Met Office

Long-term airborne measurements of pollutants over the UK, including during the COVID-19 pandemic, to support air quality model development and evaluation

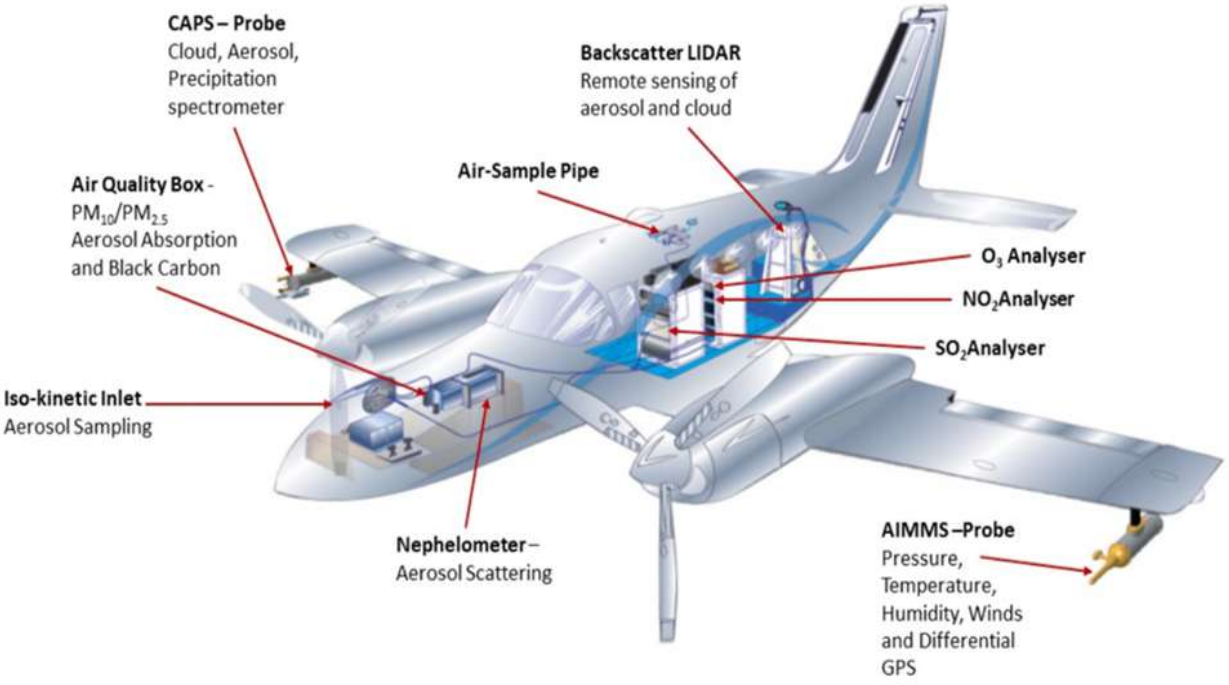
Angela Mynard, Joss Kent, Eleanor R Smith, Andy Wilson, Kirsty Wivell, Noel Nelson, Matthew Hort, James Bowles, David Tiddeman and Justin M. Langridge

Why: Skilful representation of pollutant distributions throughout the atmospheric column is important to enable skilful prediction at the surface.

- Requirement for model evaluation at elevated altitudes
- Bonus use: A unique resource to explore changes in atmospheric composition associated with reduced emissions during the COVID-19 period.

MOASA

Crew	1 pilot, 1 mission scientist, optional second pilot/observer
Flight endurance	Approximately 4 hours
Pressurised Cabin	Yes. Max cabin alt is 10,000 ft
Nominal science speed	85 ms^{-1}
Max alt	25,000 ft whilst operating in UK airspace
Min alt	500ft, dependent on airspace restrictions, geography and meteorology
Ascent rate	800 ft per minute
Decent rate	1000 ft per minute
Effective horizontal sampling scale (1 Hz)	85 m
Effective vertical sample scale (1 Hz)	4 m (ascent), 5 m (descent)



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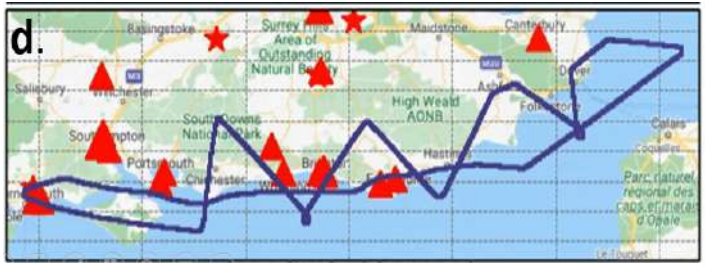
Sorties



