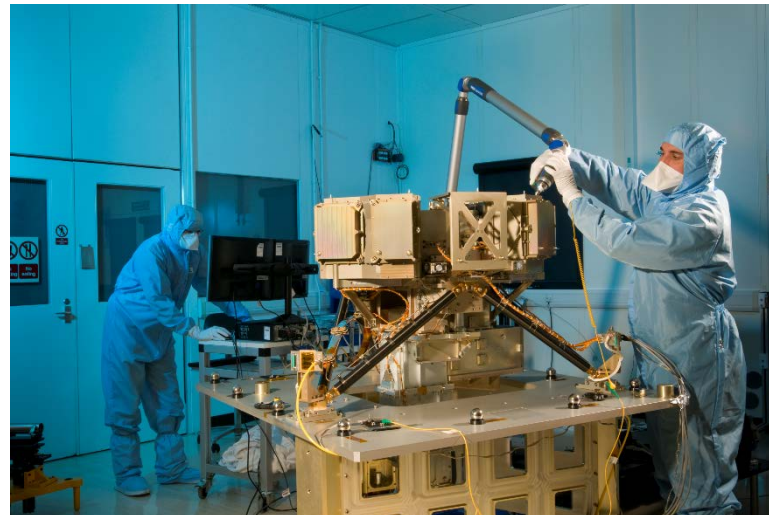
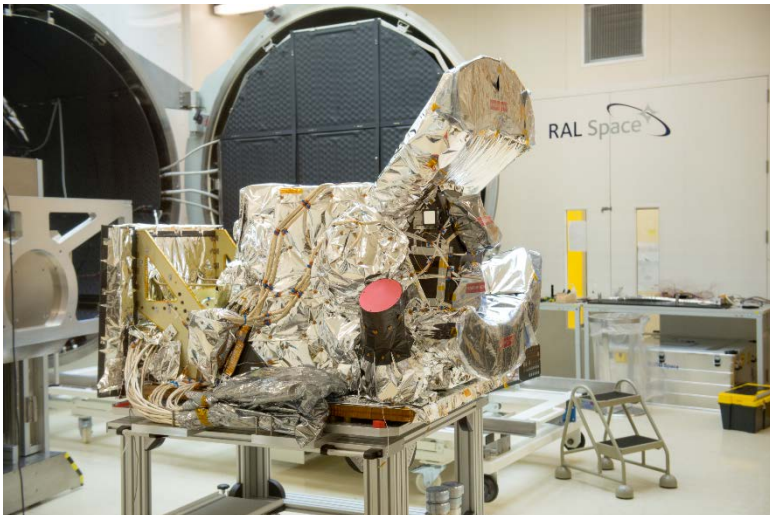




# Atmospheric Science and Air Quality at Chilbolton Observatory

Judith Jeffery, lidar and meteorological instruments manager





# Chilbolton Observatory



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## Active in supporting STFC, HEIs and UKRI research into:

- Atmospheric science
- Radio science
- Space
- Astronomy



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# Chilbolton Observatory 1967...



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- Field Station for “research on radio propagation, including study of problems concerning satellite communications systems”
- Took 4 years to build and commission
- Cost = £428,000



# Atmospheric Science



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- In recent years, atmospheric science measurements have been our largest area of work.
- Our radio communications measurements required a lot of supporting weather information, so meteorology was a natural progression.
- Our measurements today fit into 2 categories:
  - Ground-based profiling: radar, lidar and microwave radiometer
  - In-situ measurements: a wide range of sensors for weather, rainfall, solar radiation, air quality...



