

METEOROLOGY, AIR QUALITY, AND HEALTH IN LONDON

The ClearLo Project

BY S. I. BOHNENSTENGEL, S. E. BELCHER, A. AIKEN, J. D. ALLAN, G. ALLEN, A. BACAK, T. J. BANNAN, J. F. BARLOW, D. C. S. BEDDOWS, W. J. BLOSS, A. M. BOOTH, C. CHEMEL, O. COCEAL, C. F. DI MARCO, M. K. DUBEY, K. H. FALOOD, Z. L. FLEMING, M. FURGER, J. K. GIETL, R. R. GRAVES, D. C. GREEN, C. S. B. GRIMMOND, C. H. HALIOS, J. F. HAMILTON, R. M. HARRISON, M. R. HEAL, D. E. HEARD, C. HELFTER, S. C. HERNDON, R. E. HOLMES, J. R. HOPKINS, A. M. JONES, F. J. KELLY, S. KOTTHAUS, B. LANGFORD, J. D. LEE, R. J. LEIGH, A. C. LEWIS, R. T. LIDSTER, F. D. LOPEZ-HILFIKER, J. B. MCQUAID, C. MOHR, P. S. MONKS, E. NEMITZ, N. L. NG, C. J. PERCIVAL, A. S. H. PRÉVÔT, H. M. A. RICKETTS, R. SOKHI, D. STONE, J. A. THORNTON, A. H. TREMPER, A. C. VALACH, S. VISSER, L. K. WHALLEY, L. R. WILLIAMS, L. XU, D. E. YOUNG, AND P. ZOTTER

This document is a supplement to “Meteorology, Air Quality, and Health in London: The ClearLo Project,” by S. I. Bohnenstengel, S. E. Belcher, A. Aiken, J. D. Allan, G. Allen, A. Bacak, T. J. Bannan, J. F. Barlow, D. C. S. Beddows, W. J. Bloss, A. M. Booth, C. Chemel, O. Coceal, C. F. Di Marco, K. H. Faloon, Z. L. Fleming, M. Furger, J. K. Gietl, R. R. Graves, D. C. Green, C. S. B. Grimmond, C. H. Halios, J. F. Hamilton, R. M. Harrison, M. R. Heal, D. E. Heard, C. Helfter, S. C. Herndon, R. E. Holmes, J. R. Hopkins, A. M. Jones, F. J. Kelly, S. Kotthaus, B. Langford, J. D. Lee, R. J. Leigh, A. C. Lewis, R. T. Lidster, F. D. Lopez-Hilfiker, J. B. McQuaid, M. K. Dubey, C. Mohr, P. S. Monks, E. Nemitz, N. L. Ng, C. J. Percival, A. S. H. Prévôt, H. M. A. Ricketts, R. Sokhi, D. Stone, J. A. Thornton, A. H. Temper, A. C. Valach, S. Visser, L. K. Whalley, L. R. Williams, L. Xu, D. E. Young, and P. Zotter (*Bull. Amer. Meteor. Soc.*, **96**, 779–804) • ©2015 American Meteorological Society • *Corresponding author:* Sylvia I. Bohnenstengel, Department of Meteorology, University of Reading, Earley Gate, P.O. Box 243, Reading RG6 6BB, United Kingdom • E-mail: s.i.l.d.bohnenstengel@reading.ac.uk • DOI:10.1175/BAMS-D-12-00245.2

