Utilising dense observation networks in air quality episodes

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In the Helsinki metropolitan area in Finland, a dense observation network (Testbed) implemented by The Finnish Meteorological Institute (FMI) and Vaisala Oyj has been operational for almost a year now. We have utilised the profile observation from the network in analysing two recent air quality episodes.

September and the beginning of November 2005 was exceptionally warm in Finland. In Mid-November the air cooled down. On November 22nd southern Finland belonged to an area of high-pressure and the winds calmed down. After a calm and cold night air pollutant concentrations rose and air quality was ‘poor’ or ‘very poor’ for the whole day. Temperature profiles obtained from radio acoustic sounding system (RASS) located at Malmi airport and frequent radio soundings combined with dense network of mast measurements made it possible to investigate the inversion layer and its temporal evolution.

Particulate matter (PM) related air quality episodes are a continuous problem during springtime in Finland, because huge amounts of sand and salt are spread on the streets for reducing slipperiness during wintertime. In the beginning of April 2006 PM concentrations remained mainly low, because the ground and streets were either snow covered or wet. After Mid-April the weather conditions caused a fast drying of the streets causing an immediate rise in measured PM concentrations.

The area of high-pressure remained almost still for nearly two weeks, thus causing the general airflow to come from the same direction for the same period. This allowed long-range transport of particles to have a significant effect on the air quality and visibility especially in southern Finland. Very high small particular matter (PM2.5) pollutant concentrations were mostly due to the forest and field fires going on in Russia and the Baltic countries. The general airflow transported the smoke and pollutants directly towards Finland. Locally the concentrations were also raised by dust from the dry streets.

In addition to the surface observations of pollutants, it was also possible to study the aerosol profiles obtained from several ceilometers in the Helsinki Testbed network. Dense observation network gives new possibilities to develop air quality forecasting systems that use real-time and accurate observation data. It can also make it possible to better control air quality related phenomena in an urban environment.