HARMONISATION OF AIR QUALITY ASSESSMENT APPROACHES AT NATIONAL AND EUROPEAN LEVELS – THE ITALIAN AND UK CASE STUDIES

Ana Grossinho[1] , Fabio Monforti-Ferrario [2], Janet Dixon[3] , Noel Nelson [4] , Richard Maggs[5]
[1]Bureau Veritas HS&E Limited, Air Quality, Environment Division, Expert Member of the European Data Exchange Group, London, UK
[2]ENEA, The Italian Agency for New Technologies, Energy and the Environment, ACS-INN Section, Air Pollution Group, Member of the European Data Exchange Group, Bologna, Italy
[3] Defra, Air Quality Division, Member of the European Data Exchange Group, London, UK
[4] Royal Commission on Environmental Pollution, London, UK
[5] Bureau Veritas HS&E Limited, Air Quality, Environment Division, Air Quality Business Director, London, UK

INTRODUCTION

The Clean Air for Europe (CAFÉ) programme's Steering Group has advised the European Commission to undertake a renovation of Member States' current air quality assessment and reporting procedures for compliance purposes. Following the general endorsement of the concepts discussed, the new Air Quality Directive proposal embedded these considerations and has been submitted to the co-decision process, currently unfolding within the Council, European Parliament and Commission. The provisions associated with the New Air Quality Directive are envisaged to be linked to other initiatives on environmental information such as the Exchange of Information (EoI) Decision[1], INSPIRE *directive (INfrastructure for SPatial InfoRmation in Europe*)[2], the Shared Environmental Information System (SEIS), new ways to assess air quality including EU initiatives such as GMES[3] and further development of EU-wide quality assurance schemes for the field of air quality assessment.

The European Commission Expert Group on Data Exchange (DEG) is involved in the delineation of the Implementing Provisions for Reporting under the New Air Quality Directive. The working group has recognised the need to help the adoption of harmonised air quality assessment and reporting approaches across Member States to enable the reporting provisions envisaged. In the light of the forthcoming air quality legislation, reporting requirements and data sharing, Member States are currently analysing their adopted air quality assessment and mapping techniques for compliance and reporting purposes.

THE EUROPEAN COMISSION AIR QUALITY REPORTING SYSTEMS AND THEIR LINKS WITH EU WIDE QUALITY ASSURANCE SCHEMES - INSPIRE

The current European Commission reporting system uses the questionnaire method as defined by the Commission Decision of 29 April 2004 (Decision 2004/461/EC) laying down a questionnaire to be used for annual reporting on ambient air quality assessment under Council Directives 96/62/EC and 1999/30/EC and under Directives 2000/69/EC and 2002/3/EC of the European Parliament and of the Council. The EU Data Exchange Group has been tasked to take into account the recent Commission decision to streamline the existing reporting proceedures and consider links with the INSPIRE Directive (Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community), which aims to make available relevant, harmonised and quality environmental geographic information to support formulation, implementation, monitoring and evaluation of Community policies.

[1] EU Commission Decision 97/101/EC
[2] http://www.ec-gis.org/inspire/home.html
[3] http://www.gmes.info/

The new envisaged reporting system is likely to initially address the harmonisation of reporting procedures, addressing harmonisation of assessment methodologies used by the various Member States at a later stage. The Data Exchange Working Group has identified the need to lay down a common framework for reporting purposes that will allow the usage of geographic information systems to map data reported to the European Commission. This new reporting approach is likely to replace the traditional questionnaire format and does not require alteration of the assessment method currently used by each member state nor require extra data collection. The new proposed reporting methodology uses the same principles as the INSPIRE directive as it:

- lays down general rules to establish a System of Digital Information for the purposes of Community environmental policies;
- is to be based on the infrastructures for spatial information established and operated by the Member States;
- does not require collection of new environmental or spatial data;
- does not affect existing Intellectual Property Rights;
- adopts as a prime objective data interoperability and data sharing;
- will meet the needs of INSPIRE.

