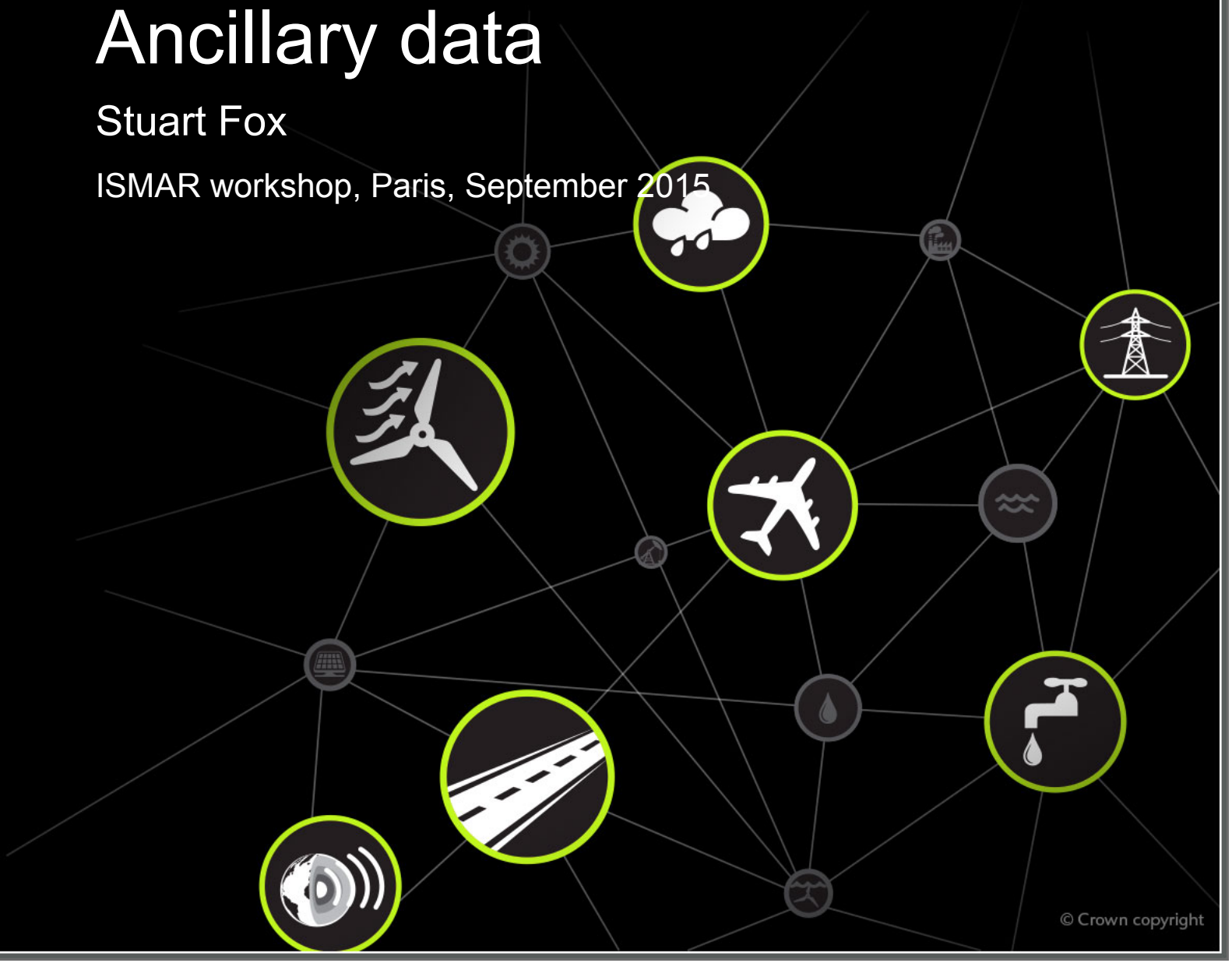
Ancillary data

Stuart Fox

ISMAR workshop, Paris, September 2015

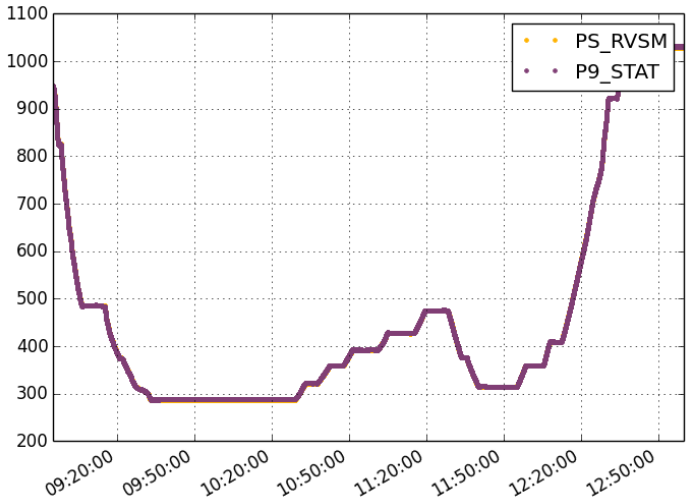


FAAM core data

- Available on BADC (registration required): http://browse.ceda.ac.uk/browse/badc/faam/data
- core_faam_*.nc
- 1 Hz and full data rate files available
- Use latest revision number
- Variables have associated FLAG indicating data quality – meaning is instrument dependent

