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Simulating the emission and transport of gases on 100-meter resolution in a 100-kilometer domain.

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Climate regulations and satellite monitoring on increasingly high resolution creates a demand for an insight into emissions on an urban scale. The aim of the Ruisdael Observatory (www.ruisdaelobservatory.nl) is to provide just that: detailed and high-resolution modelling and measurements of weather and air quality in a domain covering the Netherlands.

The Ruisdael Observatory created a renewed impulse in the developments of the DALES Large-eddy simulation (LES) model (Heus et al., 2010, Ouwersloot et al. 2016) to find and push the limits of atmospheric modelling. Typical simulations with DALES will use a spatial resolution in the order of 100m in domain sizes spanning over 100x100 km. This high resolution justifies the complexity and the multitude of emission sources and resulting transport of pollutants in the atmospheric boundary layer.

The combination of high resolution and large domain sizes allows us to investigate how emissions disperse in a turbulent environment which is forced by large-scale flow at the same time. Parameterizations are no longer needed to calculate horizontal or vertical transport in the boundary-layer. This way, we can provide new insight into the transport of emissions in the boundary layer and the detrainment of gases out of the boundary layer into the free atmosphere.

We will discuss the construction of our emission database for the Netherlands with a 100-meter and 1-hourly resolution. For this, we started from the official E-PRTR reported emission inventories (www.emissieregistratie.nl) and enriched with high resolution activity data from mostly open-source datasets. Moreover, large emissions sources (accounting for e.g. >80% of CO2 emissions) are subject to mandatory registration and their locations are known exactly. Emissions from different source categories can be tracked individually and compared to measurements from the Ruisdael Observatory measurement sites. Examples of simulations of fair-weather summer days will be compared to surface measurements and showcase the data richness of our new model and combination to measurements from our network.