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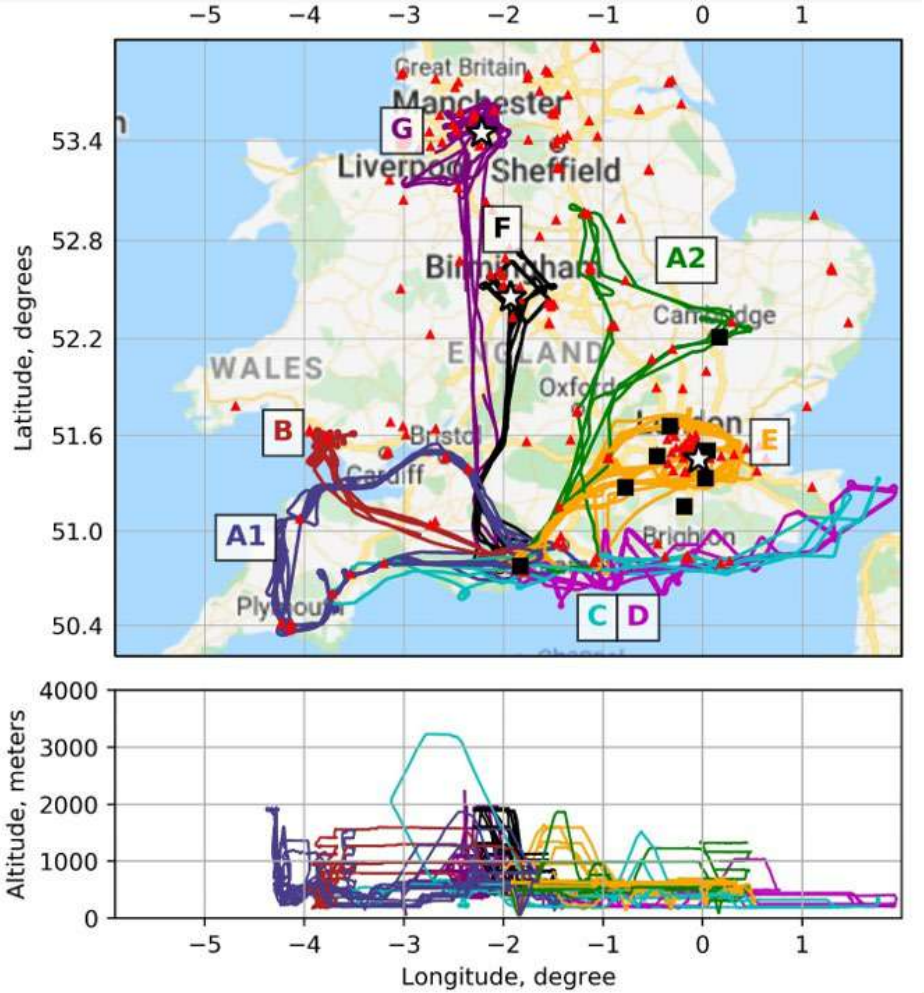
+ 44 flights… so far
+ 100 hours of sampling)
x2 (summer and winter) IOPs

Data:

- NetCDF
- Time synchronised, three-dimensionally geo-located time-series
- Calibrations and corrections applied (where applicable)
- Metadata
- Flags
- Instrument Database
- Configuration file
- On request (for now)



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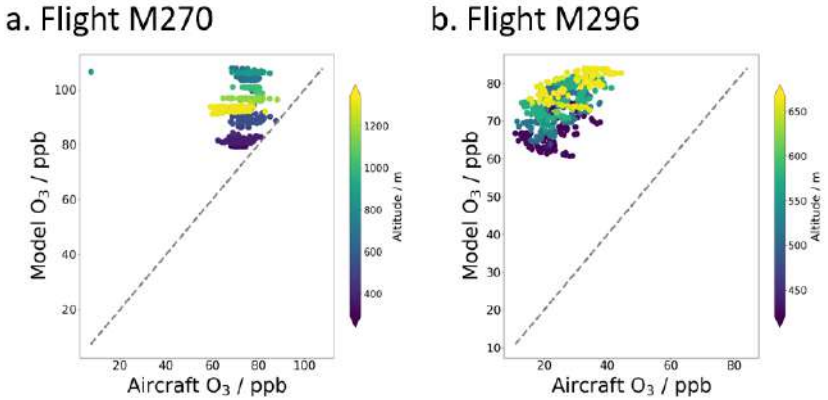
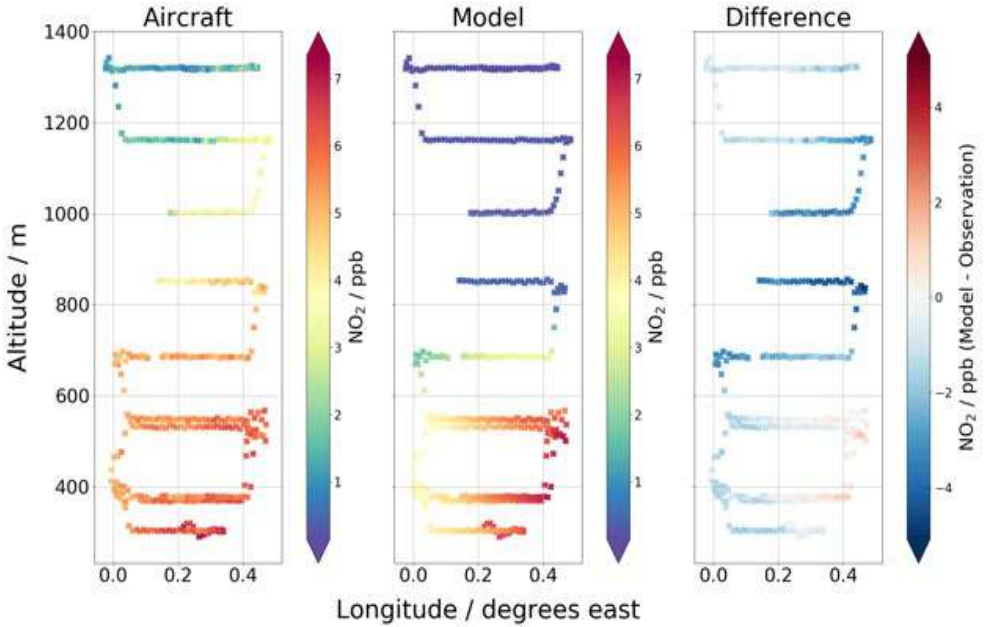
Preliminary model evaluation



