Lohmeyer

Air Quality | Climate
Aerodynamics | Environmental Software

Status: 28.03.2024

WinMiskam

... Miskam© for Windows
Manual

from version 2024.1.0

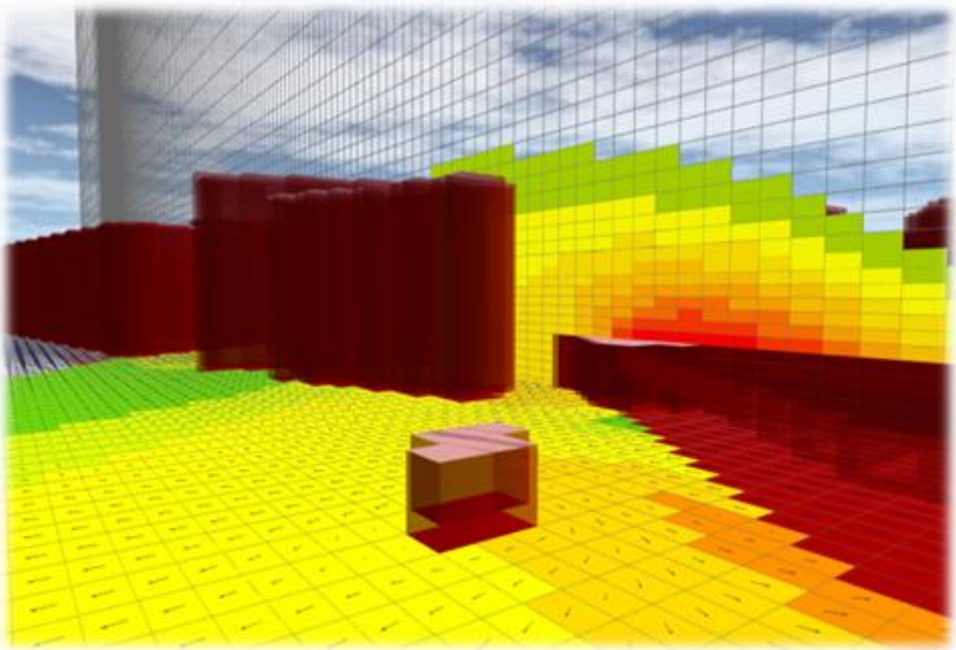

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Table of contents

1 CHANGES IN THE PROGRAM VERSIONS

Changes in WinMISKAM and MISKAM program versions.

1.1 WinMISKAM

Change in WinMISKAM program version 2024.1.0. compared to WinMISKAM program version 2019.6.1

- Complete redesign of the user interface (more modern, more intuitive, more compact, clearer, more accessible)
- New improved graphics, 3D view
- Based on a GIS system
- Introduction of a WinMISKAM project file for better project management
- More extensive legend settings
- Only the latest version of MISKAM (currently: MISKAM version 6.42 64bit, 22.10.2021) can still be used

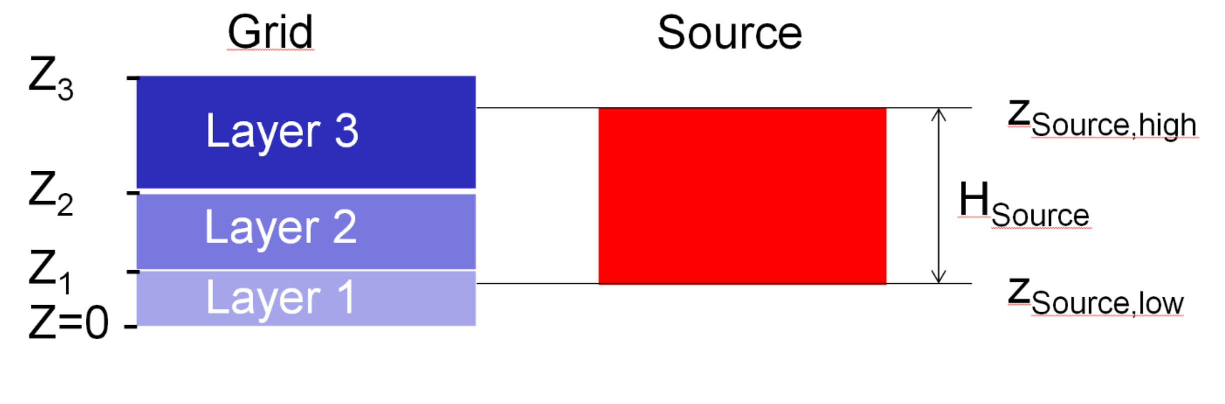
Change in WinMISKAM program version 2019.6.1 compared to WinMISKAM program version 2018.5.6.

