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Development of a cloud-accessible application to bring meteorological data to users in public health sector in England

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8th February 2021

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Weather, Climate Change & Health

- Surveillance of air pollution (interpretation)
- Weather Surveillance: e.g. asthma and pollen
- Cold and Heat stressors (e.g. heatwaves, cold weather alerts)
- Infectious disease surveillance e.g. RTSS, including:
    - influenza and seasonal infectious diseases
    - zoonosis/vector borne diseases
- Extreme events e.g.:
    - flooding
    - forest fires
    - storms, etc.

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Reasons for linking weather data with other data for public health purposes

- **Public health surveillance/vigilance**
  - Risk assessment for harm reduction
  - Environmental events/incidents, Infectious diseases
  - Hazard, exposure, health outcome surveillance
- **Operational response services**
  - Major incidents/emergencies responses and advice
  - Health protection interventions and advice
  - Health improvement interventions and advice
  - Public health data, knowledge and intelligence services
- **Research and Development**
  - Health Protection Research Units (HPRUs)
  - Other research collaborations
- **Global Public Health**
  - Drought/famine/food & water security
  - Population displacement/migration due to weather or climate change

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Precursor: MEDMI

- MEDMI = Medical & Environmental Data Mash-up Infrastructure
- Funded by Medical Research Council (MRC) and NERC
- Partners included European Centre for Environment and Human Health / University of Exeter, Met Office, LSHTM and others
- The main aim of the MEDMI project was to create a central data and analysis source as an internet-based platform as a vital common resource for medical and public health research in the UK and beyond
- Web site at URL https://www.data-mashup.org.uk/

