Progress in Understanding the Low Marine Cloud-Aerosol Interactions during CSET using LES

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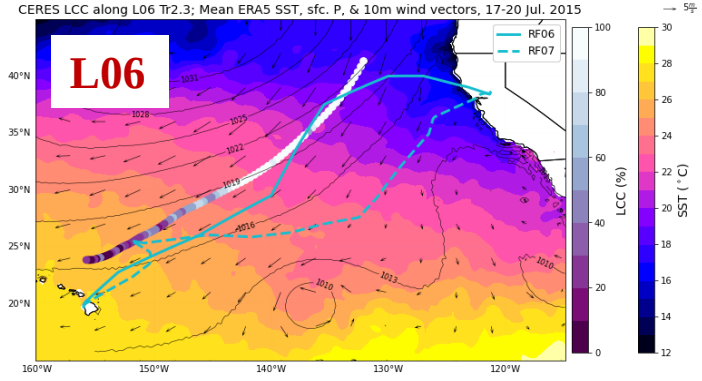
Objective:

Assess and predict aerosol-cloud interactions during LES simulations of observed stratocumulus-to-cumulus transitions (SCTs) with both observed and perturbed aerosols

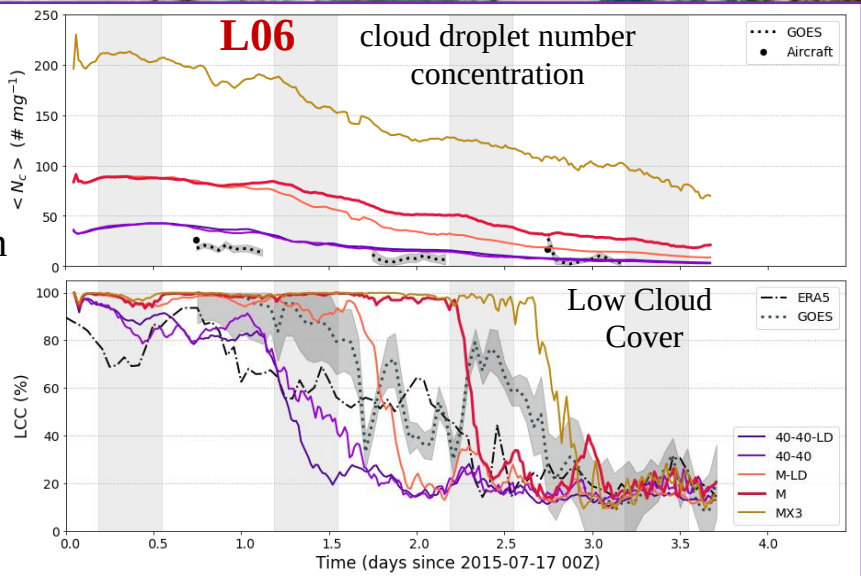
Methodology:

- Lagrangian trajectory: CSET L06 Tr2.3 (Not shown: simulations of L10 Tr6.0.)
- LES: System for Atmospheric Modeling (SAM) coupled to a single-mode bulk aerosol scheme
- Multiple experiments with different initial and free troposphere aerosols



L06 Case Study:

- Characteristics:
  - A clean, well-mixed marine boundary layer (MBL) on the 1st day
  - continuous MBL deepening, precipitation onset, and cloud breakup after the 1st day
- Overall, the LES simulates general MBL features seen in observations.
- The runs with enhanced aerosols show delayed precipitation onset and cloud breakup.



Transition by Precipitation:

The decrease in MBL cloud fraction (CF) and cloud-layer total aerosol number concentration (N_a) after the precipitation onset during SCT implies that precipitation-induced reduction in aerosol enhances the breakup of inversion cloud.