LONDON climate change PARTNERSHIP

Observing London:
Weather data needed for London to thrive

July 2013

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Weather data needed for London to thrive

LCCP, Met Office, Lloyd's

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Update from 2013

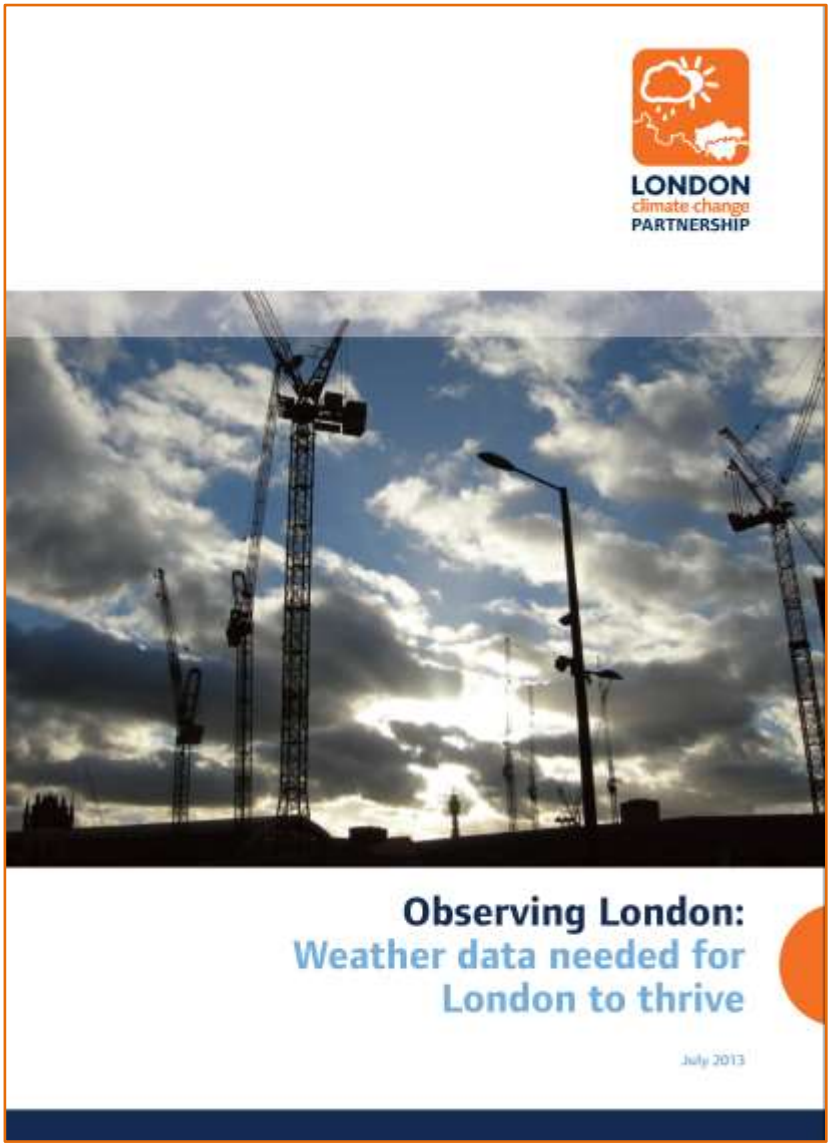
Recommendations

- For a London Climate Data Portal
- To improve quality of the currently collected data
- To evaluate data gaps
- To ensure continuity of stations
- For new observations

see Report p79- 80

Report includes survey of:

