ORACLES-2017 Sc-to-Cu transition (SCT) LES/SCM study from trajectory ensembles

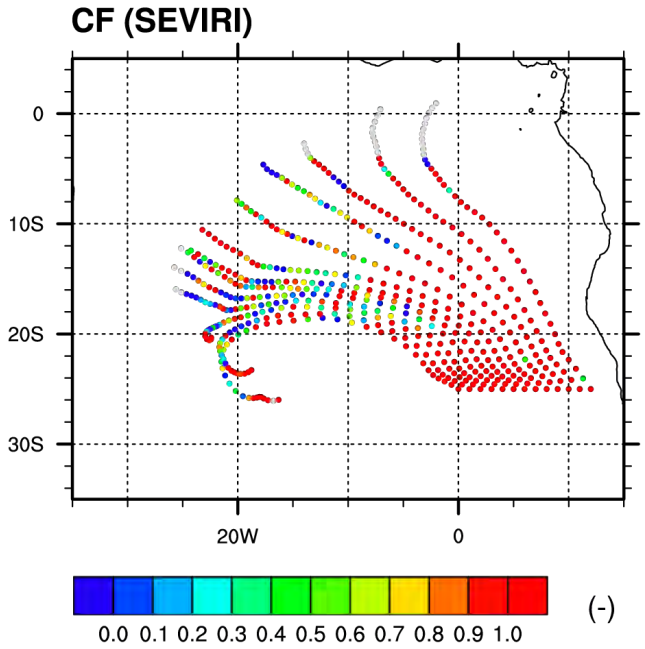
Ackerman, Fridlind (GISS), Lee (Kongju Nat'l Univ),
Painemal (LaRC), da Silva (GSFC)

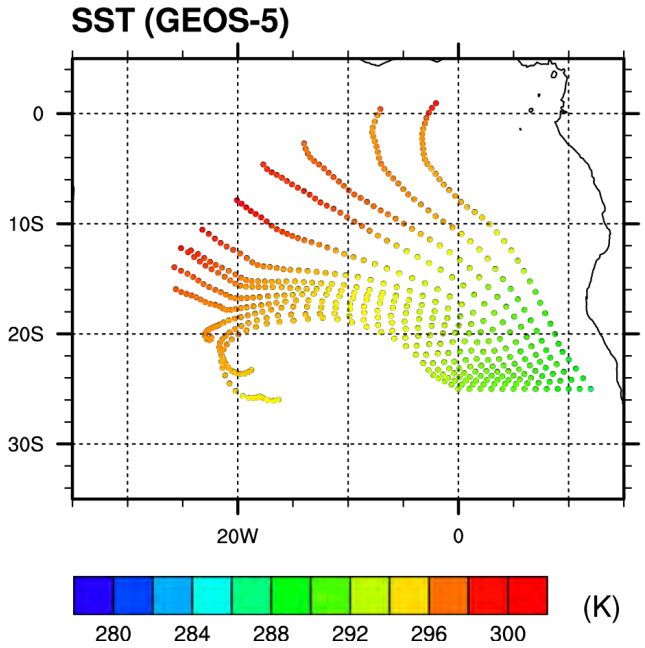
Dual objectives:

1. Investigate impact of overlying BBA plume on SCT in SEA
2. Case study for GISS ModelE3 SCM, for constraining tuning parameters and for evaluating performance

To discuss: compare AMIP-style ModelE3 runs with LASIC AMF observations to add statistical constraints on model performance?