A COMMON FRAMEWORK FOR REPORTING

A method has been proposed to the Data Exchange Group (Grossinho, 2006) to allow a harmonised reporting of the national air quality assessment results as yielded by each Member state using GIS. A common grid of 1km by 1km resolution is suggested for reporting purposes. Member states would allocate a value (or a series of values within a sub-grid if the spatial resolution for which there is reporting information available is higher) to each grid cell to report specific variables for each air quality pollutant defined (e.g. number of exceedences for pollutant A in each grid cell; maximum reported annual value, etc.).

The proposed system allows a flexible reporting approach in terms of the assessment method and scales used being able to accommodate current individual Member states approaches. The method envisaged considers either a common European framework (grid) provided by the European Environment Agency or a set of mapping rules is defined across member states to allow data to be mapped on a common map projection and datum system. The main implications of the future method are a better visualization of the various assessment scales, methods and results across Europe. The European Commission has envisaged a pilot study to test the method proposed across selected Member States.

AIR QUALITY ASSESSMENT TECHNIQUES FOR COMPLIANCE AND REPORTING PURPOSES - UK & ITALIAN CASE STUDIES

The UK Case Study

The UK has been divided into 43 zones for air quality assessment and compliance purposes. There are 28 agglomeration zones and 15 non-agglomeration zones. The status of each zone is currently determined from a combination of monitoring data and model results. Air quality modelling is carried out to supplement the information available from the UK national air quality monitoring networks.

Figure 1 shows a map of annual mean roadside NO_2 concentrations for urban major road links (A-roads and motorways) across the London Area for 2005. The dominant contributions to measured NO_2 concentrations in the London area are typically from major road sources. For background NO_2 the traffic area source contribution has been modelled using a kernel-based

area source model which has been calibrated empirically using measurement data. Roadside concentrations of NO_2 have been estimated by adding a roadside increment to the modelled background concentrations. This roadside increment has been calculated using road link emission estimates and dispersion coefficients derived empirically from roadside monitoring data (Defra, 2006). Figure 2 presents a map of annual mean roadside NO_2 concentrations for a local area in London for 2005. This local assessment was performed using the Gaussian model ADMS roads with the grid spacing set to a suitable resolution so that concentrations relevant to public exposure are correctly predicted. Figure 3 illustrates the overlay of the two previously described assessment approaches performed at two different scales (national and local), mapped onto the same spatial resolution. The local air quality assessment was performed using ADMS roads with a spatial resolution of 1.37 meters (results expressed in a regular grid) whereas the national assessment was performed using the method described above (Defra, 2006) with the results expressed in a GIS line format (each road link expresses a annual mean roadside NO_2 concentration). Figure 4 presents one of the possible reporting methods. It shows the national annual mean roadside NO_2 concentration mapped onto a 1km by 1km grid (superimposed with the local NO_2 assessment results). This reporting method uses a common 1km by 1km grid and reports the maximum annual mean roadside NO_2 concentration value registered within each grid square. Figure 5 shows the same method and spatial resolution but reports the average annual mean roadside NO_2 concentration value registered within each grid cell.

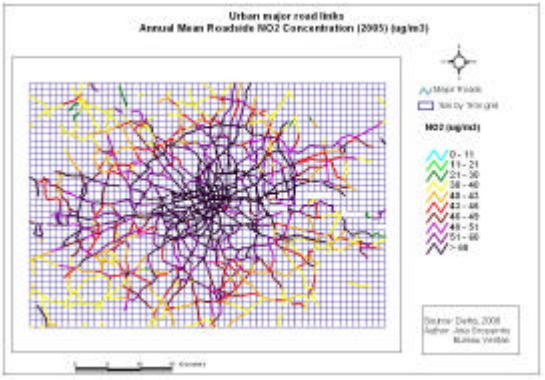

Fig. 1; Annual Mean Roadside NO_2 concentrations (2005)($\mu g/m^3$) – National Assessment, UK.

