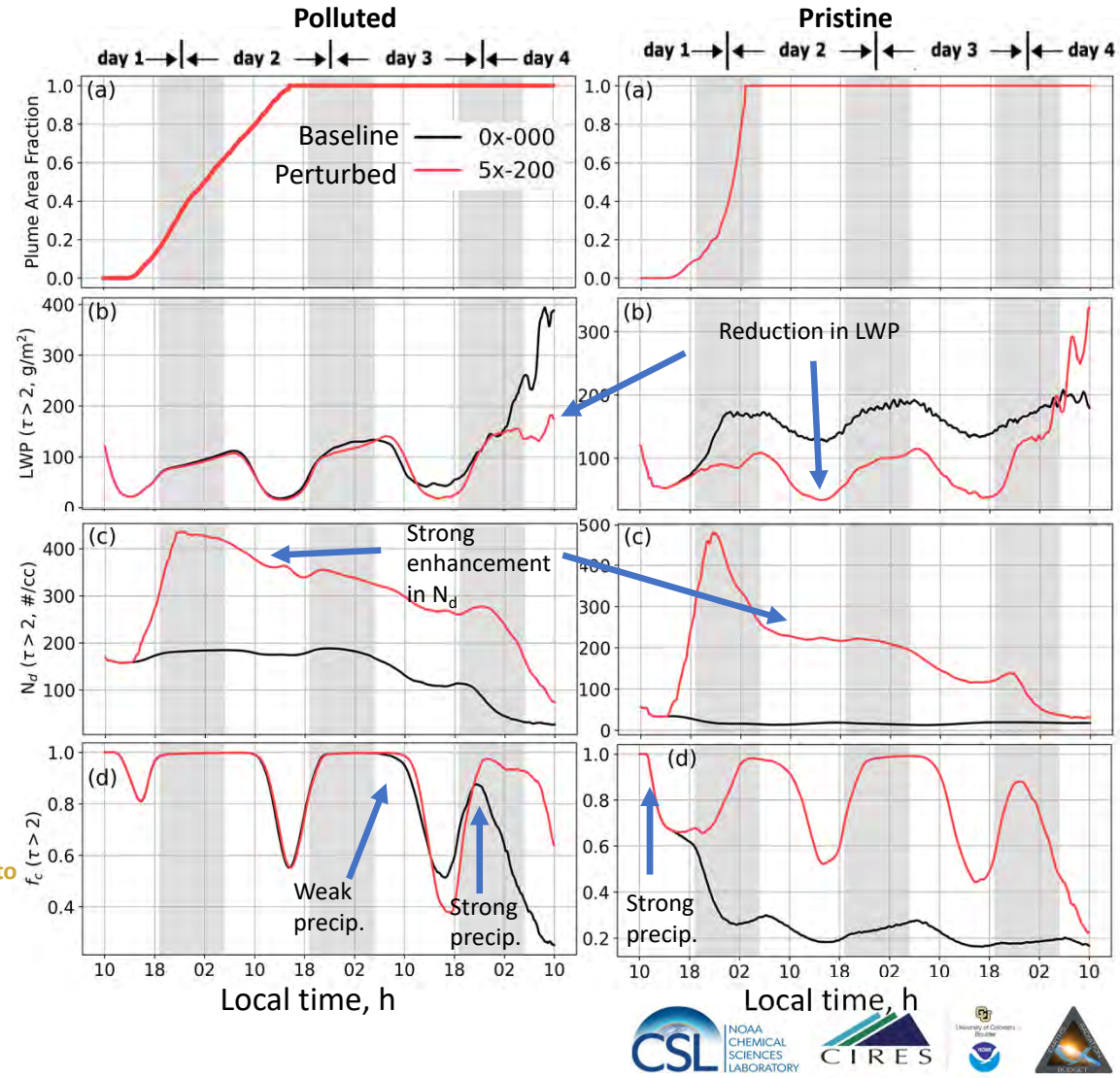


- **Lagrangian LES (domain = 128x128 km^2)**
- **Mimic seeding with pulsed injections in a polluted (N_d = 150/cc) and a pristine (N_d = 50/cc) cloud system – Sandu & Stevens 2011.**
- **Vary: amount/frequencies/number of sprayers.**



Summary:

- Injection of aerosol delays the transition in both systems.
- Precip. suppression results in substantial cloud brightening.

