



DAFNI

Introduction to DAFNI

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Science and
Technology
Facilities Council



Engineering and
Physical Sciences
Research Council



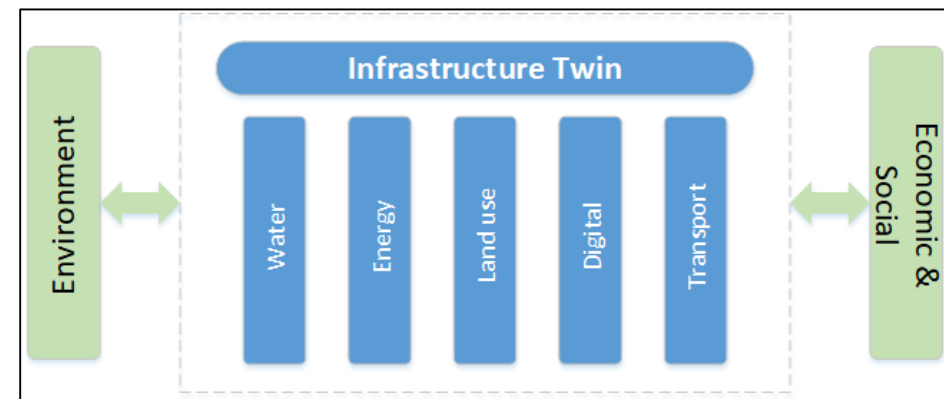
UKCRIC

Why DAFNI ?

- **Scaling up**
 - More data
 - Higher resolution
 - More compute resources
- **Data integration and exchange.**
 - Share data between infrastructure models
 - Security respected
 - Common standards for interchange and interoperation
 - Common Metadata standards
- **Integration between models**
 - Capture the interdependencies
 - Integration across scales - Nation to Item
 - Integration across sectors
- **Supporting an ecosystem of Digital Twins**
 - Integrated data infrastructure
 - Connections to sensors and “real-time” I/O
 - Analysing large-scale historic data to propose decisions



Integration across scales



Integration across sectors

- **A Place for sharing data and models**
- **A Place to support collaborations**
- **A Place as a legacy**

- **A hybrid high-performance computing platform**
- **A secure repository for heterogeneous national infrastructure data and models.**
- **A collaborative platform to research and develop multi-system models of infrastructure assets and systems**
- **A place to make data and models available for long-term accessibility**

