

Air Pollution



ANALYSIS OBJECTIVE

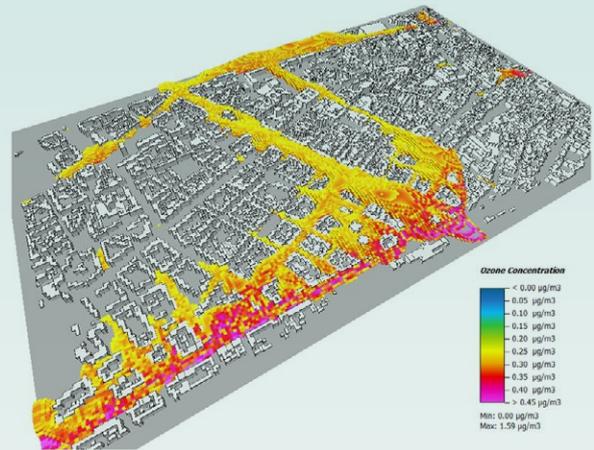
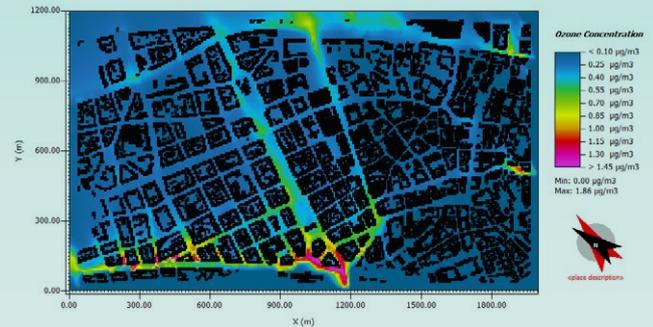
ENVI-met provides a multitude of tools to simulate and analyze air pollution in your simulation area.

In an exemplary study, the link between different urban layouts and the concentration of Ozone and NO_x has been analyzed. For that purpose, the inner city of Mainz in western Germany has been digitized in a 2000 m x 1200 m x 90 m large model area. A map of the absolute numbers of vehicles per day and lane, the daily traffic value (DTV), was digitized. The values are based on hypothetical amounts depending on the importance and usage of the street.

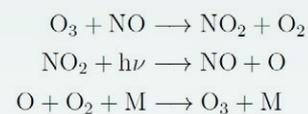
ANALYSIS

As urbanization keeps intensifying and more and more people move into cities, climate sensitive urban planning becomes increasingly vital. In addition to thermal properties, the urban microclimate is characterized by elevated levels of air pollutants, e.g. NO_x and O₃, especially during heat waves. Ozone is not a primary pollutant in the troposphere, meaning that - other than nitrogen monoxide and nitrogen dioxide - it is not directly emitted into the atmosphere but rather formed by photochemical reactions in the troposphere. In the absence of free radicals, the ozone concentration forms a photochemical equilibrium with the concentrations of nitrogen monoxide and nitrogen dioxide, where the ozone concentration depends on the ratio of NO₂ and NO. Tropospheric ozone is mainly formed under the influence of NO_x. With cars and other vehicles being the main emitters of NO_x, heightened O₃ concentrations are clearly linked to the proximity of highly frequented streets.

SIMULATION RESULTS



The dominant processes in this chemical equilibrium are:



As can be seen in the reactions above, the atmospheric conditions (mainly shortwave radiation and ambient temperature) play a vital role in the formation and destruction of O₃ - resulting in an inhomogeneous distribution of the same. With ENVI-met's high spatial resolution, however, these local changes in microclimate and thus their influence on the O₃ concentration can be adequately simulated. This study shows ENVI-met's capability to analyze air pollution concentration in a model area. Apart from this, ENVI-met offers a multitude of options to analyze active chemistry and dispersion within the model area.

