High resolution measurements of aerosols, microphysics, and turbulence at stratocumulus cloud top: A possible flight project near the ENA site

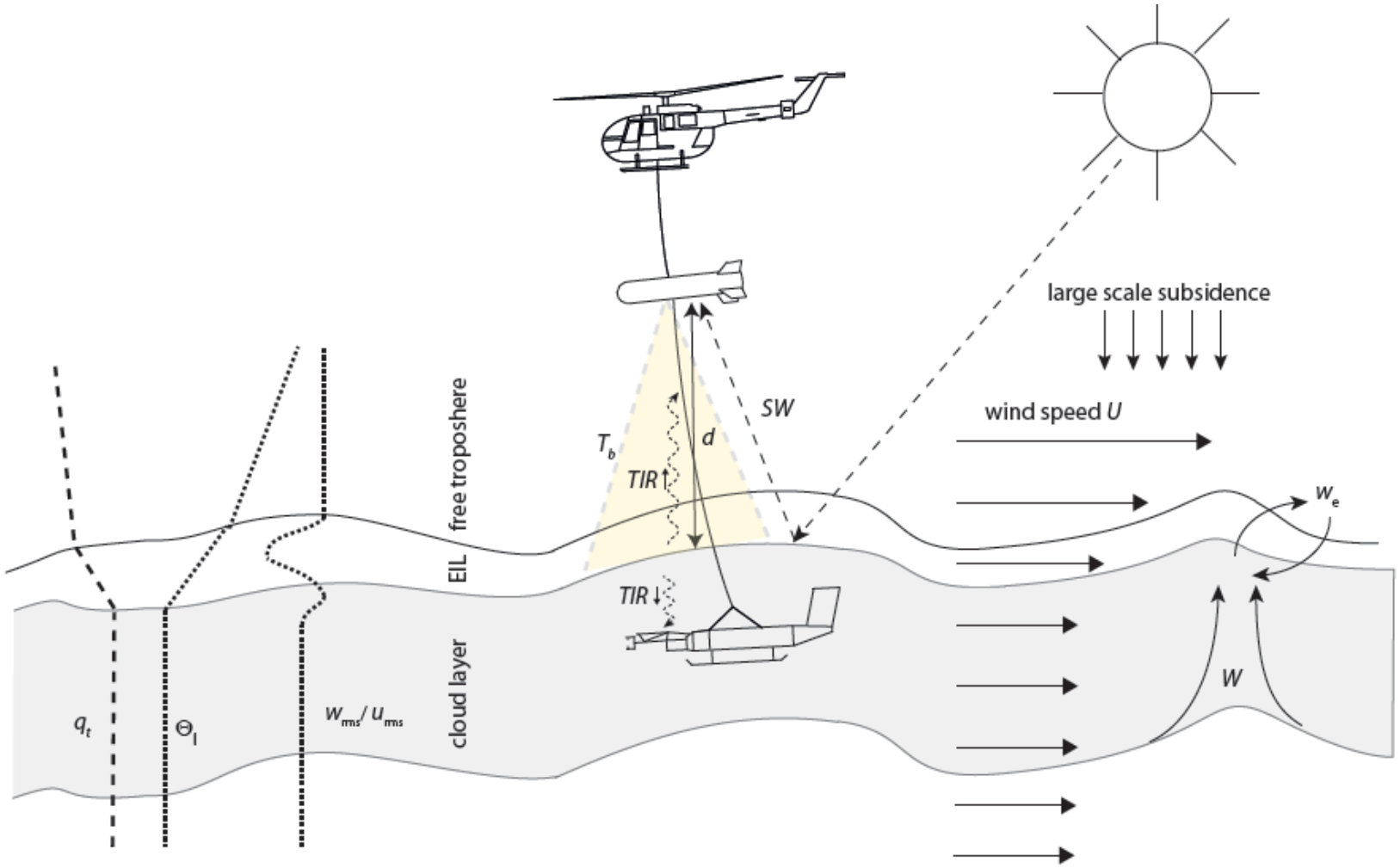
R. A. Shaw[1], H. Siebert[2], M. Wendisch[3],