- **MISKAM version 6.42** (64bit, 22.10.2021) applicable.
- **MISKAM version 6.3** (29.07.2014) only applicable as 64bit version.
- WinMISKAM add-on module Interface MISKAM wind and turbulence fields for AUSTAL: Austal2000 replaced by **AUSTAL 3**
- Licensing possible with new CodeMeter dongle
- Shape export function:
    - for PM10 and NOx additional column PM10_ExCnt or NO2_ExCnt (number of exceedances)
    - Additional column "u" and "v" for wind fields
- Calculation of statistical parameters: Additional option to save and load settings (*.skwcfg)
- When calculating individual points, the point name is written to the SKW file
- Internal adjustments/corrections

Change in WinMISKAM program version 2018.5.6 compared to WinMISKAM program version 2017.5.4.

- WinMISKAM add-on module Line sources:
    - Line sources are now also mapped to the MISKAM calculation grid in **underflow areas** (tunnels, passages, etc.).

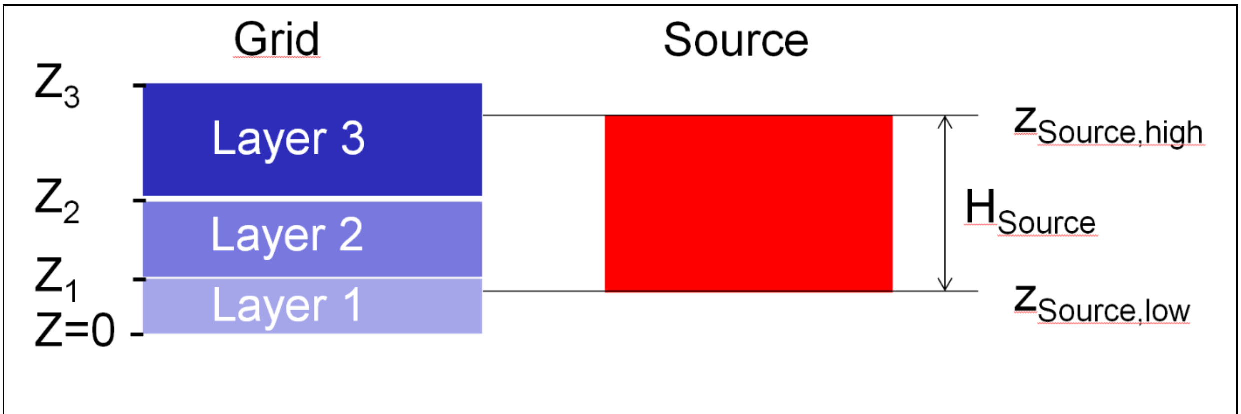
- All truncated vertical layers of the grid are assigned emissions that are weighted in proportion to their length, see example



Proportion of the emissions at cutted layers	
Method in WinMISKAM program version 2018.5.6	**Current method**
Layer 1: Proportion: z_1-$z_{Quelle,unten}$ / H_{Quelle}	Layer 1: Proportion: 1 / 3
Layer 2: Proportion: z_2-z_1 / H_{Quelle}	Layer 2: Proportion: 1 / 3
Layer 3: Proportion: $z_{Quelle,oben}$ – z_2 / H_{Quelle}	Layer 3: Proportion: 1 / 3

- Tab. 1.1

  Important note: If the lower edge and/or the upper edge of the source do not coincide with the layer heights of the MISKAM calculation grid, the current method provides a different vertical source distribution compared to the previous method and therefore a different pollutant concentration distribution. However, this does not affect the total amount of pollutants emitted.



