Materials regarding potential observations for VOCALS

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Lessons from EPIC Sc

- 3 hrly upper air soundings were insufficient to document the extent to which BL decoupling was influenced by drizzle
- Most drizzle evaporates before reaching the surface, hence surface measurements of particle size spectra cannot substitute for measurements or retrievals within the cloud layer.
- Areal context of drizzle from C-band scanning radar was a major advantage in interpretation of ship-based surface and vertically-pointing observations.

Science Objectives

- Test hypothesis that drizzle causes BL decoupling.
- Test hypothesis that marine Sc heavy drizzle events preferentially occur in low-aerosol “clean” regimes.
- Refine hypothesis that drizzle preferentially occurs in mesoscale patches of open cellular structure.

Unraveling the relationship between aerosol and drizzle would be aided by partitioning measured effective radius into cloud and precipitation parts.

All $$r_{eff} = \frac{\int_0^{\infty} r^3 n(r) dr}{\int_0^{\infty} r^2 n(r) dr}$$

Cloud $$r_{eff} = \frac{\int_0^{500\,\mu m} r^3 n(r) dr}{\int_0^{500\,\mu m} r^2 n(r) dr}$$

Drizzle $$r_{eff} = \frac{\int_{500\,\mu m}^{\infty} r^3 n(r) dr}{\int_{500\,\mu m}^{\infty} r^2 n(r) dr}$$

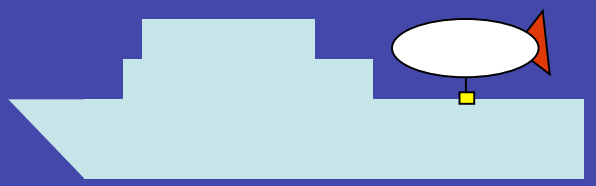
Measurement Objectives

- Investigate joint variability of thermodynamic profiles, areal drizzle rates, aerosol optical depth, r_{eff} of cloud particles < 500 μm, and r_{eff} of precip particles > 500 μm.
- Evaluate satellite retrievals of aerosol optical depth and r_{eff} along ship track.

Remote sensing of cloud versus precip particles

- Different radar frequencies observe different portions of particle size spectra
  - 5 cm band does not observe cloud-size particles
  - 0.87 cm band observes cloud and precip-sized particles, and becomes saturated in moderate to heavy precip
- Dual frequency radars can be used to estimate r_{eff} using differential attenuation methods (following Meneghini's studies).
- Need feasibility study:
  - Whether methods would be sufficiently sensitive
  - Modifications to convert community vertically-pointing radars into beam-matched dual frequency mode.

Tethered sondes obtain high time resolution boundary layer measurements (press, RH, temp) at different altitudes



Measurement Wish List

- High time resolution (< 3 hrly) thermodynamic measurements of BL using tethersonde
- Scanning C-band radar
- Vertically-pointing observations for retrieval of aerosol optical depth, cloud $r_{eff,}$ precip r_{eff}