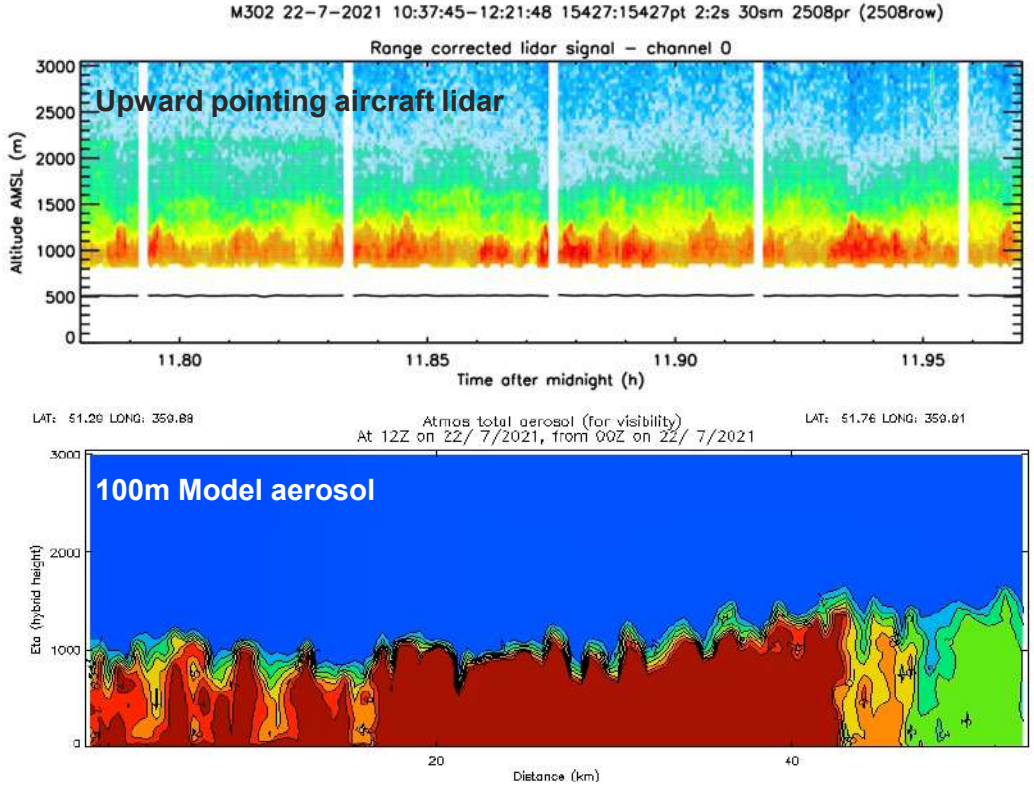
Ozone bias



Nitrogen Dioxide and boundary layer height (M270)

Urban Boundary Layer Spatial dependence

South – North leg



22 Jul 2021

- Technique clearly shows potential for comparing spatial structure of BL to model.
- Lacking a case with clear urban signal due to unfavourable meteorology (E wind).

Future work

- Finalise data
- Finalise preliminary evaluations (Long term pollutant changes observed over London during the COVID-19 pandemic and NO_2 concentration around Birmingham)
- April: removing the science kit and decommissioning the aircraft.

Image: Tim Lewton, Alto Aerospace, Flight M306, 23rd November 2021

Questions?

Angela.Mynard@metoffice.gov.uk

Joss.kent@metoffice.gov.uk

Image: Tim Lewton, Alto Aerospace, London IOP M311, 28th January 2022

The Clean Air programme is led by NERC and the Met Office, with Innovate UK, EPSRC, ESRC, MRC, NPL & Defra as delivery partners.