[1]Michigan Technological University, Houghton, USA

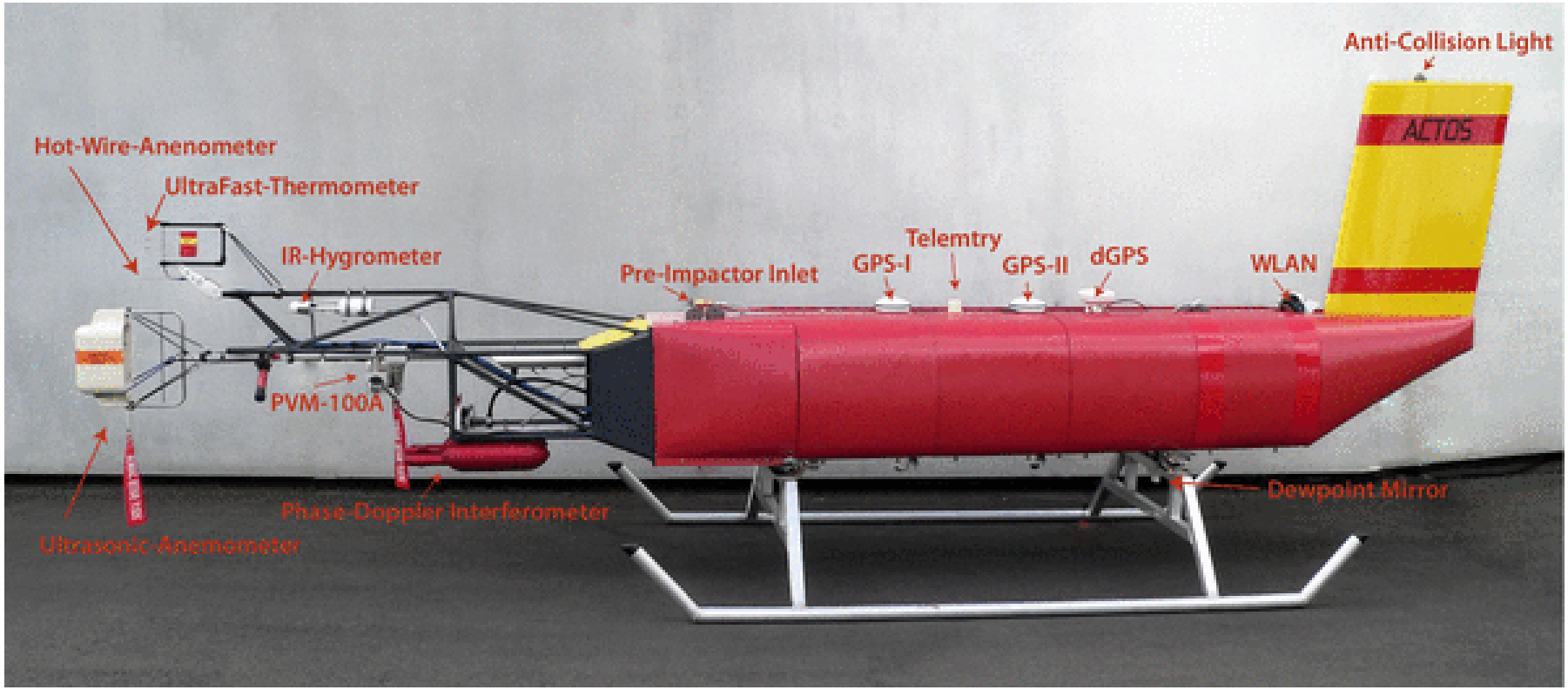
[2]Institute for Tropospheric Research (TROPOS), Leipzig, Germany

[3]Leipzig University, Germany

Stratocumulus measurement concept



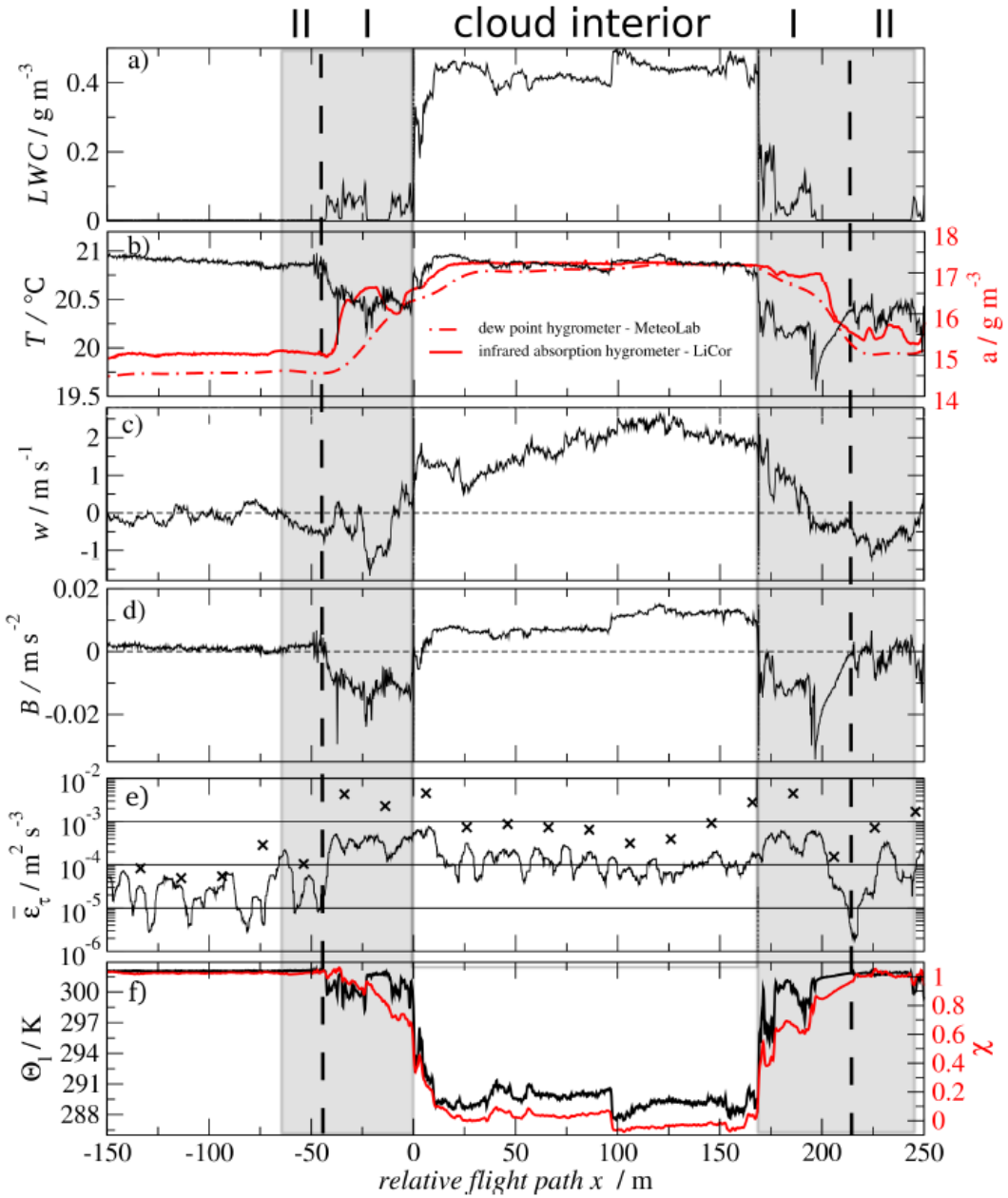
ACTOS: airborne cloud-turbulence observation system