TABLE ES1. Location, main contact, instrument, species measured, and deployment period for the long-term measurement infrastructure.					
Location ¹	Institute ² /investigator	Instrument	Species/parameters measured ⁴	Additional information ⁵	Deployment period
NK	York/J. Lee	TTrace Analytical (TA) 3000 gas chromatograph/ HgO bed	CO		Apr 2011–Sep 2012
	Manchester/J. Allan, P. Williams, D. Young	Aerodyne Research, Inc., carbon time-of-flight aerosol mass spectrometry (c-TOF-AMS)	Nonrefractory, submicron particulate (SO ₄ ²⁻ /NO ₃ ⁻ /Cl ⁻ /NH ₄ ⁺ /Organics)		
	York/E. Finessi	Low-volume air sampler (Partisol Plus 2025, Thermo Fisher Scientific)	PM _{2.5} filter collection plus offline analyses of organics		
	KCL/D. Green	TSI, Inc. aerodynamic particle sizer (APS) 3321	Particle size (0.542–19.81 μm)		
	KCL/S. Grimmond	Vaisala CL31 ceilometer	Backscatter profiles, MH		Feb 2011–Dec 2013
NK from NDT to NTT	KCL/S. Grimmond	Kipp and Zonen large aperture scintillometer (LAS) 150	Structure parameter, sensible heat flux		Oct 2011–Mar 2013
NK from NGT to NTT	KCL/S. Grimmond	Kipp and Zonen LAS MKII	Structure parameter, sensible heat flux		Feb 2012–Mar 2013
NK between NTT, NGT, NDT	KCL/S. Grimmond	Kipp and Zonen LAS MKII	Structure parameter, sensible heat flux		Feb 2012–Mar 2013
NDT	KCL/S. Grimmond	Davis Vantage Pro2 plus weather station	T, RH, <i>p</i> , <i>U</i> , <i>dd</i> , shortwave radiation, UV radiation, rain	Moved to IMU	May 2011–Mar 2013
NGT	KCL/S. Grimmond	Davis Vantage Pro2 plus weather station	T, RH, <i>p</i> , <i>U</i> , <i>dd</i> , shortwave radiation, UV radiation, rain	Moved to IML	Jan 2012–Feb 2013
NK between NDT, NTT, NGT	KCL/S. Grimmond	Scintec BLS900 LAS ³	Structure parameter, sensible heat flux, crosswind		Jun 2011–Mar 2013
BT Tower	CEH/C. Helfter	Picarro G2301-f Cavity Ringdown Spectrometer (CRDS)	CO ₂ , CH ₄ , H ₂ O (concentrations and fluxes)		
	CEH/C. Helfter	Aerolaser AI5002	CO (concentrations and fluxes)		
	Reading/J. Barlow	LI-COR infrared hygrometer	CO ₂ , H ₂ O (gas)		
	York/J. Lee	ECO PHYSICS 780TR	NO, NO ₂		Nov 2011–Jun 2013
	York/J. Lee	Thermo 49i	O ₃		Nov 2011–Jun 2013
	CEH/C. Helfter	Rapid Ozone Flux Instrument/ECO PHYSICS	O ₃ , NO, NO ₂ (fluxes)		
	Manchester/J. Allan, P. Williams	Thermo dichotomous filter dynamics measurement systems (FDMS) tapered element oscillating microbalances (TEOM)	PM ₁₀ and PM _{2.5} semi- and nonvolatile mass		Nov 2011–Feb 2013
	Manchester/J. Allan, P. Williams; Birmingham/R. Harrison	Magee AE31 aethalometer	Seven-wavelength aerosol optical absorption and equivalent black carbon		Jan 2012–Jan 2013
	Manchester / J. Allan, P. Williams	TSI scanning mobility particle sizer (SMPS) 3080	Particle size (14–661 nm)		Nov 2011–Feb 2013