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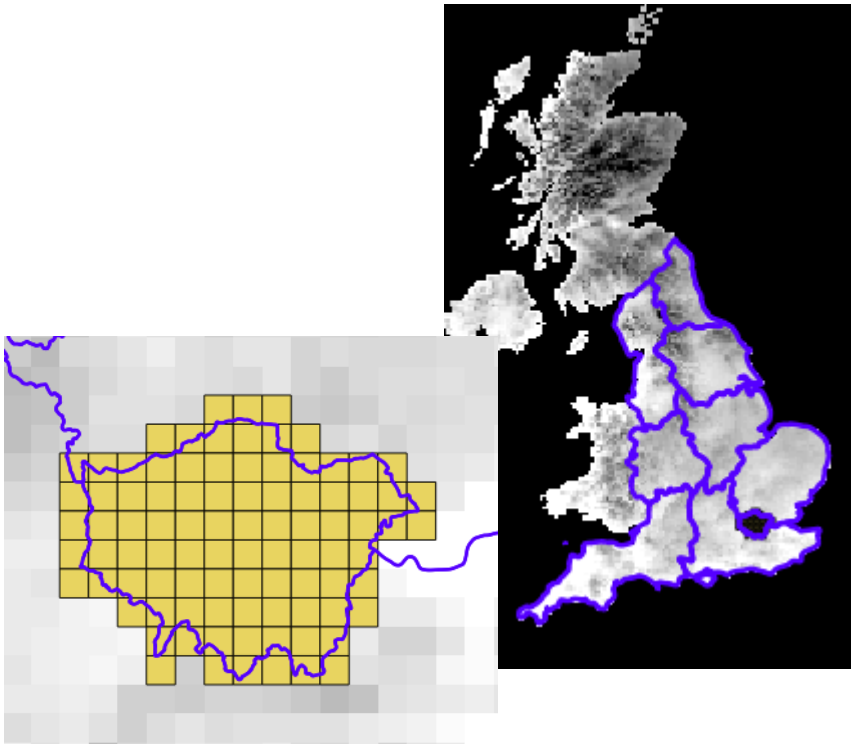
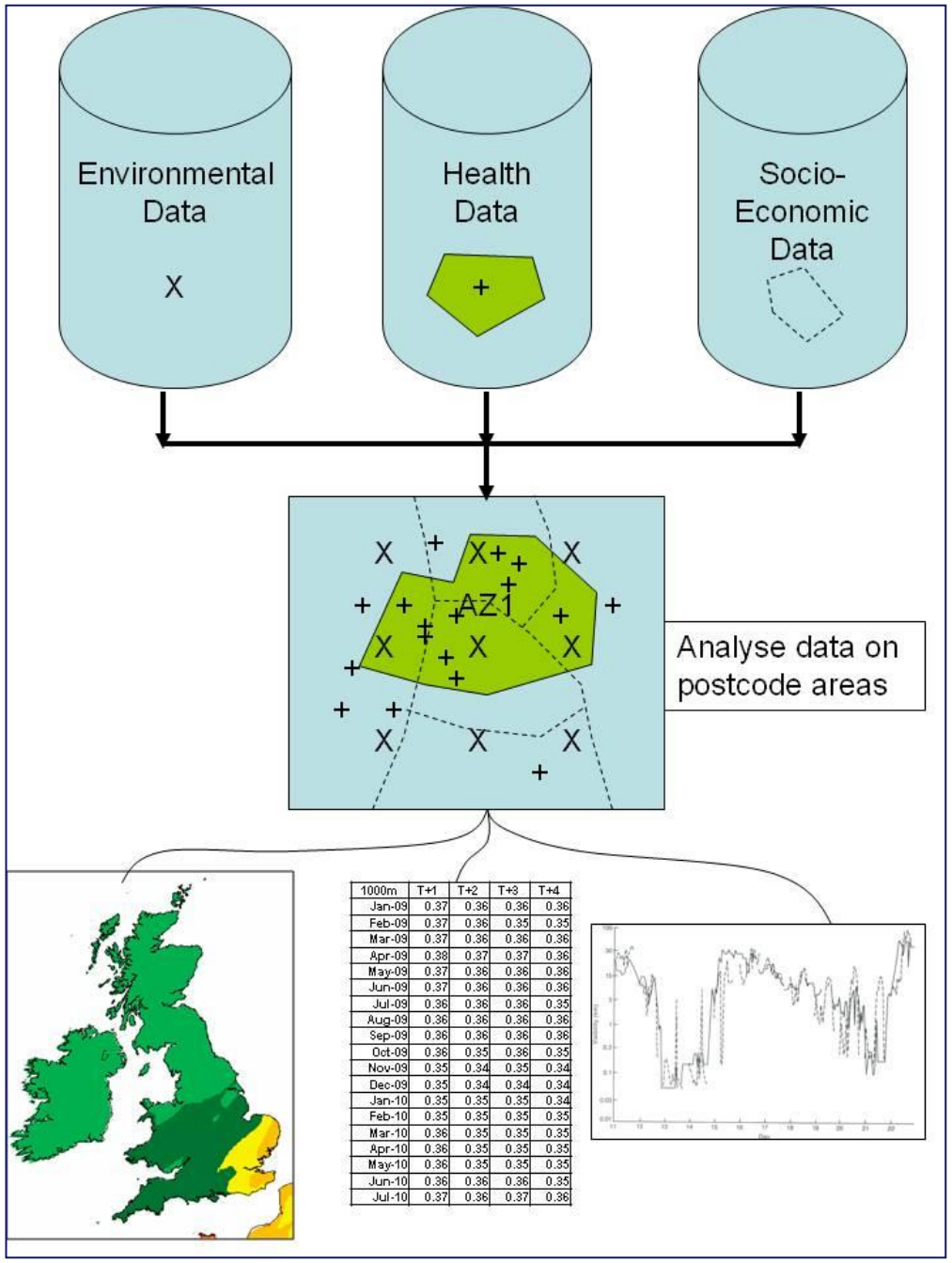
MEDMI Model





1000m	T+1	T+2	T+3	T+4
Jan-09	0.37	0.36	0.36	0.36
Feb-09	0.37	0.36	0.35	0.35
Mar-09	0.37	0.36	0.36	0.36
Apr-09	0.38	0.37	0.37	0.36
May-09	0.37	0.36	0.36	0.36
Jun-09	0.37	0.36	0.36	0.36
Jul-09	0.36	0.36	0.36	0.35
Aug-09	0.36	0.36	0.36	0.36
Sep-09	0.36	0.36	0.36	0.36
Oct-09	0.36	0.35	0.36	0.35
Nov-09	0.35	0.34	0.35	0.34
Dec-09	0.35	0.34	0.34	0.34
Jan-10	0.35	0.35	0.35	0.34
Feb-10	0.35	0.35	0.35	0.35
Mar-10	0.36	0.35	0.35	0.35
Apr-10	0.36	0.35	0.35	0.35
May-10	0.36	0.35	0.35	0.35
Jun-10	0.36	0.36	0.36	0.35
Jul-10	0.37	0.36	0.37	0.36

