* Overview
  + Improved understanding of certain cloud precipitation processes is essential to characterizing how those processes contribute to deviations from modeled parameter values
  + Truthful LWC and droplet size distributions measurements are vital for understanding several essential cloud processes
    - Droplet activation/formation processes
      * Condensational growth
    - Primary precipitation processes
      * Collection/coalescence
      * Bergeron
    - Dynamic processes
      * Entrainment/mixing
* Significance
  + Considerable sizing and counting uncertainty impacts CDP LWC/droplet size distribution retrieval capability
    - Major contributing factors
      * Sample area dimension uncertainty
      * Non-uniform response throughout sample area
      * Coincidence error
  + Nevzorov hotwire probe provides an independent bulk LWC measurement
    - Nevzorov advantages
      * Collector/reference sensor pairing reduces uncertainty, baseline noise
      * Nevzorov/CDP LWC has been shown to be in good agreement
    - Has several known, but not completely characterized, uncertainty sources
      * Dry air heat losses
      * Non-unity particle collection efficiency
      * Sensor saturation effects
  + CDP performance investigation possible using CDP/Nevzorov’s mutual LWC retrieval
    - CDP LWC is derived from droplet concentration/sizes
      * Possible to constrain CDP performance with respect to different droplet concentrations/sizes using…
        + Nevzorov LWC
        + Previous CDP uncertainty studies
* Background
  + CDP
    - Lance, 2010
      * Basis for droplet generator setup
      * Significant droplet sizing/droplet concentration/LWC uncertainty due to…
        + Coincidence error, which introduces bias by…

Mis-sizing droplets

Mis-counting droplets

* + - * + Non-uniform counting/sizing performance within sample area
  + Nevzorov
    - Significant LWC uncertainty due to…
      * Dry air heat losses
        + Dependent on airspeed and environmental pressure fluctuations (Korolev 1997)
      * Non-unity liquid particle collection efficiency
        + Especially for 5 um < VMD < 25 um (Korolev 1997, Strapp 2003, Schwarzenboeck 2009)
      * Sensor saturation effects significant where…
        + MVD > 50 um (Strapp 2003)
        + LWC > 1.3 g m-3 (Sulskis, 2016)
    - Nevzorov algorithm development
      * Minimized dry air heat loss uncertainty caused by airspeed/pressure deviations
      * Characterized other major uncertainty sources
        + Aircraft orientation
        + Unity collection efficiency assumption (in VMD 2-50 um range)
        + Fixed latent heat of vaporization assumption
  + CDP/Nevzorov LWC comparison
    - CDP LWC in significantly better agreement with Nevzorov LWC than LWC-100 or PVM-100A LWC (Sulskis, 2016)
      * Very little Nevzorov LWC bias evident for 0.02 < LWC < 1.3 g m-3
* Objectives
  + Improve UW King Air LWC/droplet size distribution retrieval confidence
    - Develop droplet generator and base operating procedures suitable for…
      * Testing CDP performance
      * CDP calibration
    - Develop/test in-house Nevzorov data processing algorithms
      * Test calculation truthfulness/algorithm robustness using…
        + COPE 13 dataset

Including Korolev’s Nevzorov calculations

* + - * + Spring/Fall 2016 UWKA data
    - Better characterize Nevzorov LWC uncertainty sources
    - Propose methods to further investigate CDP performance/limitations using…
      * CDP/Nevzorov LWC comparison
      * Established CDP performance characterization
      * Improved Nevzorov uncertainty characterization

* Timeline
  + End of 2016 spring semester
    - Nevzorov uncertainty characterization completed
    - First iteration Nevzorov algorithms performing consistently
  + End of summer 2016
    - Nevzorov algorithms/documentation in form suitable for in-department use
    - Major droplet generator components obtained and in place
  + End 2016 fall semester
    - Nevzorov algorithm robustness tested with fall 2016 UWKA flight data
    - Nevzorov algorithms/documentation finalized for in-department use
  + End of winter break 2016
    - Droplet generator producing droplets within acceptable tolerances
    - Droplet generator/CDP used to collect initial, proof-of-concept, dataset
    - Initial thesis writing stages
  + Mid 2017 spring semester
    - Droplet generator procedures finalized and documented
    - Initial thesis draft complete
  + End of 2017 spring semester
    - Thesis approved by committee