	Manchester/J. Allan, P. Williams	TSI APS 3321	Particle size (0.542–19.81 μm)	Nov 2011–Feb 2013
	Reading/J. Barlow	Vaisala WXT520 weather station	T, RH, p, U, dd	
	Reading/J. Barlow	Gill R3 sonic anemometer	Wind speed and direction, turbulence, fluxes	
	Reading/J. Barlow	Kipp and Zonen net radiometer	Incoming and outgoing shortwave and longwave radiation	
MR	CEH/B. Langford	Aerodyne Research, Inc. quadrupole aerosol mass spectrometer (Q-AMS)	Nonrefractory, submicron particulate (SO ₄ ²⁻ /NO ₃ ⁻ /Cl ⁻ /NH ₄ ⁺ /Organics)	Jan 2012–Feb 2013 (with gaps)
	KCL/D. Green	TSI APS 3321	Particle size (0.542–19.81 μm)	
	KCL/S. Grimmond	Vaisala CL31 ceilometer	Backscatter profiles, MH	Mar 2011–Dec 2013
KSSW	KCL/S. Grimmond	Vaisala CL31 ceilometer	Backscatter profiles, MH	Mar 2009–Dec 2013
(during 2012, KSS moved to KSSW)	KCL/S. Grimmond	Campbell Scientific CSAT sonic anemometer	Wind speed and direction, turbulence, fluxes	Apr 2012–Dec 2013
	KCL/S. Grimmond	LI-COR Li-7500 infrared gas	CO ₂ , H ₂ O (gas)	Apr 2012–Dec 2013
	KCL/S. Grimmond	Kipp and Zonen CNR4 net radiometer	Incoming and outgoing shortwave and longwave radiation	Apr 2012–Dec 2013
	KCL/S. Grimmond	Vaisala WXT520 weather station	T, RH, p, U, dd, rainfall	Apr 2012–Dec 2013
	KCL/S. Grimmond	Skye Instruments ultraviolet A (UVA) radiometer	UVA	Apr 2012–Dec 2013
	KCL/S. Grimmond	Skye Instruments ultraviolet B (UVB) radiometer	UVB	Apr 2012–Dec 2013
	KCL/S. Grimmond	Skye Instruments photosynthetically active radiation (PAR) radiometer	PAR	Apr 2012–Dec 2013
	KCL/S. Grimmond	Delta-T Devices sunportin1 (SPN1) sunshine pyranometer	Total shortwave radiation, diffuse radiation, sunshine hours	Apr 2012–Dec 2013
	KCL/S. Grimmond	Campbell Scientific rain gauge	Rain	Dec 2009–Dec 2013
	KCL/S. Grimmond	LI-COR Li-7500 infrared gas	CO ₂ , H ₂ O (gas), profile	Apr 2012–Dec 2013
KSS	KCL/S. Grimmond	Campbell Scientific CSAT sonic anemometer	Wind speed and direction, turbulence, fluxes	Sep 2009–Mar 2012
(this moved to KSNW)	KCL/S. Grimmond	LI-COR Li-7500 infrared gas	CO ₂ , H ₂ O (gas)	Sep 2009–Mar 2012
	KCL/S. Grimmond	Kipp and Zonen CNR1 net radiometer	Incoming and outgoing shortwave and longwave radiation	Sep 2009–Mar 2012
	KCL/S. Grimmond	Vaisala WXT520 weather station	T, RH, p, U, dd, rainfall	Sep 2009–Mar 2012
KSK	KCL/S. Grimmond	Campbell Scientific CSAT sonic anemometer	Wind speed and direction, turbulence, fluxes	Oct 2008–Feb 2013
	KCL/S. Grimmond	LI-COR Li-7500 infrared gas	CO ₂ , H ₂ O (gas)	Oct 2008–Feb 2013

TABLE ESI. Continued.

Location	Institute/investigator	Instrument	Species/parameters measured	Additional information	Deployment period
	KCL/S. Grimmond	Kipp and Zonen CNR1/CNR4 net radiometer	Incoming and outgoing shortwave and longwave radiation	Moved to KSNW	Oct 2008–Feb 2013
	KCL/S. Grimmond	Vaisala WXT520 weather station	T, RH, p, U, dd, rain	Moved to KSNW	Oct 2008–Feb 2013
Strand/KSNW	KCL/S. Grimmond	Campbell Scientific CSAT sonic anemometer	Wind speed and direction, turbulence, fluxes		May 2012–Dec 2013
	KCL/S. Grimmond	LI-COR Li-7500 infrared gas	CO ₂ , H ₂ O (gas)		May 2012–Dec 2013
	KCL/S. Grimmond	Kipp and Zonen CNR4 net radiometer	Incoming and outgoing shortwave and longwave radiation		May 2012–Dec 2013
	KCL/S. Grimmond	Vaisala WXT520 weather station	T, RH, p, U, dd, rain		May 2012–Dec 2013
	KCL/S. Grimmond	LI-COR Li-7500 infrared gas	CO ₂ , H ₂ O (gas), profile		May 2012–Dec 2013
Strand/KSB	KCL/S. Grimmond	Gill R3 sonic anemometer	Wind speed and direction, turbulence, fluxes		Mar 2013–Dec 2013
RGS	KCL/S. Grimmond	Vaisala CL31 ceilometer	Backscatter profiles, mixing height		Mar 2010–Dec 2013
RGS	KCL/S. Grimmond	Kipp and Zonen LAS 150	Structure parameters, sensible heat flux		
RGS	KCL/S. Grimmond	Kipp and Zonen LAS MKII	Structure parameter, sensible heat flux		
Thames River RNLI	KCL/S. Grimmond	Tinytag water temperature	Water temperature		Apr 2010–Dec 2013
Harwell	Birmingham/Bill Bloss	TSI APS 3321	Particle size (0.542–19.81 μm)		Mar 2011–Sep 2012
Chilbolton	York/J. Lee	TA3000 GC/HgO bed	CO		Oct 2010–Sep 2012
	York/J. Lee	Thermo 491	O ₃		Oct 2010–Sep 2012
Detling	KCL/D. Green	TSI SMPS	Particle size (14–661 nm)		
	Reading/J. Barlow	Vaisala CL31 ceilometer	Backscatter profiles, MH		
	Reading/J. Barlow	Gill R3 sonic anemometer	Wind speed and direction, turbulence, fluxes		
			PM _{2.5}		