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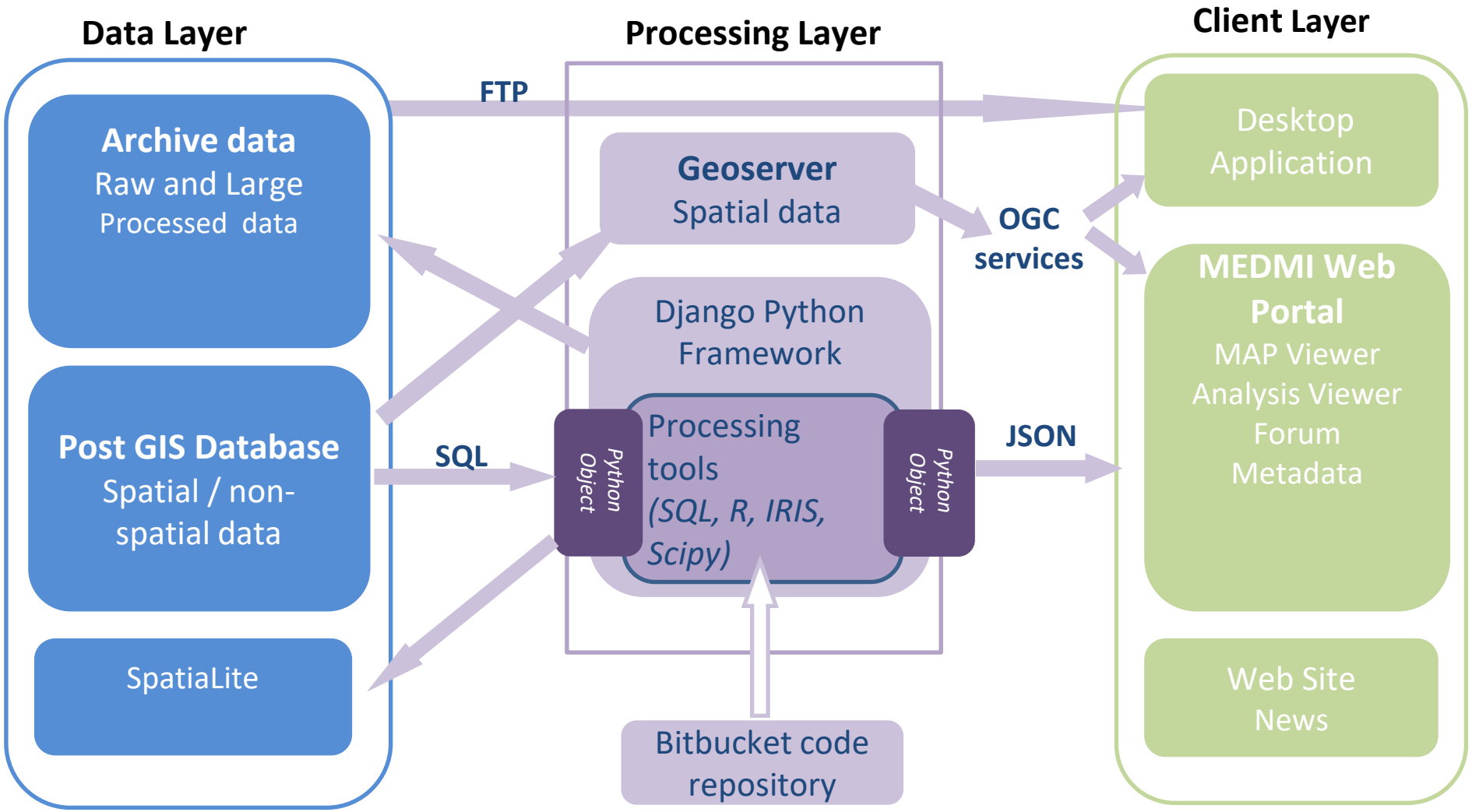
MEDMI System Architecture