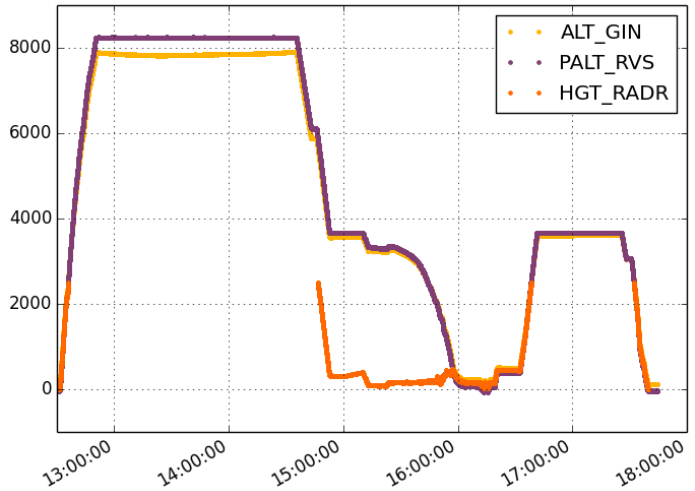
Pressure

- Two static pressure measurements:
  - PS_RVSM (from aircraft data system)
  - P9_STAT (from fuselage static ports)



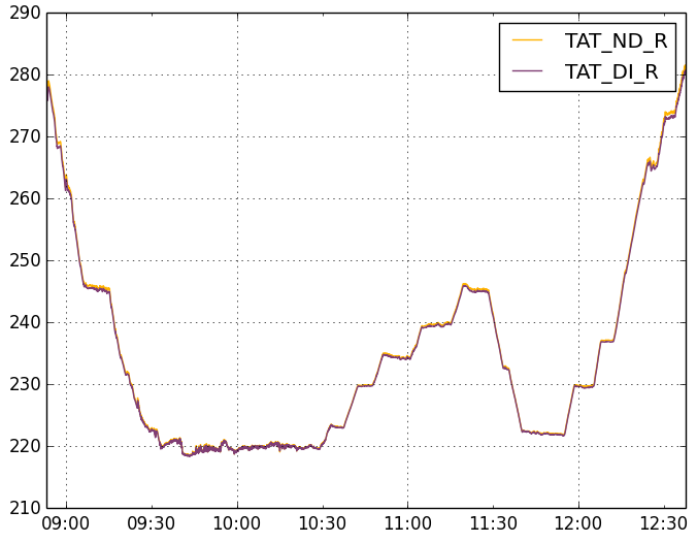
Altitude

- Altitude from GPS/ INU (ALT_GIN)
  - Height above ellipsoid
- Pressure altitude (PALT_RVS)
  - Based on standard atmosphere
- Radar altitude (HGT_RADR)
  - True height above ground, only below ~2500m