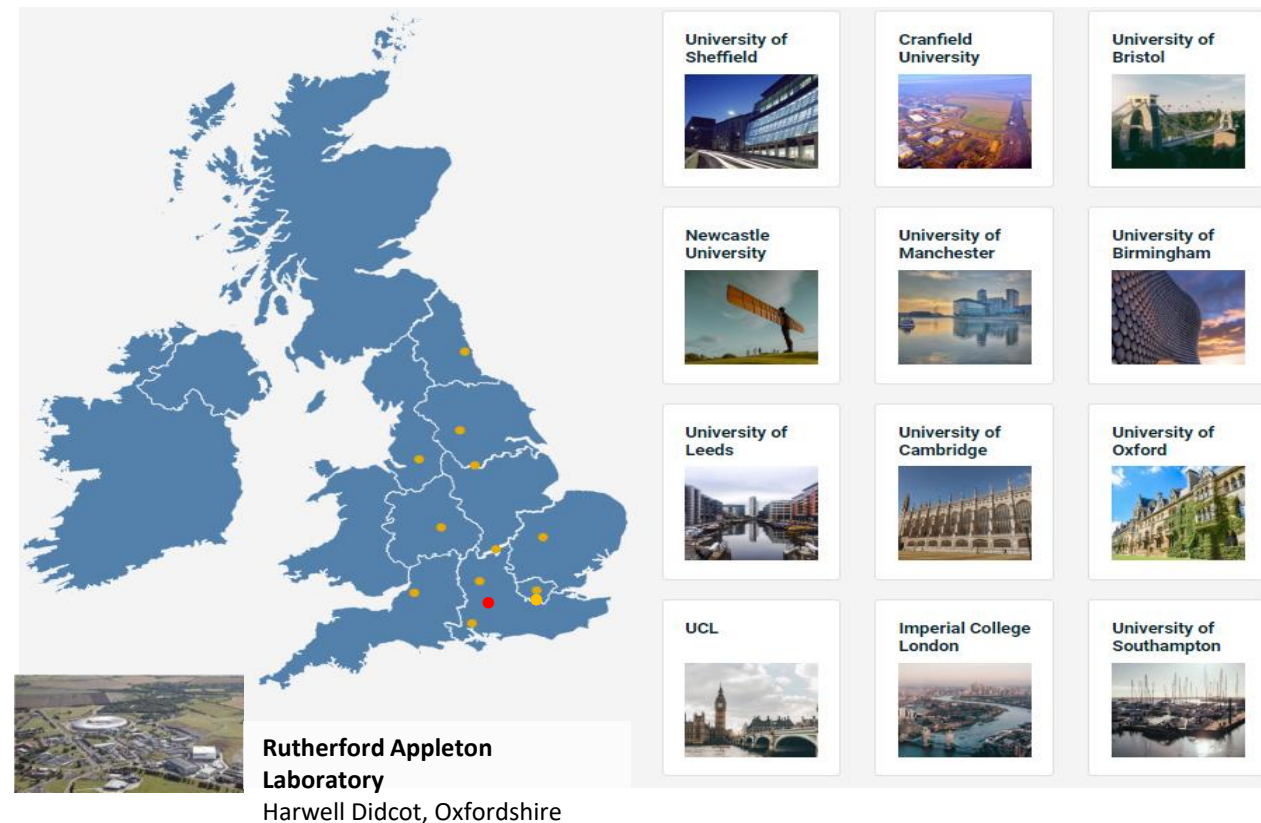
What DAFNI can offer

Providing a computing platform to improve decision making for national infrastructure

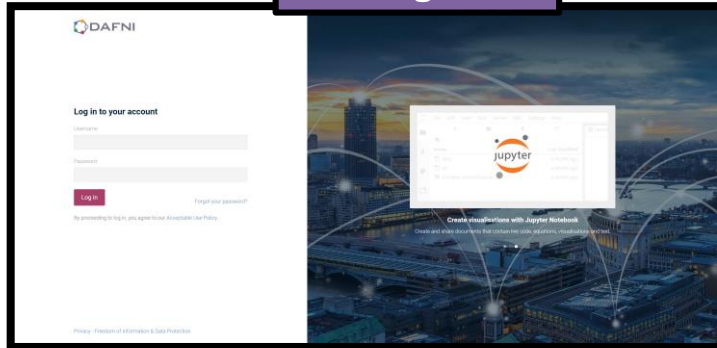
UK's next generation platform to support research into infrastructure decisions: planning, investment, design and operation.

- £8M investment 2017-2021 under the UKCRIC programme
- 12 partner universities
+ STFC as development and hosting partner

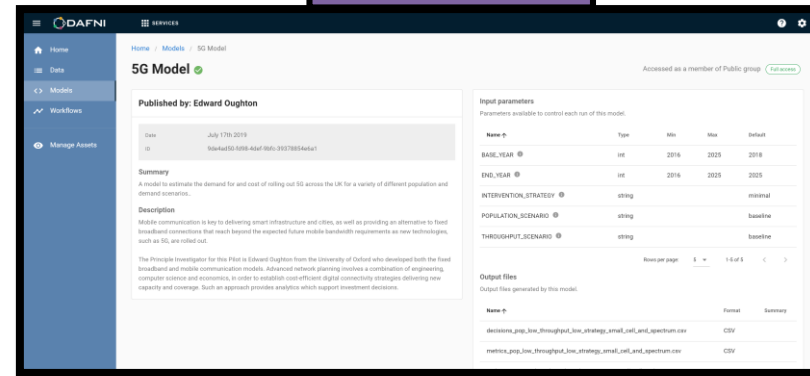
Partnerships between Academia, Government, Industry