- Data availability
- Data users
- Data needs



Data Availability

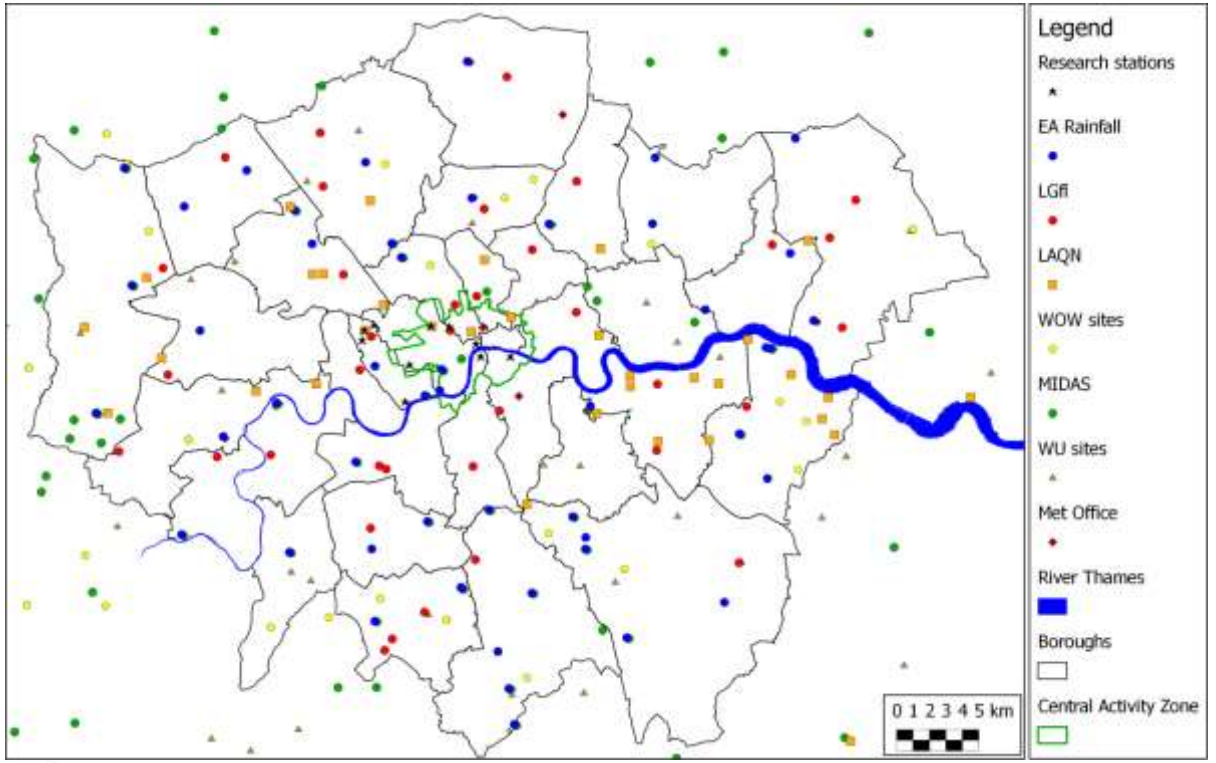
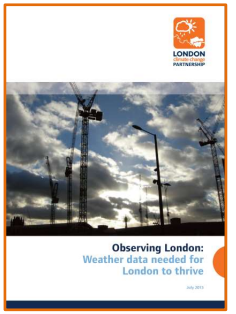


Table 1: Summary of key networks, their purpose, approximate number of currently active stations and quality control of data.

Network	Features	Number of stations (year last audited)[10]	Network Quality Control
Met Office	WMO certified weather stations	7 (2010)	Yes (including retrospective checks)
MIDAS	Land surface stations	39 (2011)	Yes (retrospective)
Weather Underground	AWS at private residences	64 (2010)	No (Data real time)
LGfL	AWS at educational facilities	33 (2013)	No (Data real time)
LAQN	Air Quality	37 (2010)	Yes
WOW	AWS at private residences	24 (2013)	No (Data real time)
Environment Agency	Rain gauges TBR 32/ Storage 14	46 (2013)	Yes
Borough of Bromley	Road maintenance	2 (2013)	
Lambeth Meters	Brixton	1 (2013)	
Research sites: Universities	KCL ACTUAL Imperial (RainDrain)	4 2 3	Yes
Research sites: Companies	ARUP EDF trading (Croydon)	1 1	
Private	Identified but not in a network	1+*	