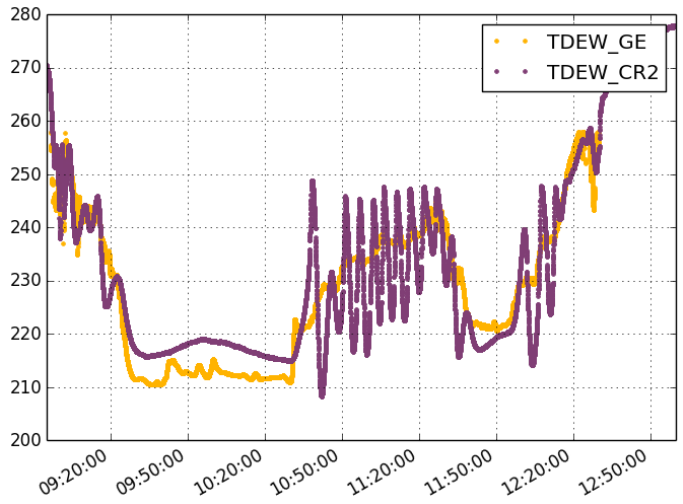
Temperature data

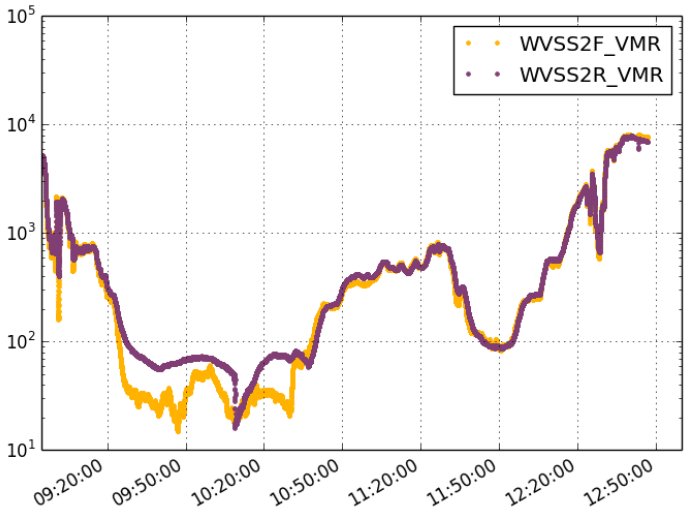
- Two temperature sensors (rosemount inlets)
- Non-deiced (TAT_ND_R) and deiced (TAT_DI_R)
- Non-deiced is preferred unless in icing conditions (supercooled liquid cloud)



Humidity

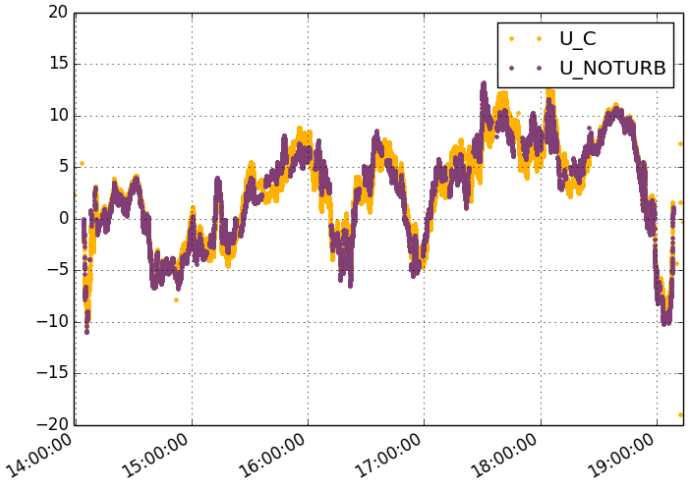
- Two chilled mirror hygrometers: General Eastern (TDEW_GE) and Buck CR2 (TDEW_CR2)
  - Meteorological standard instruments
  - Slow response time
  - Uncertainty between dew/frost point, particularly during ascents
  - Buck not always working well during STICCS or COSMICS
- Two WVSS-II tuneable laser diode hygrometers: flush-mount inlet (WVSS2F_VMR) and rosemount inlet (WVSS2R_VMR)
  - Preferred humidity measurement
  - WVSS2F has faster response but tends to over-read at low humidity
  - WVSS2R susceptible to liquid cloud