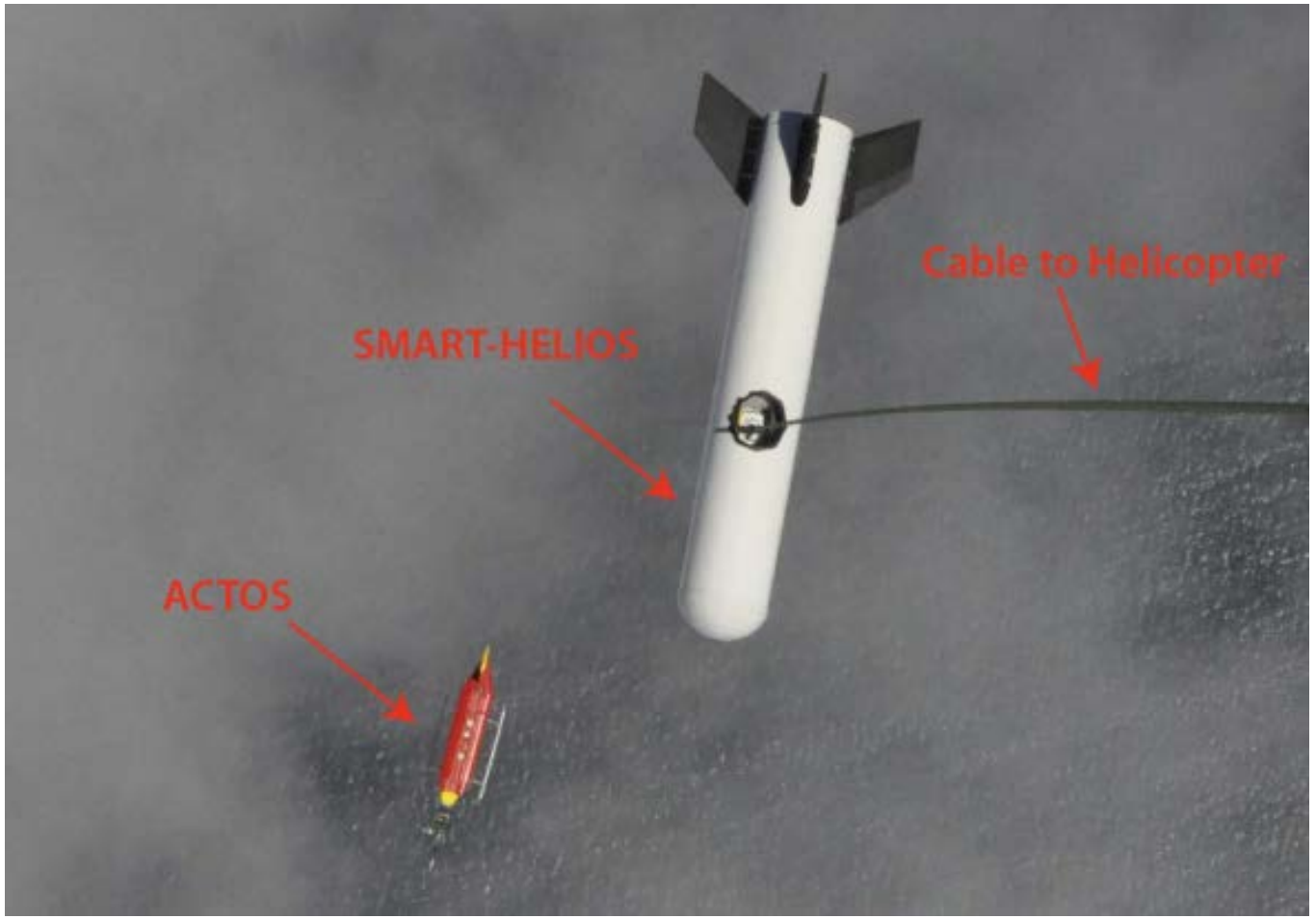
Measures: thermodynamics, turbulence, aerosol, cloud microphysics, spectral radiation