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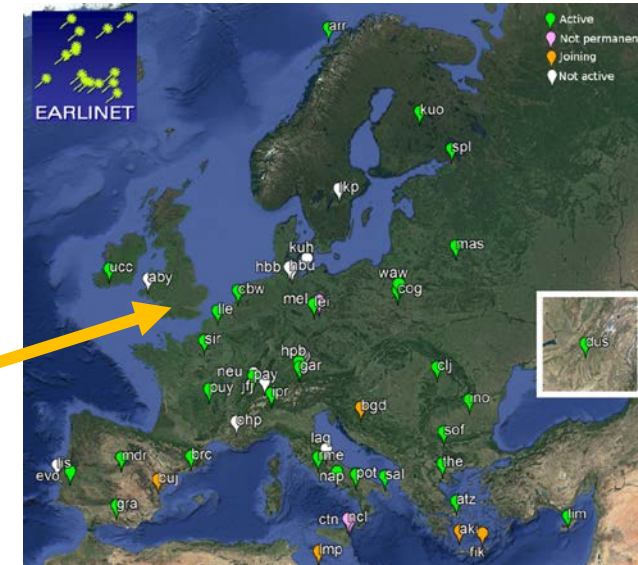
## Atmospheric observation facilities for NERC science

Under the scientific direction of NCAS, STFC operates NFARR on behalf of NERC as part of its Scientific Support and Facilities (S&F) portfolio.

From April 2020 this will be part of a wider Atmospheric Measurement and Observation Facility (AMOF).

STFC staff associated with Chilbolton are also members of NCAS.

- Multi-instrumented facility for studying clouds, rainfall, boundary-layer processes and aerosols.
- High-resolution meteorological and cloud radars
- Data archived at Centre for Environmental Data Analysis (CEDA).
- Long-term measurements as part of international networks
  - AERONET (Aerosol Robotic Network)
  - ACTRIS (Aerosol, Clouds and Trace Gases Research Infrastructure)
    - Currently cloud remote sensing (as part of Cloudnet).
    - Planned aerosol profiling with procurement of new Raman lidar



# Rain with high resolution radar

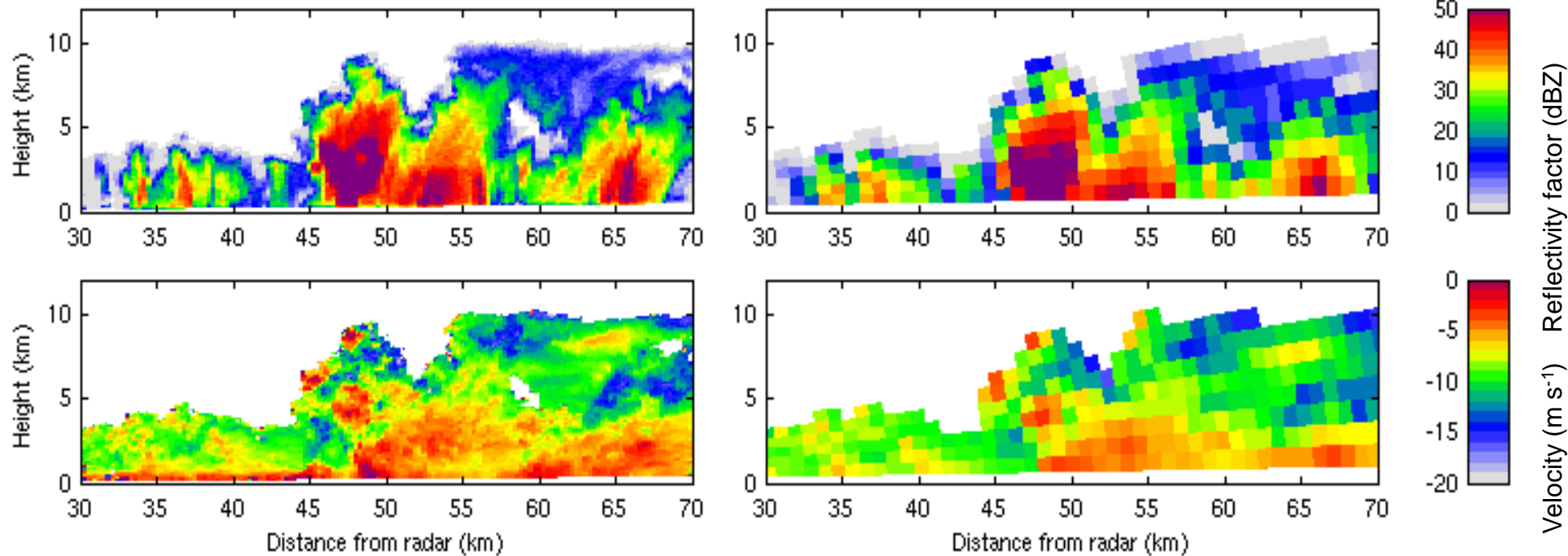


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Chilbolton: 0.28deg x 300m

Radar with 1deg x 900m



The 25 m radar dish allows high resolution observations to distances of over 100 km.