¹ NK = North Kensington; NDT = North Kensington Dartrey Tower; NTT = North Kensington Trellick Tower; NGT = North Kensington Grenfell Tower; MR = Marylebone Road; KSSW = King's College London, Strand campus, Strand building west; KSS = King's College London, Strand campus, Strand building; KSNW = King's College London, Strand campus, north wing; KSK = King's College London, Strand campus, King's building; KSB = King's College London, Strand campus, Strand building balcony; RGS = Royal Geographical Society (with the Institute of British Geographers); RNLI = Royal National Lifeboat Institution.

² York = University of York; Manchester = University of Manchester; KCL = King's College London; CEH = Centre for Ecology and Hydrology; Birmingham = University of Birmingham; Reading = University of Reading.

³ Various configurations were deployed with four different instruments and three different models/makes.

⁴ MH = mixing height; T = temperature; RH = relative humidity; p = pressure; U = zonal wind; dd = wind direction.

⁵ IMU = Islington Michael Cliffe upper; IML = Islington Michael Cliffe lower.

TABLE ES2. Additional instruments installed during ClearFlo winter IOP (6 Jan–11 Feb 2013).			
Location	Institute*/investigator	Instrument	Species/parameters measured
NK	York/J. Lee	AL5002 CO	CO
	York/J. Lee	Air Quality Design NOx	NO, NO ₂
	Birmingham/W. Bloss	Thermo 42i	NO, NO ₂
	Leicester/R. Graves, R. Leigh	CityScan	NO ₂ and O ₄ differential slant column densities (DSCD)
	York/J. Lee	Thermo 49i	O ₃
	Birmingham/W. Bloss	Thermo 49i	O ₃
	York/J. Hopkins	Gas chromatography with flame ionization detector (GC-FID)	C ₂ –C ₈ nonmethane hydrocarbons (NMHCs), oxygenated VOCs (oVOCs),
	York/R. Holmes	Two-dimensional GC-FID (GCxGC-FID)	C ₆ –C ₁₀ NMHCs, oVOCs
	Leicester/I. White, I. Goodall, S. Barber	Proton-transfer-reaction time-of-flight mass spectrometry (PTR-ToF-MS)	Gas-phase VOC and oVOC
	CEH/B. Langford, A. Valach	PTR-MS	Gas-phase VOC
	UEA/B. Bandy	Aero Laser 402i	Formaldehyde
	Manchester/T. Bannan	Chemical ionization mass spectrometer (CIMS)	Formic, acetic, nitric acid, hydrogen cyanide (HCN)
	UEA/D. Oram, G. Mills	Agilent gas chromatography negative ion chemical ionization mass spectrometer (GC-NICI-MS)	Alkyl nitrates and selected halocarbons
	UEA/D. Oram, G. Mills	Agilent GC electron ionization mass spectrometer (GC-EI-MS)	Selected halocarbons
	UEA/D. Oram, G. Mills	GC with electron capture detector (GC-ECD)	Peroxyacetyl nitrate (PAN)
	Leeds/L. Whalley	Fluorescence assay with gas expansion (FAGE)	OH, HO ₂ , RO ₂ , OH reactivity
	Leeds/L. Whalley	National Centre for Atmospheric Science (NCAS) spectroradiometer	Photolysis frequencies
	CEH/E. Nemitz	Gradient system for reactive aerosols and gases with online registration (GRAEGOR)	NH ₃ /HNO ₃ /SO ₂ /NH ₄ ⁺ /NO ₃ ⁻ /SO ₄ ²⁻ /HONO/Cl ⁻ /HCl, hourly
	Manchester/J. Allan, P. Williams, D. Young	ARI c-TOF-AMS	Nonrefractory, submicron particulate (SO ₄ ²⁻ /NO ₃ ⁻ /Cl ⁻ /NH ₄ ⁺ /organics)
	Manchester/J. Allan, P. Williams, D. Young	ARI soot particle AMS (SP-AMS)	Nonrefractory submicron particulate plus black carbon
	Birmingham/D. Beddows	TSI aerosol time-of-flight mass spectrometers (ATOFMS)	Size-resolved particle composition
	Manchester/M. Gallagher	Wideband integrated bioaerosol sensor (WIBS-4)	Bioaerosols
	PSI/S. Visser	Three-stage rotating drum impactor	Trace elements in PM _{1.0} , PM _{2.5} , and PM ₁₀
	York/E. Finessi	HiVol 3000 Ecotech	PM _{2.5} filter collection plus offline analyses of organics
	Birmingham/D. Beddows	HiVol filter sampler	PM _{2.5} chemical composition

