

AIR QUALITY FORECASTING PROJECT IN NORWAY

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The Norwegian Air Quality Forecasting Project (Clean City Air) started as a developing project some years ago, and is now conducted on a regular daily routine basis during the winter season from October to April.

A Norwegian Air Quality Forecasting consortium was established in 1997. The partners are:

Norwegian Meteorological Institute – met.no
Norwegian Road Authority
Norwegian Institute for Air Research - NILU
Local Authorities

In Nordic countries air pollution problems occur mainly during the winter season, since high concentrations of PM₁₀, PM_{2,5}, NO_x, and CO occur mainly during persistent high pressure situations with cold and very stable air.

The pollutants are produced by traffic and domestic sources. The sources have changed over the years. Up to and including the 1970's, reductions in air quality were mainly due to fossil fuels and emissions from industry. Now the pollution is mainly caused by traffic emissions and heating by wood burning.

The bases for the project are given in the European Framework Directives (Air Quality Framework Directive 96/62/EC, Supplementary Directive COM/97/500 and Directives on SO₂, NO_x, PM, lead, benzene and CO).

The directives states that (member) countries are responsible for establishing a monitoring and evaluating program for air quality in order to:

- Improve the quality of urban life
- Improve damage assessment on cultural heritage
- Give strategic approaches and methodologies in urban planning towards sustainable urban transport.

Concentrations of urban pollutants are driven by a series of natural processes. These processes are very dependent on meteorological conditions. The actual weather situation and forecasts of weather conditions that may lead to episodes with high concentrations of pollutants are therefore key issues. That is the main reason for met.no's role in the project.

Air pollution forecasts connected to population exposure can then form the basis of relevant abatement actions to be taken in order to reduce or prevent the pollution exposure to the general public.

The Air Quality Forecasting Project started on a test basis for the cities of Oslo and Bergen, and has now been extended to include the cities of Drammen, Stavanger and Trondheim. Air Quality Forecasts are produced on a regular daily basis.

The Norwegian Road Authority sponsors the project and met.no and NILU have been contracted by them to run numerical models for the calculation of specific meteorological parameters and the calculation of dispersion (AirQUIS) as a basis for forecasting the degree of air pollution (air quality).

The meteorological input to the dispersion model, AirQUIS, is supplied by met.no's operational model, HIRLAM10, or the non-hydrostatic numerical forecast model, MM5, that are set up for all the actual cities. MM5 is run every morning for the cities of Oslo and Drammen. For the other cities included in the system, MM5 is run on a request basis when episodes of peak concentrations of pollutants are expected. The reason for this is lack of computer capacity at met.no to run MM5 on a regular daily basis for all five cities. Model output from HIRLAM10 or MM5 is then used as input to the dispersion model, AirQUIS. This model is set up at met.no on separate computers (PC's) for each of the cities. When the respective computer runs are finished the results are presented as plots, diagrams and tables on the Internet.

Results of the meteorological models, other available relevant meteorological data and knowledge, and output from the dispersion model runs then form the basis for the Air Pollution Forecasts. Since meteorological conditions are very relevant for the degree of pollution, comments on the results of MM5 are provided by the duty forecaster after each run to secure its relevance in the best possible way.

The forecasted pollutants are:

- Particulate matter PM 10,0 (particles less than 10 $\mu\text{g}/\text{m}^{-3}$)
- Particulate matter PM 2,5 (particles less than 2,5 $\mu\text{g}/\text{m}^{-3}$)
- Nitrogen Dioxide NO_2

Forecasts are issued by met.no forecasters directly or by qualified representatives for local authorities, based on "background" information provided by met.no.

All forecasts are issued and presented on the Web as text messages and graphs. Local Authorities are responsible for monitoring and a network has been established. The measures of pollutant values are presented on Web in near real time.

