16th International Conference on
Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes
8-11 September 2014, Varna, Bulgaria

ENVIRONMENTAL SENSITIVE TRAFFIC MANAGEMENT SYSTEM PROKAS^{ONLINE}

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INTRODUCTION

The administrations on local and global level still need to find strategies to reduce air pollutant concentrations. The amount of vehicle traffic is one of the main causes of air pollution in urban areas. In Addition to implement air quality action plans according to the EU-guideline 2008/50/EG, guiding traffic to areas with less affected population and better dispersion conditions is a suitable mitigation measure.

At this time there are many efforts in different regions of Germany to implement environmental sensitive traffic management systems (ETMS). ETMS combines the advantage to optimize the traffic flow and to improve the air quality beyond the population can be informed about the current traffic situation and the level of air quality.

ENVIRONMENTAL MODULES

In this context Lohmeyer GmbH & Co. KG developed the online monitoring and short time predicting modelling system PROKAS^{Online} and ProFet, which are suitable for coupling with a traffic management system as an environmental module.

PROKAS^{Online} is able to modelling hourly air pollutant concentrations in street canyons and nearby roads considering current measurement or predicted data of the meteorology and background concentrations. Beyond PROKAS^{Online} contains a traffic emission module which requires the current or predicted road traffic situation which could be simulated by a traffic model considering traffic measurement data. The optional integration of PROKAS_B or MISKAM as dispersion model allows a balance between necessary forecast accuracy and program costs. PROKAS^{online} has its strengths in forecasting NO_2-concentrations, because the relevant traffic and meteorological influences including the chemical synthesis of NO_2 made by NO and Ozone, taking into account the meteorological parameters (temperature and radiation). Just the NO_2 synthesis is a very important criterion for the dispersion model quality. PROKAS^{online} also includes a module for assessing the effectiveness of traffic reduction effects on air pollution.

ProFet (program system for fine dust forecast) is based on a multi-linear regression model, which is evaluated by representative measured concentration time series. His strengths it has in the PM10 short-term forecasting, as the most important factors related to PM10 meteorological aspects, such as rainfall, length of dry seasons, season, etc., can be taken into account explicitly.

Fig. 1 shows an overview of the methodologies, input data and the advantages of the online forecasting models.

	ProFet	**PROKAS^{Online}**	
Method	a multi-linear regression	Emission and dispersion modelling	
Dispersion model	-	PROKAS_B	MISKAM
Spatial resolution	1 point (monitor station)	Road net work (1 representative concentration for 100 m road segment)	coverage and high resolution of a whole area
Input	Wind, Temp., rainfall, season, duration if inversion, background concentration, weekday	Wind, Temp., radiation, background concentration, traffic density, traffic situation, parameterized street canyons	Wind, Temp., radiation, background concentration, traffic density, traffic situation, 3D-building model
operational strength	Forecasting of PM10-concentrations as daily mean	Forecasting of hourly NO_2-concentrations for large road networks	Forecasting of hourly NO_2-concentrations for city centres

Figure 1: Overview of the methodologies, input data and the advantages of the online forecasting models for Environmental Sensitive Traffic Management System

ProFet is in operational use in environmental protection agency of Saxony-Anhalt (LAU) for several years. Among others it serves currently to inform the LAU, as well, if PM10 limit exceedances are forecasted, for activating a truck transit ban in Wittenberg and the signaling of a speed limit of 30 km/h on the Merseburger Straße in Halle/Saale. Since summer 2012 additionally PROKAS^{Online} is in use for the main road network of Halle and Magdeburg. **Fig. 2** shows the function diagram.

PROKAS^{Online} is installed also in the city of Stuttgart for several years and supplies there (autonomously) corresponding hourly values of NO_2 concentrations, which are published in the Internet (PROKAS^{Online} with MISKAM, see http://www.stadtklima-stuttgart.de/index.php?luft_onlineschadstoffe_einleitung) or **Fig. 3**.