TABLE ES2. Continued.

Location	Institute*/investigator	Instrument	Species/parameters measured
	Birmingham/J. Yin	Partisol sampler	PM _{2.5} chemical composition
	Manchester/J. Whitehead	Hygroscopic tandem differential mobility analyser (HTDMA)	Aerosol hygroscopic growth factors
	Manchester/J. Allan, P. Williams, D. Young	Cloud condensation nuclei (CCN)	Size-resolved cloud condensation nuclei
	Manchester/J. Allan, P. Williams, D. Young	DMT SP2	Black carbon (BC) number, mass loading, and coating thicknesses
	Manchester/J. Allan, P. Williams, D. Young	Magee AE31 aethalometer	Seven-wavelength aerosol optical absorption and equivalent black carbon
	Manchester/J. Allan, P. Williams, D. Young	TE multiangle absorption photometer (MAAP)	Aerosol optical absorption and equivalent BC
	Manchester/J. Allan, P. Williams, D. Young	DMT photoacoustic soot spectrometer, three wavelengths (PASS-3)	Three-wavelength aerosol optical absorption, scattering
	Manchester/J. Allan, P. Williams, D. Young	TSI APS	Particle size and number (0.5–20 µm)
	Manchester/J. Allan, P. Williams, D. Young	TSI differential mobility particle sizer (DMPS)	Particle size and number (10–600 nm)
	Birmingham/D. Beddows	TSI SMPS	Particle size and number (14–661 nm)
	Manchester/J. Allan, P. Williams, D. Young	TSI condensation particle counters (CPCs)	Particle number
	CEH/E. Nemitz	WXT	Wind speed, wind direction, RH, T, wetness
BT Tower	CEH/C. Braban	Automated ammonia analyzer (AIRrmonia)	NH ₃
MR	CEH/C. Braban	AIRrmonia	NH ₃
	CEH/B. Langford, A. Valach	PTR-MS	Gas-phase VOC
	PSI/S. Visser	Three-stage rotating drum impactor	Trace elements in PM _{1.0} , PM _{2.5} , and PM ₁₀
Chelsea	Leicester/R. Graves, R. Leigh	CityScan	NO ₂ , O ₄ , DSCDs
Harwell	CEH/E. Nemitz	ARI high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS)	Nonrefractory, submicron particulate (SO ₄ ²⁻ /NO ₃ ⁻ /Cl ⁻ /NH ₄ ⁺ /Organics)
Detling	ARI/S. Herndon	2B Technologies	O ₃
	ARI/S. Herndon	Thermo 42i	NO
	ARI/S. Herndon	ARI cavity attenuated phase shift (CAPS)	NO ₂
	ARI/S. Herndon	LI-COR	CO ₂
	ARI/S. Herndon	ARI quantum cascade laser (QCL)	CO, N ₂ O
	ARI/S. Herndon	ARI QCL	NO ₂ , HCHO