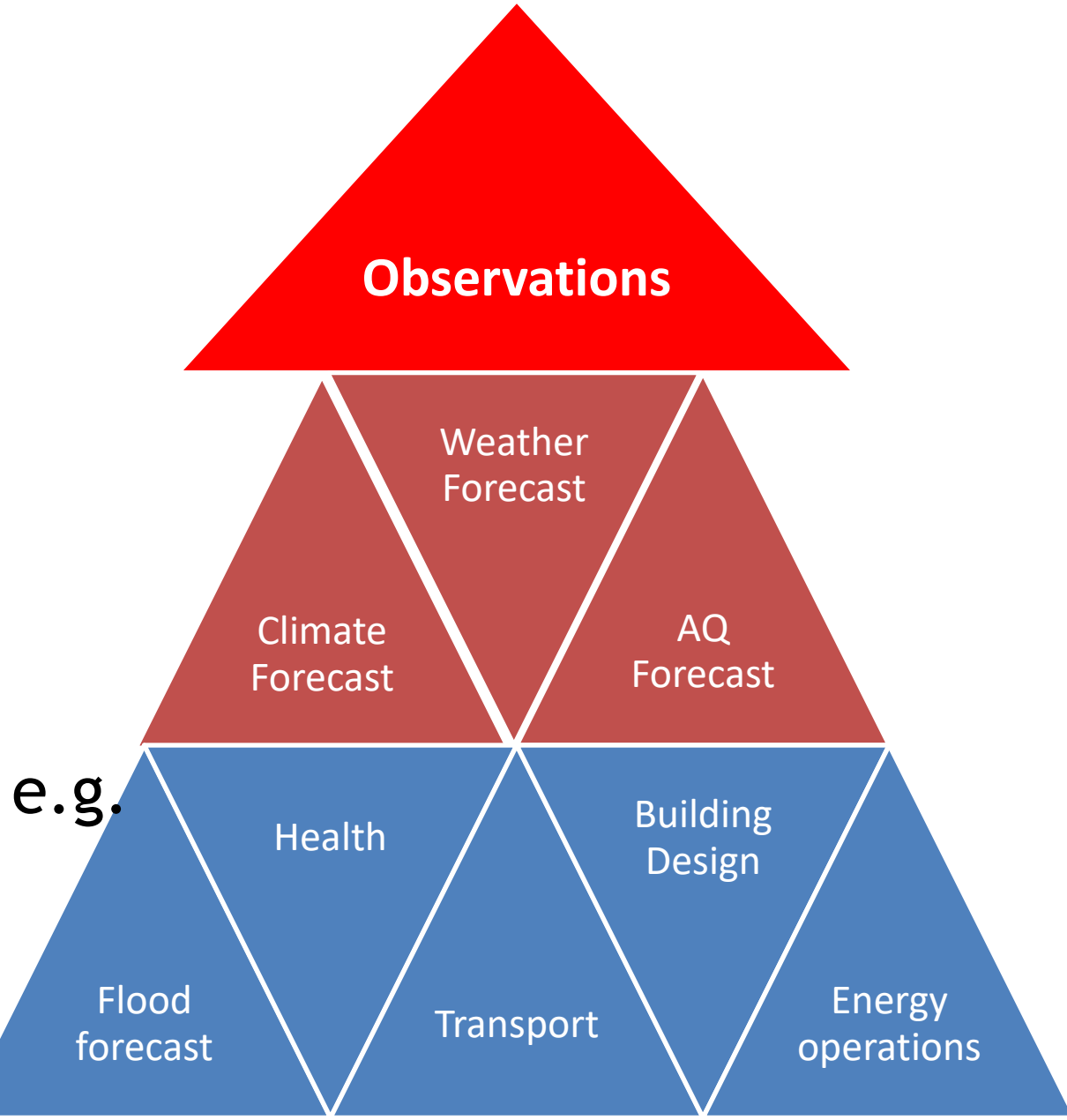
* There are no doubt many other stations in this category across London

New sensors
e.g. Netatmo (QC=no)



Current Issues with Data

- Availability
- Quality Control
- Location
- Representativeness
- Meta data
- Ease of use
- .. which impact use



Data Use & Users

Table 5: Sites explicitly identified as current sources of data

Airport sites (mentioned as a group)
Biggin Hill
Botley Hill, Surrey
Bracknell
Bromley stations
EA stations
Gatwick
Heathrow
London Weather Centre[17]
MORECS[18]
Own research sites
St James's Park

