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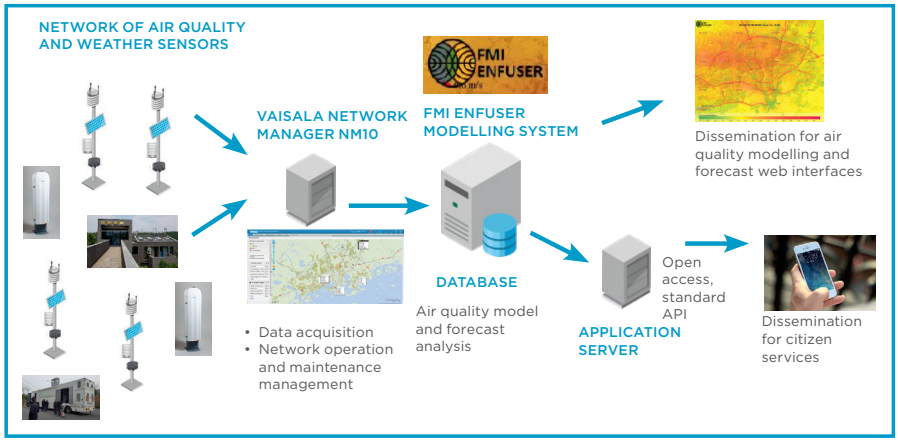
Groundbreaking New Concept to Measure Air Quality in Nanjing, China

A joint Sino-Finnish collaboration project will create a unique demonstration environment for air quality measurement in China. The project consists of a dense air quality observation network and modeling capability in the megacity of Nanjing in the Yangtze River Delta. The services and applications developed as part of the project will provide crucial data for local air quality forecasts.

A Unique Platform for Air Quality Monitoring

The project will establish a pilot for next-generation pollution monitoring and modeling infrastructure in Nanjing. The project will employ several new approaches to ambient air quality monitoring: a dense monitoring network based on compact air quality sensors combined with comprehensive observations from one stationary and one mobile super site, remote sensing for vertical pollutant profiling, nanoparticulate monitoring, and advanced fusion-based air quality modeling. A software platform will support data dissemination to various applications.

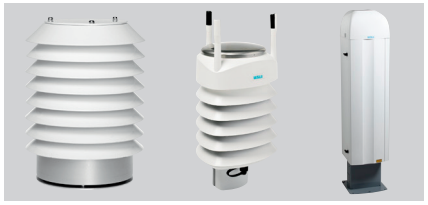


Sino-Finnish Project Partners

- **Vaisala Oyj** is a global leader in environmental and industrial measurements. Building on 80 years of experience, Vaisala provides a comprehensive range of innovative observation and measurement products and services for weather, environmental, and industrial applications.
- **The University of Helsinki Institute for Atmospheric and Earth System Research (INAR)** carries out world-recognized research on biosphere-atmosphere interactions and air quality, with a particular focus on secondary atmospheric pollution.
- **Nanjing University's School of Atmospheric Sciences** is widely recognized for its comprehensive atmospheric research in China.
- **The Finnish Meteorological Institute (FMI)** is the national authority for weather services and the competent body for air quality measurements in Finland. FMI carries out research and consultation services for air quality assessment and modeling globally.
- **Kunshan Yangchen Langdu Environment Institute Ltd.** is a well-known environmental high-tech enterprise in Jiangsu province, specializing in the industrialization of advanced environmental technology.
- **Climblue Technology Ltd.** utilizes satellite, in-situ, and weather modeling data to provide a platform for regional air quality analysis and forecasting.

Dense Air Quality Network with 3D Monitoring Capability

An important part of the project is a dense air quality monitoring network that provides high-resolution in-situ air quality data for the Nanjing region. The main component of the network is **Vaisala Air Quality Transmitter AQT420**.



Vaisala Air Quality Transmitter AQT420, Vaisala Weather Transmitter WXT530 Series and Vaisala Ceilometer CL51.

AQT420 is a compact, low-power instrument that measures six important parameters that reveal the quality of the ambient air: nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter ($PM_{2.5}$ and PM_{10}). Thanks to its small size, light weight (less than 1.5 kg), and low power consumption (typically < 2W) it is easy to install in a variety of locations.

The project also introduces a 3D component into air quality monitoring by providing on-line information about the boundary layer height and vertical profile of the atmosphere. Together with pollution emission sources, weather influences, and long-range transportation and deposition, boundary layer height is a key parameter for the characterization of air quality. Air quality models typically take boundary layer height data from weather models.

In the Nanjing project, operational real-time boundary layer height data is measured with **Vaisala Ceilometer CL51** and further fed to the air quality modeling system. As a result the real-time boundary layer height data provides a new vertical component to the air quality monitoring solution. It is also expected to improve the accuracy of the modeling results.

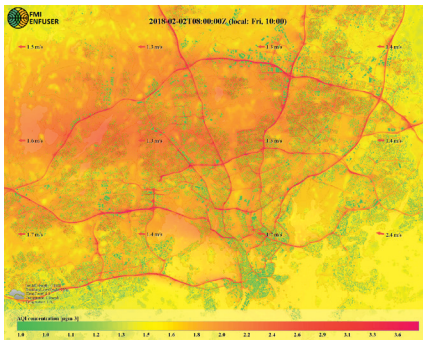
The Relationship between Weather and Air Quality

Weather has a strong influence on local air quality; poor air quality can also influence weather. When including critical weather measurements like wind and rain in air quality monitoring stations, we can better understand the sources and dispersion of the pollutants. **Vaisala Weather Transmitter WXT530 Series** are installed in connection with the air quality sensors to provide critical weather information from a specific site.

Modern Data Fusion Modeling

FMI-ENFUSER is a unique air quality modeling system that combines traditional dispersion modeling with modern data fusion technologies. It fuses various datasets to model and forecast air quality in high resolution. The data inputs utilized in the model are typically modeled meteorological and regional air quality data, air quality and weather measurements, and various GIS datasets available in the city – for instance land use and traffic flow data.

With this methodology the model can reach an extremely high modeling accuracy down to street



FMI-ENFUSER model

block level. Forecasts are provided for up to 72 hours ahead. The results can be used for various decision-making purposes to target actions aimed at improving air quality. Alerting and pollution tracking are common applications that take advantage of the model´s extremely high accuracy.

State-of-the-Art Data from SORPES Station

The project also uses high-end air quality data from Nanjing **SORPES** (Station for Observing Regional Processes of the Earth System) station. SORPES is a wide-scale air quality research station of **JirLATEST** (Joint International Research Laboratory of Atmospheric and Earth System Sciences) operated by Nanjing and Helsinki Universities.

The SORPES data provides unique possibilities for advanced research, sensor data verification, and network optimization. As an example, so called proxies for air quality variables are developed as part of the project. The data is combined to enable a deeper understanding of the driving forces behind pollution episodes.

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