

Overview of WinKFZ 7.2

WinKFZ is a software tool that allows the user to simulate the atmospheric dispersion of toxins, taking such things into consideration as topography, buildings and meteorology. The toxins can be neutral or heavy gases, and are released from point-shaped, line-shaped or diffuse emission surfaces.

The software allows the simulation of continuous dispersions or of statistical mean values for a variety of separate situations, thus providing average hourly, daily and annual immission concentration levels.

With regard to the current PM10 problem as often described in the news and in other media, dissolving inversion layers and the subsequently higher immission concentrations at ground-level can be calculated.

The following bulleted lists outline the possibilities that WinKFZ offers when assembling a scenario:

Meteorology

- One or more ground-level meteorological stations can be incorporated, providing data such as the wind direction, wind speed, atmospheric stability, precipitation, temperature, mixing height, etc.
- One or more vertical wind profile measurements (wind speed and direction for N measurement heights) can be incorporated.
- Several inversion layers can be incorporated.
- Simulations can either be sequential (each half-hour episode is based on the previous episode) or weighted (each half-hour episode is simulated separately, later all episodes are weighted according to occurrence statistics and combined into a single immission field).

Streets

- Streets, each consisting of a number of nodes at constant traffic data, can be added to a scenario.
- Tunnels, bridges, embankments can be incorporated
- Flexible and highly configurable traffic data is assigned to each street: different street types, traffic volume and mix as well as velocity, predefined traffic situations, etc.

Emission factors

- By default, traffic emission factors are assigned to vehicle-induced emissions from the German HBEFA, a set of government guidelines and tables.

- The default data can be overwritten with user-defined emission factors.

Emission points

- Point- or circle-shaped emission sources can be incorporated, e. g. industrial chimneys or diffuse emitters.
- For chimneys, the mechanical and thermal plume rise is automatically calculated.

Buildings

- Buildings can be incorporated into a scenario. Each building is consisting of exactly four points. However, multiple of these simple buildings can be grouped together to represent larger, complex buildings.
- Parking buildings can be defined as parking facilities, where user-defined emissions are released.
- Sound reflection barriers can be incorporated.

Topography

- Each scenario can be assigned a 3D topography grid
- User-defined isolines of constant height can be transformed into a 3D grid, e.g. when digitising maps.

Receptors

- Receptor points at user-defined coordinates throughout the scenario provide information on the immission concentration at that point.
- Vertical profiles allow the immission distribution to be plotted on the X/Z axes.

Toxins

- WinKFZ provides a list of default toxins, as defined in the HBEFA: NO₂, PM₁₀, etc.
- To simulate the dispersion of non-standard toxins, an appropriate tool is provided for editing the list of toxins.

Graphical results

- Graphical 2D plots of the immission concentration at ground-level
- Vertical profiles of the concentration distribution can be provided
- 2D plots can either be of a single episode, or of the mean value of all episodes
- Separate GIS layers (streets, building, etc) can be turned on or off.
- Topography layer can be turned on or off.
- Separate meteorological measurements can be incorporated into the plots.
- A sequence of single-episode plots can be exported to an animation file.

Tabular results

- All input and output data is provided in full.
- All data is presented hierarchically, in nested tables, thus allowing the user to choose which level of detail is displayed.
- A number of tabular and graphical statistics analyses are provided.

Planned extensions

- Module for presenting the scenario and the simulation results in 3D
- Module for simulating heavy gases
- Module for simulation accidental scenarios, e.g. explosions and fires, including the effect on population and construction.

Software modules

- Windfield: we use a diagnostic windfield model with linearised Navier-Stokes solvers, which allow the realistic simulation of slope flow, channelling through houses and/or topography, etc.
- Dispersion model: we employ a validated numerical particle model which uses the Lagrange particle model approach.
- Accidental analysis: we employ software to assess heat fluxes and pressure waves with respect to men as well as to structures
- Toxic Module: we evaluate the impact to men of pollutants with respect to the governmental regulation
- User interface: WinKFZ is presented as a standalone application for Microsoft Windows. It was developed using the .NET framework version 1.1.