How do you use weather/ climate data?	Air Temperature	Relative Humidity	Wind	Surface temperature	Precipitation + Snow	Solar Radiation	Cloud cover	Radar	Air Quality	Soil moisture	Boundary Layer Height	Other	Number of responses
Research	70	58	70	43	63	47	39	16	37	21	21	16	105
Resilience & emergency response	71	38	67	55	74	29	33	31	33	19	7	12	42
Personal use	65	43	68	40	63	35	38	20	25	15	8	10	40
Design	67	61	64	33	48	55	52	15	27	15	6	15	33
Education	78	69	72	44	75	50	38	16	41	16	13	19	32
Weather forecasting	87	70	80	57	90	50	50	47	37	30	23	20	30
Long term operations	88	65	85	62	96	38	38	42	38	23	15	23	26
Health	68	58	63	68	74	53	47	11	58	16	16	5	19
Transportation planning	79	53	68	63	84	32	47	32	32	42	21	11	19
Construction	63	58	63	42	53	58	47	16	47	11	11	16	19
Water Management	88	53	71	53	100	29	35	59	29	29	12	24	17
Insurance	44	19	81	38	81	13	19	44	6	44	25	31	16
Other public	62	54	54	38	62	38	38	31	31	15	15	8	13
Air Quality related	54	54	62	38	54	54	54	15	62	15	54	15	13
Other commercial	67	67	67	11	56	44	44	22	44	22	33	22	9
Strategic planning	86	29	57	57	86	0	29	43	29	0	14	43	7
Short term operations	80	60	80	40	80	20	60	40	60	0	0	0	5
Energy Trading	100	67	100	67	100	67	67	67	67	33	33	33	3
Energy Usage	100	50	50	0	50	50	50	50	50	50	50	50	2
Waste	0	0	0	100	100	0	0	0	0	0	0	0	2
Software Development	100	100	100	50	100	50	50	100	50	100	100	100	2

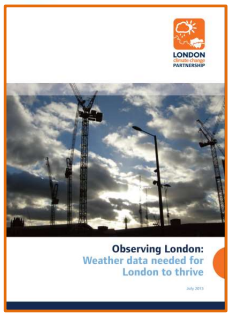
Percentage use

Lowest — Highest

0	10	20	30	40	50	60	70	80	90	100

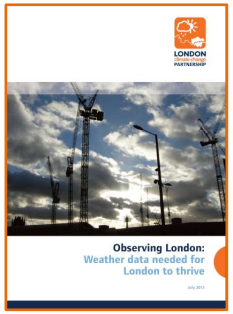
Table 4: Summary of how survey respondents use specific weather or climate data

Many respondents use data for multiple purposes, hence there are more responses in total than respondents. The numbers in each cell indicate percentage engaged in that application (row) using the variable (column). Rows are ordered from highest number of reasons for use to least (right hand most column).



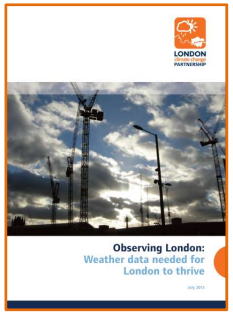
What Is Needed?

- Improved spatial (& temporal) availability of data
- Accessible and easily used data formats
- With meta-data
  - Improved QA/QC
- Mechanism to archive/access historic data
- London Climate Data Portal (LCDP)



Why?

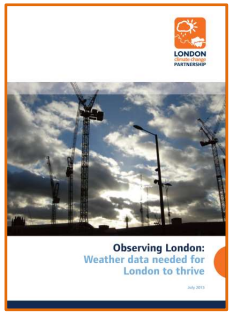
- Improve the **resilience of London**
  - Improve design for the future
  - Improve the current management of London
- Develop New & Unexpected ways
  - Helsinki – become a place to test new instruments
    - Range of commercial users that were not expected
  - Shanghai – integrated across a series of organizations –multi-hazard early warning system
    - Rapid communication across agency to facilitate preparedness and response
    - e.g. users: Construction industry now wants tailored
  - Birmingham - network established – wide range of users – but after NERC funding
- Identify real data gaps
  - Ensure data are not lost
- Develop new **economic opportunities**



