Aerosol Information from Lidar

- Three ways lidar can contribute to air quality studies:
  - PBL height for model evaluation
  - Retrievals of near-surface aerosol extinction
  - Insight into aerosol type
- Lidar strengths/weaknesses:
  - high vertical resolution (order 30 m)
  - constraints on aerosol microphysical properties
  - nadir-only/sparse sampling
- Current resources:
  - CALIPSO/CALIOP – backscatter lidar in polar orbit
  - Airborne High Spectral Resolution Lidar (HSRL)
    - ✓ Flown by NASA, U Wisconsin, U Wyoming, DLR, CNRS
- Future:
  - ATLID/EarthCARE – 355 nm HSRL in polar orbit, 2022 launch (?)
  - ACCP - Decadal Survey mission under study for launch in late 2020's
  - Emerging networks of advanced ceilometers (EPA-PAMS, Copernicus)

- PBL height for model evaluation
  - From detection of aerosol gradient at top of mixed layer
  - Several algorithms have been published (eg: McGrath-Spangler, 2013)
- Near-surface aerosol extinction
  - Near-surface aerosol extinction related to PM2.5 more robustly than AOD (Kaku et al. 2018)
  - CALIOP: retrieves near-surface aerosol, but uncertainties can be large
  - HSRL: more accurate retrievals, no assumptions required
- Aerosol type information based on aerosol intensive properties
  - CALIOP: dust/non-dust from lidar depolarization profiles
  - HSRL: additional intensive properties to also distinguish coarse-mode/fine-mode, absorbing/non-absorbing