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Challenges for a New Air Quality Directive: The role of monitoring and modelling techniques



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ABSTRACT

Air pollution is a major environmental health problem. The current Directive 2008/50/EC on ambient air quality and cleaner air for Europe establishes the need to reduce pollution to levels which minimise harmful effects on human health, paying particular attention to sensitive populations, and the environment as a whole, to improve the monitoring and assessment of air quality including the deposition of pollutants and to provide information to the public.

This work presents an overview of the major guidelines of the Air Quality Directive concerning modelling and monitoring techniques and of current European initiatives on the subject. Also identifies the new challenges for the forthcoming directive, namely on the combined use of monitoring and modelling techniques and also on human exposure assessment. These challenges are illustrated by novel monitoring and modelling assessment approaches and innovative exposure assessment methodologies, for which selected examples are provided.

A methodology to use monitoring data to improve AQ modelling performance was proposed using a set of statistical methods of data fusion, in which the bias correction technique RAT04 achieve the best performance.

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Moreover, methodologies based on personal monitoring, with AQ sensors, and/or on human exposure modelling, appear as tools for a more accurate exposure assessment.

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1. Introduction

Air pollution is a major environmental health problem that can result from both human and natural actions. Human sources of air pollutants include emissions from industry, agriculture, forestry, transportation, power generation, and house heating, whereas natural sources derive mainly from forest fires, vegetation, volcanic emissions, and dust.

Recent studies show that ambient air pollution is a significant risk factor for health. In 2010 in Europe air pollution has contributed to over 430,000 premature deaths and over 7 million years of healthy life lost from exposure to particulate matter with an aerodynamic diameter below 2.5 μm (PM_{2.5}). When the risk factors are ranked by their attributable burden of disease in western Europe, air pollution is in eleventh place, with tobacco smoking in first (Lim et al., 2012).

In May 2008, the European Parliament and the Council adopted the European Union (EU) Directive on ambient air quality and cleaner air for Europe, the Directive 2008/50/EC (EC, 2008). This Air Quality Directive (AQD) replaced earlier directives simplifying and streamlining existing provisions, and introducing new provisions, in particular new objectives concerning PM_{2.5} and the possibility of postponing the attainment year of some limit values. Whilst previous directives have based assessment and reporting largely on measurement data, the current AQD encourages the use of air quality (AQ) models in combination with monitoring in a range of applications.

The AQD explicitly states that the “emissions of harmful air pollutants should be avoided, prevented or reduced and appropriate objectives set for ambient air quality taking into account relevant World Health Organization standards, guidelines and programmes”.

Exposure to air pollutants is largely beyond the control of individuals and requires action by public authorities at the national, regional and international levels. A multisectoral approach, engaging such relevant sectors as transport, housing, energy production and industry is needed to develop and effectively implement long-term policies that reduce the risks of air pollution to health (WHO, 2013).

In the framework of the EU's Year of Air in 2013, the World Health Organization (WHO) Regional Office for Europe is implementing two projects: (a) evidence on health aspects of air pollution, to review EU policies, REVIHAAP; and (b) health risks of air pollution in Europe, HRAPIE, with financial support from the European Commission (EC). These projects will provide scientific evidence-based advice on the health aspects of air pollution, to support the comprehensive review of the EU's air quality policies (WHO, 2013).

Under the “Review of the Thematic Strategy on Air Pollution: Provision for Air Quality Measurement, Air Quality Modelling, Management Framework, Assessment, and Public Information, and Stakeholder Consultation Support” service three reports have been carried out concerning different approaches. The first one relates to the Assessment of AQUILA (The Network of Air Quality Reference Laboratories) (ECORYS, 2013a), the second relates to models and the assessment of FAIRMODE (The Forum for Air Quality Modelling in Europe) (ECORYS, 2013b) and the third produces an Assessment of the Stakeholder Expert Group Recommendations for the revision of the current Air Quality Legislation (ECORYS, 2013c).

A recent evaluation of the existing air quality standards in the AQD under the EU Clean Air Programme for Europe concludes that they are still insufficient in relation to the WHO air quality guidelines, which represent the levels where health risks are minimized. Nevertheless, it is a general consensus that further tightening in existing EU air quality standards will be ineffective unless actual cuts in air pollution from the main sources are conducted.

Since several Member States are currently facing infringement cases for failing to reach existing standards, the European Commission points out first for a new policy with stricter emission ceilings

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