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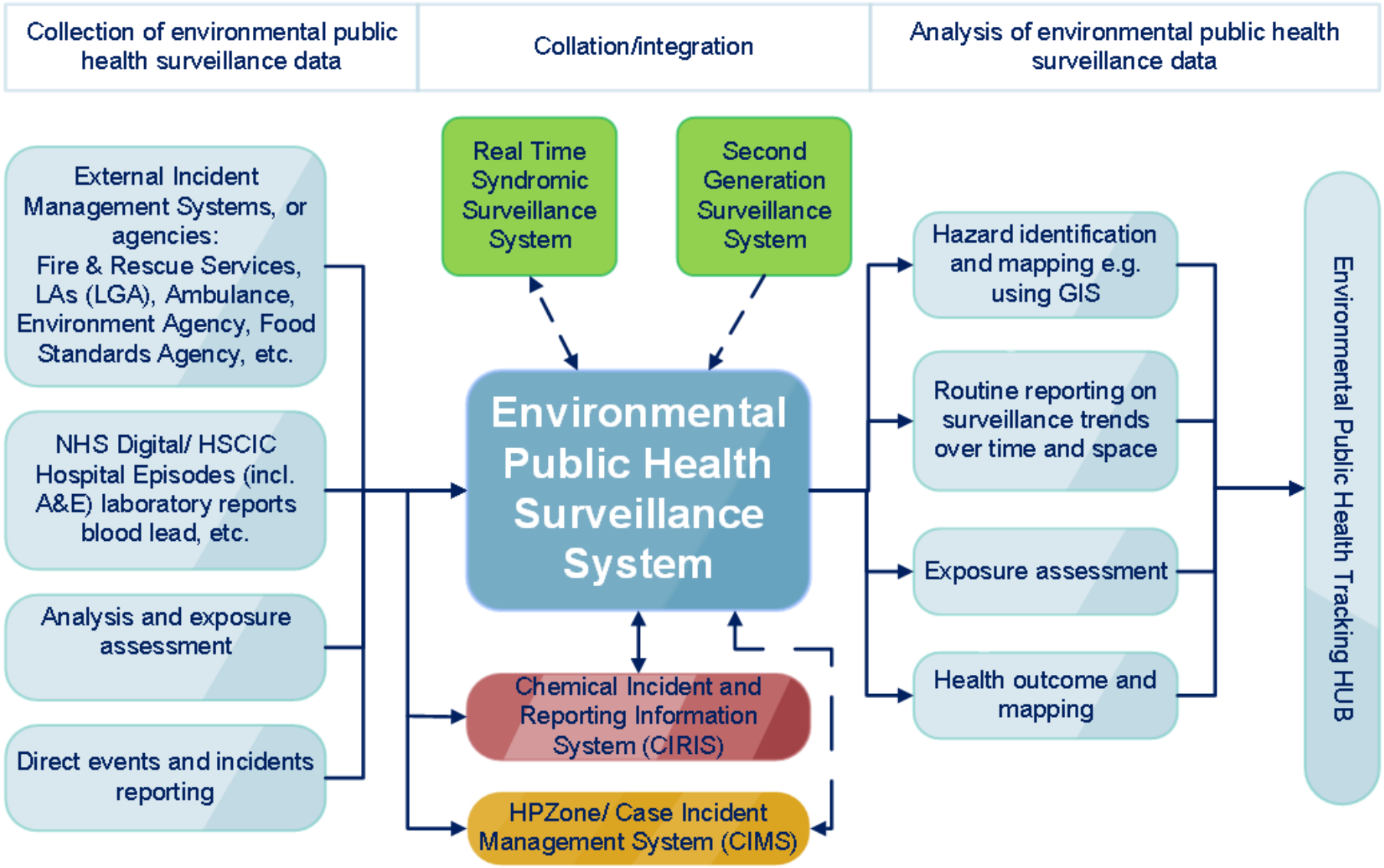
Environmental Public Health Surveillance System