Need

- Identify how the LCDP could be funded
  - Establishment
  - Maintained

- Wide range of people are ready to:
  - Contribute data
  - Use the data
  - Develop applications
  - Improve their use of data in decision making for London



London Climate Data Portal

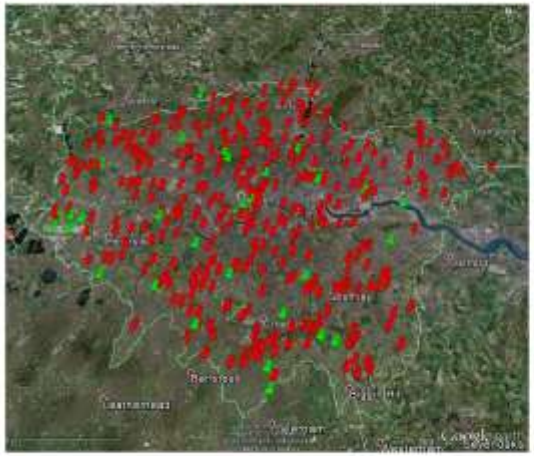
- Minimum – bring data sources together
  - i.e. just links

- Preferred
  - QAQC data across networks
    - Automated error detection – improve observations
  - Meta data
    - Identify what data applicable for (scale, type of land cover characteristics)
  - Make data available in formats that are easier to use
  - Identify gaps in data availability – so new sensors installed in places of need

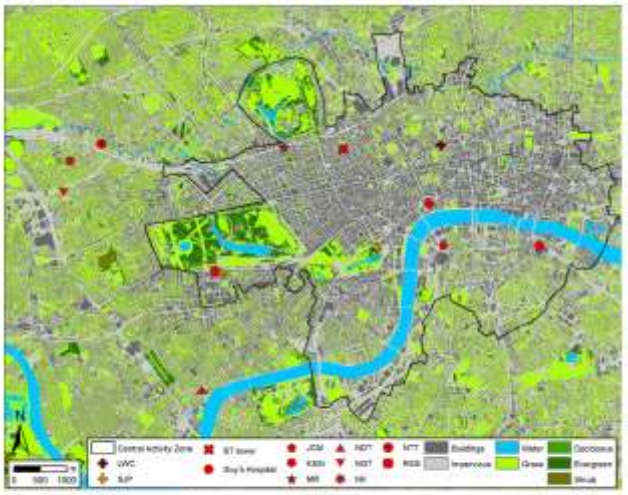
Loss & Continuity of Data

- Numerous stations have been established for various purposes
  - Record of availability of data (with meta data)
  - Follow-up to obtain data after any embargo period
    - Research, Commercial etc
  - Enormous effort put into establishing sites but not

MIDAS station sites (last updated 05-Jan-2011)[65]. Red sites (below) are no longer



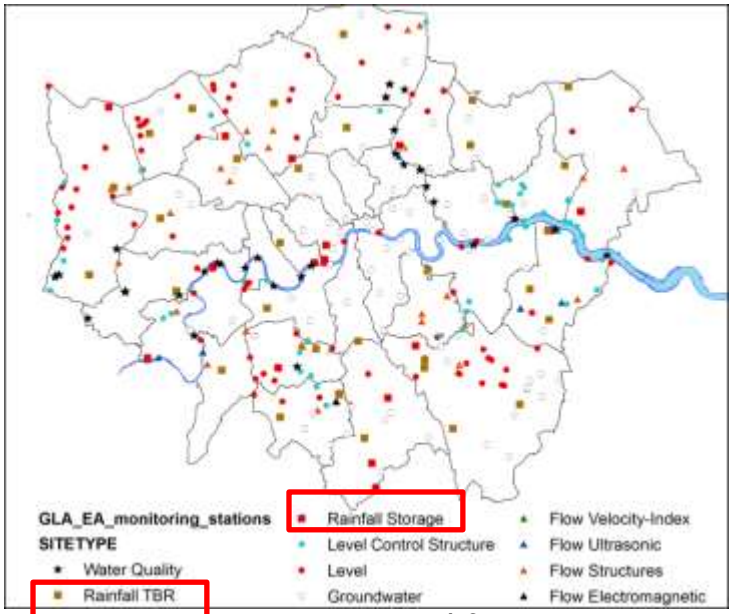
Met Office Land surface synoptic sites near London[66] (May 2010, see Figure 3). Detailed metadata, data access procedures are available via the BADC website[67]



