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Urban Air Quality Information and Forecasting Systems for Saving of Cultural Heritage

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Abstract

Materials of historical/cultural monuments, as well as any construction materials, are affected by harmful pollutants and meteorological stressing factors. This paper presents new opportunities for creation of information systems for prediction and minimising destructing impacts on monuments. In some European cities, early warning tools like Urban Air Quality Information and Forecasting System (UAQIFS) are already employed for air pollution and population health issues.

Materials & Methods

For application to the cultural heritage problems, such systems need to be refocused, improved, verified, supplemented by specific models of exposure and impact on monuments, and then implemented in interested cities/towns to provide better protection of historical monuments (along with human and environmental health). An integrated UAQIFS developed in the European project FUMAPEX (http://fumapex.dmi.dk/) encompasses emissions, urban meteorology and population exposure for urban air pollution episodes; assessment of urban air quality and health effects; and emergency preparedness issues for urban areas [1].

This integrated system allows effectively forecasting the air pollution and health risks. Furthermore it suggests modelling background and natural methodology for
(i) forecasting and assessment of combined effects of meteorological and air-pollution factors on monuments, and
(ii) providing decision makers with essential information about possible harmful impacts and practical recommendations.

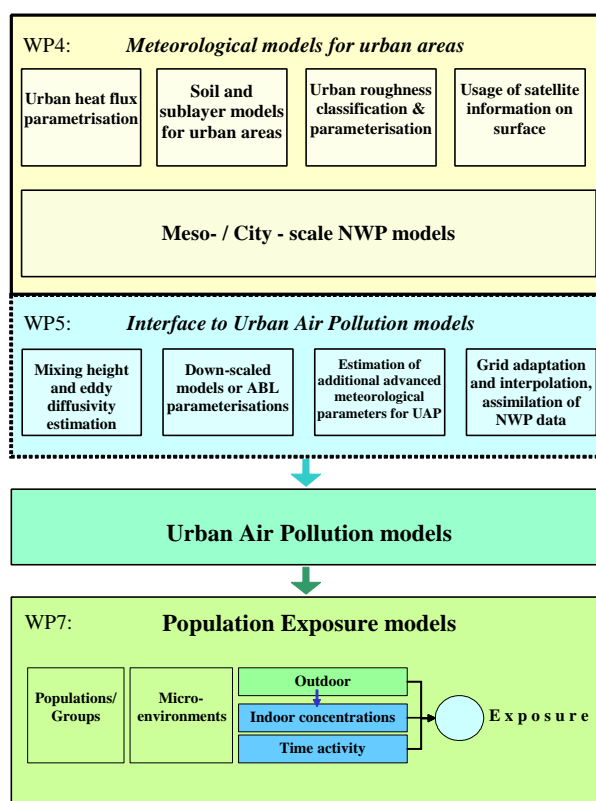Fig. 1; FUMAPEX scheme of the integrated Urban Air Quality Information Forecasting and Information Systems (UAQIFSs).

Two possible options of the methodology are discussed in the paper:

(i)   operational or early warning systems, like the FUMAPEX UAQIFSs [2,3] (see Figure 1), and

(ii)   systems for probabilistic risk studies and long-term impact assessments [4] (see Figure 2).

We shortly present the methodology of the FUMAPEX UAQIFSs and discuss prospects for its further improvements and reorientation to the cultural heritage issues.
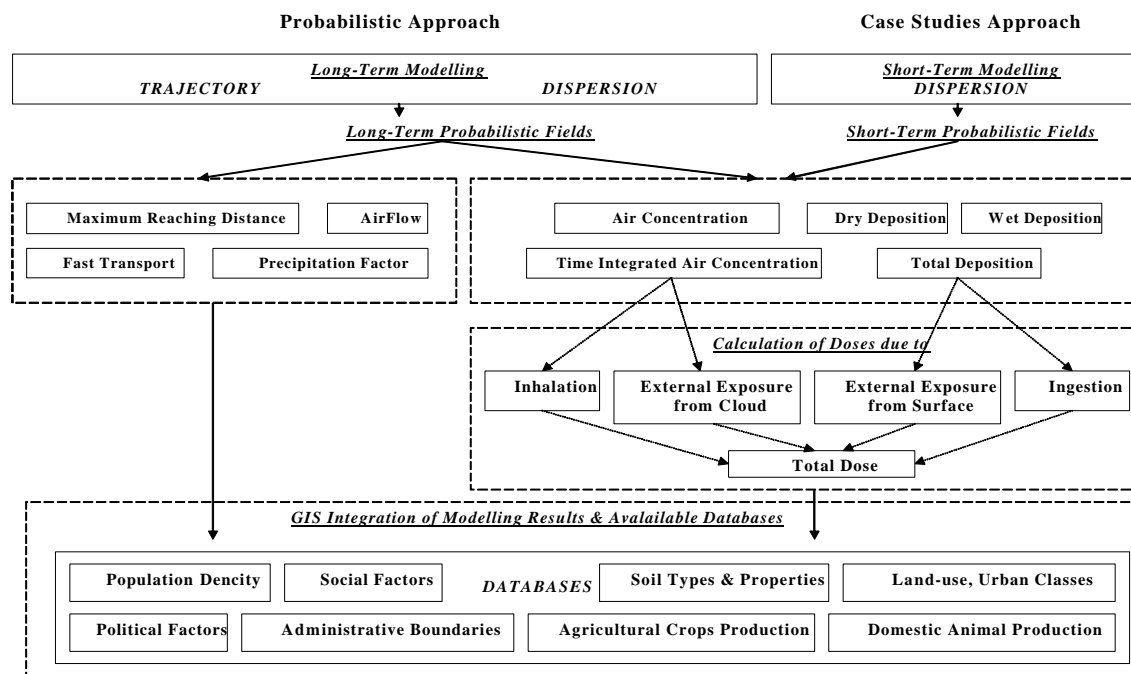
Fig. 2; General scheme of probabilistic assessment of risk sites' impact (on example of nuclear risk sites).

References

1) A. Baklanov, Overview of the European project FUMAPEX. *Atmospheric Chemistry and Physics*, 6 (2006), 2005–2015.

2) A. Baklanov, P. Mestayer, A. Clappier, S. Zilitinkevich, S. Joffre, A. Mahura, N.W. Nielsen, On the parameterisation of the urban atmospheric sublayer in meteorological models. *Atmospheric Chemistry and Physics Discussions*, 5 (2005), 12119-12176.

3) A. Baklanov, O. Hänninen, L.H. Slørdal, J. Kukkonen, J.H. Sørensen, N. Bjergene, B. Fay, S. Finardi, S.C. Hoe, M. Jantunen, A. Karppinen, A. Rasmussen, A. Skouloudis, R.S. Sokhi, Integrated systems for forecasting urban meteorology, air pollution and population exposure. *Atmospheric Chemistry and Physics Discussion*, 6 (2006), 1867–1913.

4) A. Baklanov, A. Mahura and J. H. Sørensen, Methodology for Prediction and Estimation of Consequences of Possible Atmospheric Releases of Hazardous Matter: 'Kursk' Submarine Study. *Atmospheric Chemistry and Physics,* 3 (2003), 747-762.