Siebert et al. ACP 2013

Collocated, high-resolution measurements



SMART-HELIOS

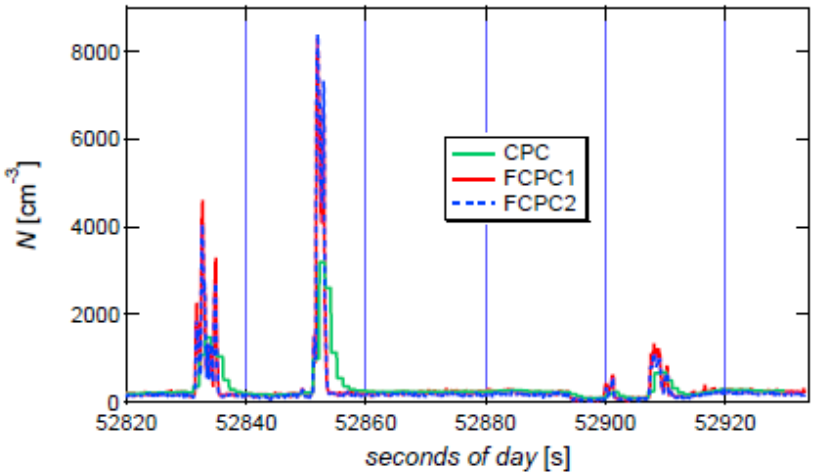


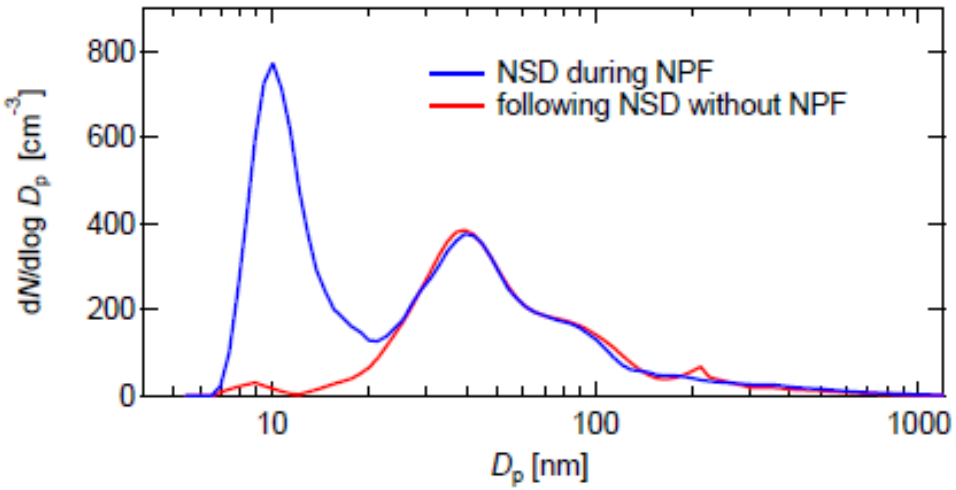
Measures: upward spectral irradiance and radiance

- Visible band 300-1000 nm with 2-3 nm resolution
- Near infrared band 900-2100 nm with 8-10 nm res

Werner et al. JGR 2014

Aerosol size distribution and concentration





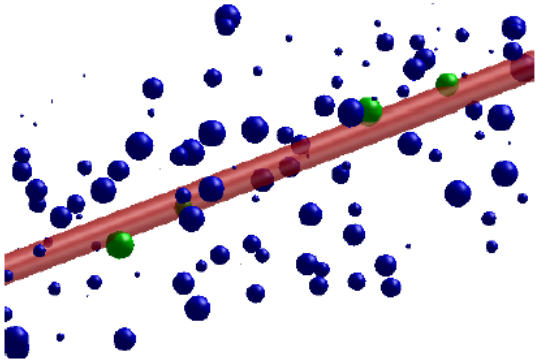
- Optical Particle Counter (OPC), 250 nm to 2.5 um with 1 s sampling
- Fast Condensation Particle Counter (FCPC), >7 nm at 10 Hz
- Scanning Mobility Particle Sizer (SMPS), 6 to 250 nm with 120 s sampling

Wehner et al. 2015

HOLODEC: holographic detector for clouds

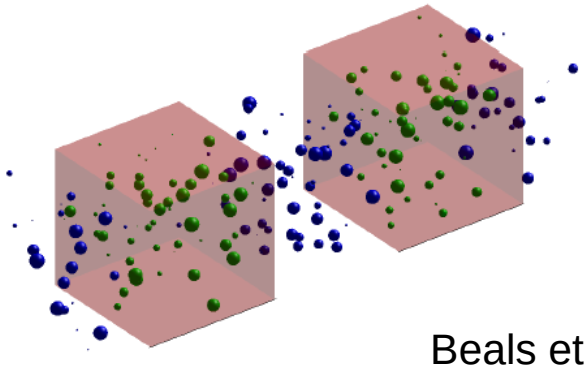
Single Particle

- Measures the volume one droplet at a time
- Sweeps a very small sample region along a long path length
- Poor spatial resolution: requires $\sim 100m$ of path length to obtain significant volume