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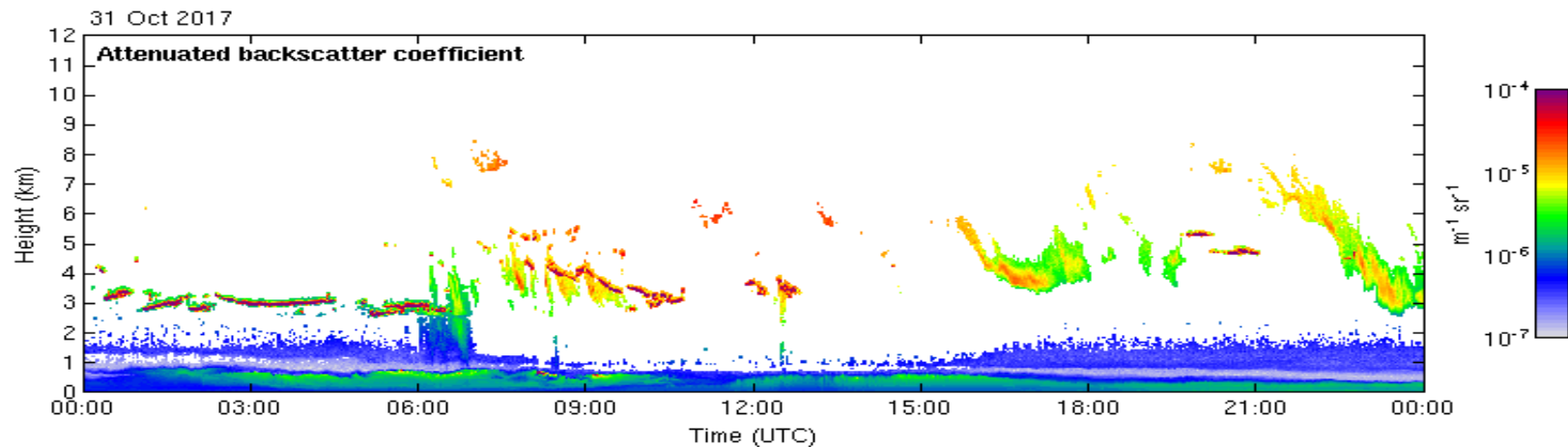
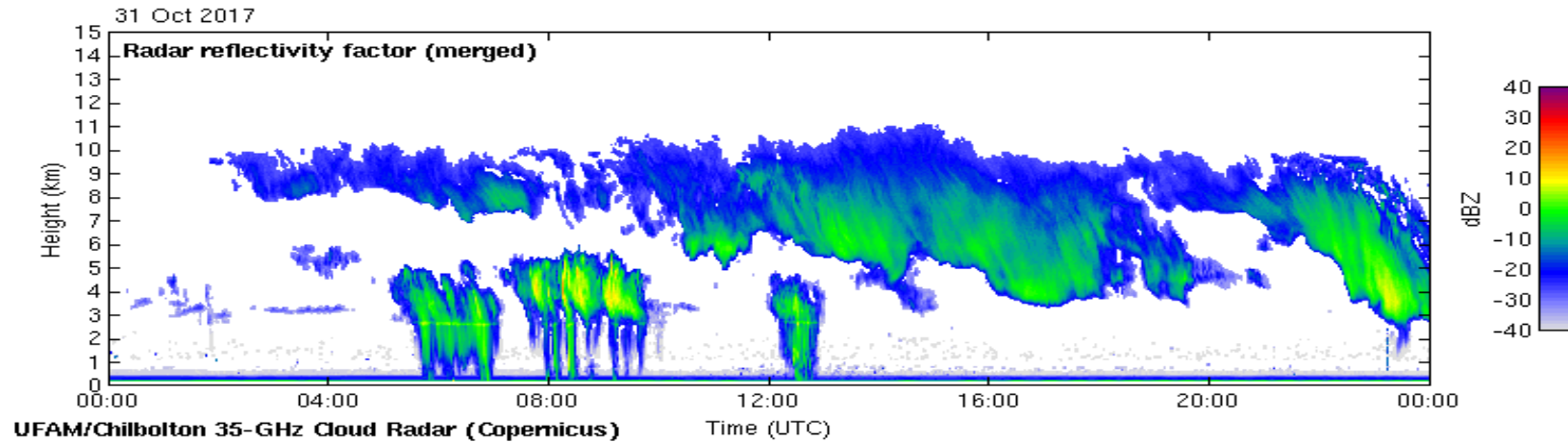