Proportion of the emissions at cutted layers

Method in WinMISKAM program version 2018.5.6	Current method
Layer 1: Proportion: z_1-$z_{Quelle,unten}$ / H_{Quelle}	Layer 1: Proportion: 1 / 3
Layer 2: Proportion: z_2-z_1 / H_{Quelle}	Layer 2: Proportion: 1 / 3
Layer 3: Proportion: $z_{Quelle,oben}$ – z_2 / H_{Quelle}	Layer 3: Proportion: 1 / 3

Tab. 1.1: Example of mapping sources to the MISKAM calculation grid in the current version of the WinMISKAM add-on module Line sources

Change in WinMISKAM program version 2017.5.4 compared to WinMISKAM program version 2016.5.3:

- Shape export: new option "Screen area", new option "without rotation", settings "Load" and "Save" (indices)
- Maximum number of usable calculation cores increased to 36
- Complete integration of RosePlot (display, edit and import meteorological time series)
- Import of meteorological time series in uSonic3 format (dat)
- Internal adjustments / corrections

Change in WinMISKAM program version 2016.5.3 compared to WinMISKAM program version 2014.5:

- Calculation of statistical parameters: Extrapolation of the measured wind speed to reference height (= 100 m) with logarithmic profile. The previous method (= power law) can still be used.
- The anemometer position can lie within the MISKAM calculation area.
- In addition to Gauss-Krüger reference coordinates, UTM reference coordinates can also be used.
- Calculation of the mean velocity in horizontal sections in the MISKAM calculation area.

Change in WinMISKAM program version 2014.5 compared to WinMISKAM program version 2012:

- **MISKAM version 6.3** (08.11.2013) applicable.
- **MISKAM version 6.3 64bit** (08.11.2013) applicable.
- 3D visualization of building structures with horizontal sections.

Change in WinMISKAM program version 2012.4 compared to WinMISKAM program version 2011:

- Nitrogen oxide conversion implemented according to Düring et al. (2011).

- Grid generation generalized in vertical direction: As in horizontal direction, a grid can be generated that consists of several equidistant and non-equidistant partial zones.

Change in WinMISKAM program version 2011.4 compared to WinMISKAM program version 2010:

- **MISKAM Version 6.1** (12.11.2011) applicable[1] .
- Grid generation generalized in horizontal direction: A grid can be generated that consists of several equidistant and non-equidistant subzones.
- Source positions and source strength (if constant over time) can be imported from an AUSTAL2000.txt file

Change in WinMISKAM program version 2010.2.9 compared to program version 2008.2.3:

- **MISKAM version 6.00** (15.02.2010) applicable.
- **Multicore capability** for MISKAM calculations and menu item "Multiple flow angles ..." or batch mode and selection of "Multiple flow angles" in the "Batch mode" dialog. The number of calculation cores can be selected according to the available hardware. The maximum number of computing cores is currently set internally to 16.
- Check the road network for duplicate road segments and road segments shorter than 1 cm.
- The content of the Status dialog window is written to the LOG program subdirectory. The name of the log file is provided with the current date.

1.2 MISKAM

Changes to MISKAM 6.42 (16.11.2021) compared to MISKAM 6.3 (26.01.2020):

- For the lateral inflow profile, a roughness length can be selected that is no longer limited by the selected vertical screen grid, but results from the respective specific requirements, e.g. 2 m for a continuous urban character.
- The turbulent Schmidt number was adjusted. This results in very small differences in the concentrations compared to MISKAM 6.3. This adjustment has no influence on flow. The validation protocol for MISKAM 6.4 therefore continues to apply.

Changes to MISKAM 6.4 (26.01.2020) compared to MISKAM 6.3 (08.11.2013):

- Setting of the turbulence closure changed, the default setting is Kato-Launder closure. Kato-Launder-Lopez (default setting in MISKAM 6.3) can still be selected with parameter value 'el'.

[1] **Important note**: ZWU, ZWK files from MISKAM version 6.1 **cannot** be read by WinMISKAM 2010 and older WinMISKAM versions.

- Creation of the validation protocol in accordance with guideline VDI 3783 Sheet 9 (2017).