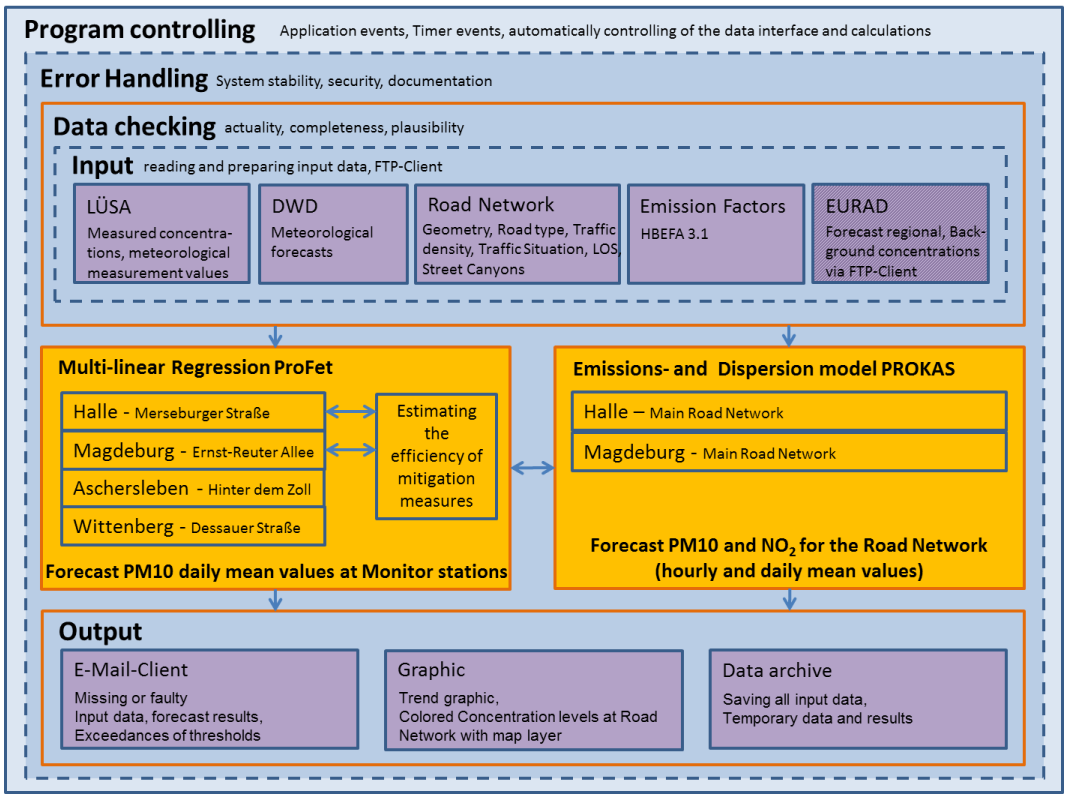

Figure 2: Function diagram ProFet/PROKAS^{Online} for Saxony-Anhalt.

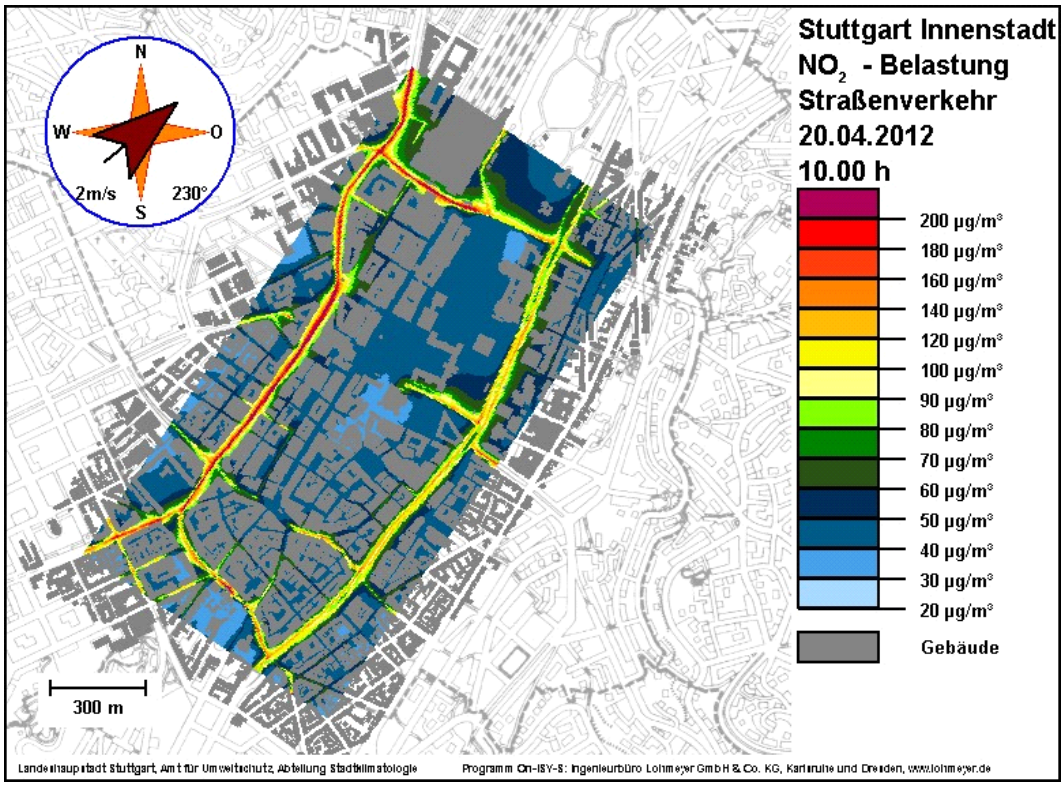

Figure 3: Example of a hourly NO_2 forecast using PROKAS^{online} using the MISKAM module.