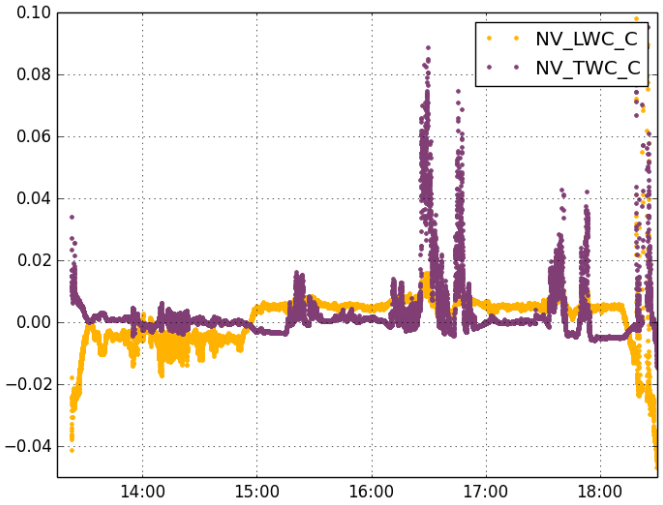
Winds

- Eastward (U_C) and Northward (V_C) wind components from 5-hole turbulence probe
  - Not available from B884 onwards due to replacement nose
- Also versions calculated without turbulence probe (difference between air speed and ground speed) (U_NOTURB, V_NOTURB)
  - Lower frequency data
  - Only during straight flight
- High-frequency wind data also available from AIMMS probe (not in core file)



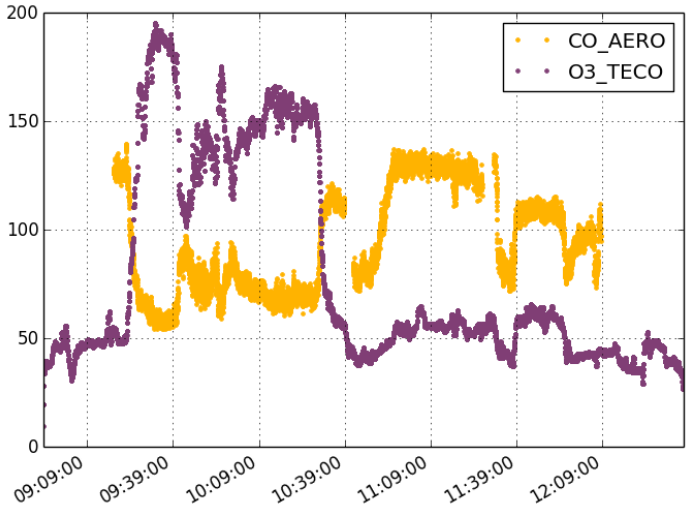
Cloud bulk water content

- Liquid water content and total (liquid+ice) water content from Nevzorov probe (NV_LWC_C and NV_TWC_C)
  - May need to download latest revision of file to get corrected data
  - Probe baseline changes with temperature and altitude
  - Core processing removes gross baseline
  - May be possible to improve by re-processing and including data from other probes
- Liquid water content from Johnson-Williams (LWC_JW_U)



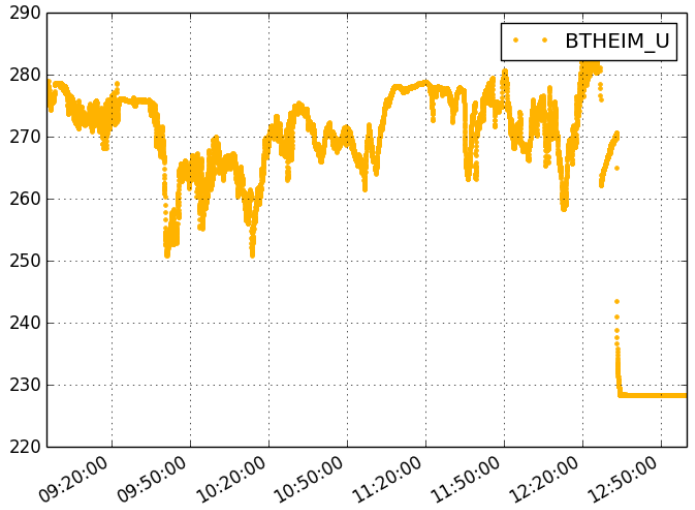
CO and O_3

- Carbon monoxide (CO_AERO)
- Ozone (O3_TECO)



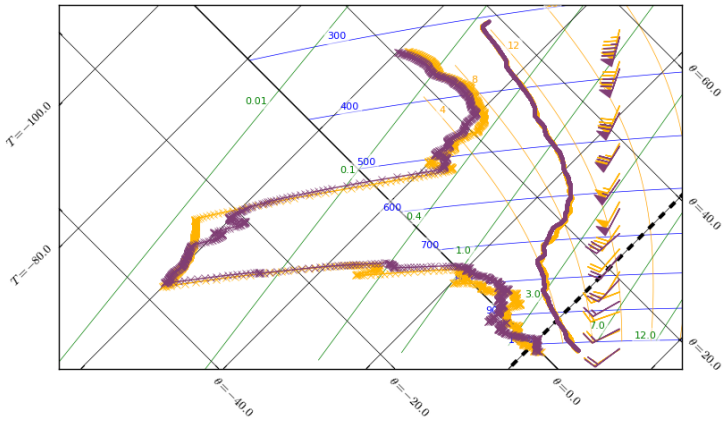
Heimann IR thermometer

- Thermal IR radiometer (BTHEIM_U)
- Downward pointing
- 8-15μm
- No corrections applied for emissivity or atmospheric absorption
- For best results calibrate against ARIES