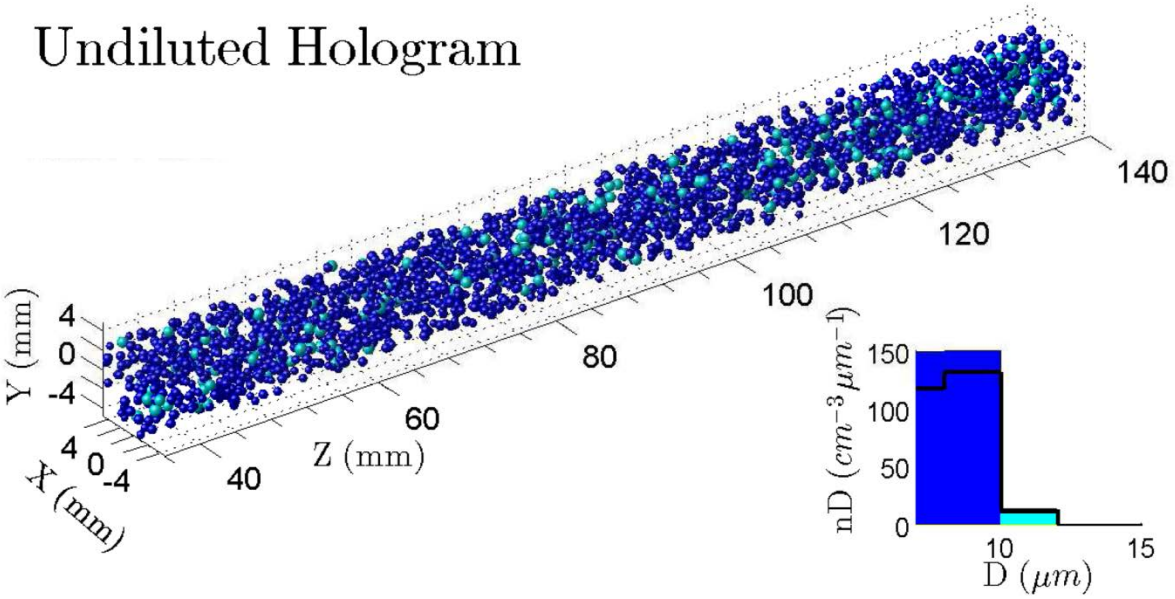
Holography

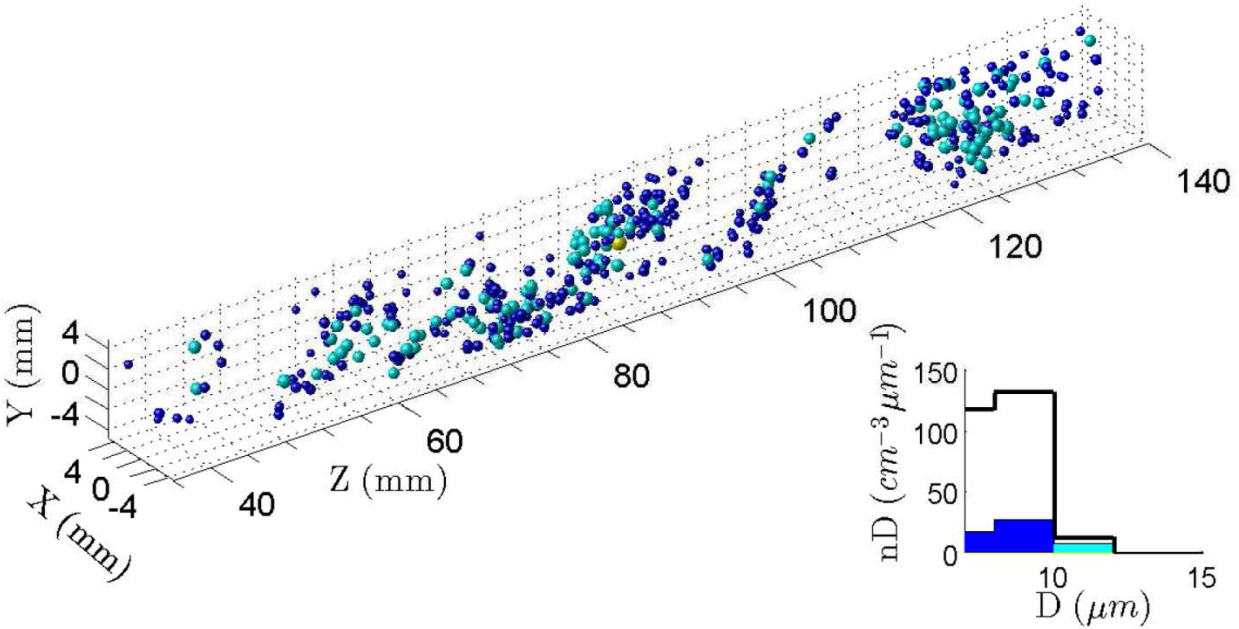
- Captures sequential, discrete volumes
- All targets in volume are imaged
- Sample volumes can be large enough to be statistically significant