CEH/D. Famulari	ARI mini QCL	N ₂ , CO ₂ , H ₂ O
LANL/A. Aiken	Picarro CRDS	CH ₄ , CO ₂ , H ₂ O
ARI/S. Herndon	GC-FID	Gas-phase VOC
MSU/W. B. Knighton	PTR-MS	Gas-phase VOC
UW/C. Mohr	ARI chemical ionization high-resolution time-of-flight mass spectrometer coupled to a micro-orifice volatilization impactor (MOVI-HR-ToF-CIMS)	Gas and particle phase organic acids
GIT/N. L. Ng	ARI HR-ToF-AMS	Nonrefractory, submicron particulate (SO ₄ ²⁻ /NO ₃ ⁻ /Cl ⁻ /NH ₄ ⁺ /Organics)
ARI/L. Williams	ARI SP-AMS	Nonrefractory submicron particulate plus BC
PSI/S. Visser	Three-stage rotating drum impactor	Trace elements in PM _{1.0} , PM _{2.5} , and PM ₁₀
PSI/P. Zotter	HiVol sampler	¹⁴ C in TC and EC/OC concentrations
KCL/D. Green	Partisol	PM _{2.5} chemical composition
LANL/A. Aiken	DMT SP-2	BC number, mass loading, and coating thicknesses
PSI/P. Zotter	Magee AE31 aethalometer	Seven-wavelength aerosol optical absorption and equivalent BC
ARI/L. Williams	Thermo MAAP	Aerosol optical absorption and equivalent BC
LANL/A. Aiken	DMT PASS-3	Three-wavelength aerosol optical absorption, scattering
ARI/P. Massoli	ARI Cavity Attenuated Phase Shift extinction monitor (CAPS PMex) 630	Aerosol extinction at 630 nm
LANL/A. Aiken	ARI CAPS PMex 450	Aerosol extinction at 450 nm
LANL/A. Aiken	TSI laser particle sizer 3340	Particle size and number (0.07–10 μm)
LANL/A. Aiken	TSI SMPS	Particle size and number (8–600 nm)
ARI/L. Williams	Portamet	T, RH, wind speed and direction
ANL/R. Coulter	Vaisala WXT520 weather station	T, RH, wind speed and direction, precipitation
ANL/R. Coulter	Micropulse lidar	Cloud base, aerosol extinction via backscatter
ANL/R. Coulter	Pyranometer SPN-1	Total, diffuse radiation
ANL/R. Coulter	Sodar	Wind field up to 500 m
ANL/R. Coulter	Multifilter rotating shadowband radiometer (MFRSR)	Radiance, seven wavelengths

* Leicester = University of Leicester; UEA = University of East Anglia; PSI = Paul Scherrer Institute; ARI = Aerodyne Research, Inc.; LANL = Los Alamos National Laboratory; MSU = Montana State University; UW = University of Washington; GIT = Georgia Institute of Technology; ANL = Argonne National Laboratory.

TABLE ES3. Additional instruments installed during ClearLo summer IOP (21 Jul–31 Aug 2012). ARSF = Airborne Research and Survey Facility.