Dropsondes

- Near-vertical profiles of temperature, humidity and horizontal wind
- Available from BADC
  faam-dropsonde_faam_*.nc
- One file per sonde
- Profiles are co-incident with radiative measurements

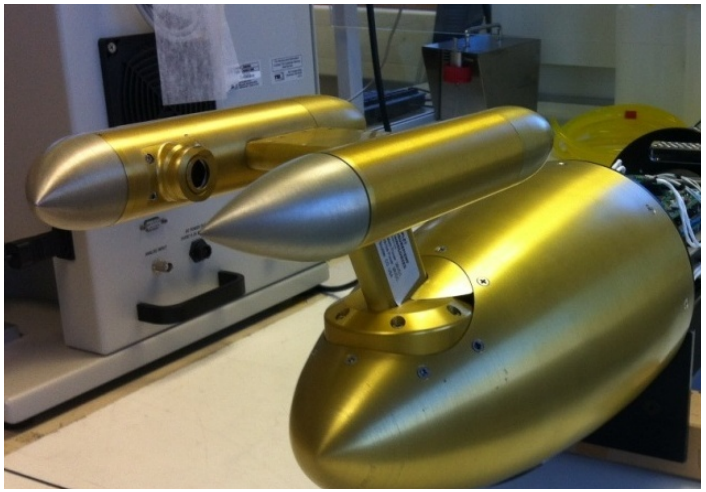


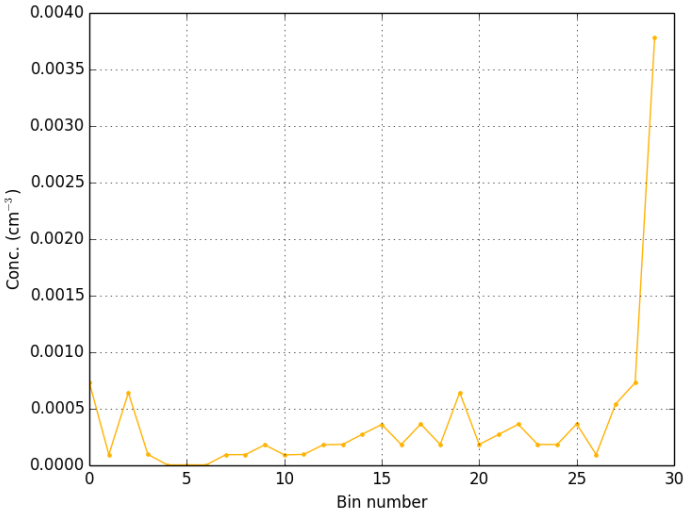
Cloud physics

- Measure particle size distribution
- Multiple probes to cover full particle size spectrum
- Two main types:
  - Scattering probes
  - Imaging probes