# Radar and lidar together



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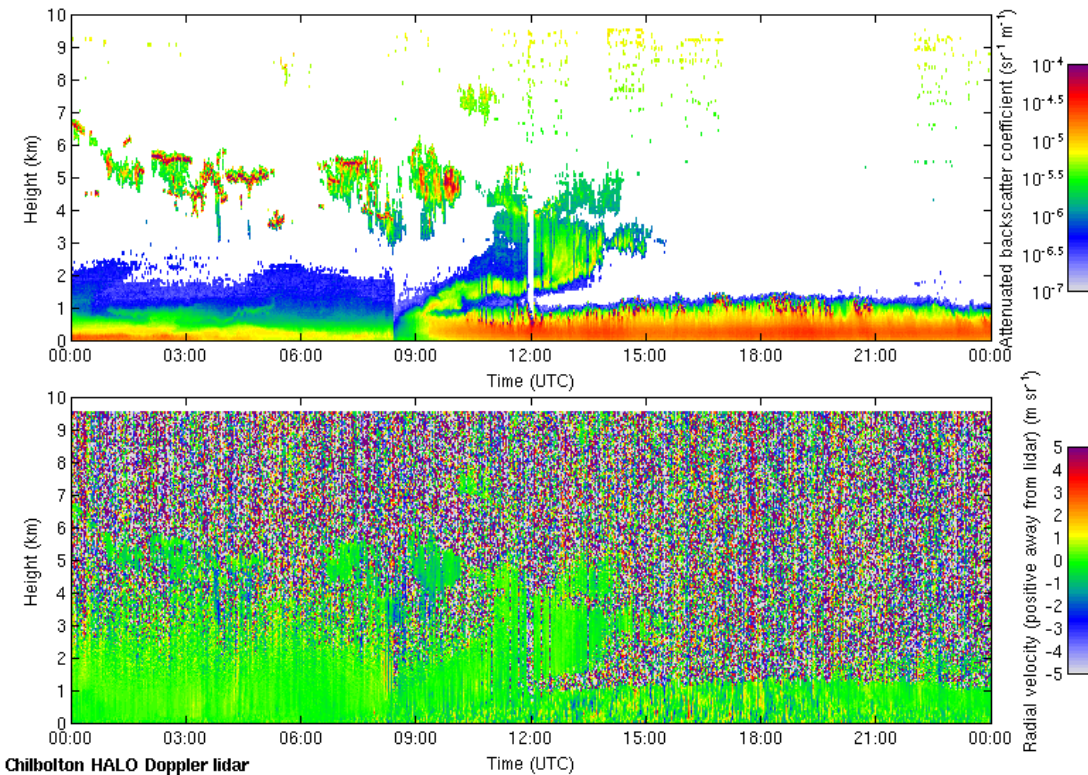
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# Boundary layer properties



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Chilbolton HALO Doppler lidar

Storm Ophelia – 16/10/2017

- Halo Doppler lidar provides both aerosol backscattering and boundary layer radial winds
- When combined with 3D sonic anemometer data, boundary layer can be classified into different types, e.g. stable, unstable and the boundary layer height derived (Natalie Harvey, U. Reading)
- Halo lidar data used as a rural reference in studies of the development of the urban boundary layer over London (Janet Barlow, U. Reading)
- Boundary layer conditions have large influence on dispersal of pollutants – area for future collaboration?



