

COMPLEX TERRAIN & SPECIAL METEOROLOGICAL CONDITIONS

A strategy to overcome application limits of the dispersion model of the German TA Luft: Coupling with the prognostic flow model FITNAH

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INTRODUCTION

In 2002, the German legal regulation guideline TA Luft, which defines the procedure of dispersion modelling in licensing processes, was updated. In appendix 3, a Lagrangian particle model has been introduced, which makes use of wind and turbulence information calculated by a diagnostic flow model. Due to the physical limits of the diagnostic approach, in section 11 the applicability of this model approach is limited only to smoothly formed terrain (slopes <1:5) and to cases, where special meteorological conditions like drainage flows are not likely to occur.

In fact, this regulation classifies almost 75 % of the southern half of Germany as areas to be treated not by the standard method of the TA Luft, but with the help of higher sophisticated models: prognostic models.

APPLIED MODELS

The Lagrangian Particle model used in this study is **LASAT** (LAgrange Simulation of Aerosol Transport), which satisfies the requirements of the TA Luft and the VDI-Guideline 3945/3. As prognostic flow model serves **FITNAH** (Flow over Irregular Terrain with Natural and Anthropogenic Heat-Sources). FITNAH has been developed (and constantly updated for almost 25 years) to calculate thermally induced wind systems and flow formed by the 3D interaction of terrain structures. The model solves prognostic equations for wind vector, turbulence, temperature, humidity and additional scalar variables.

STRATEGY

Since the operation of a prognostic model is very time consuming, the complete calculation of a full years hourly cycle (8.760 situations), as required by the TA Luft, is not possible in suitable time in licensing procedures.

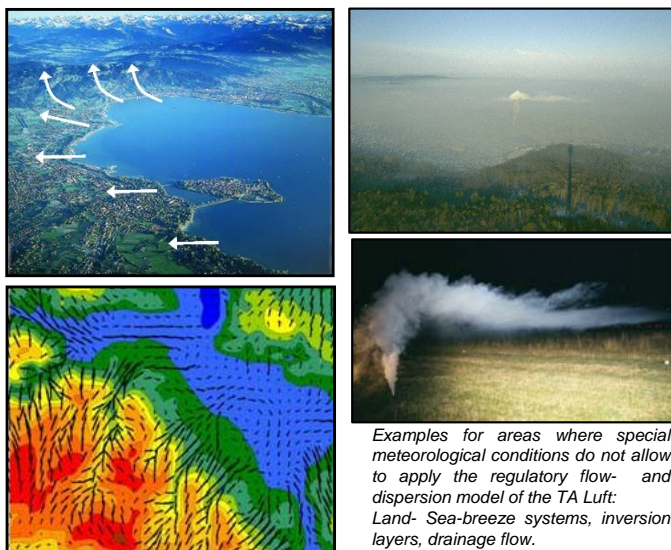
Therefore, the idea is to calculate the 3 or 4 meteorologically significant situations (e.g. drainage flow and main wind directions) with prognostic flow (FITNAH) and Lagrangian dispersion (LASAT). The concentration results of this simulation are compared to those which can be obtained by use of the diagnostic flow model.

To reduce the difference, the meteorological input data to run the diagnostic model is modified in such a way, that the results of the dispersion calculation with diagnostic flow is similar to the concentration field of the prognostic run.

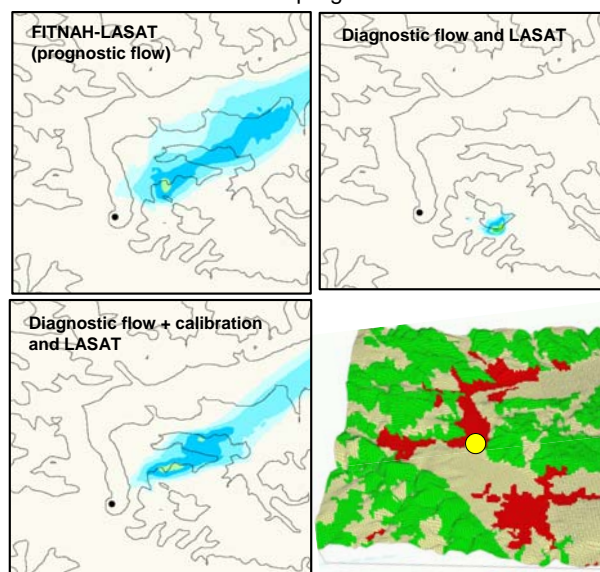


Examples for industrial plants in terrain which does not allow to apply the regulatory flow- and dispersion model of the TA Luft

The diagnostic approach usually starts with a horizontally homogeneous wind field over flat ground. The terrain is introduced and distorts the grid. Finally, the flow is adjusted to assure mass conservation in each grid cell. This model is not able to calculate thermally driven wind systems or terrain induced vertical vortices. For such situations, a prognostic model is needed.



Examples for areas where special meteorological conditions do not allow to apply the regulatory flow- and dispersion model of the TA Luft: Land-Sea-breeze systems, inversion layers, drainage flow.



Calibration technique to use the diagnostic flow model and get similar concentration results as the application of a prognostic one. Calibration priority here has been set to location and magnitude of maximum and to direction of the plume.

RESULTS AND CONCLUSIONS

The calibration approach offers a very time-efficient way to incorporate prognostic flow into one-year-based dispersion modelling, even when diagnostic models are in fact not suitable for use in that terrain. The approach has been applied on several very controversially discussed licensing procedures, e.g. for waste incineration plants or cement works, and has been fully accepted by several supreme authorities in Germany.

REFERENCES ...are listed in the extended abstract published in the proceedings...

