Earth Observation for Local Government

Earth Observation has been used successfully for spatial planning and urban monitoring purposes in local government. This document presents case studies on water quality and green space mapping, the detection of ground movement and the evaluation of surface temperature and air pollution

Complexity

- Clear method and straightforward
- Clear method but complex
- Possible; needs research

Resource

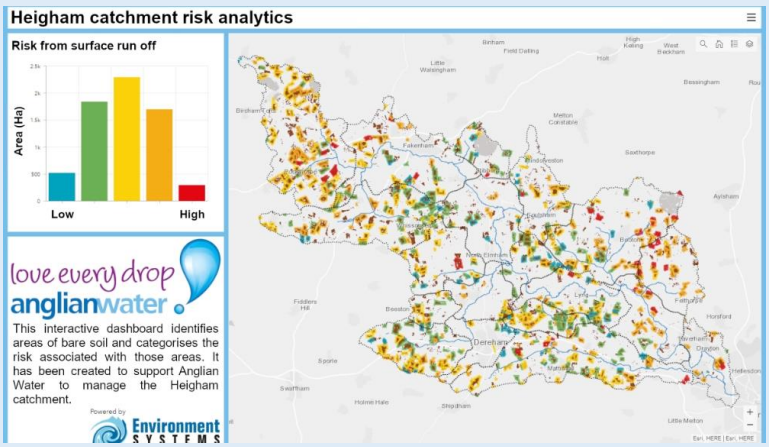
- £ Low
- ££ Medium
- £££ High

Case Study I: Water quality risk mapping

Environment Systems and Anglian water use Earth observation data to create a water quality risk map for the Heigham catchment in Norfolk. The method detects areas of bare soil and takes into account slope, vegetation cover and distance to river networks for estimating risk of water pollution due to erosion and run-off. The data is presented in an interactive dashboard and Anglian Water are working on a roll-out of the method to other catchments in their business area.

The method is owned by Environment Systems and details on the modelling approach and resolution of input data are currently unknown. Adopting the tool in Scotland should be straightforward and would require a contract with Environment Systems. Some staff training on use of the platform and analysis of the data will be required.

A workflow for data processing is already in place and could be purchased from Space Intelligence. Data storage and processing will require a cloud environment which comes with a small charge, as does the hosting of a user dashboard. Costs would increase if data with very high spatial resolution is purchased for this work only.



Case study I:

Assessment of risks to water quality from bare soil and field run-off in Norfolk

Case Study II: Urban greenspace mapping

Ordnance Survey use aerial imagery, high-resolution satellite data and machine learning approaches to estimate the amount of urban green space in residential areas. Initial results suggest that up to 62% of garden space in GB is vegetated. The approach was a prototype project only and is not currently available as product.

The method tested several deep-learning classifiers with no approach performing significantly better than others. The models are currently limited by a small training dataset as well as shadow in the images which degrades the outputs. Further work is required to improve the models and scale the workflow for operational use.

A small expert team would be required to develop the workflow further and improve classifications. Data storage and processing would require a cloud environment which comes with a small charge. Purchase of the required high-resolution data would have medium to high cost depending on the required scale.

Further products and applications

Roof type classification / Solar panel detection / Energy efficiency of buildings / Landscape Evaluation Tool

Case Study III: Urban temperature impervious surfaces and air quality

Copenhagen Municipality and DHI use Sentinel and Landsat data to monitor various dynamics in the city. This includes the mapping of impervious surfaces, temperature assessments for the detection of urban heat islands and the quantification of aerosols for air quality estimations. Data for 2020 is presented in a dashboard but the frequency of updates to the layers is not known.

The method uses a combination of different satellites and an automated, object-based approach to generate the required metrics. The method is clear and entirely based on open data but would need some effort to transfer to another area. Some statistics can only be generated on a district level due to the limited spatial resolution of input data. Higher resolution products would improve the mapping and the developers plan to use this alongside machine learning models to further develop the method and add additional layers, such as a classification of roof materials, to the dashboard.

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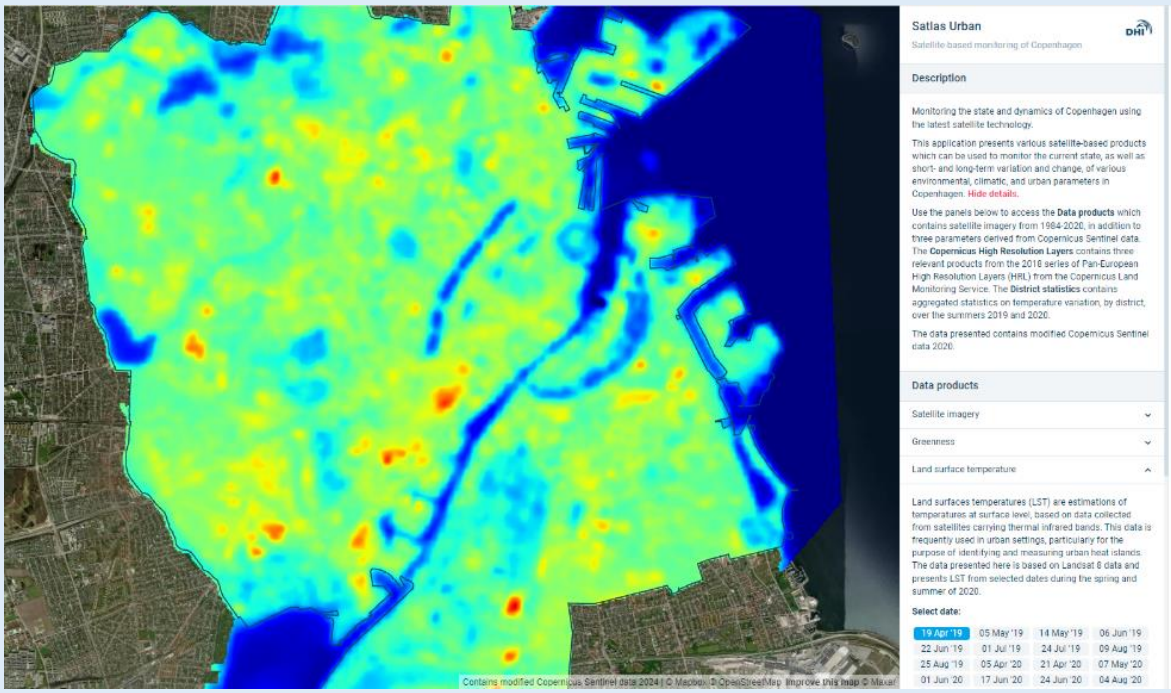
A small expert team would be required to transfer the method to the UK. Data is freely available, but storage and processing might require a cloud environment if larger areas are to be mapped. Further charges would occur from the dashboard development to make outputs available to end users. Costs would increase if data with very high spatial resolution is purchased for this work only.



Case study III: Surface temperature mapping in Copenhagen

Case Study IV: Ground motion and infrastructure

Danish government use Sentinel-1 data to generate country-wide ground motion maps. These are used to monitor subsidence effects on critical infrastructure such as sewage systems, railway and harbours and also provide evidence for planning of new construction works. Data is updated annually and made available via web portal alongside further tools for download and analysis.

The method is based on interferometric synthetic-aperture radar processing which can be used to map ground movements with millimetre precision. Processing algorithms are well known and widely used but complex to implement due to the size of data and required computing resources.

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A workflow for operational, routine processing of the required data does not currently exist in the UK and implementation would require a team of experts and extensive computational resources. Once in place, processing can be automated and generated products can be applied in a large variety of use cases. Data storage and a user access portal would incur additional medium to high costs.

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