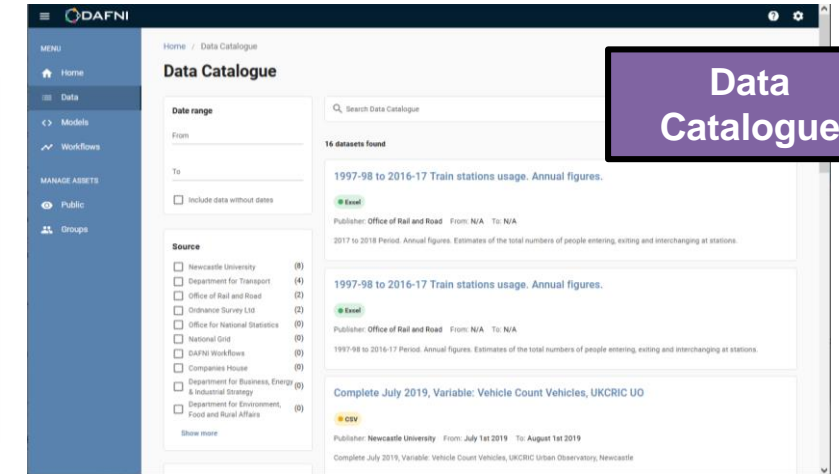
Login



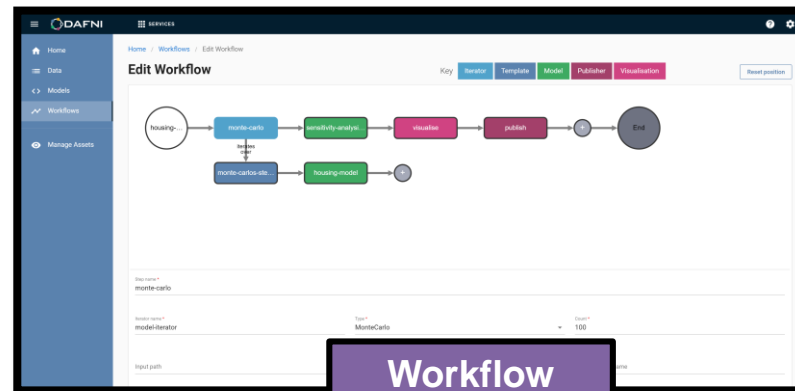
Data



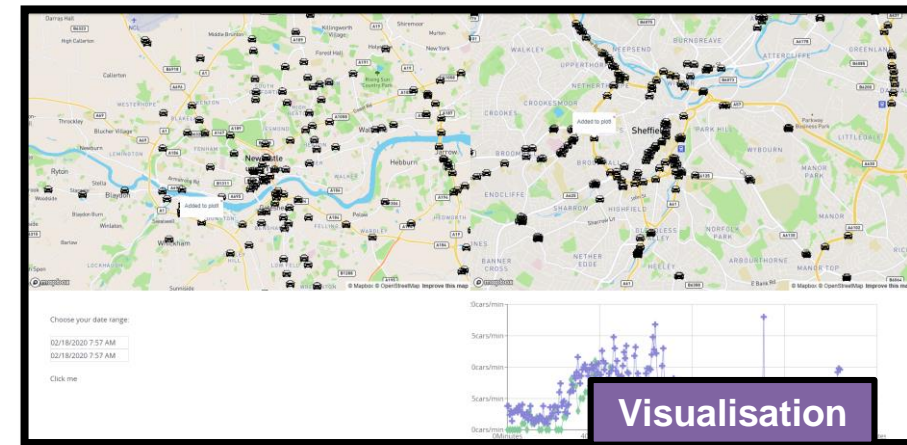
Data Catalogue



Models

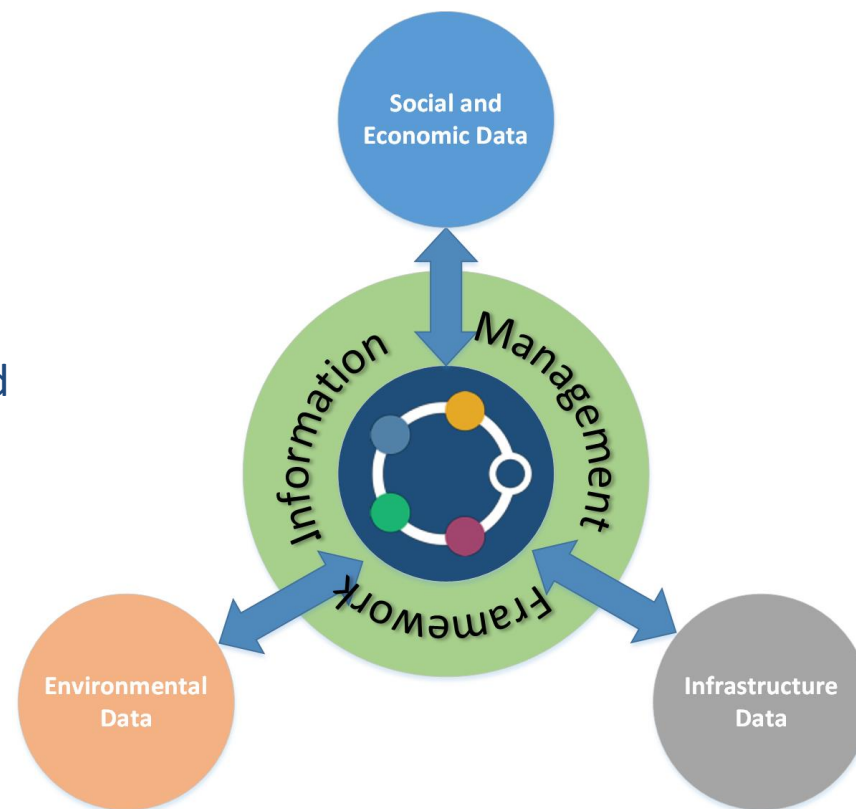


Workflow Management



Visualisation

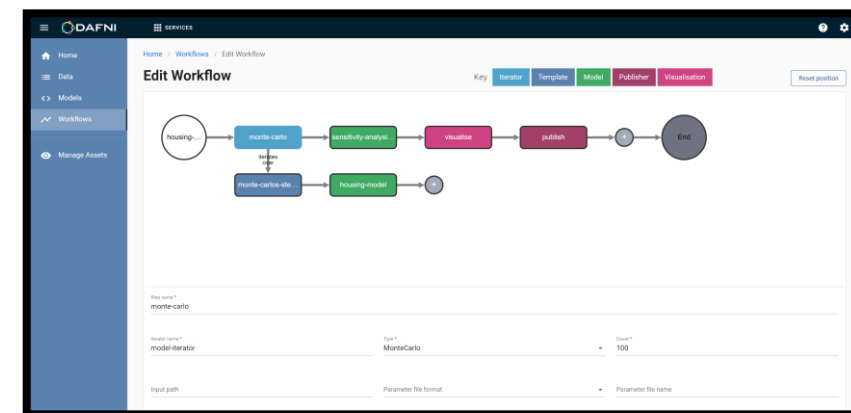
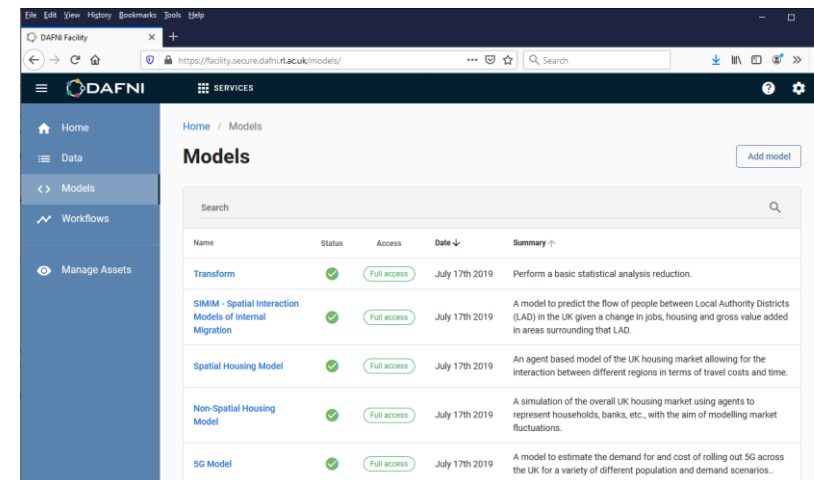
- DAFNI provides a Data Hub
 - Data sharing
 - Data integration
 - Data curation
- The DAFNI NID provides
 - A trusted secure space to hold and access data
 - Importing from and linking to other data sources
- A metadata framework for the data catalogue
 - DCAT 2.0
 - Common search and access



