MODELLING TOOLS FOR CALCULATIONS IN AIR

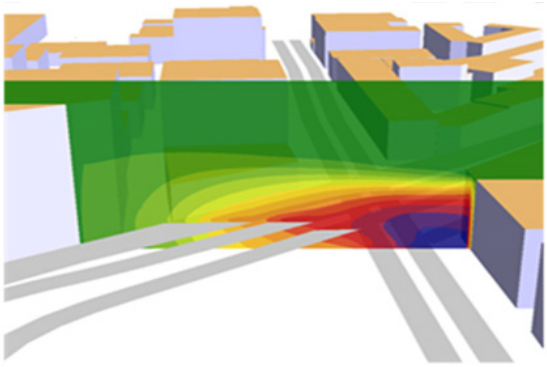
Several different modelling tools for calculations of pollutants in air are used at IVL– ranging from advanced three dimensional dispersion models to empirical models. The choice of model is dependent on the purpose of the study and the size of the geographical area of interest. A description of the modelling tools used by us at IVL is summarized below.

By using dispersion modelling, we can calculate the dispersion and contribution to air pollutant levels of different gases, particles, aerosols and odours from various sources. The emission sources that can be modelled range from one separate smokestack to all emissions associated with a certain industry or road system. The choice of model depends on the preferred resolution, the size of the area and what chemical processes are calculated.

The three dispersion models mostly used by us at IVL are:

- TAPM (The Air Pollution Model)
- ADMS (Atmospheric Dispersion Modelling System)
- CFD-modellen MISKAM (CFD: Computational Fluid Dynamics)

Each model has its advantages and field of application it is best suited for. In addition to the dispersion itself, these models can also be used to model high-resolution meteorology, chemical processes in the atmosphere and in flue gas plumes, as well as dry and wet deposition.



Dispersion in an urban street canyon where the built structure influences the ventilation

- Dispersion modelling can be used for calculations in city, block, or street canyon environments in order to treat issues such as:
- How is the ventilation and pollution levels affected by urban densification?
- What is the best location for building a wind turbine in an urban or rural environment?

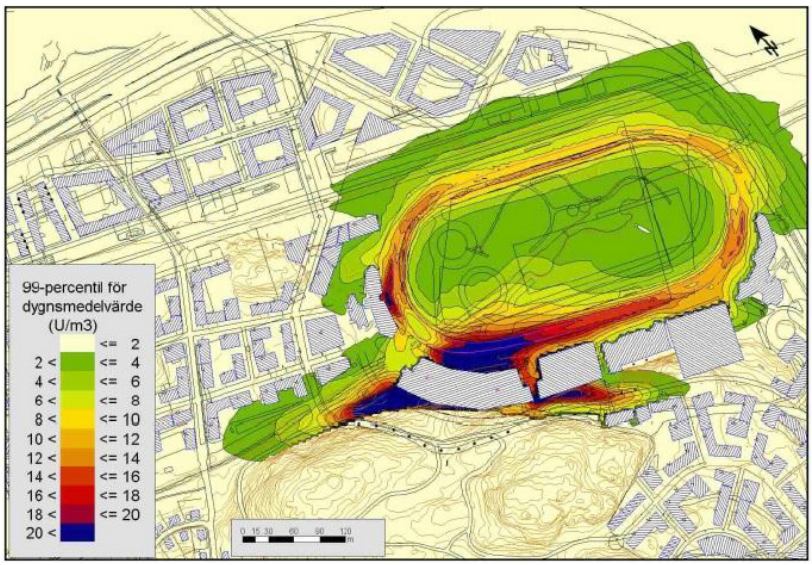
Odour is another issue that concerns many industries. We can model specific odorous substances. If the odour is caused by a combination of gases, we can calculate the dispersion of odours based on samples from the emission source and an odour panel.

Pollutant level contribution to air from an industry.

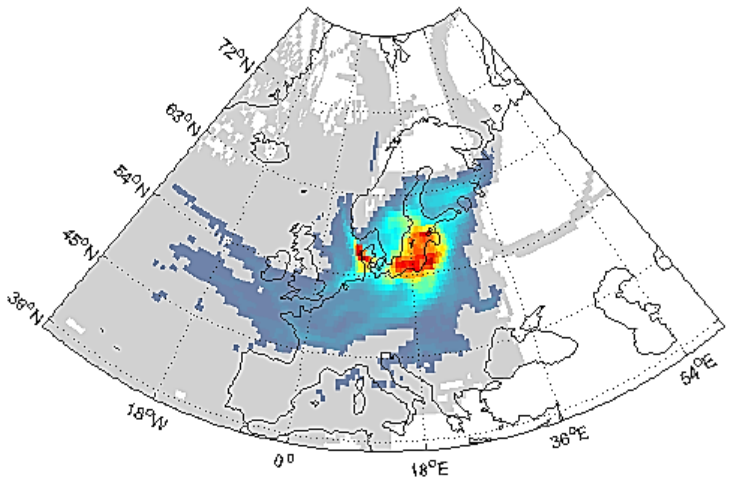
Sometimes it is desirable to find out where emissions of particles or other pollutants originated from as opposed to their dispersion. In these cases, we can use trajectory modelling in order to determine the origin of the air which has carried the pollution, by tracing the air back in time to find the source. Trajectory modelling is based on meteorological data and can be run forward or backward in time, making it a tool that can be adjusted to treat many different issues.

We have developed an empirical model, called the LUR model (Land Use Regression), for a coarser estimation of the urban pollutant level contribution of nitrogen dioxide and particles. The LUR model is based on the relationship between the urban pollutant level contribution, meteorological parameters and population distribution. It includes geographical distribution of the urban contribution, which means that it takes into account the fact that pollutant levels are not evenly distributed over a city, but decreases in relation to the population density.

Together with models for regional background pollutant levels, such as the EMEP model, the LUR model can also be used to calculate the exposure of NO2 and particles to the entire population of Sweden, but also for separate municipalities.



Dispersion of allergenic agents.



Example of results from trajectory modelling.

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