Beals et al. 2015

Local measurements of n and d





Beals et al. 2015

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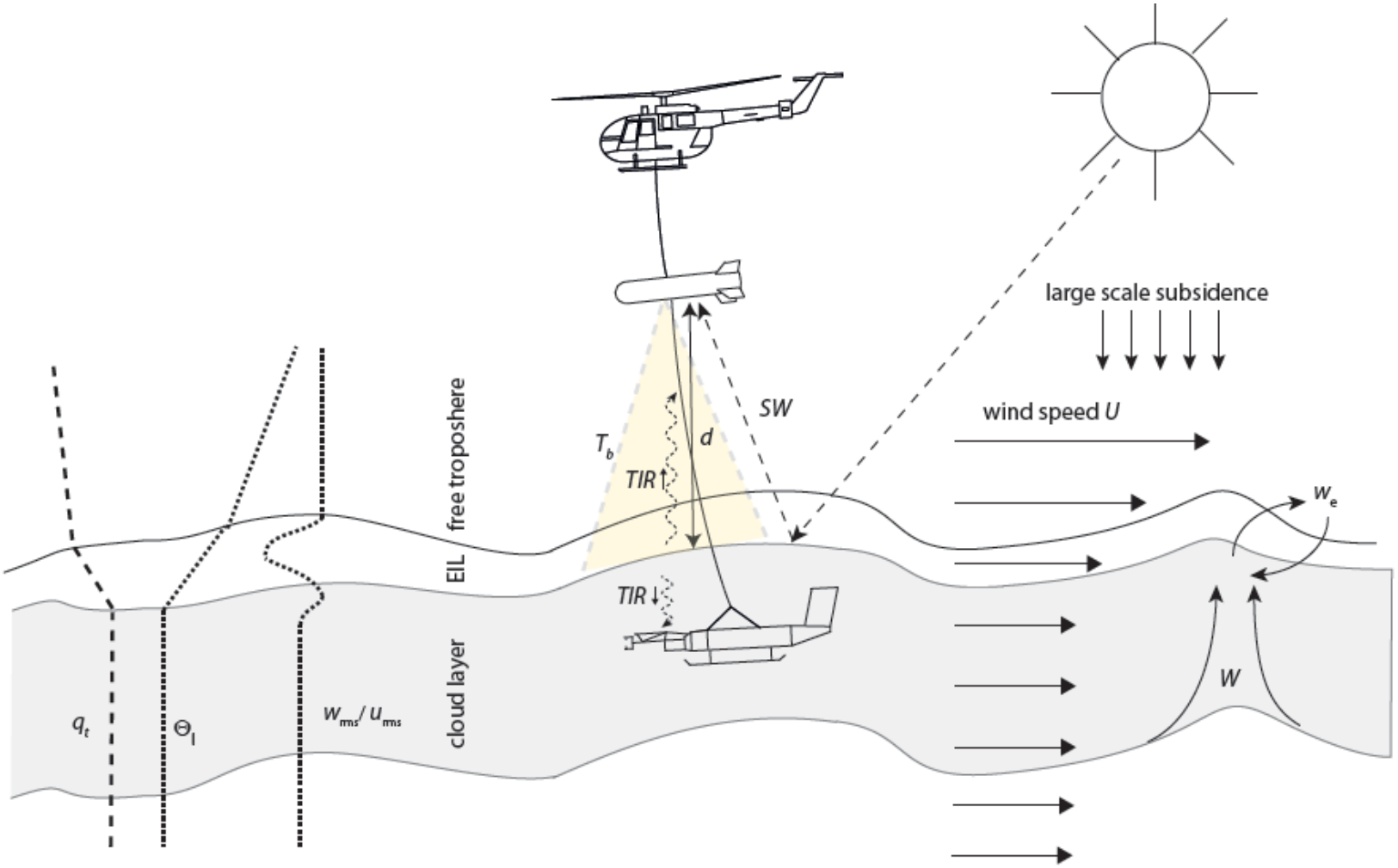
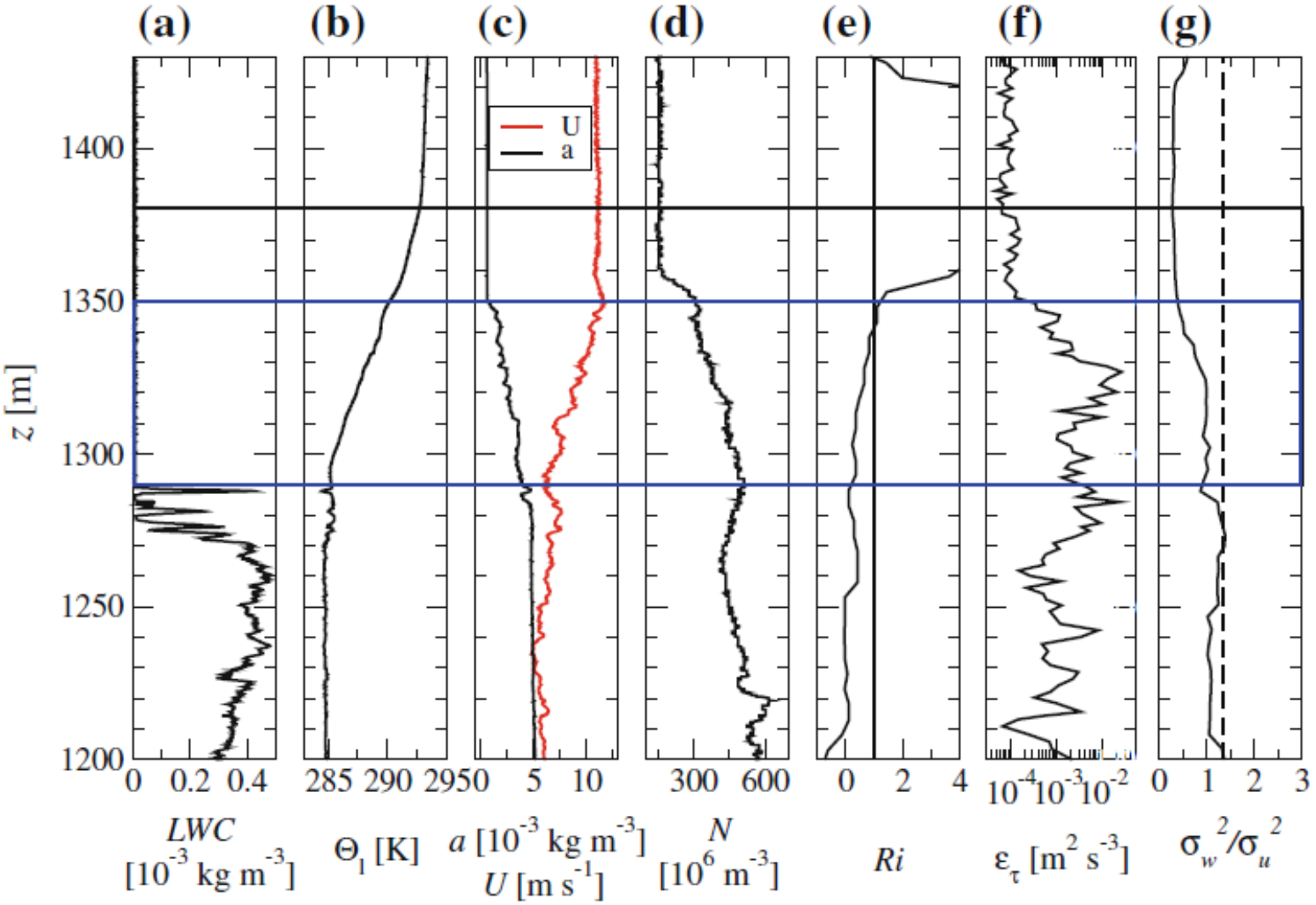