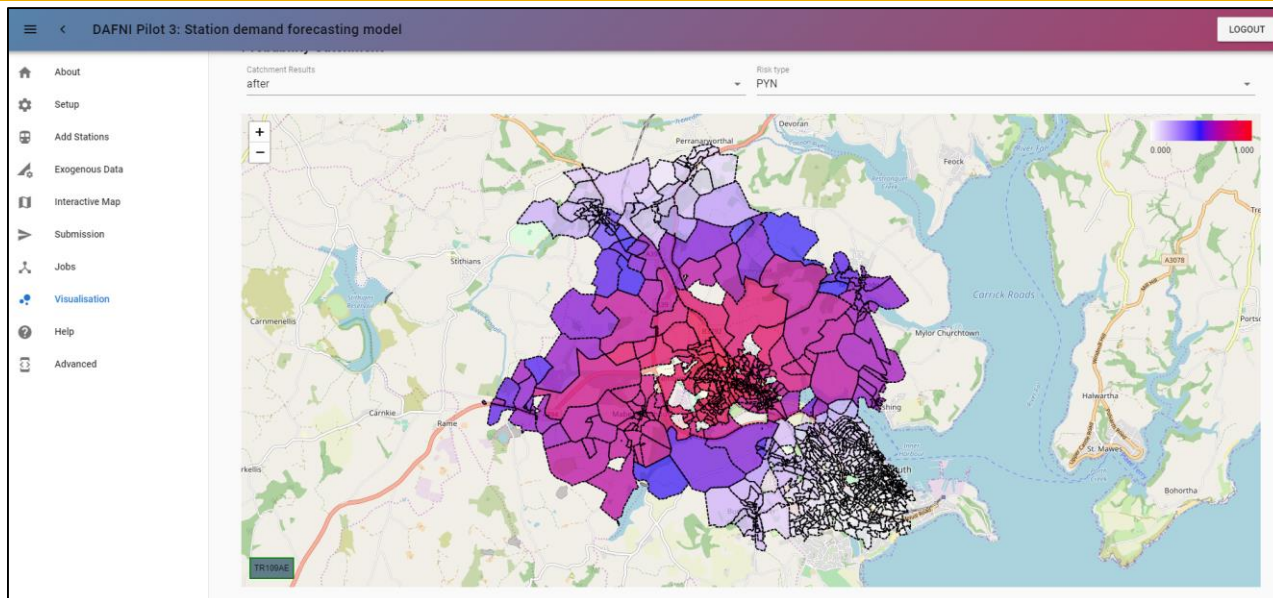
A platform for integrating and combining data

- DAFNI's NID provides basis for representing data from different sources
 - Extensible to sectors: water, energy, transport ...
 - Support an Ontological framework for data
- A data store – but not all data needs to be held centrally

- Upload models from anywhere into a model repository
 - Models “containerised” using Docker
 - Independent of code and operating systems
 - Sharing models
 - Within the same security framework
- Models can then be run on the HTC cluster
 - Kubernetes orchestration of containers
 - Scale up models for more compute
 - Access to data in the NID
 - Access to visualisations
- The NIMS allows workflows to be constructed
 - Chaining models together
 - Coupling models together
- Key feature of providing an Infrastructure Ecosystem
 - Coupling different sectors
 - Coupling different scales

