Air Quality Now-Cast System for The Township of Haifa, Israel

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Overview

A now-cast system has been developed by the Norwegian Institute for Air Research (NILU), in conjunction with the Haifa District Municipal Association for the Environment (HDMAE), for the township of Haifa in Israel.

Now-casts are produced on an hourly basis using up-to-date stack emission and meteorological measurements, combined with archived traffic emission data. These are used as input to the AirQUIS dispersion models, which calculate concentration fields at a resolution of 500 m. These concentration fields are then adjusted using observed air quality data. Maps produced by the system are displayed through a public web portal.

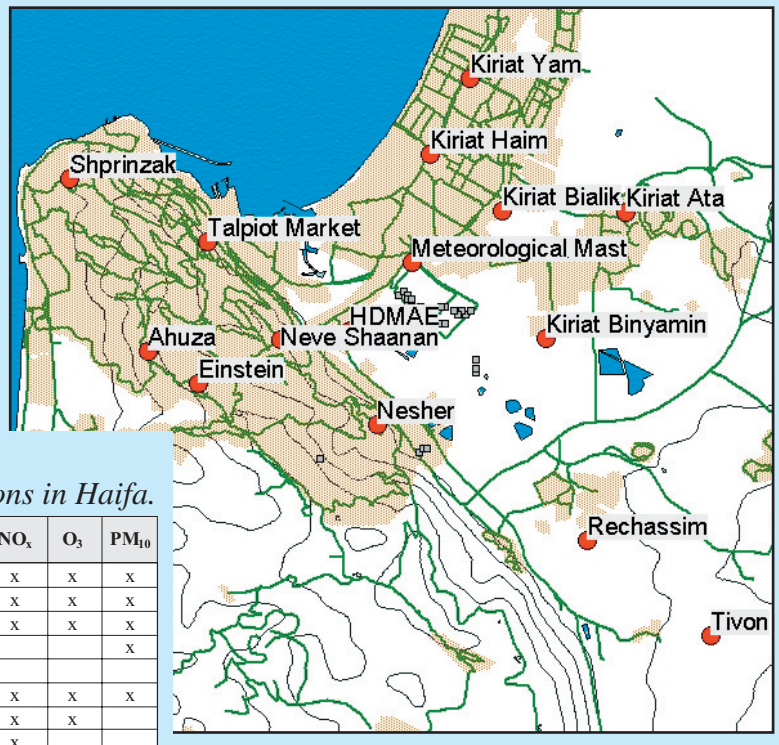

Figure 1. *Model domain and the monitoring stations in Haifa. Line sources included in the calculations are shown in green, stacks as grey squares and contour lines at 100 m intervals in black. The urban regions are shaded in orange.*

Table 1.
Monitoring stations in Haifa.

Monitoring Stations:	SO_2	NO_x	O_3	PM_{10}
Neve Shaanan	x	x	x	x
Nesher	x	x	x	x
Kiriat Ata	x	x	x	x
Kiriat Haim	x			x
Einstein	x			
Talpiot Market	x	x	x	x
Tivon	x	x	x	
Ahuza	x	x		
Kiriat Yam	x			
Shprinzak	x	x	x	
Kiria Motzkin	x			
Kiriat Bialik	x			
Rechassim	x			
HDMAE	x	x	x	x
Kiriat Binyamin	x			x

Real time data collection

Input data is collected on an hourly basis

- 15 monitoring stations provide air quality data for assimilation (*Figure 1, Table 1*)
- Emission rates from major stacks are continuously monitored
- Meteorological data are collected at monitoring stations and at a centrally located meteorological mast

Now-cast system

Now-cast modelling is carried out using the AirQUIS system (**www.nilu.no/airquis**)

- Models include an Eulerian grid model (EPISODE), the Gaussian line source model (HIWAY2) and the Gaussian puff model (INPUFF)
- 1700 road links and 45 stacks are included in the calculations
- Pollutants covered are SO_2, NO_X, NO_2, PM_{10} and O_3
- Assimilation of monitoring data used to adjust and improve model concentration fields
- Concentration maps for each compound, and an air quality index, are produced at 500 m resolution
- A web portal is used to communicate both now-casts and monitoring results to the public (**www.aironline.info/haifa**)
- Concentration maps are available after one hour

Results

The now-cast quality in Haifa is judged by an acceptance criteria. This states that model results within 25% of observed concentrations, and within a 1 km radius of the monitoring station, are acceptable

- The overall acceptance rate at the model grid position, over a period of 1 year, is 52% (Table 2)
- Acceptance rate within a 1 km radius is 72%

Table 2. Summary of total acceptance rates for each of the simulated compounds. Acceptance rates over all stations are included for an 11 month period.

Compound	Number of stations	Model acceptance (grid)	Model acceptance (1 km)	Missing data
NO_2	7	43 %	78 %	20 %
NO_x	7	32 %	72 %	9 %
SO_2	14	71 %	80 %	9 %
PM_{10}	6	39 %	46 %	28 %
All	14	52 %	72 %	15 %

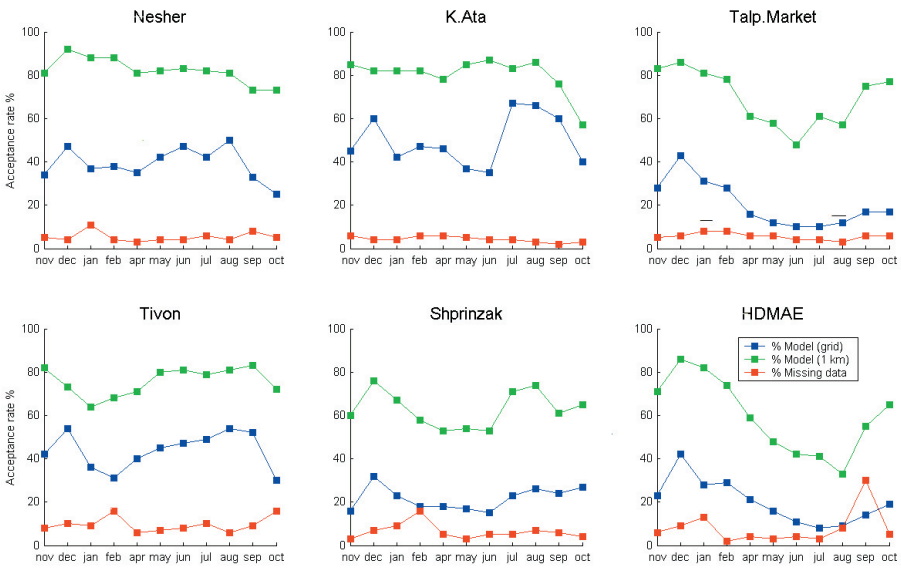

Figure 2. Example of the monthly acceptance rate for NOx based on half-hourly now-cast results for direct model values (blue) and for model results within a 1 km radius of the monitoring station (green). The rate of missing data is also shown (red). Results are for the year 2003/2004 with the exclusion of March 2004 when now-casts were not operative.

Conclusions

- The now-cast system combines modelling and monitoring data to produce reliable maps of air quality for the township of Haifa
- The assimilation technique is effective in improving concentration fields
- Acceptance rates are generally good but improvements to the system are possible
- Summertime low in acceptance rate for NO_X is related to the poor representation of turbulence in the urban environment
- The system has been publicly accessible since November 2004 and will continue to operate over the next 10 years with regular assessment and improvements.