- Summer 2016 – Core support from TROPOS; Pending from DFG
- Possible IOP to coordinate with ENA science infrastructure

ACTOS ENA deployment and radar science

- The radar science group is interested in actively participating in an ACTOS ENA deployment (P. Kollias contact)
  - Coordinate radar scans to best sample the same area sampled by the ACTOS platform
  - Use the ACTOS observations to evaluate and refine a suite of algorithms:
    - Cloud and drizzle microphysics
    - Dynamics (eddy dissipation rate, vertical air motion)
  - Other focus groups with interest in this activity:
    - vertical velocity
    - entrainment
    - uncertainty quantification

Entrainment interfacial layer



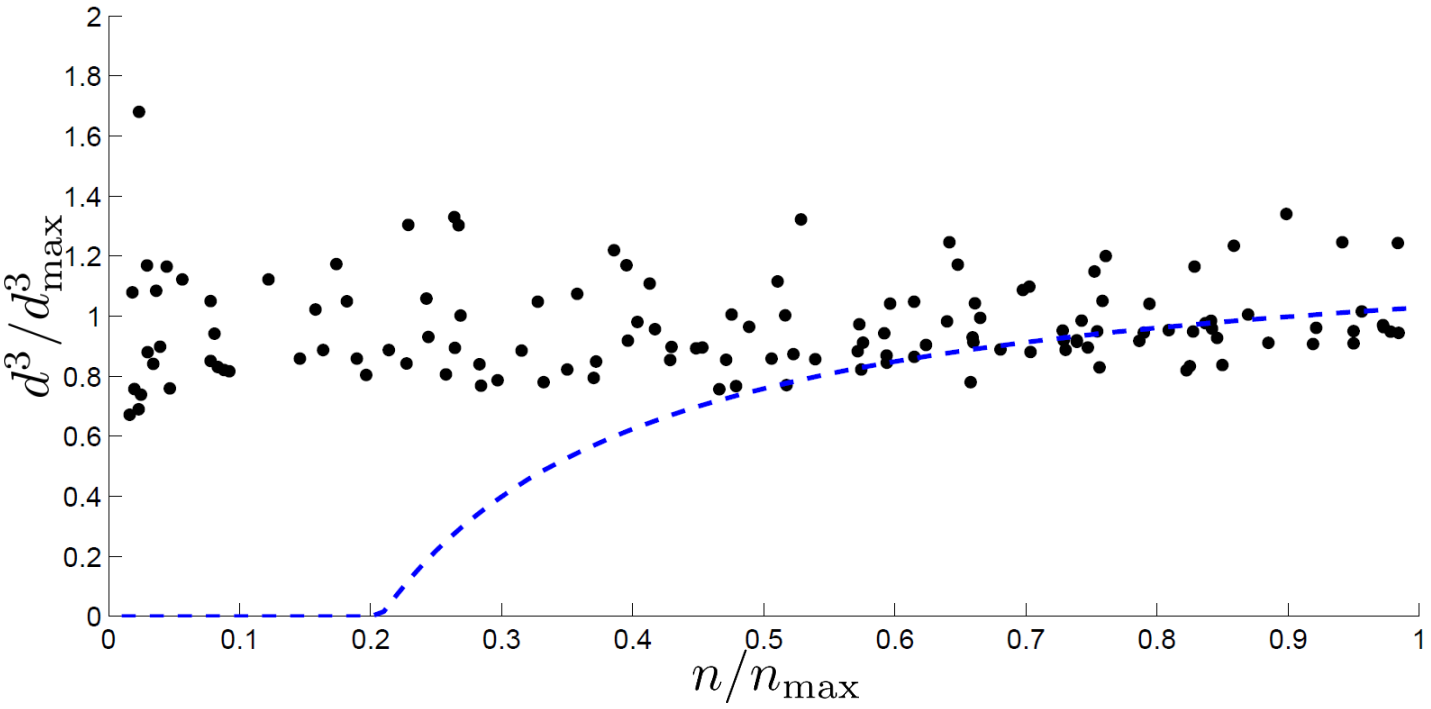
Within blue lines can be called the "turbulent inversion layer"