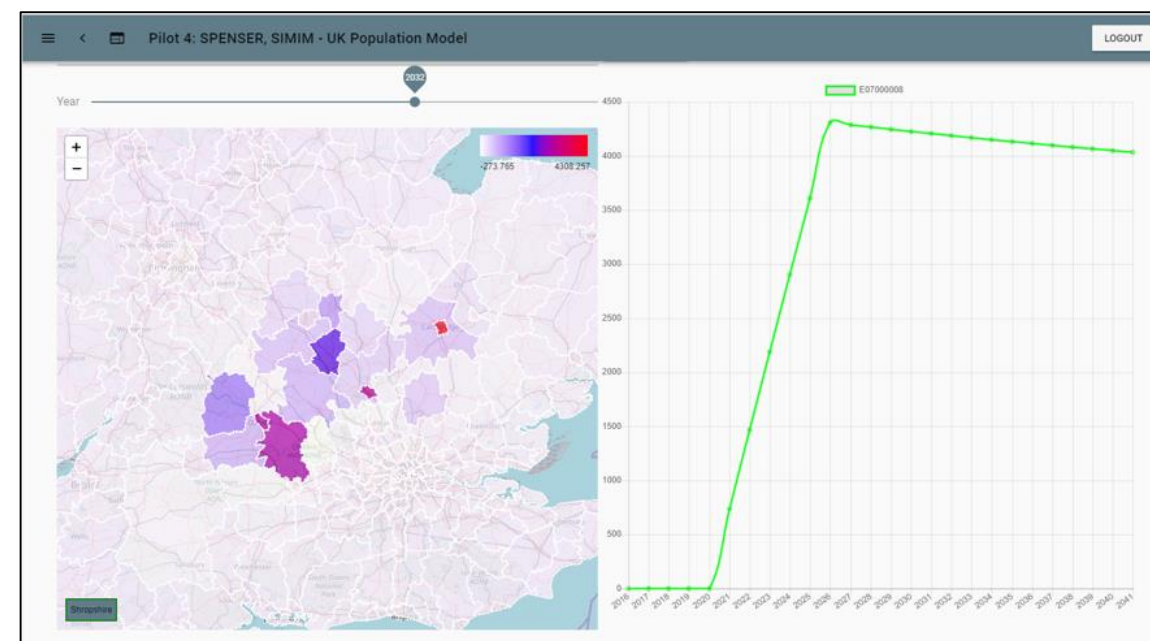


How is DAFNI being used?



A map showing the probability catchments of Penryn station after adding a new station in Helston
Station demand model, University of Southampton

Map showing the CAMCOX corridor and the movement of people given a change in households, jobs and GVA
SIMIM model, University of Leeds



From 2011 the UK Infrastructure Transitions Research Consortium (ITRC) has developed:

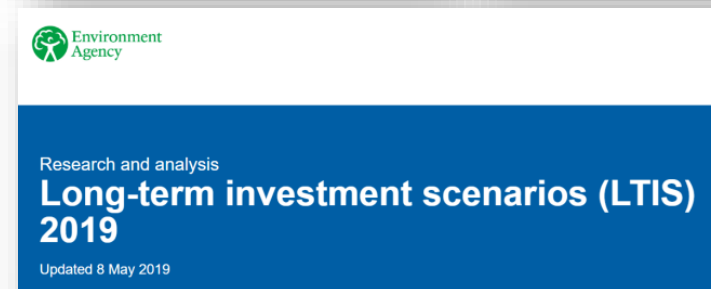
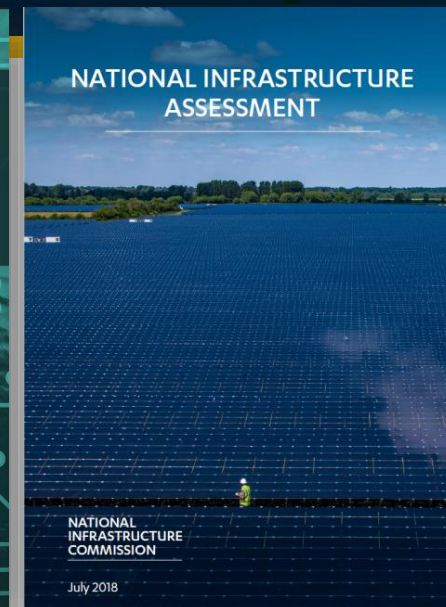
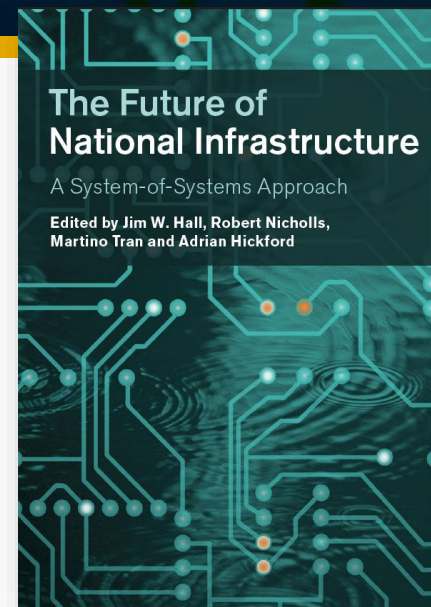
The NISMOD national system-of-systems model (energy-transport-digital-water-waste) for infrastructure **planning** in Britain