Fig. 1

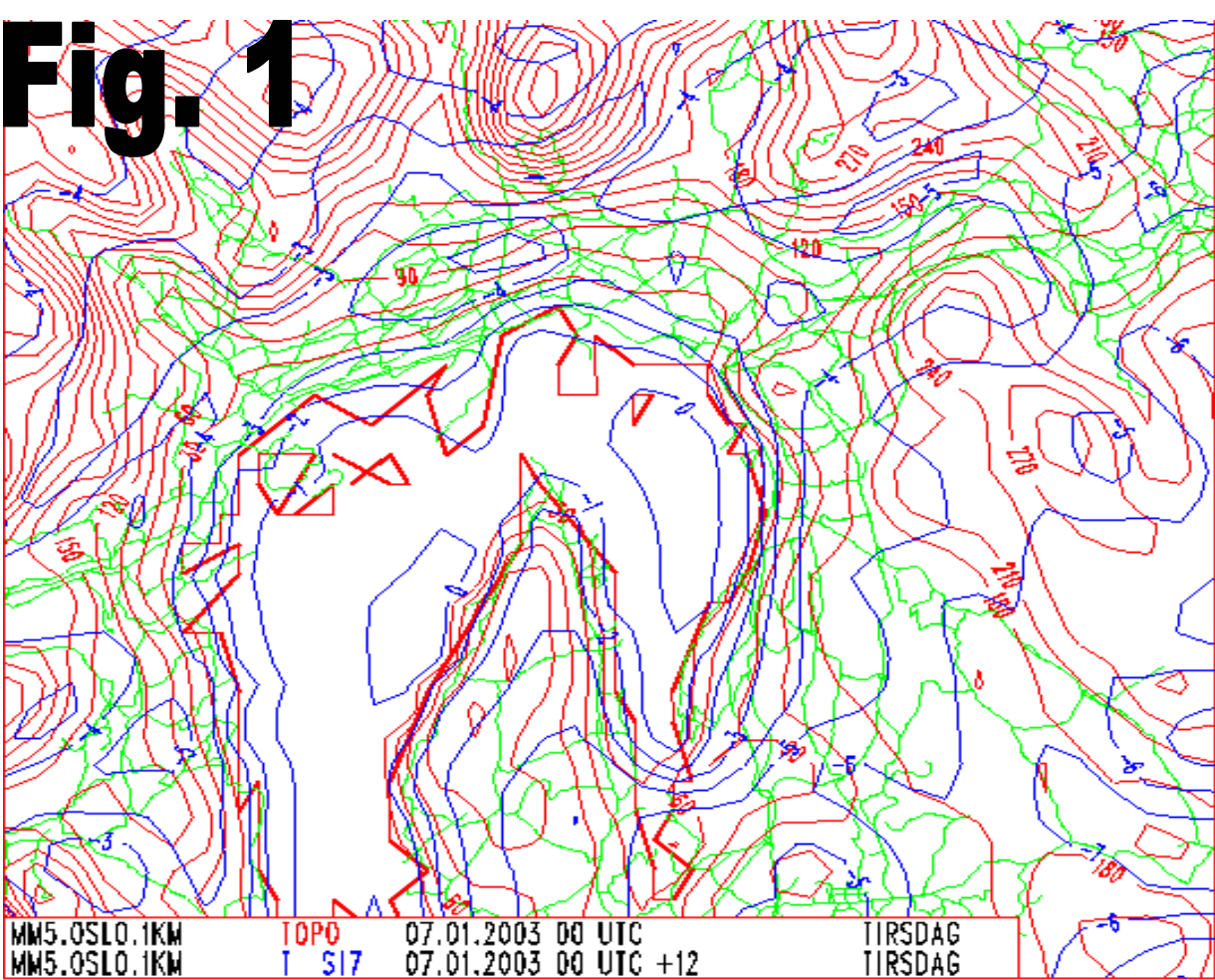


Fig. 2

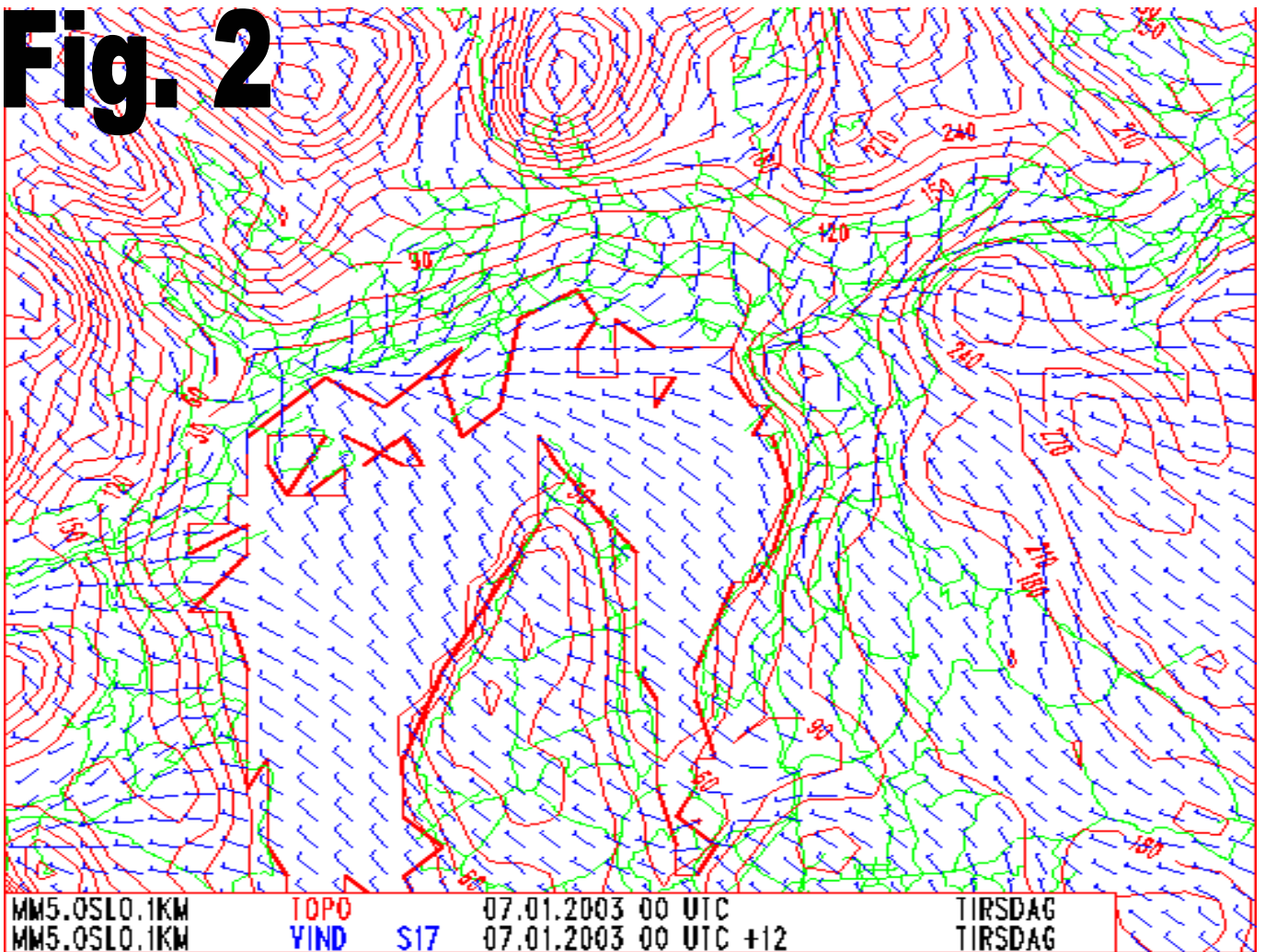


Fig. 3