- EPHSS = Environmental Public Health Surveillance System
- Funded internally by PHE
- Partners included several internal PHE groups (e.g. GIS) and Met Office
- Focus here is on the meteorological module, based on requirements from public health professionals by leveraging cutting-edge ‘on-premise-to-cloud’ technologies.
- The graphical interface allows the user to define requests on longitudinal (time series on an individual location) or cross-sectional (spatial area covered by a grid, single point location or time) investigations.
- Locations can be specified either in latitude/longitude coordinates, or by area geographies. Users then choose meteorological parameters and how they want the raw data to be processed.

Environmental Public Health Surveillance Dataflows

- Collation and Integration of data from multiple sources and formats



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Public Health Users – Requirements

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Groups and services within PHE that use weather data

- Emergency Response (CBRN incidents, Volcanic ash)
- National Infectious Services including Field (Epidemiology) Services
- Climate Change Group (urban heat islands/built environment)
- Air Pollution Group
- Extreme Events and Health Protection Group (heat waves, floods)
- Environmental epidemiology and public health tracking
- Real-time Syndromic Surveillance Team (asthma, pollen, heat-stoke)
- Knowledge and Intelligence Teams (indicators)
- Radiation Assessments Group
- Gastro-intestinal, Emerging and Zoonosis Infections
- Others

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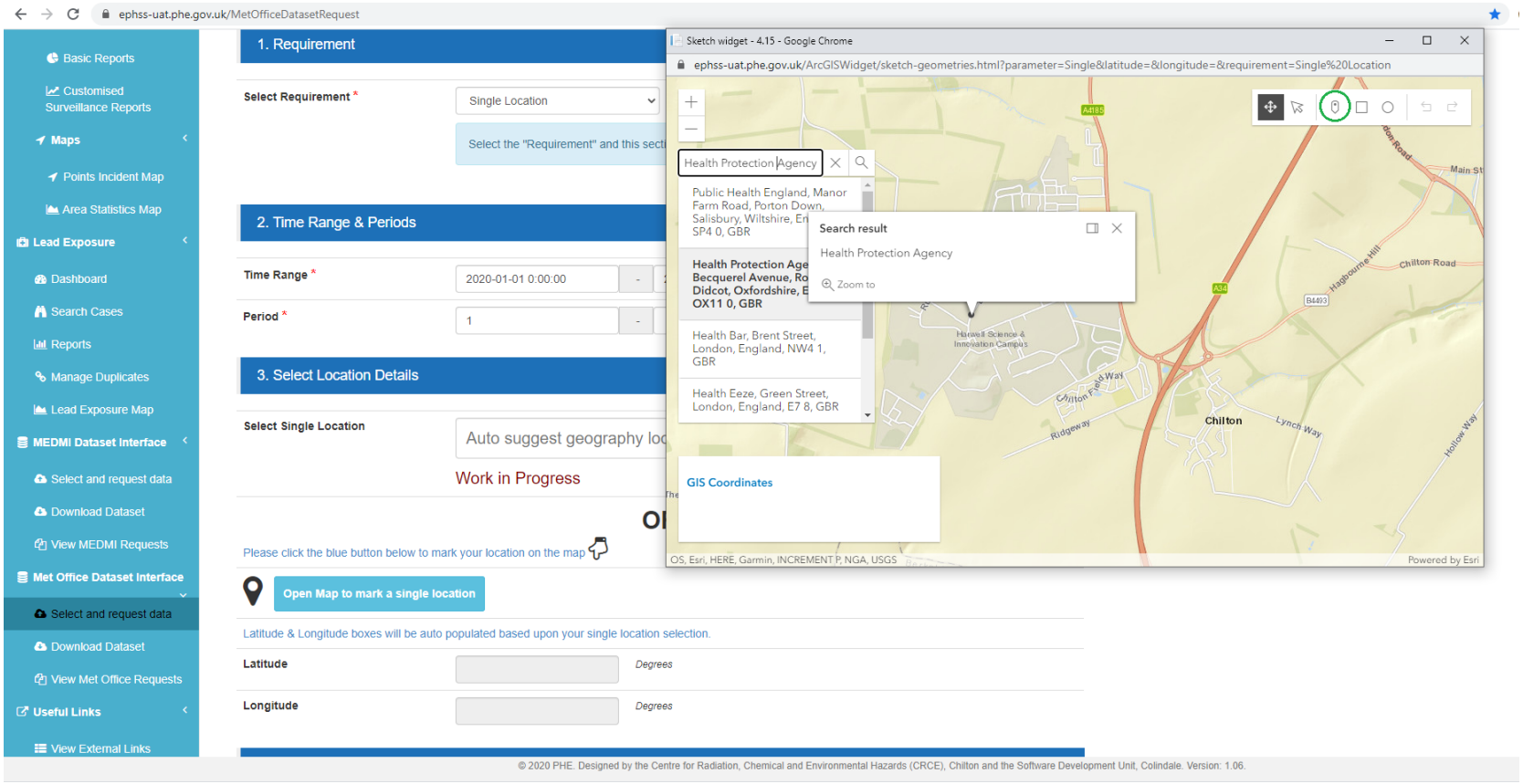
Accessing Meteorological Data in EPHSS