EXPERIENCES

ProFet/PROKAS^{online} for Saxony-Anhalt also PROKAS^{Online} for Stuttgart are running since several years yet. Following conclusions follow from these experiences:

- Sophisticated test algorithms for the input data for completeness and plausibility checks are necessary for autonomous operation and reliable forecasts. This is ensured in both programs. In Saxony-Anhalt the possibility is established, to perform a correction or completion of data if there are data problems by giving notice via e-mail to the duty of the air monitoring system before the actual calculation run.
- The accuracy of the forecasts in the critical mass depends on the quality of the forecast input data (meteorological, traffic, traffic situation, background loads). So, the meteorological forecasts (wind, precipitation, temperature, inversion) are supplied by the German weather service in Saxony-Anhalt. At regular intervals, therefore forecast values compared with meteorological data at the reference stations of emission forecasts and if necessary correction functions are derived.
- A validation of emission forecasts is needed not only on the basis of current measures values, but also on the basis of the above forecast input data. This was conducted in Saxony-Anhalt for ProFet/PROKAS^{online} several times.
- For forecasts with PROKAS^{online} or similar systems on the basis of (classical) emission and dispersion calculation it has to be ensured that local traffic conditions on the monitoring station are sufficiently accurately mapped. This concerns in particular the local traffic situations close to junctions, traffic volumes and compositions. Should no traffic data are available, appropriate adjustments of the nearest measurement point must be carried out.

POSSIBILITIES OF USE

Fig. 4 shows extended applications of the presented environmental modules. In principle, these are used to inform about current or expected air pollution situations and furthermore are supporting the control of traffic control and guidance systems.

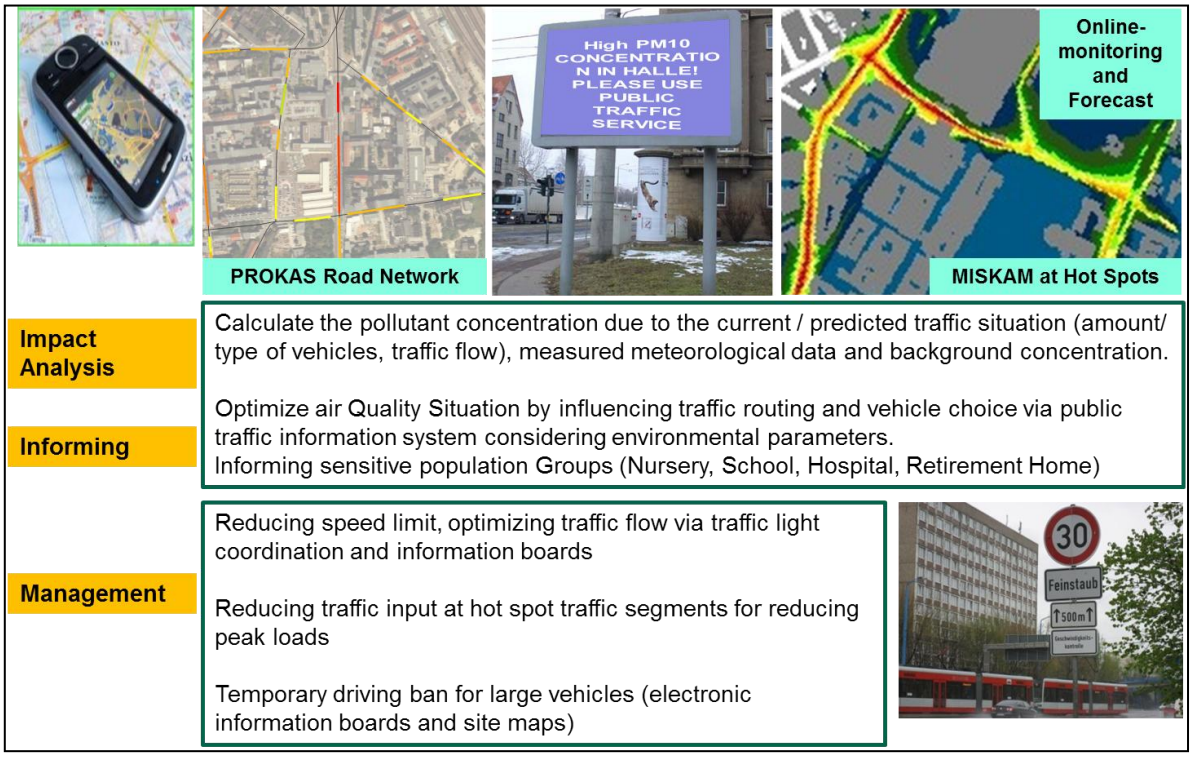

Fig. 4: uses of the environment modules

GENERAL

The input data and the result data could be published in a web portal.

PROKAS^{Online} is already in use in Stuttgart, Halle, Magdeburg and other cities (all in Germany). The conference presentation will present the model system PROKAS^{Online} on some examples, shows the area of applications and provides an outlook for further developments.

LINKS

PROKAS^{Online}:
http://www.lohmeyer.de/en/content/software-sales-distribution/product-overview/prokas-online