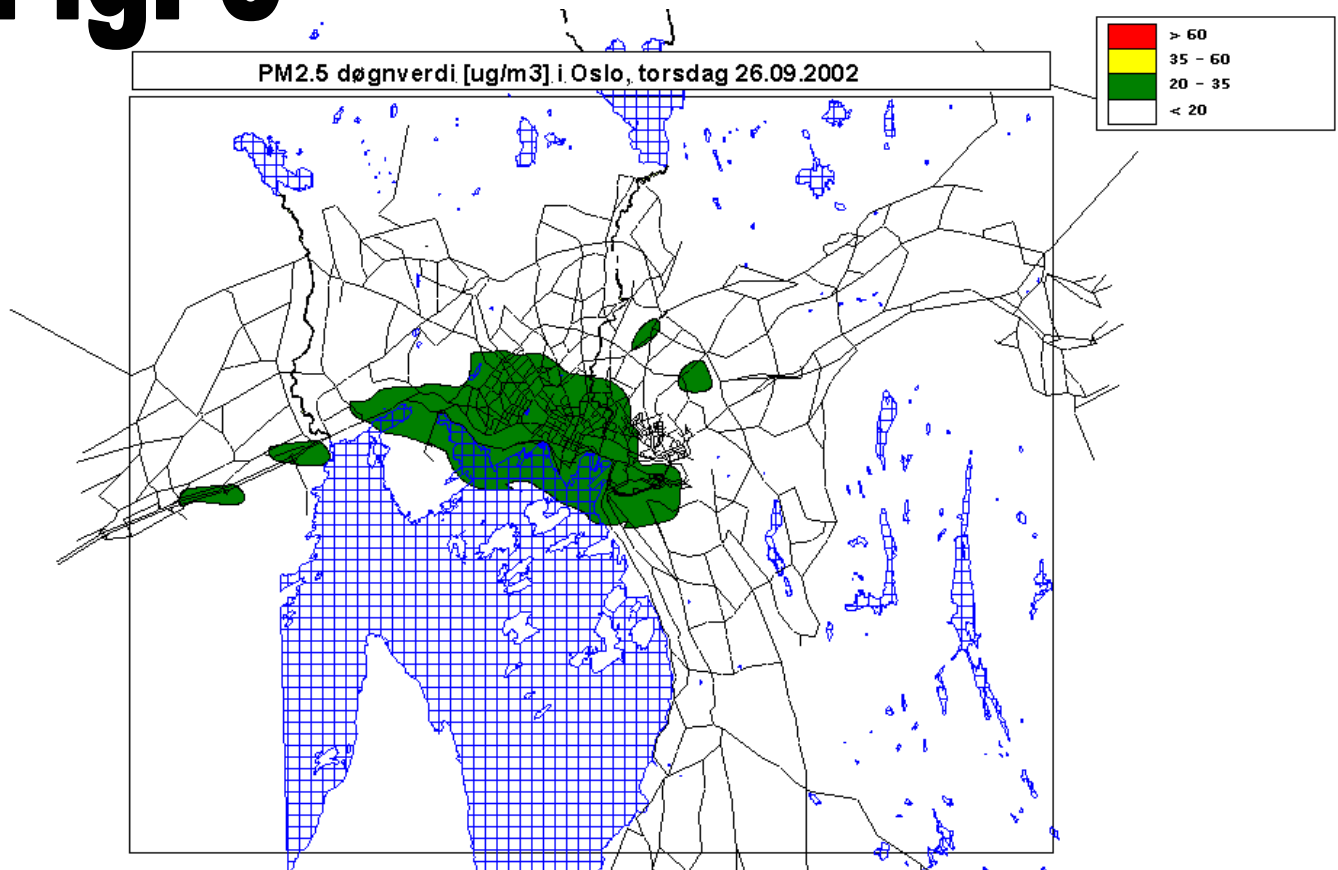


Figure 1. Example of MM5 output - temperature distribution.

Figure 2. Example of MM5 output - wind distribution.

Figure 3. Example of MM5 output – PM 2,5 plot for Oslo area.