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Data items available from MIDAS

- Maximum air temperature
- Minimum air temperature
- Precipitation amount (hourly rainfall)
- Precipitation amount (daily rainfall)
- Calculated relative humidity
- Thunder day flag
- Mean wind speed
- Mean wind direction
- Pollen

The current EPHSS Met Office web-interface uses a file transfer protocol to send requests to & receive the data from the Met Office server.

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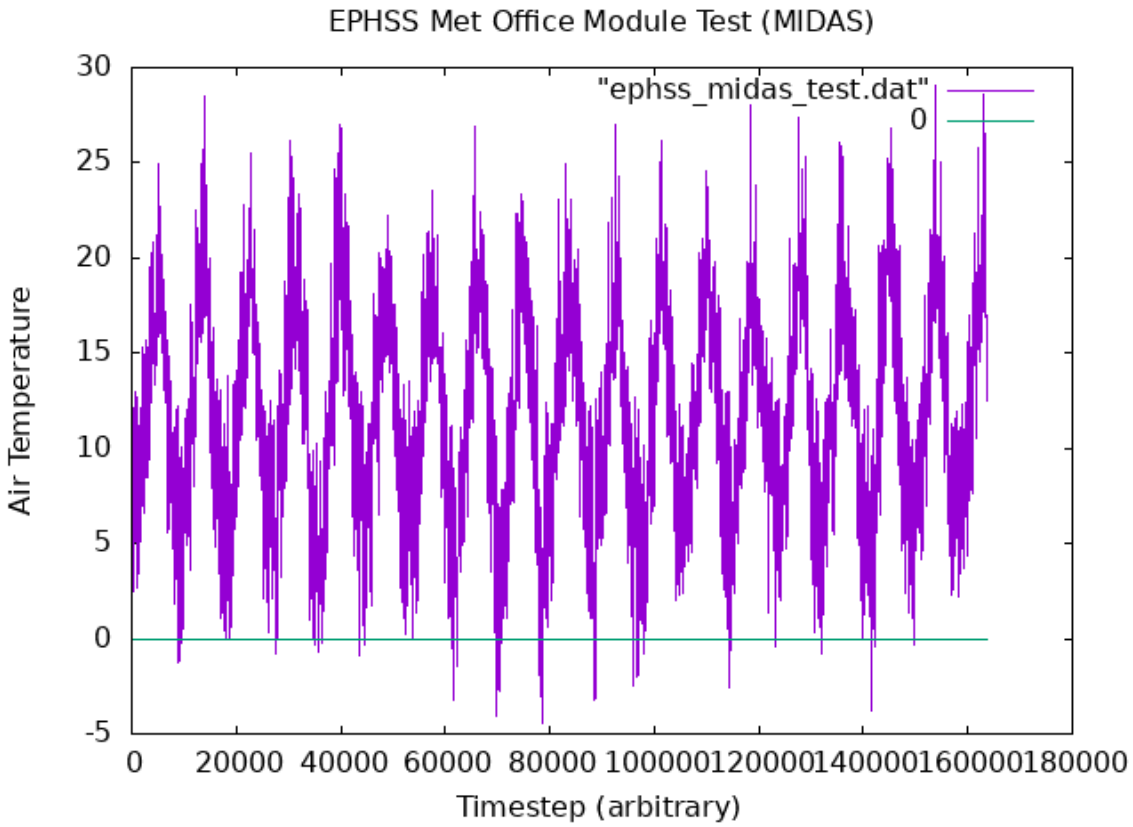

