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THOR – an operational and integrated model system for air pollution forecasting and management from regional to local scale

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The integrated model system, THOR, includes several meteorological and air pollution models capable of operating for different applications and at different scales. The system is capable of accurate and high resolution three-days forecasting of weather and air pollution from regional scale over urban background scale and down to individual street canyons in cities – on both sides of the streets. The coupling of models over different scales makes it possible to account for contributions from local, near-local as well as remote emission sources in order to describe the air quality at a specific location - e.g. in a street canyon, in a park or in rural areas.

The THOR system can in general be applied for forecasting, nowcasting, retrospective analysis and air pollution assessments and management at different scales. The system is used for information and warning of the public in cases of high air pollution levels and for policy management (e.g. by emission reduction or traffic scenarios). The system is additionally used in connection with urban and rural monitoring programmes. Furthermore, the system is used to forecast air pollution from accidental releases from point and area sources as e.g. power plants, industrial sites and natural or human made fires.

The system consists of several different air pollution models covering different scales and purposes. The system includes global meteorological data from either NCEP or ECMWF used as initial and boundary conditions for the numerical weather forecast

model MM5 and/or Eta. The weather data from these models are used to drive the air pollution models: the Danish Eulerian Hemispheric Model (DEHM), the Urban Background Model (UBM), the Operational Street Pollution Model (OSPM), the accidental release model (DREAM), the Gaussian plume model (OML) and others. The long-range transport model, DEHM, which covers the Northern Hemisphere, has nesting capabilities, which allows for a large mother domain as well as one or two nested domains each with a three times higher horizontal resolution over a limited area. The DEHM model exists in five different versions used for studying specific air pollutants. This includes a chemical version with a chemical scheme with 63 species.

Results from the air pollution models have been implemented and used e.g. in models for human exposure, marine models, and economic assessment of impacts on human health. Ongoing developments include e.g. pollen forecasting, climate change impacts on air pollution levels, chemical data assimilation of satellite data and improved modelling of particulate matter at all scales.