Katzwinkel et al. BLM 2012

Summary...

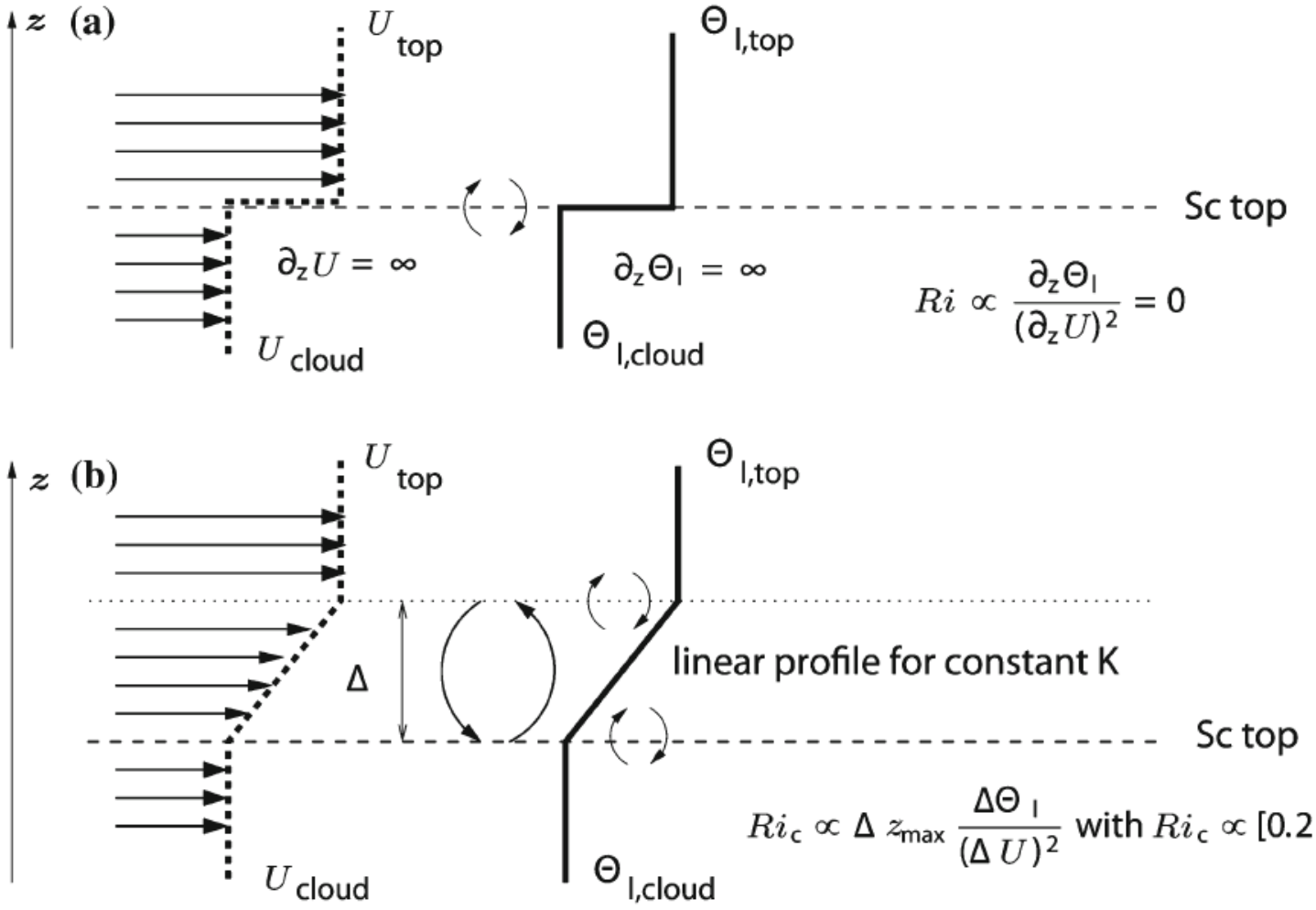
- *Azores summer 2016, primarily funded by TROPOS and (pending) DFG*
- *Possible coordination with IOP at ENA site for remote sensing measurements, etc.*
- *Focus of project is to investigate microphysical links to aerosols, turbulent entrainment/mixing, and radiation*
- *ACTOS allows a unique opportunity for very high resolution measurements within the entrainment interfacial layer*

Local measurements of n and d



Beals et al. 2015

Entrainment interfacial layer



Katzwinkel et al. BLM 2012