Sites in Central London[68] operated as part of the ClearfLO project. This includes Air quality sites (NK, MR), ceilometer sites (KSSi, MR, RGS, NK), eddy covariance (BT Tower, KSSi). Doppler LiDAR (near MR)

Clear Gaps

- Rainfall information
  - Radar resolution
  - Rain gauge – may be improved by synthesis across networks



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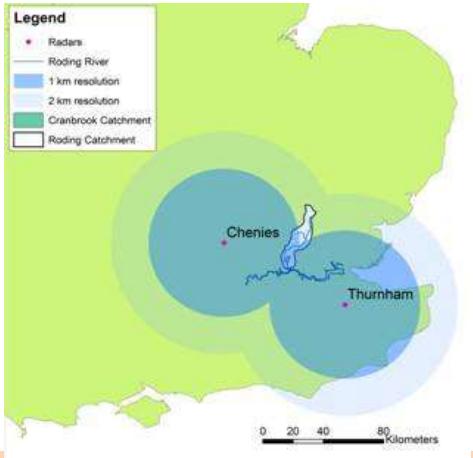

RainDrain Imperial

Rain gauges:

- 3 tipping bucket rain gauges with 0.2 mm resolution and 1 min data sampling operated by Imperial College London and equipped with wireless real-time communication devices.

Radars:

- The area is within the coverage of two C-band radars operated by the UK Met Office:

Specifications	Chenies Radar	Thurnham Radar
Radar type	C-band	C-band
Polarisation	Horizontal*	Dual-polarisation
Doppler	No*	Yes
Antenna	Parabolic 3.6 m diameter, 43 dB gain	
Beamwidth	1°	
Frequency range	5.4 – 5.8 GHz	
Range resolution	1 km up to 50 km range/2 km up to 75 km range	
Temporal resolution	5 min scan repeat cycle**	
Elevations (°)	0.5, 1.5, 2.5, 4.0, 5.0	0.5, 1.0, 1.5, 2.5, 4.0

*Currently being upgraded to dual-polarisation and doppler
**Within the RainGain project the potential benefits of reducing the repetition cycle to 2-3 min will be tested

Wind / Turbulence/ Vertical Information

- Almost all research data
  - Potential to use
    - BT Tower ?
    - LiDAR, ceilometers

- Wind – meta data critical

Met Office

Weather Observations Website (WOW)

London Grid for Learning

Windfinder

Next Steps

- London Climate Data Portal
  - Simple – bring all the data access points together
  - More Useful – perform some form of data analysis
  - Plan to use wide range of data sources
  - Plan to install equipment where there are gaps
  - Ongoing funding – to ensure continuity and quality
    - New technologies, new data needs

- Vertical Information
  - BT tower
  - Ceilometer
  - LiDAR

Figure Sources

- http://ukclimateprojections.defra.gov.uk/21863
- http://www.metoffice.gov.uk/public/weather/observations/#?tab=map&map=Temperature&zoom=9&lon=-0.19&lat=51.57&fcTime=1366747200
- http://www.metoffice.gov.uk/public/weather/observations/#?tab=map&map=Wind&zoom=9&lon=-0.19&lat=51.57&fcTime=1366747200
- http://wow.metoffice.gov.uk/
- http://weather.lgfl.org.uk/map.aspx?view=london
- http://www.windfinder.com/weather-maps/report/unitedkingdom#9/51.4266/0.0467

Objectives

Weather and climate data currently collected in London

- Why are the data collected?
- Types of data currently collected
- Location of data collection
- Who funds the data collection
- Availability of data

Weather and Climate data currently used in London

- Uses of Weather and Climate Data in London
- Data used
- Methods used to Purchase or Obtain Data
- Other groups who could be using Weather Data in London

Improvements to London's Weather Observations

- Respondents' suggestions
- Benefits of Additional Data Being Available
- New data needs
- Continuity of Sites and Data streams