Changes to MISKAM 6.3 (08.11.2013) compared to MISKAM 6.1 (27.02.2011):

- Time step for turbulence calculation can also be split into four sub-steps
- Instabilities eliminated at very high grid resolution
- Improvement of the advection calculation through optional use of the McCormack scheme for the velocity components and the MPDATA algorithm for all scalars

Changes to MISKAM 6.1 (12.11.2011) compared to MISKAM 6.1 (27.02.2011):

- Corrections for vegetation
- Correction when importing "old" INP files that only contain floor and wall roughness (and not yet roof roughness)

Changes to MISKAM 6.1 (27.02.2011) compared to MISKAM 6.0 (15.02.2010):

- Roof and wall roughness can be selected separately.
- Corrections in the turbulence model

Changes in MISKAM 6.0 (15.02.2010) compared to MISKAM 5.02 (7.03.2007):

- Impulse advection optionally using MacCormack scheme and/or turbulence advection optionally using MPDATA scheme
- Corrections in the turbulence model
- Correction of the lateral boundary conditions in the dispersion model
- Revisions to reduce the computing time

2 INTRODUCTION

The WinMISKAM program system is a combination of a user-friendly interface (Lohmeyer GmbH) and the MISKAM calculation program (Eichhorn University Mainz[2]). MISKAM (Microscale Climate and Dispersion Model) is a three-dimensional non-hydrostatic flow and dispersion model for small-scale forecasting of wind distributions and immission concentrations in built-up areas. The simulation of the influence of buildings and other obstacles on the flow conditions is made possible in the form of rectangular block structures.

WinMISKAM's user-friendly interface allows you to create the input files required for the calculation. Based on digital plan and map templates, it is possible to record the buildings, sources, vegetation and flow and to define the calculation grids on the screen. The digitized data is transferred to the calculation grids using WinMISKAM. WinMISKAM offers the calculation of individual cases and the automated batch processing of several individual cases. The calculated concentration fields can be used for the calculation of statistical characteristic values on the basis of given wind statistics. A generally prevailing homogeneous pollutant preload or a preload of an existing road network calculated by the PROKAS program system can be taken into account.

This manual explains the functions of the WinMISKAM program system. If you still have any questions regarding project processing with WinMISKAM or the MISKAM calculation model, please contact the hotline on 0351 83914 0. The current manual and the latest additions to it can be found at https://www.lohmeyer.de/softwarevertrieb/produktuebersicht/winmiskam.

2.1 Installation

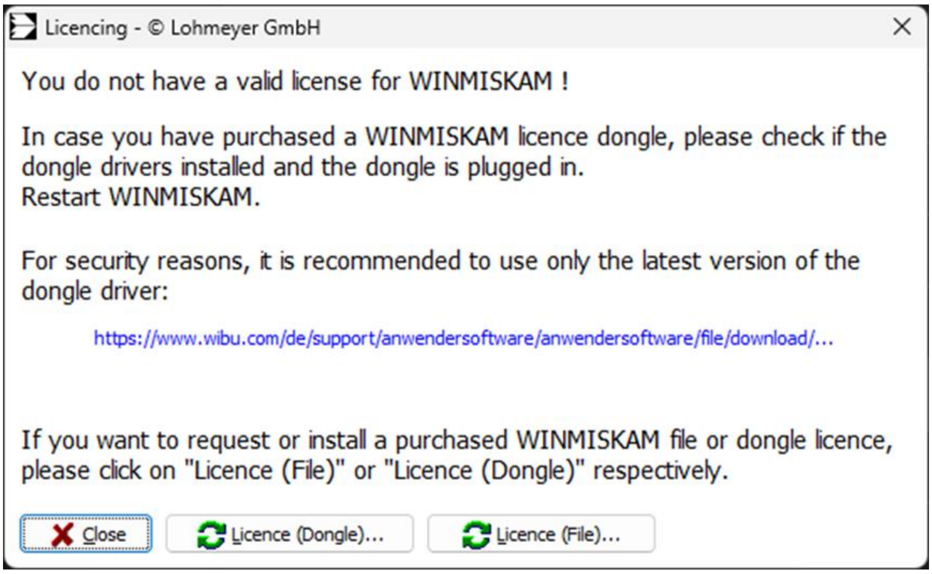
The WinMISKAM program system was developed and tested for the Windows 11 operating system. WinMISKAM is installed by executing the Windows installation file "setup.exe". Follow the instructions of the installation program.