Polluted:

- Slower spread rate of the aerosol plume.
- Delay in the transition is affected by the **total aerosol injected into the MBL prior to the transition**.
- Dominant contributors to brightening: **N_d (day 2 and day 3), f_c (day 4)**

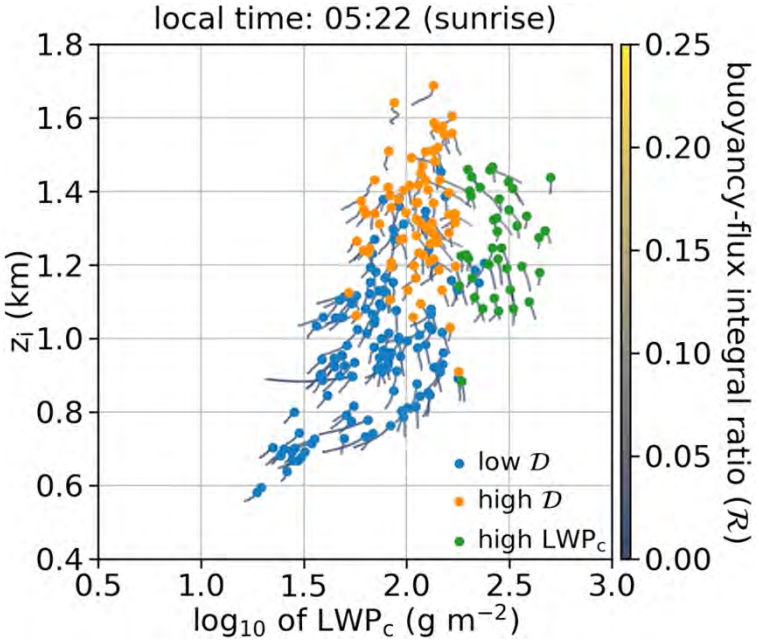
Pristine:

- Faster spread rate of the aerosol plume – **secondary circulation**.
- Only the strong perturbations make a significant impact.
- Dominant contributors to brightening: **f_c (day2 to day 4)**

NOAA MCB LES: LES ensemble

Yao-Sheng Chen, Jianhao Zhang, Xiaoli Zhou, Tak Yamaguchi, and Graham Feingold

From individual cases to behavior of an LES ensemble of stratocumuli

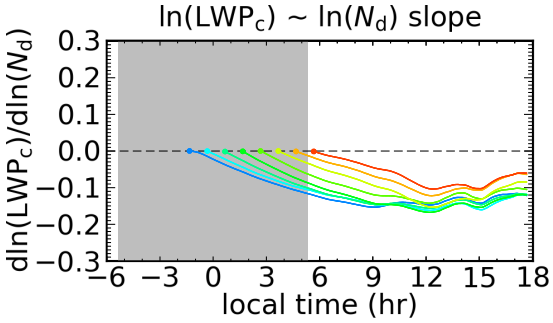


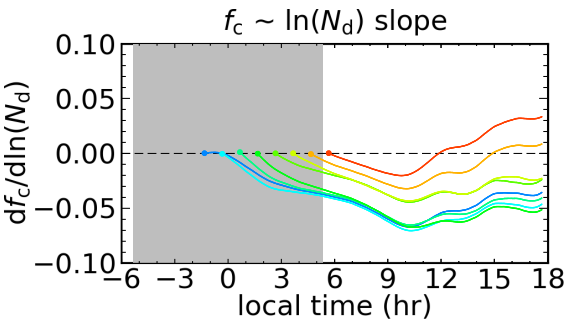
Nighttime: FT q_t correlates very well with LWP$_c$
Daytime: evolution closely tied to coupling state

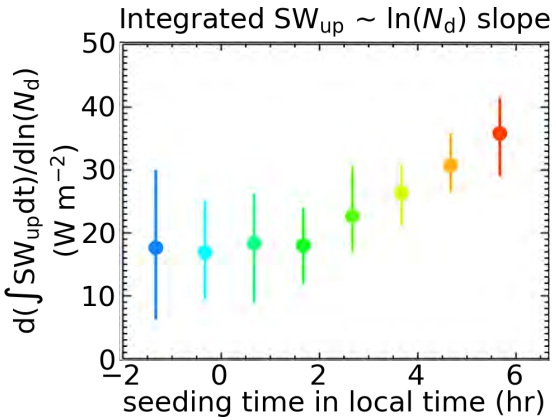
z_i: inversion base height; **LWP$_c$**: cloud liquid water path; f_c: cloud fraction; N_d: cloud droplet number concentration; **FT q_t**: free-tropospheric total water mixing ratio; **D**: relative decoupling index

Explore impacts of seeding time on MCB effectiveness with a conditional Monte Carlo sampling approach

- Sample the full LES ensemble for subsets with near zero LWP$_c$–N_d slope, f_c –N_d slope, and meteorology-N_d correlation at different times
- Calculate the N_d-dependence of integrated shortwave radiative impacts







Seeding at sunrise is likely the most effective strategy