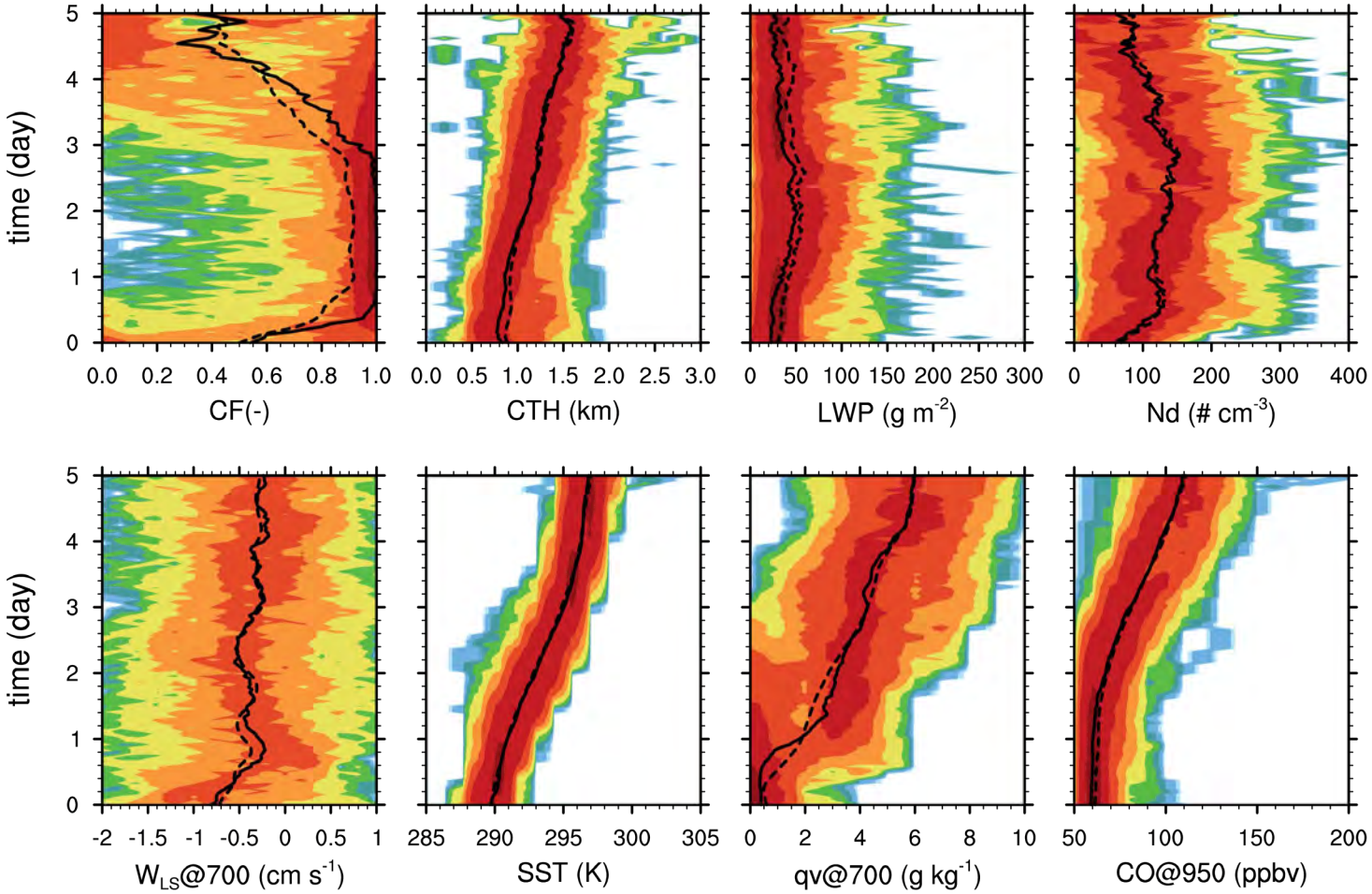
Composite trajectories —> case study





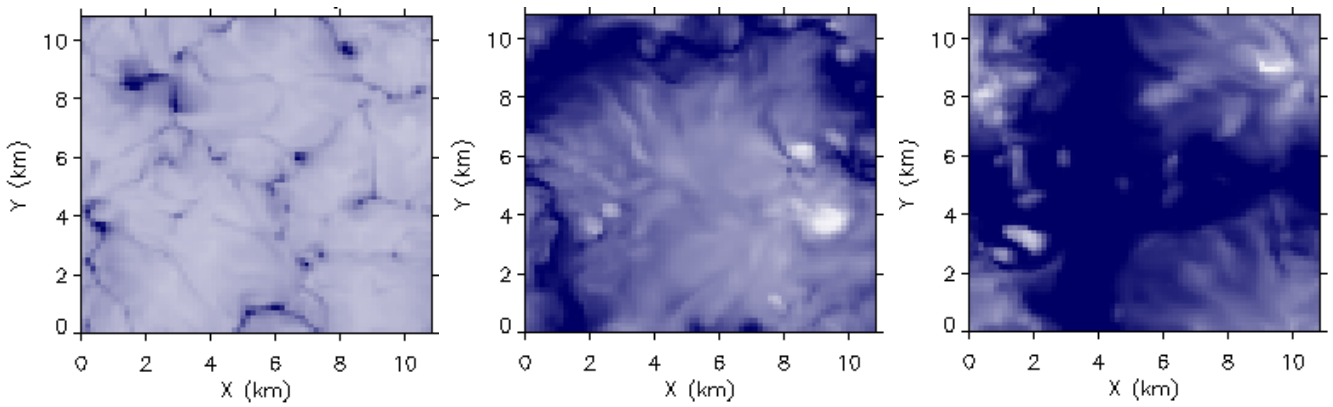
Year 2017

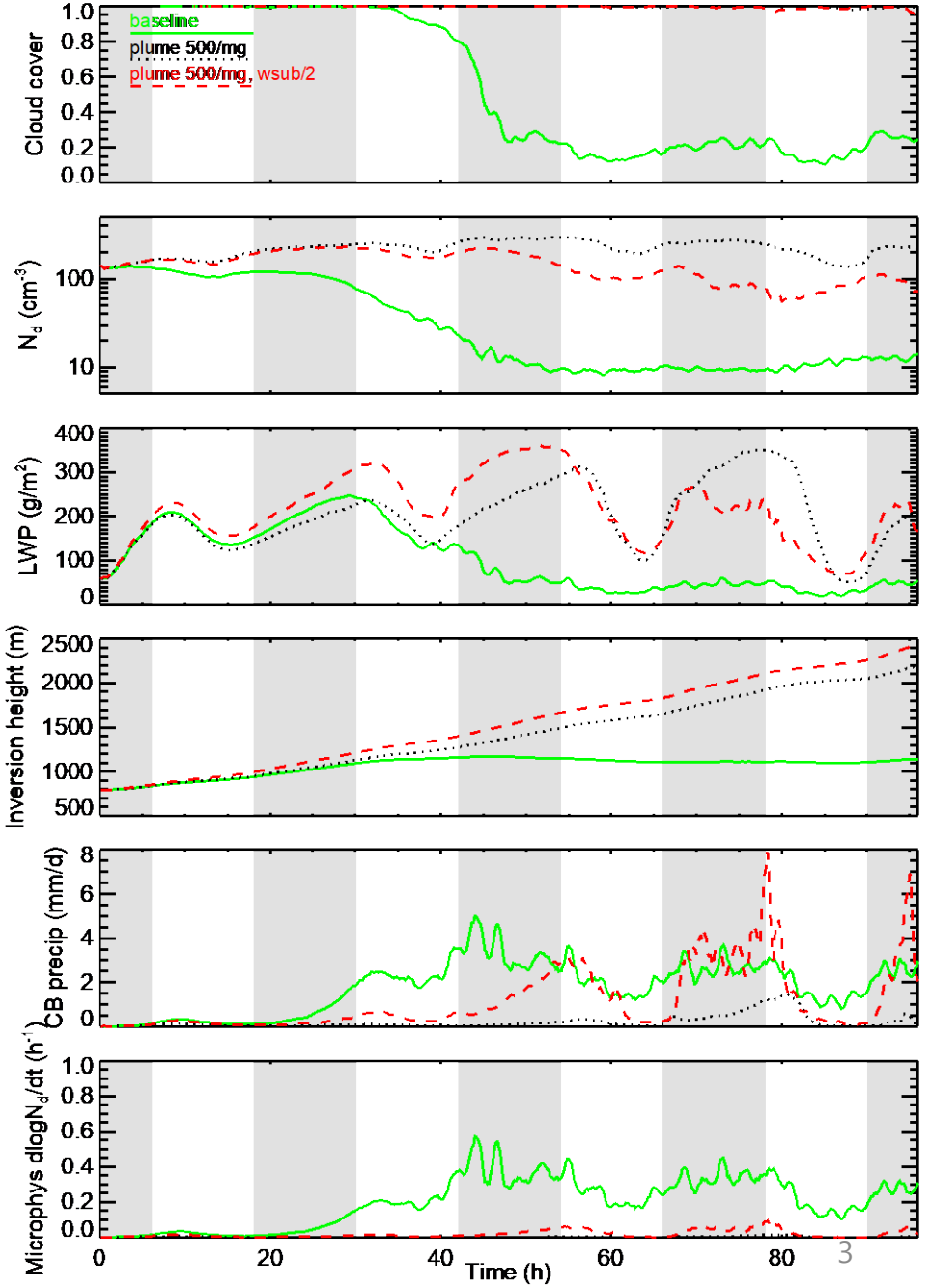
LTS_{day1} > 21.6 K, CO_{day5} > 232.2 ppbv, # of trajectories = 213



LES results

- reproduce essence of Yamaguchi et al. (2015) results: N_d catastrophe required for transition (at least over 4 days), entrained aerosol plume averts transition
- with subsidence rate halved (from solar heating of absorbing aerosol), PBL deepens faster, and transition barely averted





LES summary

- for SE Atlantic SCT composite trajectory and family of variants, N_d catastrophe resulting from aerosol loss via coalescence necessary for transition to cumulus and *seems* critical component of SCT theory
- catastrophe timescale of O(day) for microphysics parameterization variations on this trajectory and family of variants
- timing of transition depends on microphysics parameterization specifics, forcings, and initial conditions (e.g., 40 m shallower initial depth of PBL)
- final state for catastrophe not Tr Cu but instead shallow open cells
- sustained microphysical loss τ < ~3 h seems necessary for catastrophe and transition