Observations of marine stratocumulus microphysics, turbulence, and aerosols during ACE-ENA

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Remote vs in-situ turbulence energy dissipation rate

- Favorable comparison of ACTOS in-situ cloud turbulence observations with RADAR observations

RF0716: 10 km ACTOS flight path

The mean energy dissipation rate ($\varepsilon$) matches well

Narrow distribution for RADAR due to larger averaging time
- **RF0709-P1 and P2** Same cloud system, but two microphysical regimes
Wind shear is stronger in P2 than in P1.

The values of in-cloud vertical velocity (W) of P1 show higher fluctuations than those of P2.
- Slope value ($\gamma_s$) in Log L and Log $\tau_p$ space is close to -1 if mixing is inhomogeneous.
- Shown below: $\gamma_s$ for multiple G1 flights in stratocumulus clouds, organized by height within the cloud: inhomogeneous near cloud top.
- Slope value ($\gamma_s$) in Log L and Log $\tau_p$ space is close to -1 if mixing is inhomogeneous.
- Shown below: Mixing diagrams and averaged values of $\gamma_s$ for P1 and P2

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<tr>
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<th>RF0709-P1</th>
<th>RF0709-P2</th>
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<tbody>
<tr>
<td>$\gamma_s$</td>
<td>-0.98</td>
<td>-0.93</td>
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Mixing diagrams and averaged values of $\gamma_s$ for P1 and P2.
Discussion

- The mean diameter ($D_m$) versus the standard deviation of diameter ($\sigma_D$) and relative dispersion ($\sigma_D/D_m$) for each penetration.

- Why are the relationships between $D_m$ and $\sigma_D/D_m$ different between RF0709-P1 and P2?
- Favorable comparison of remote and in-situ estimation of turbulence energy dissipation rate.

- Sharp transitions of cloud microphysical properties were found in one stratocumulus cloud system (RF0709-P1 and P2).

- Compared to P1, the wind shear and turbulent dissipation rate are stronger and larger in P2.

- The slope value ($\gamma_s$) analysis suggest inhomogeneous mixing near cloud top, but there is a slight difference between each penetration perhaps due to larger turbulent dissipation rate.

Future work and collaboration

- The horizontal structure of the cloud top will be investigated by using observations from the thermal-infrared camera. (Dr. André Ehrlich)