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# Meteorological instruments



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- A wide range of meteorological measurements are made at Chilbolton Observatory, most with a continuous time series of 10 years or more.
- The site is large, with space and flexibility to accommodate visiting instruments.
- Part of worldwide AERONET network, which measures aerosol optical depth and aerosol properties, since 2005.



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# DEFRA air quality monitoring



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- Since 2016 the UK rural background site for air quality has been located at Chilbolton Observatory
- A wide range of species are measured 24/7:  
particulates, NO<sub>x</sub>, ozone, SO<sub>2</sub>, benzene...



# Air quality networks



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- Air quality measurements at Chilbolton are part of several networks:

AURN: Automatic Urban and Rural Network

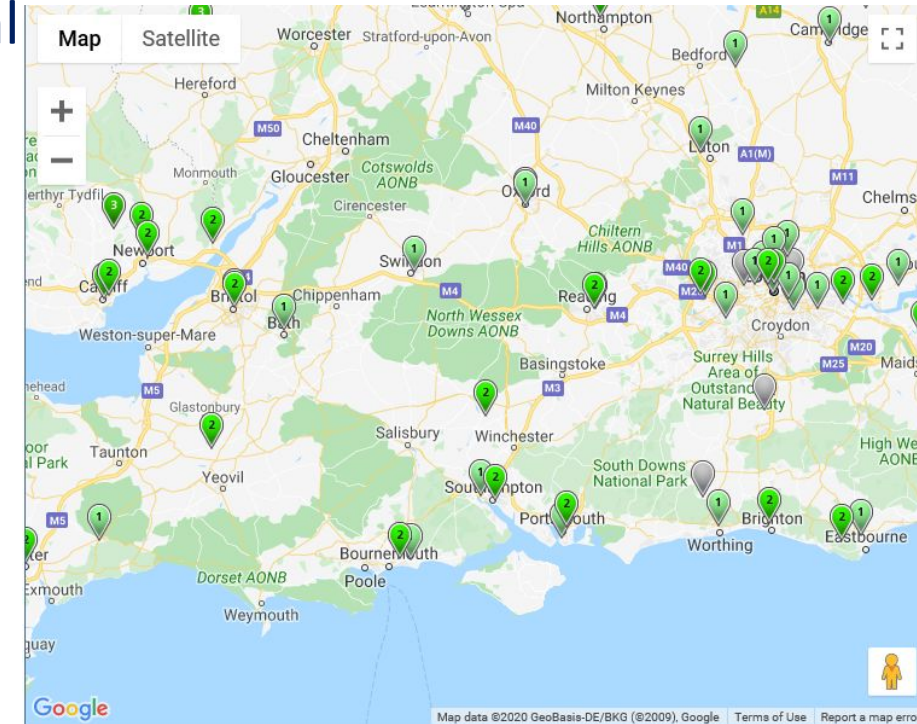
AHN: Automatic Hydrocarbon Network

UKEAP: UK Eutrophying & Acidifying Network, including acid gases, rainfall, aerosol and rainfall

PAH: Polycyclic Aromatic Hydrocarbons

Heavy metals, including mercury

MARGA: Monitor for Aerosols and Gases in ambient Air  
Particulates



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# Recent projects



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- Chilbolton Observatory has supported several projects in recent years which had an air quality component:
  - BIOARC: current research project to measure the bio-aerosol climatology of the UK. Field measurements of particulates, particularly pollen, at Chilbolton Observatory in 2019 and 2020 and FAAM research aircraft flights
  - APPRAISE: Aerosol Properties, PRocesses And InfluenceS on the Earth's climate. Field measurements of particulates at Chilbolton Observatory



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# Questions...