Scattering probes

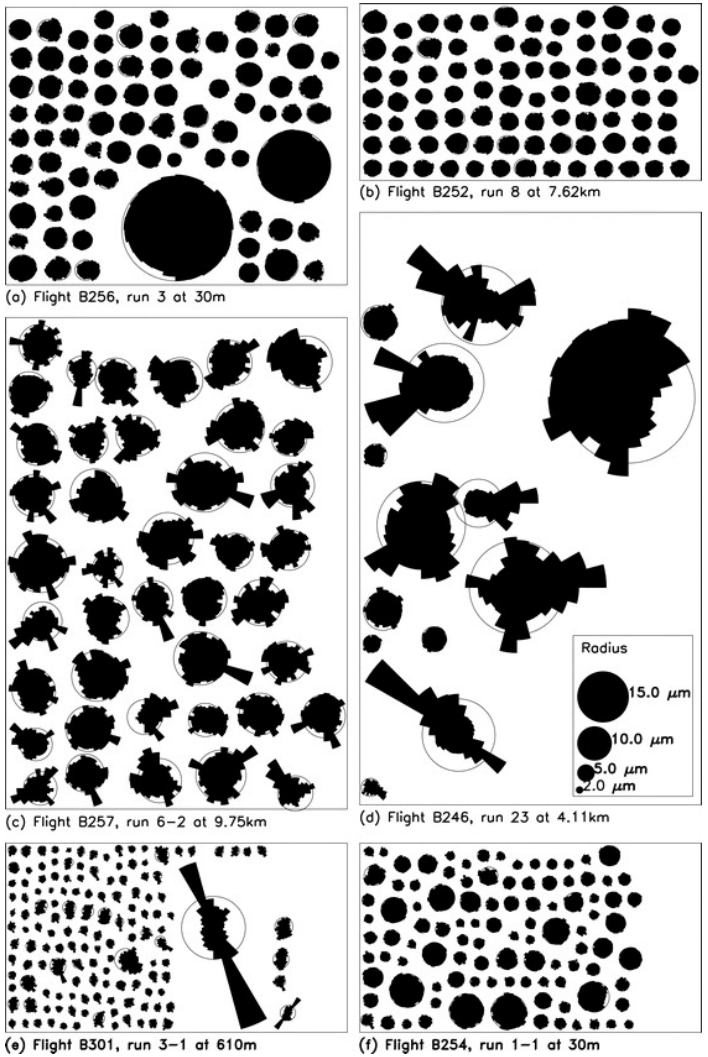
- Cloud droplet probe (CDP)
  - Measures scattering cross section of particles in 30 size bins
  - For known refractive index and spherical particles can convert to particle size
    - Much trickier for ice!
  - Processed data on BADC (core-cloud-phy_faam_*.nc)
    - Particle concentration in each size bin
    - Nominal bin sizes for liquid water drops (2-50 micron)
    - Campign-specific calibrations can be applied by user





Scattering probes

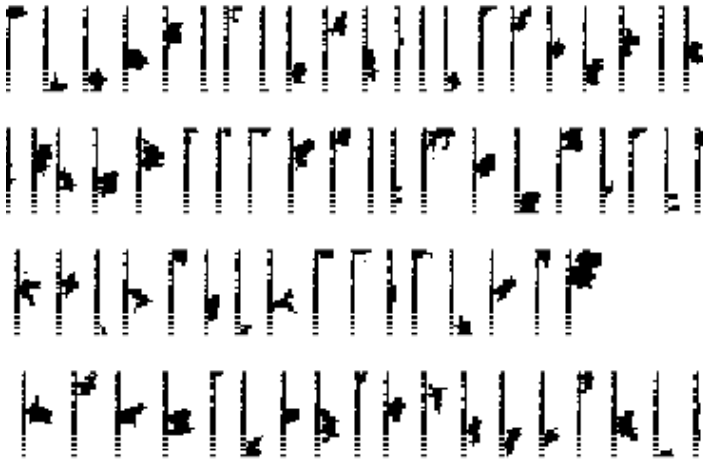
- SID-2 (small ice detector)
  - Up to 140 micron
  - Photodetectors arranged in ring so angular scattering pattern detected
  - Data from Met Office
  - Damaged by lightning strike, repaired for COSMICS
- SID-3
  - Scattering pattern imaged on CCD
  - University of Hertfordshire instrument
  - Only fitted during COSMICS

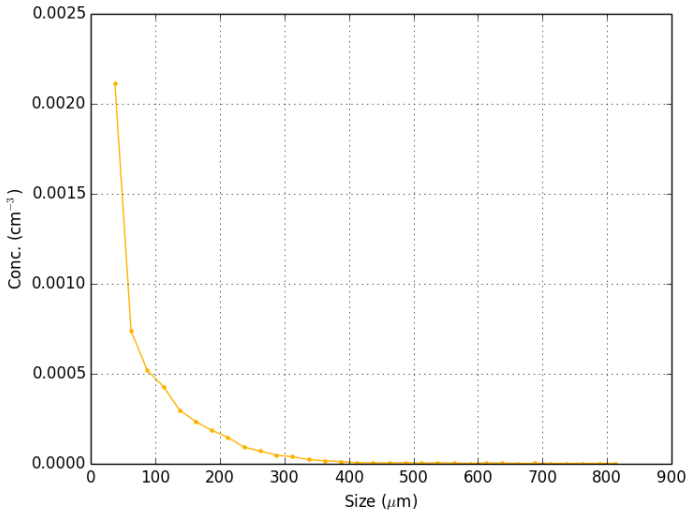


Cotton et alJ. Atmos. Oceanic Technol., 27, 290–303.

