ISHTAR: Integrated Software for Health, Transport Efficiency and Artistic Heritage Recovery

A contribution to subproject SATURN

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Summary

During the year 2001 the research work of the group was on one side dedicated to the further development of the microscale dispersion model GRAMM, the Lagrangian particle model GRAL but also to the application of dispersion models in a model chain from transport, emissions to dispersion and impact. The main focus of this contribution should be the explanation of the European research project ISTHAR (Integrated Software for Health, Transport Efficiency and Artistic Heritage Recovery), where such a model suite will be created and applied to certain test cases.

European cities face common challenges concerning their quality of life: degradation of the urban environment, significant risks for citizens health, traffic congestion causing stress and economic inefficiency, progressive damage of the artistic and monumental heritage. Additional difficulties derive from the lack of integrated tools that allow cities to make balanced decisions on a wide range of issues. The aim of ISHTAR Project is to build an advanced software suite for the analysis of the effects of measures implemented in time scales ranging from a few hours to a year to improve the quality of the environment, citizens health, conservation of monuments. The suite will include both existing and newly developed models, covering the areas of citizens' movements, transport, vehicles emissions noise and safety, pollutants dispersion, buildings related atmospheric emissions, health, and monuments degradation. These tools will be integrated by the use of a GIS and a user-friendly interface software. The models suite will be an innovative tool for advanced urban management and will allow the integrated analysis of the various environmental effects of technical and non technical measures. This will represent an attractive alternative to the usual separated analysis of the effects of such measures on the various elements of the urban environment.

Aim of the research

Aim of ISTHAR

The aim of project ISHTAR is to build an advanced software suite for the analysis of the effects of temporary and medium term measures to improve the quality of the environment, citizens safety and health, conservation of monuments. The activities will start and conclude in the seven involved cities, and will be a continuous ‘open gate’ to all the European cities interested in ISHTAR activities.

The measures to be tested in the field and modeled with the suite will be defined by the cities, the first users of the results. The suite will include both existing and newly developed models, covering the areas of citizens behavior, transport, vehicles emissions noise and safety, pollutants dispersion, buildings related atmospheric emissions, health, monuments degradation.

These will be integrated by the use of a GIS and a user-friendly integration software. The result will be the building and application to real cases of an innovative tool for advanced urban management.

Approach for ISTHAR

The ISHTAR Project Objectives will be reached on the basis of the following characterizing features of the Project:

a) The extensive multi-impact modeling of the effects of urban measures, based on transport models fitted for various types of action, emissions/safety integrated modeling, pollutants and noise dispersion, use of pollution 4D fields for health and building-monuments impacts appraisal, global evaluation by CBA/MCA techniques;

b) Extreme flexibility of use of the Suite, deriving from the spatial-temporal elasticity of the models and from a user friendly GIS based interface software;

c) High technical innovation, based on the realization of a wide suite and the development of specific advanced modules on transport emissions, detailed health effects, integrated emissions/safety impacts, flexible transport modeling based on alternative tools for the analysis of different scenarios;

d) Maximization of the European Added Value, deriving from the size of the consortium (including 19 partners, 7 Countries and 7 cities testing the final product) and the effort in the dissemination and exploitation tasks that will be based on the building of wide user groups;

e) Provision of a clear response to a widespread socioeconomic issue represented by the negative effects of urban pollution, congestion, monuments degradation, road and health risks (these matters heavily limit our quality of life and imply huge costs for the society);

f) Project goals based on European Union Policies on Environment, Transport, and Urban Quality of Life;

g) Liaison with Projects in the same Key Action and within the 5th Framework Program in general, deriving from the multi-disciplinary character of ISHTAR Project and the complexity of the issues covered by the Project, linked with other Key Actions in the 'Energy Environment and Sustainable Development' Program, and with Programs 1 (Quality of Life) and 2 (Information Society Technologies);

h) Stakeholder-oriented activities as shown by the interactions with cities, professionals, institutions both at technical and dissemination level.

The main 'global' target of the ISHTAR Project is to develop a model Suite which allows the evaluation of the impacts of various types of urban policies and actions on the quality of life of citizens, and in particular on traffic congestion, air quality, citizens health, conservation of cultural heritage

Aim of dispersion model development

The further development of existing dispersion models is crucial for the validation of models. The development mainly consists of the application of the models to different validation data sets and to real life applications. For the Lagrangian particle model GRAL the comparison to data from the model validation kit of NERI Denmark is ongoing. It is also validated against several dispersion studies which are carried for the national highways in very complex terrain. One important comparison was against the tracer experiments, carried out in the research project *Dispersion modeling of pollutants released from road tunnel portals* (Öttl et al. 2002a,

Öttl et al. 2002b). The microscale dispersion model GRAMM will be validated against the CEDVAL data of the University of Hamburg. The other application will be against the tracer dispersion experiment from highway tunnel exits in Austria.

Activities during the year

The activities during the year 2001 were the start of the ISTHAR project. It included the choice of dispersion models and the selection of test cases.
The further development and the validation of the Lagrangian particle model GRAL (Graz Lagrangian particle model) (Öttl et al., 2001a). The model has been applied to different test cases and the results have been published in peer reviewed journals (Öttl et al., 2001b). There was also a new development of the model concerning dispersion along major line sources and tunnel portals (Öttl et al. 2002a, Öttl et al. 2002b). The model development for a microscale part of GRAMM (Graz mesoscale model) was continued.

Principal results

For the development of dispersion models the ongoing validation is important for a better reliability. E.g. it was found that one important process was the influence of the changing ambient wind field direction (meandering) on the position of the jet stream of the tunnel portal. The position changes are of the order of decameters, while the characteristic length scales of eddies evolving at the surface between the jet stream and the ambient wind field are of the order of some meters. Another finding was the difficulty to simulate dispersion from major road emissions, when there are low ambient wind velocities prevailing and the wind direction is parallel to the line source. Other applications of the dispersion model GRAL in complex terrain show difficulties with flow field realizations which fulfill the continuity equation and are fast enough to result in reasonable calculation times.

Aims for the coming year

The key result of ISHTAR Project will be the realization of a multi-impacts models suite for the assessment of short and long-term measures intended to improve the quality of urban life. The tool will be described by manuals for expert and non-expert users. The application of the tool to the measures tested in the partner and cities involved will provide indication of the tool's usefulness, accuracy, applicability and estimation of impacts on health, environment, monuments. The users' involvement will provide evidence of the impact of the research performed.

Current activity is being devoted to the review of available and existing models, and to the refining of the application matrix represented by the seven case studies to be used for the demonstration of the ISHTAR Suite.

The aim of the research work for the coming year will be the further validation of the microscale model part of GRAMM and its application to the tracer gas dispersion experiments near a highway tunnel portal within the FWF (Austrian science fund) project P 14075 TEC. In this project the influence of the traffic induced wind speed, the buoyancy and the traffic induced turbulence on the pollution dispersion is studied. For the further development of the Lagrangian particle model GRAL a research project with long time sonic measurements on a 160 m mast was submitted and is in the review process

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