CASE STUDY

Introducing DAFNI's role in the UrbanAIR project

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Introduction

UrbanAIR (Urban simulation for air quality and heat resilience strategies) is a pan-European project funded by Horizon Europe, developing a decision support tool that will allow urban planners to model, pre-empt and respond to the effects of air pollution and heat stress in cities.

The project combines data from the European Space Agency (ESA) and European Centre for Medium Range Weather Forecasting (ECMWF) through Destination Earth (DestinE), an initiative aimed at creating a digital twin of our planet.



By bringing together climate, environmental and urban data, UrbanAIR empowers policymakers and planners to make informed decisions that enhance resilience, improve public health and quality of life, ultimately creating healthier and more sustainable cities for current and future generations.

Within the project, DAFNI is providing the data integration, modelling and decision-support expertise needed to help cities make use of complex climate and urban data.

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What would you identify as the main impact of this work?

Climate, environmental and city-level data are often available in varied formats and scales, making it difficult to translate them into scenarios, risk analysis or to use in planning.

Building on its expertise in computational modelling, data and analytics, DAFNI is supporting the project by creating a tool to bridge the gap between complex computational fluid dynamics modelling and practical applications for city planners.

By connecting large-scale climate models with local urban models, UrbanAIR is seeking to bring together data and modelling on climate impacts at a much more detailed scale than previously. This will allow policymakers and researchers to model the impacts of extreme heat, airflow and pollution at neighbourhood, street and even building level, and to identify interventions to pre-empt or overcome heat hotspots and pollution risks.

Key challenges that UrbanAIR aims to solve

Decision-makers currently do not have evidence-based scenarios or visualisations at neighbourhood level to more accurately plan and measure the impact of introducing new clean air zones, new housing developments, alternative travel options, green and grey infrastructure, and more.

For example, DAFNI is working with VITO (https://vito.be/en) and supported the creation of an interactive dashboard providing initial demonstrators showing wind flow around Antwerp with colour-coded visualisations in a dashboard, based on DAFNI's models, workflow and data management. They are working on an urban air quality demonstrator, and a green potential demonstrator for blue green infrastructure initiatives.

Key aims of the project

UrbanAIR aims to improve understanding of how climate change impacts urban environments at city, street and building scale. It is seeking to develop tools for urban planning to enable cities to test the impact of potential interventions before implementation.

The project is contributing to the broader DestinE programme by helping to integrate climate and urban data into an interoperable digital twin for urban planning.

Benefits

Ultimately UrbanAIR will support more resilient, healthy and sustainable cities across Europe.

By translating complex modelling outputs into intuitive visualisations and decision-support tools, UrbanAIR bridges the gap between scientific research and practical urban planning.

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What does DAFNI's work allow the UrbanAIR project to achieve?

DAFNI is providing technical and software engineering foundations to integrate digital twin, data and decision support software, integrating data and workflows to the DestinE platform from academic, government and industry partners.

The DAFNI platform is already providing a trusted environment for data integration with simulation models and visualisation, building on its expertise developed through projects such as digital twin Climate Resilience Decision Optimiser in CReDO, enabling organisations to move beyond siloed thinking and understand how climate-related risks propagate in real-world scenarios.



How will DAFNI's work with UrbanAIR contribute to wider goals?

DAFNI's primary goal is to support national infrastructure through tools, models and insights, enabling researchers to study and analyse how climate change affects national infrastructure, and to present that data in an accessible way to policymakers.

For the United Nations Sustainable Development Goals (SDGs), the work directly impacts SDGs including SDG 13 – climate action, SDG 9 – industry, innovation and infrastructure, and SDG 11 – sustainable cities and communities.

On a UK scale, one of the sectors in the government's 10-year Modern Industrial Strategy is Clean Energy. DAFNI's work allows policymakers, industry and researchers to evidence how energy systems will respond to stresses such as extreme weather, how renewable energy systems will perform, and to make more accurate decisions to support a cleaner, more sustainable energy infrastructure in today's extreme weather conditions.

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How could this work benefit society as a whole?

While there is significant work underway to study the effects of climate change and heat, UrbanAIR specifically examines how climate change will affect municipalities, towns and cities at a local scale. For example, how a new high-rise building may affect airflow or temperature, how planting and greening will mitigate and how to improve quality of life and air at city scale.

As the project progresses, engagement with city authorities will help ensure that modelling outputs always address real-world planning challenges.

How do you anticipate other researchers, policymakers and stakeholders using this work?

The city scale computational fluid dynamics (City4CFD) model in UrbanAIR, developed by Ivan Pađen, Ravi Peters, Clara García-Sánchez, and Hugo Ledoux of TUDelft, has potential applications beyond urban planning, in fields from research around pandemics, to nuclear fusion in the future.

The work will provide better data insights for each of the five cities in the study, which should drive investment into greening technology to lessen the effects of heat and to improve air quality. This is just one of the models which will build the capability around UrbanAir.

What are the next steps?

The priority is for UrbanAir to added to DestinationEarth platform (DestinE). Plans are also being made, in consultation with the UrbanAir Partnership, for elements of it to be added to the DAFNI Platform.

As UrbanAIR progresses, DAFNI's expertise in digital twins, data integration and decision-support systems will continue to help cities translate complex climate data into practical actions that lead to improved resilience and public health.

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Who's involved?

UrbanAIR is a collaborative effort involving partners from across Europe in industry, government and academia, focusing on Antwerp, Barcelona, Bristol, Paris and Rotterdam.

In the DAFNI team, **Jens Jensen** is the lead scientist, **Saiful Khan** is leading technical development working with **Sarah Byrne**, **Lyndsey Harding** provided project support and **Marion Samler** is the lead for project and stakeholder engagement.

STFC's Scientific Computing Department, the Centre for Environmental Data Analysis (CEDA), and DAFNI are working on the project, all part of the Science and Technology Facilities Council (STFC) which operates within UK Research and Innovation (UKRI).

DAFNI is providing data and infrastructure architecture expertise, STFC Scientific Computing are bringing their computational fluid dynamics expertise, while CEDA are providing climate data expertise.

When did the project start and finish?

The project started in February 2025 and is scheduled to complete in December 2028

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