Imaging probes

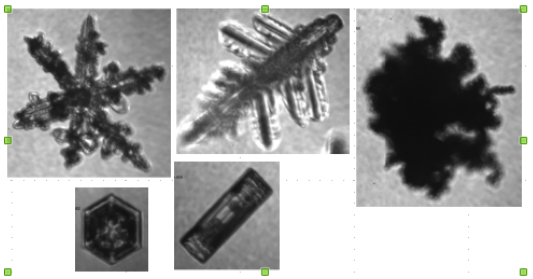
- 2DC
  - 25-800 micron
  - Processed size data on BADC (in core-cloud-phy file)
  - Images also on BADC in pdf file
  - Only fitted for STICCS, damaged by lightning strike and retired





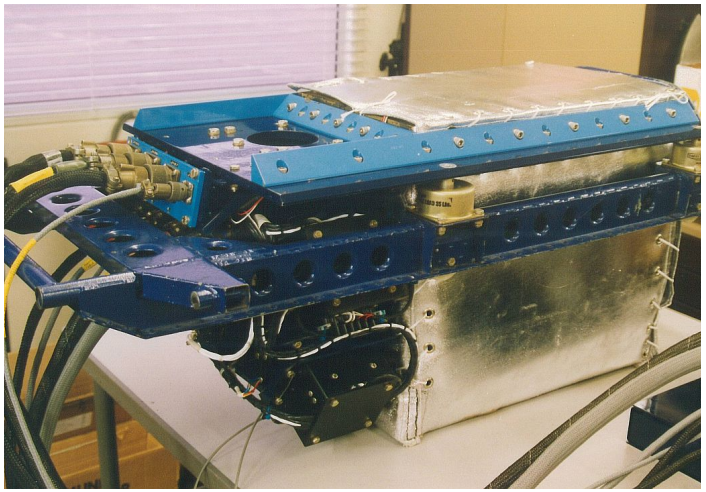
Imaging probes

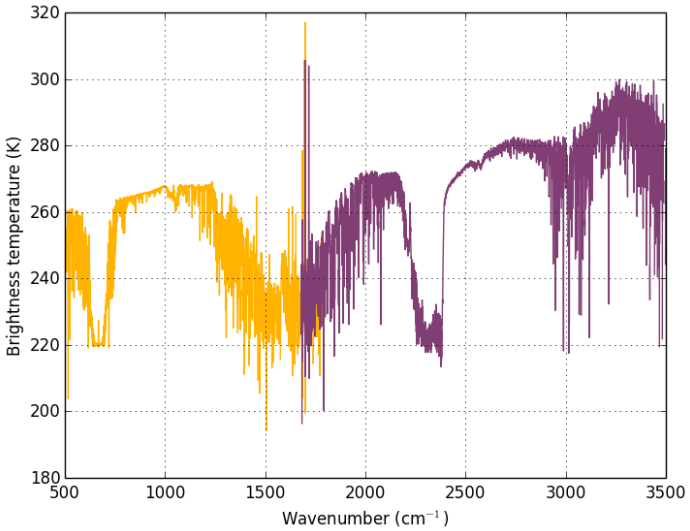
- CIP-100
  - 64 x100µm pixels
  - Some problems during STICCS
  - Data needs to be processed by user
- 2DS
  - 128x10 µm pixels
  - 2 detectors
  - Manchester University handles data
- CIP-15
  - 64x15 µm pixels
  - Part of Manchester university CAPS probe
- CPI (Manchester)
  - Images of cloud particles – idea of habit
  - New 3V-CPI during COSMICS