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Plans for Cloud Access

- Following migration of Met Office data & services to a cloud-based solution (Common Data Platform), the EPHSS will be modified to connect with real time cloud-based services via Web API hypertext transfer protocol (HTTP).
- Development of a dedicated **Health API** is planned, which can query the Met Office data situated in the cloud.
- There is a potential to connect with the Copernicus Climate Data Store Application Program Interface (**CDS API**) and other cloud-based data sets.

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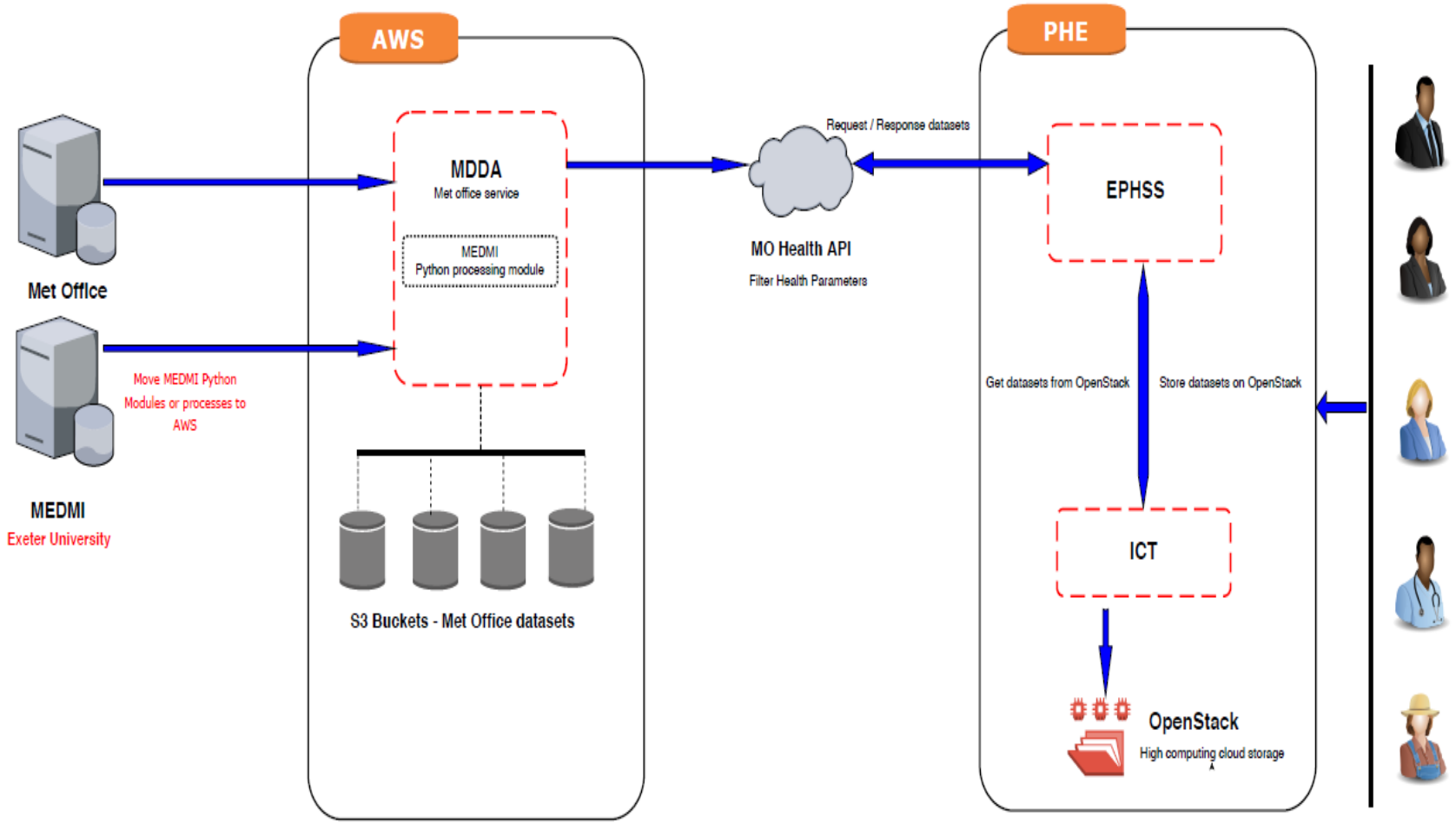
Prototype diagram for Met Office API