- NISMOD was used in the UK's first National Infrastructure Assessment

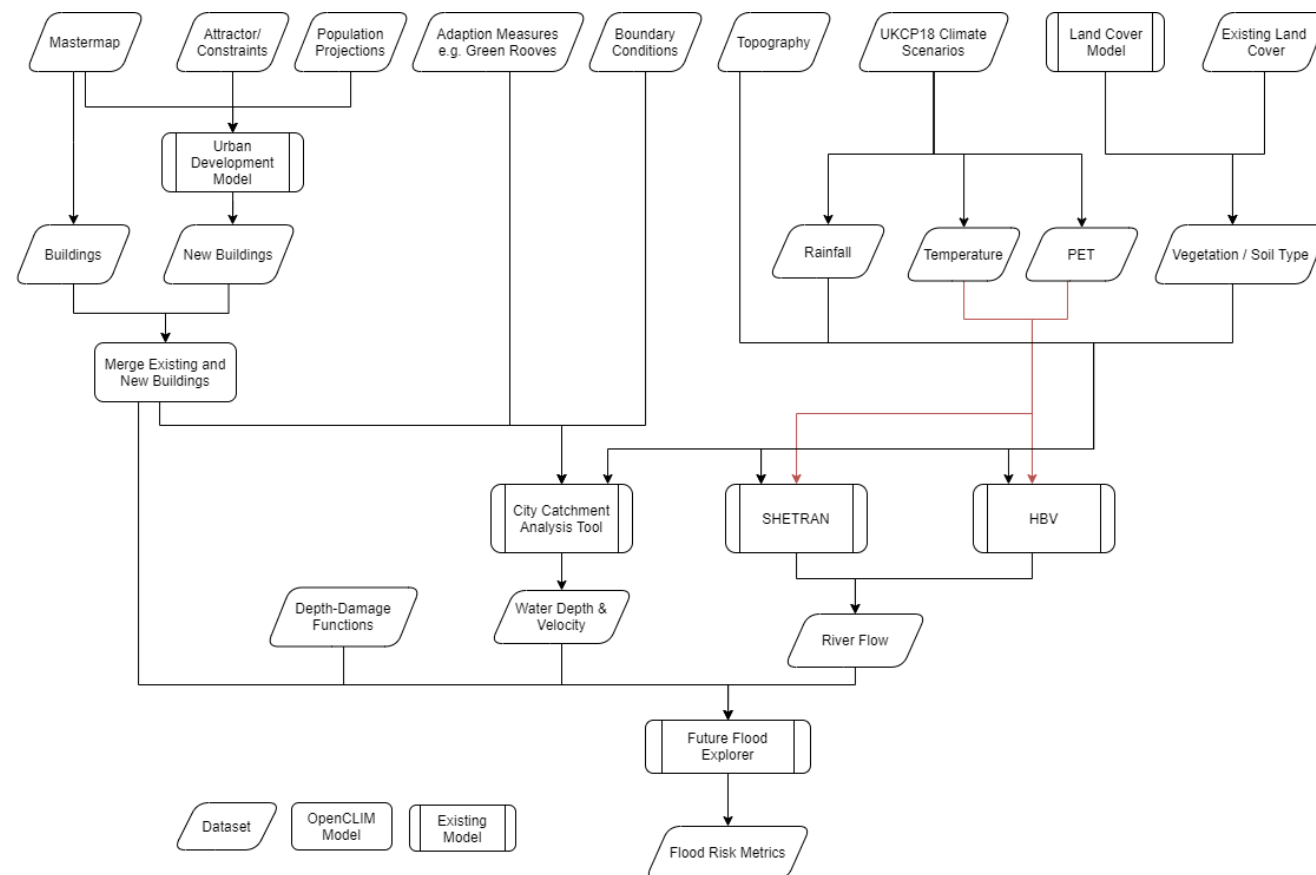
National modelling of climate **risks** to infrastructure networks

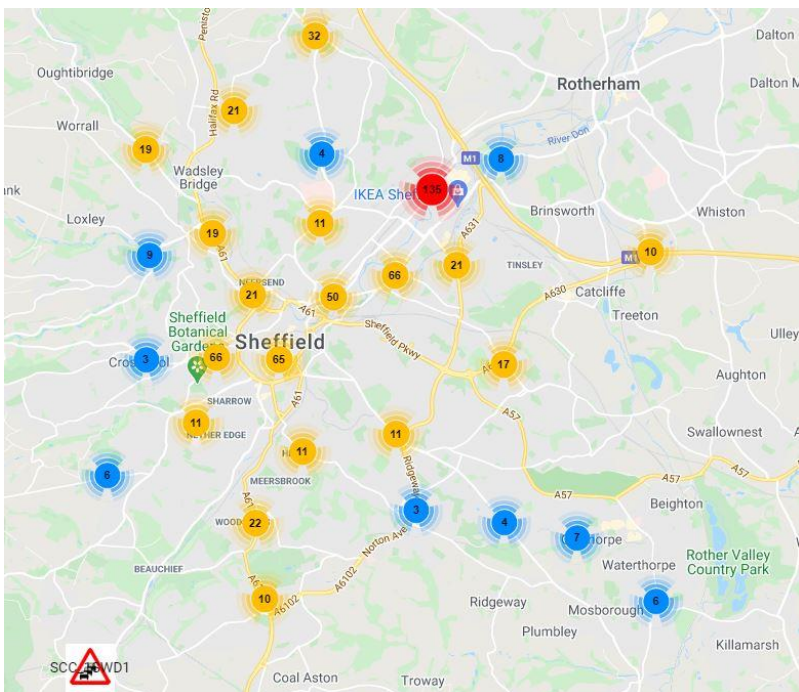
- Used to inform the Environment Agency's long term investment strategy for flood defences
- Analysis for the National Infrastructure Commission's resilience study