ARIES

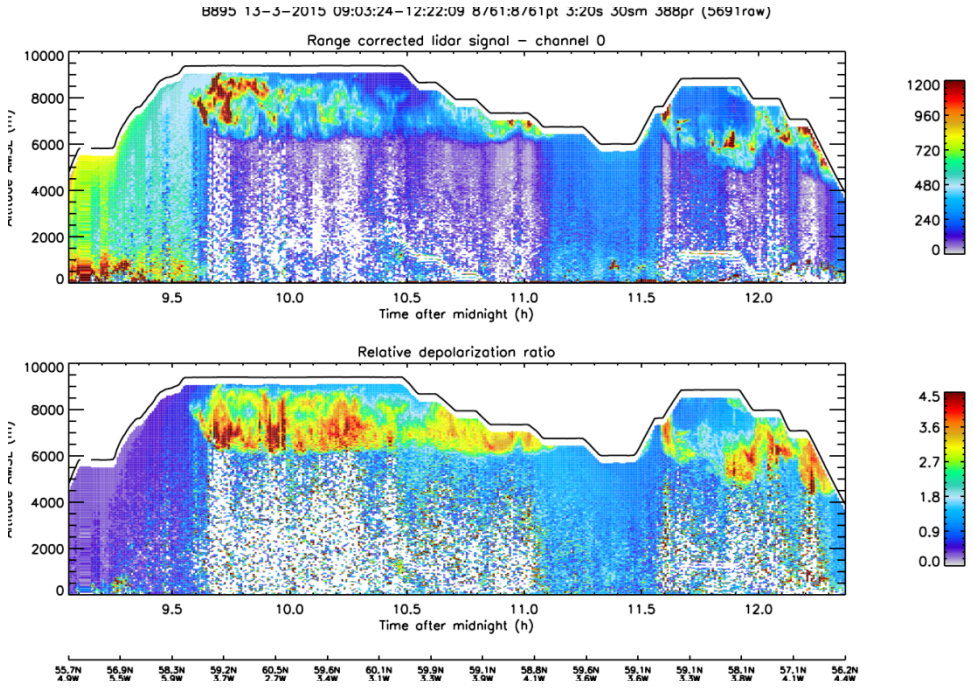
- IR Fourier Transform spectrometer
- 500-3500cm^{-1} at 1cm^{-1} resolution
- Upward and downward views, internal calibration black bodies
- Can be used to retrieve:
  - Surface skin temperature
  - IR emissivity
  - Clear-sky temperature and humidity profiles
  - ... and more
- Calibrated spectra available on BADC (mo-non-core directory)





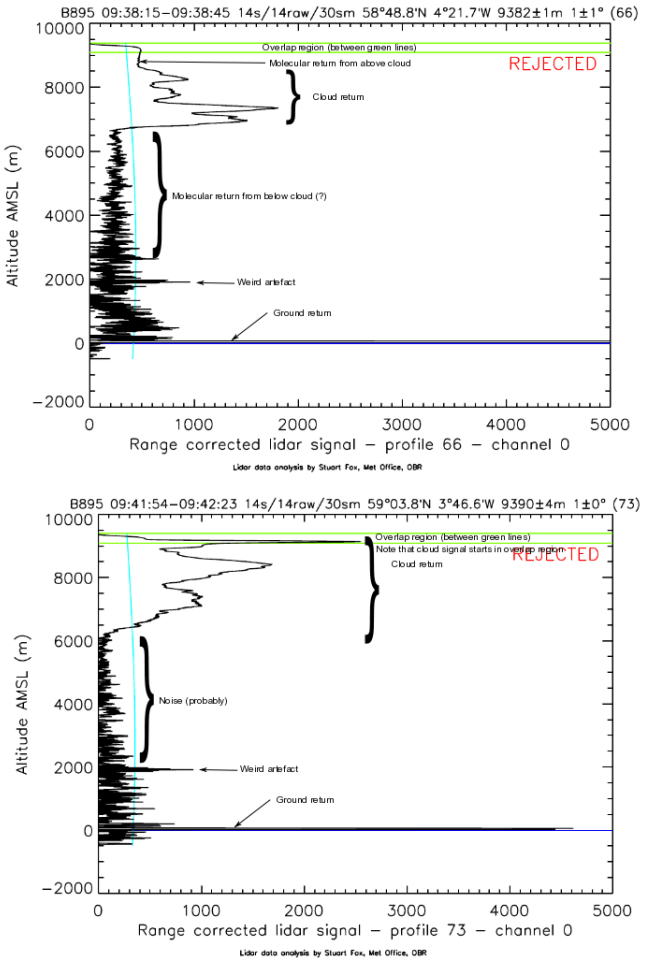
LIDAR

- Leosphere ALS450 downward pointing
  - 355nm (near-UV)
  - Depolarisation channel
- Qualitative idea of cloud layers
- Data available directly from Met Office on request



LIDAR

- Quantitative retrieval may be possible with additional analysis:
  - Cloud top height
  - Cloud base height (for optically thin clouds)
  - Extinction profiles at 355nm (with some assumptions)
  - (Extinction/backscatter ratio at 355nm)



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Questions?