Location	Institute/investigator	Instrument	Species/parameters measured
NK	Birmingham/D. Beddows	TSI ATOFMS	Size-resolved particle composition
NK	Birmingham/D. Beddows	Digital hi-volume sampler x 2	¹⁴ C in TC and EC/OC concentrations
NK	Birmingham/D. Beddows	Streaker	PM _{2.5} /PM ₁₀ metals
NK	Birmingham/D. Beddows	SMPS (inlet not dried)	Particle size (14–661 nm)
NK	Birmingham/W. Bloss	Thermo 42i	NO, NO ₂
NK	Birmingham/W. Bloss	Thermo 49i	O ₃
NK	Birmingham/W. Bloss	Ozone production rate	d[O ₃]/dt
MR	Birmingham/D. Beddows	SMPS (inlet not dried)	Particle size (14–661 nm)
MR	Birmingham/D. Beddows	Streaker	PM _{2.5} /PM ₁₀ metals
MR	Birmingham/D. Beddows	LI-COR Li-820	CO ₂ concentration
KCL	CEH/B. Langford, A. Valach	PTR-MS	Gas-phase VOC
MR	CEH/C. Braban	AiRRmonia	NH ₃
	CEH/E. Nemitz	GRAEGOR	NH ₃ /HNO ₃ /SO ₂ /NH ₄ ⁺ /NO ₃ ⁻ /Cl ⁻ /SO ₄ ²⁻ /HONO/Cl ⁻ /HCl, hourly
	CEH/E. Nemitz	WXT	Wind speed, wind direction, RH, T, wetness
	CEH/E. Nemitz	ARI HR-ToF-AMS	Nonrefractory, submicron particulate (SO ₄ ²⁻ /NO ₃ ⁻ /Cl ⁻ /NH ₄ ⁺ /Organics)
	Leeds/L. Whalley	FAGE	OH, HO ₂ , RO ₂ , OH reactivity
	Leeds/L. Whalley	NCAS Spectroradiometer	Photolysis frequencies
	Leicester/Z. Fleming	PERCA	HO ₂ + RO ₂
	Leicester/R. Graves, R. Leigh	CityScan	NO ₂ and O ₄ DSCDs
Chelsea	Leicester/R. Graves, R. Leigh	CityScan	NO ₂ and O ₄ DSCDs
Soho	Leicester/R. Graves, R. Leigh	CityScan	NO ₂ and O ₄ DSCDs
Harwell	Manchester/H. Ricketts	Eight Ozone and Aerosol Profiler	Aerosol vertical profiles to 8 km, O ₃ up to 2–3 km
	Manchester/J. Allan, P. Williams, D. Young	ARI SP-AMS	Nonrefractory submicron particulate plus BC
	Manchester/J. Allan, P. Williams, D. Young	CCN	Size-resolved cloud condensation nuclei
	Manchester/J. Allan, P. Williams, D. Young	DMT SP2	BC and coating thicknesses
	Manchester/J. Allan, P. Williams, D. Young	Magee AE31 aethalometer	Seven-wavelength aerosol optical absorption and equivalent BC
	Manchester/J. Allan, P. Williams, D. Young	Thermo MAAP	Aerosol optical absorption and equivalent BC
	Manchester/J. Allan, P. Williams, D. Young	DMT PASS-3	Three-wavelength aerosol optical absorption, scattering
	Manchester/J. Allan, P. Williams, D. Young	ARI CAPS PMex	Aerosol extinction
	Manchester/J. Allan, P. Williams, D. Young	TSI APS	Particle size and number (0.5–20 μm)

	Manchester/J. Allan, P. Williams, D. Young	TSI DMPS	Particle size and number (10–600 nm)
	Manchester/J. Allan, P. Williams, D. Young	TSI CPC	Aerosol number concentration
	Manchester/J. Whitehead	HTDMA	Aerosol hygroscopic growth factors
	Manchester/M. Gallagher	WIBS-4	Bioaerosols
	Manchester/T. Bannan	CIMS	CINO ₂ , N ₂ O ₅ , formic, acetic, nitric acids, HCN
	PSI/S. Visser	Three-stage rotating drum impactor	Trace elements in PM _{1.0} , PM _{2.5} and PM ₁₀
	PSI/S. Visser	Three-stage rotating drum impactor	Trace elements in PM _{1.0} , PM _{2.5} and PM ₁₀
	UEA/B. Bandy	AI4021 formaldehyde monitor	HCHO
	UEA/D. Oram, G. Mills	GC-ECD	PAN
	UEA/D. Oram, G. Mills	Agilent GC-NICI-MS	C ₁ –C ₅ alkyl nitrates and selected halocarbons
	UEA/D. Oram, G. Mills	Agilent GC-EI-MS	Selected halocarbons
	York/E. Finessi	HiVol 3000 Ecotech	PM _{2.5} filter collection plus offline analyses of organics
Dornier aircraft	York/J. Hopkins	GC-FID	C ₂ –C ₈ NMHCs, oVOCs,
Dornier aircraft	York/J. Lee	AL5002 CO	CO
Dornier aircraft	York/J. Lee	Thermo 42cTL	NO, NO ₂
Dornier aircraft	York/J. Lee	Thermo 49i	O ₃
Dornier aircraft	ARSF	Aircraft-integrated meteorological measurement system (AIM MS-20)	Positions, basic meteorological observations (T = Temperature, p = pressure, RH = relative humidity), turbulence parameters
Dornier aircraft	ARSF	Grimm optical particle counter (OPC)	Aerosol size distribution (0.25–10 μm)
Dornier aircraft	KCL/Ben Barratt	Picarro	Greenhouse gases (CO ₂ and CH ₄)
NK	York/J. Lee	AL5002 CO	CO
NK	York/J. Lee	Air Quality Design NOx	NO, NO ₂
NK	York/J. Lee	Thermo 49i	O ₃
NK	York/J. Hopkins	GC-FID	C ₂ –C ₈ NMHCs, oVOCs,
NK	York/R. Holmes	GCxGC-FID	C ₆ –C ₁₀ NMHCs, oVOCs