NISMOD is being migrated to a new £8million **facility** DAFNI: the Data and Analytics Facility for National infrastructure



- New project – led by University of East Anglia
- Assess the risk of climate change
 - Flooding
 - Health risk from extreme heat
 - Agriculture and biodiversity
- Affect of approaches to adaptation
- Towards CCRA4
- Multi-systems modelling approach
- Working with DAFNI to provide
 - A framework for combining models together
 - A place where users can go to access and run workflows
 - A legacy where models can be accessed for the long-term

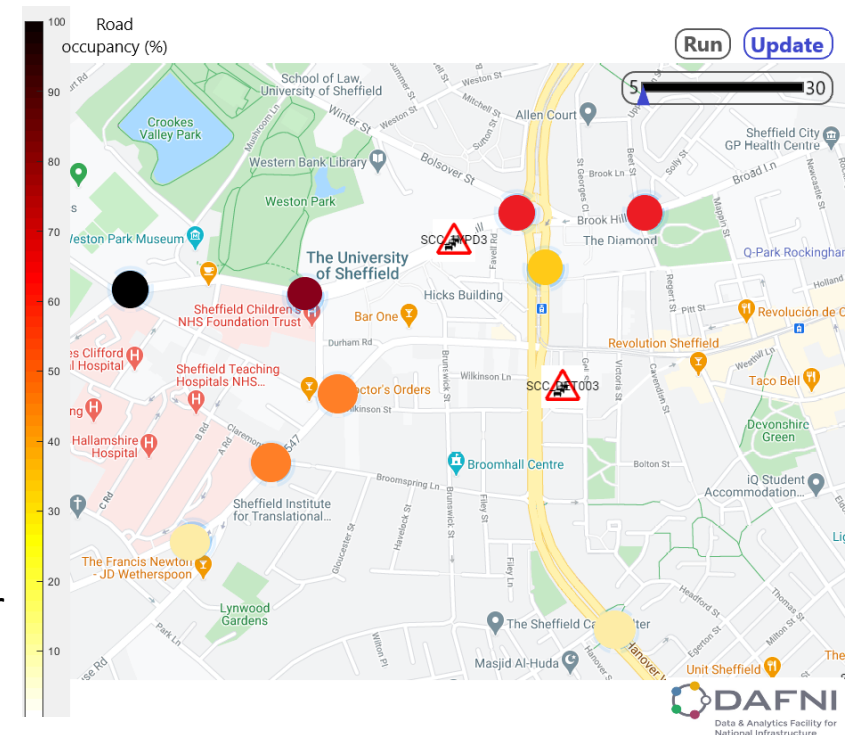




- Use traffic data from the Sheffield Urban Observatory
 - 640 sensors that report traffic flow (no. of cars/min)
 - Time resolution: 5 min
- Build AI-based model
 - updates in real-time for each sensor
 - predicts evolution of traffic (ex: 30 min ahead)
- Create a digital replica of the Sheffield traffic
- Identify areas where congestion will occur

Use cases:

- Traffic monitoring system that predicts congested areas
- Real-time traffic flow optimization



The University
Of
Sheffield.

**Christian Genes,
Daniel Coca**

An environment for research collaboration

For researchers, government and industry exploring new ideas in modelling

DAFNI Platform offers:

- A HTC platform supporting research and technology transfer
- Data sharing within a common information infrastructure
- Scaling and coupling models
- A long-term legacy for keeping such models accessible

Still work to be done:

- Digital Twin Pilots
- Experimenting with a more dynamic data management framework
- Data Ontology Support

Supporting sustainable development of infrastructure for our regions, cities, rural areas and down to the household level.



DAFNI

Thank You

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