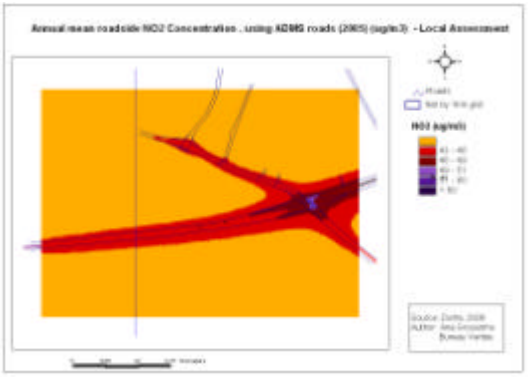

Fig. 2; Annual Mean NO_2 concentrations (2005)($\mu g/m^3$) – Local Assessment, UK.

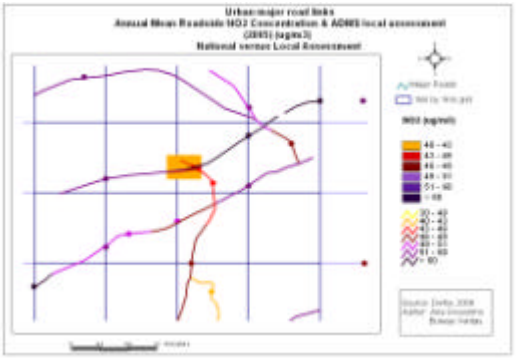

Fig. 3; Annual Mean Roadside NO_2 concentrations (2005)($\mu g/m^3$) – National Model integrated with Local Assessment results (ADMS urban model), UK.

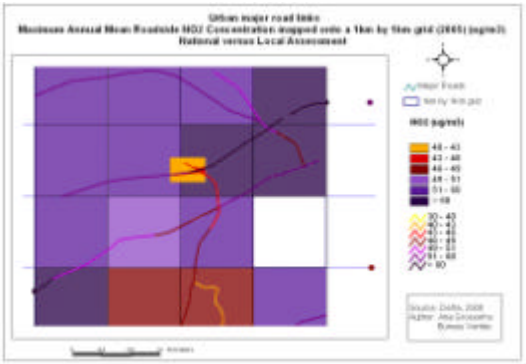

Fig. 4; Maximum Annual Mean Roadside NO_2 concentrations (2005)($\mu g/m^3$) – integrating national and the local assessment results for reporting purposes, UK .

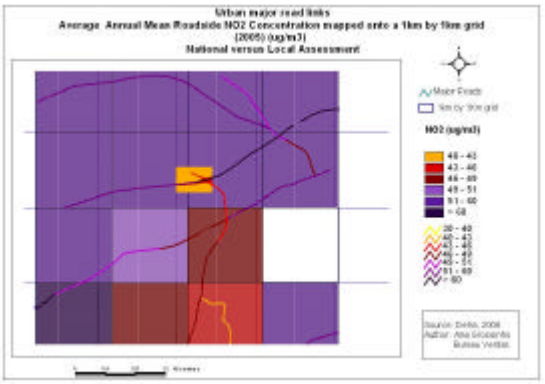

Fig. 5; Average Annual Mean Roadside NO_2 concentrations (2005)($\mu g/m^3$) – integrating national and the local assessment results for reporting purposes, UK.

This simple exercise illustrates on one hand how different assessment methods (and scales) can produce different assessment results and on the other hand how different assessment methods and scales can be mapped and integrated for reporting purposes using a common grid by means of geographic information systems.

The Italian Case Study

According to Italian legislation air quality assessment duties fall under the competence of the 20 Italian Regions and the autonomous Bolzano county. While assessment for compliance is usually performed by means of traditional communication of monitoring data a recent survey coordinated by the Italian Environment Ministry found that an increasing number of local authorities (Regions and/or Regional Environment Protection Agencies) are developing or are currently using some advanced modelling tools.