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More on cloud access …

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External groups that use weather data for public health purposes

- Public health in local authorities
- Environmental Health Officers in local authorities
- Emergency response agencies, Ambulance Trust, Fire and Rescue services
- Govt. departments (e.g. DHSC, DEFRA, CLG, BEIS)
- Regulatory agencies (e.g. EA, FSA, DWI)
- Devolved administrations (e.g. Public Health Wales)
- Academic institutions and research councils

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Conclusions

- EPHSS output files (in user-friendly CSV format) provide spatiotemporal data of meteorological parameters (e.g. a timeseries of hourly precipitation at a single location);
- these timeseries can be used for further epidemiological analysis by linking with health outcome data;
- currently some 40 internal users are accessing the system;
- from internal user feedback, we are confident that the EPHSS will become a versatile tool for health professionals seeking to study the effects of weather and climate on public health;
- work is progressing to enable external user access to EPHSS;
- we are developing the system further so it can access cloud-based data.

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Questions?

Contact us via email: epht@phe.gov.uk

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Additional Slides

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Core data items required - Radiation Assessment Dept – Air Pollution

- Temperature (in degrees Celsius)
- Wind speed (in metres per second)
- Wind direction (in degrees from North)
- Precipitation (in millimetres per hour)
- Precipitation type (e.g. rain or snow)
- Presence of fog (yes or no)
- Cloud cover (in oktas)
- Relative humidity (as a percentage)
- Boundary layer height (in metres)
- Pasquill Stability Category (A-G)
- Stability parameter (typically a numeric value, P)
- Historical hourly met data over a range of timeframes (1 hour to multiple years) and spatial domains (typically UK but also global) is of significant value.

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Core data items required - Infectious diseases

- Mean Sea-level pressure
- Max air temp ,Mean air temp , Min Air temp
- Radiation
- Mean Oktas
- Dew point temp
- Soil temp at 10cm,20cm,30cm,50cm,1m
- Air pressure
- Mean visibility
- Mean wind speed
- Relative humidity
- Sunshine duration
- Snow depth

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Core data items required - Syndromic surveillance

- Temperature data
- Humidity
- Rainfall

Need near-real-time historic data i.e. yesterday for acute response

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Value of weather data to public health

- Focus on primary prevention and wider determinants of non-communicable diseases
- Improving risk assessment and preventative action
- Improving early detection and monitoring of health impact trends
- Improving burden of disease estimates
  - (mortality, morbidity, vulnerable populations, etc.)
- Evaluation of interventions, policies, processes, strategies and behaviours
- Use of new intelligence to develop integrated environmental public health strategies

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Why collaboration to link data would be timely and mutually beneficial

- Increasing demand for weather data from the public health and research communities
- PHE successfully partnered with MEDMI and Met Office to develop routine access to Met Office/MEDMI data via portal within EPHSS
- PHE is now focusing effort to develop a new weather surveillance module within EPHSS
- Opportunity to maximise investments in Application Programming Interfaces (APIs) developments can optimise existing capabilities
- APIs provide a cost-effective, scalable solution for enhanced multi-agency data systems connectivity
- Step-wise, modular approach to streamline a select group of datasets of high value for routine data sharing