Types of Survey Respondents

UK	International
Companies	Institutes & Government Agencies Agencies
Government	Consulting
Local Authorities	International Cities
Universities	Universities
Member Organisations	

Many have multiple respondents – many different applications

Wide Range of Potential Improvements and Applications

Flood forecasting and Water management

Improved rainfall information would help with:

- Flood forecasting
- Sizing of pipework for future design

In addition to rainfall other variables (e.g. radiation, etc) would be beneficial to

- Hydrological modelling
- Modelling to assess impacts to water management to inform operations, real time data

Numerical Weather Prediction (NWP)

NWP could benefit significantly from improved weather data horizontally and vertically

- improved capability to verify forecasts and evaluate modelling systems and parameterisations within them
- Includes assessing specifically urban effects:
- UHI effect on the pressure gradient and hence winds surrounding London
- Improve UCM model evaluation
- Improved developments of UCM's
- Single vs multi-layer models
- role of large roughness elements (Buildings)
- Potential to improve forecasts through use of data assimilation.

Both for data assimilation and model evaluation improvements, the use of improved measurements, such as heat fluxes and vertical profiles of meteorological variables at scales that are actually appropriate for model evaluation would be beneficial over the current need to use data that are not really appropriate within London for model performance metrics.

Improvements to NWP would have positive ramifications for many applications.

- surface flood forecasting
- air quality modelling
- improved UCM performance - can widen their application towards local scale forecasting / scenario testing under climate change projections
- use of impact models and specifically catastrophe models will expand beyond insurance into many

Wide Range of Potential Improvements and Applications

Transport/Data assimilation

- Improvement to observational data availability around Heathrow would allow improved understanding of fog behaviour in the vicinity- this would improve operations

Air quality forecasting

- Would benefit from improvements to UCM and NWP
- Improved assessment of linked models (e.g. WRF/CMAQ, ADMS-urban) which allow identifications of parameterizations that need improvements
- Improved spatial data resolution would allow improvements to Nowcasting products (e.g., http://www.londonair.org.uk/london/asp/nowcast.asp) through improved and increased data assimilation.

Improvements to air quality modelling could improve operations related

- Health and exposure
- Transport e.g. improved information about air quality hot-spots can be used to adjust transport operations and hence improve air quality

Ecology/ Ecosystem services

Improved information about both phenology and weather conditions

- Would provide useful information on trends in how species respond to seasonal changes, potential long-term trends of rainfall and drought to inform land management, future conservation planning, impacts of climate on pathogens and pests, etc.
- Pollen forecasts are done daily for London but given the wide range of species that cause problems for individuals and the different controls on the individual species improving understanding and therefore modelling would have health benefits

Emergency Response

With improved real time data

- Emergency response triggers could be improved to sudden changes, heat or cold extremes and snow, or heavy rain.

Wide Range of Potential Improvements and Applications

Health

With improved spatial data:

- Tie data to spatially referenced health outcomes notwithstanding concerns around ethics
- Use this evidence to develop strong policies requiring buildings to be designed to mitigate overheating risk through passive measures as far as possible, reducing cooling demand. If vegetation is shown to reduce UV exposure, it could be used to help reduce the UV exposure as a result of the triple glazing, high albedo reflecting surfaces/paint in the city and surrounds

Building design/Energy Use/ Indoor Climate

With improved data availability:

- Improve testing, evaluation of models leading to:
- Provision of improved design guidance.
- Greater energy efficiency / cost savings
- Improved daylighting design
- Improve daylighting availability in buildings and reduce energy consumption
- Improvements to urban design, retrofit activity and maintenance and management of green spaces within London
- Understand better how changes in internal climate we measure at some locations are a function of the actual outside climate.

Policy Tools

Improved data:

- Would be used in conjunction with a range of factors and scenarios, it can make it more useful for decision makers whose jobs consist of thinking about these interlocking impacts e.g. policy makers, planners, any project managers of retrofit/new build, building services, health professionals etc.
- Development of an assessed tool to be able to quantify impacts of proposed developments on future temperatures and therefore potentially secure a financial contribution towards mitigation measures (e.g. if develop large hard heat generating building, mitigate impact on urban heat island by securing