Integrating air pollution and weather models improves air quality

**Air quality forecasts** have improved significantly over the last decade thanks to greater integration of air quality models and weather models, as air quality is greatly influenced by the weather. A new study discusses how advances in Chemical Transport Models can further improve predictions of air quality, to play a greater role in managing the environment and highlight the relationship between urban, regional and global air pollution.

**Chemical Transport Models** are an essential computational method used to predict air quality, which are closely aligned to weather prediction models. They also incorporate the complex reactions of pollution emissions, their dispersal in the atmosphere, the chemical transformations they undergo and their removal processes.

By combining advanced computing capabilities with remote sensing facilities, Chemical Transport Models can predict the distribution of urban pollutants in a column of air above a base less than a kilometre wide, and can profile pollution distributions around the world with a horizontal grid resolution of 50 to 100 kilometres. Chemical Transport Models are used to:

- interpret information from emissions observations
- model scenarios for reducing urban pollution levels
- design strategies to control emissions
- understand factors affecting climate change

Chemical Transport Models have led to significant improvements in air quality forecasts over the last decade. Real-time predictions of air quality now include forecasts of pollutants including ozone. Progress is continuing in the development of air quality predictions for fine particles such as PM$_{2.5}$. However, immense computational power is needed to run these models and a balance must be achieved between the complexity of the models and the cost of running these systems.

There are important differences between forecasting air quality and predicting the weather. For example, observations used in weather forecasting concentrate on adverse weather conditions, such as storms. As adverse air quality is often associated with benign weather conditions, additional observation systems are required.

Chemical Transport Models are currently used by a number initiatives, including the GEMS (The Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in situ data) project$^1$ and the Global initiative GEOSS$^2$, (the Global Earth Observation System of Systems), which is embedded with the European strand, GMES$^3$, (Global Monitoring for Environment and Security). GEOSS has been set up to monitor and manage the Earth’s environment. The GEMS project is part of the atmospheric theme in GMES and will provide new analysis and forecast products for GMES.


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1. See [http://www.ecmwf.int/research/EU_projects/GEMS](http://www.ecmwf.int/research/EU_projects/GEMS) for information on the GEMS project.
2. See [http://www.earthobservations.org/geoss.shtml](http://www.earthobservations.org/geoss.shtml) for information on GEOSS
3. GMES is supported by the European Commission’s Sixth Framework Programme [www.gmes.info](http://www.gmes.info)