The complex topography of the Italian territory does not allow satisfactory regional or national scale air quality assessments by means of simpler modelling approaches like Gaussian methods. Local authorities tend to use Eulerian Chemical Transport Models (CTMs) which are able to simulate the main features of both primary and secondary atmospheric pollutants. On behalf of the Italian Ministry of the Environment, ENEA has recently developed MINNI, a national reference air quality modelling system (G. Zanini, F. Monforti *et al*, 2004). MINNI contains a CTM currently operating at a 20x20 km^2 resolution and a downscaling to 4x4 km^2 is expected in the next few months. MINNI aims at providing national policy makers with an assessment tool covering the whole territory and enable them able to investigate national scale policies. Furthermore, air quality assessment procedures within each region tend to use the National Model as a reference approach for local scale studies.

As comparing national and local scale studies makes evident, spatial resolution is a critical issue for CTMs application. Figure 6 shows two identical simulations of the Northern Italy PM_{10} average monthly concentration performed with the current standard MINNI 20x20 km^2 (left) and the preliminary 4x4 km^2 version (right). Looking at the red areas (more than 40 $\mu g/m^3$ monthly average) it is evident that some zones are over the threshold in both simulations (e.g. the Milano area). On the contrary, there are some areas (e.g. Turin, Bologna and other smaller towns) where exceeding or not the threshold depends on the spatial scale the CTM works. Examples of this nature show the need for a common framework for reporting assessment if models are planned to be employed for legally binding purposes like reporting for compliance. For these and other reasons, including the uncertainties still present in CTMs-based assessments for most complex secondary pollutants (Ozone, secondary PM),

it is expected Member States to maintain a conservative approach strongly based on measurements yielded by national network monitoring stations. However, CTMs offer a valuable assessment method in other assessment cases, for example, pollutants with very few measurement points and/or countries with complex terrain. The results of this assessment are easily mapped on the new reporting system proposed.

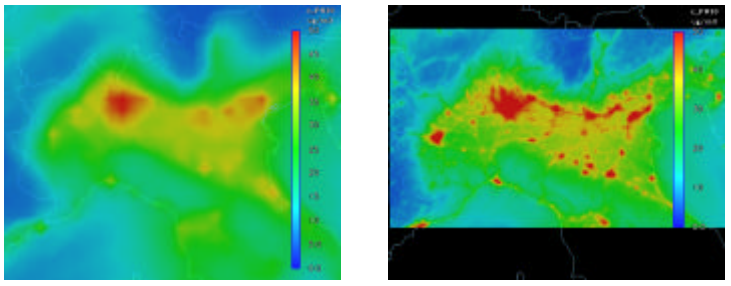

Fig 6; PM10 monthly (January 1999) average concentration in Northern Italy obtained with the MINNI model - 20x20 km^2 resolution (left) and 4x4 km^2 resolution (right).

SUMMARY

The need to harmonise air quality assessment reporting procedures using geographic information systems has been recognised by the European Commission. The method proposed:

a) allows Member States to report their current air quality assessment results, regardless of their assessment method or scale;
b) does not require the collation or production of extra information;
c) provides higher transparency in the reporting to the Commission;
d) makes easier to share national assessment results across Member States;
e) is expected to foster harmonisation of assessment methodologies across the EU.

REFERENCES

A. Grossinho, 2006: Data Exchange Working Group Technical Report: Supporting the Implementing Provisions for Reporting under the New Air Quality Directive Preparatory Material - Assessment Reporting Procedures, Brussels, Belgium.

Defra, 2006: The UK air quality modelling for annual reporting 2005 on ambient air quality assessment under Council Directives 96/62/EC, 1999/30/EC and 2000/69/EC report, London, UK.

G. Zanini, F. Monforti et al, 2004: The MINNI project, Proceedings of the 9th International conference on harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, 243-247.- Garmisch, Germany.