The WinMISKAM program system is available as a single license. The license key is registered with a license file or a USB dongle. To install the dongle device driver required for dongle licensing, run the supplied file "CodeMeterRuntime.exe" and follow the instructions of the installation program.

(Download: https://www.wibu.com/de/support/anwendersoftware/anwendersoftware.html).

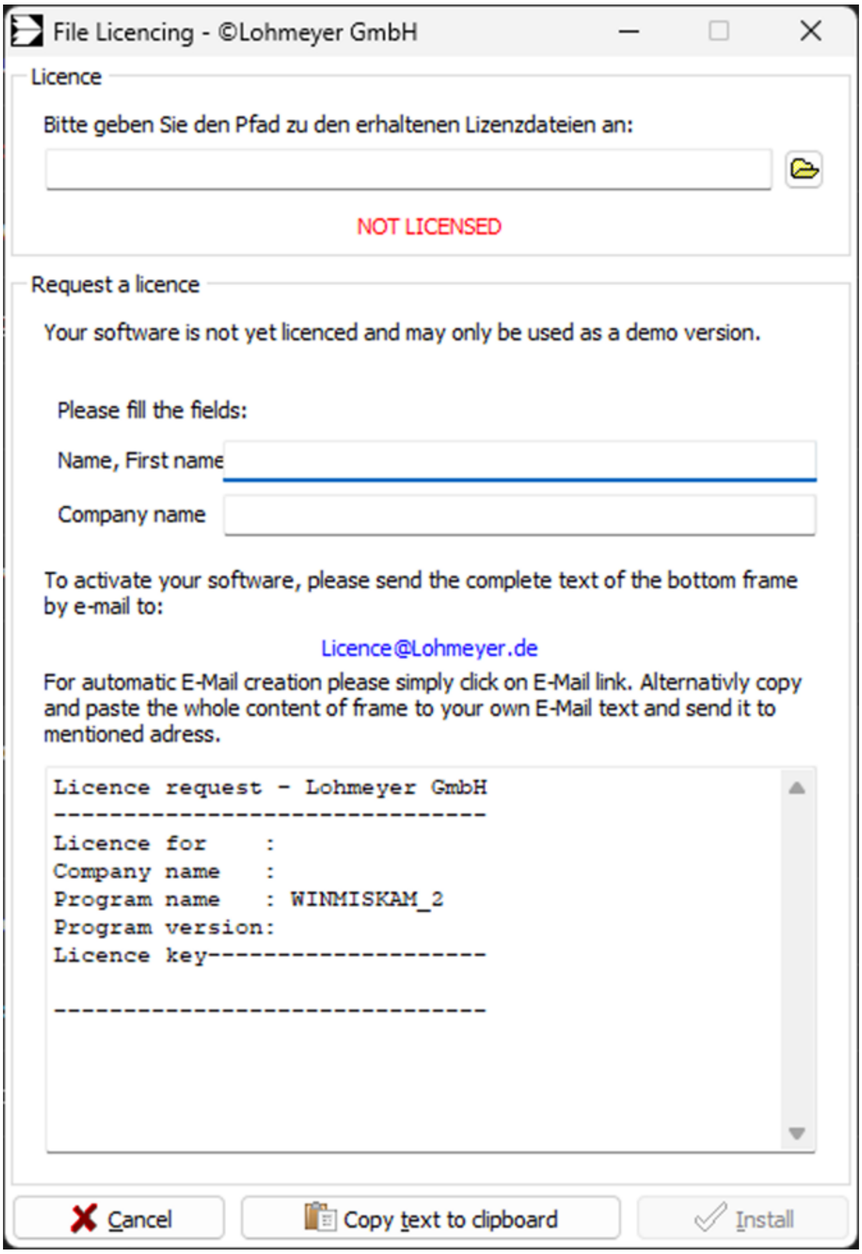
[2] Dr. J. Eichhorn, Urban Climate Working Group, Institute of Atmospheric Physics, Johannes Gutenberg University, D-55099 Mainz

When the program is started for the first time, if no license is available or the license dongle is not plugged in, the *Licensing* window appears.



If a WinMISKAM license dongle is connected to the PC, click on the *License (dongle)* button. Further explanations can be found in section 3.2.6.

However, if you intend to install a (temporary) file-based license, click on *License (file).* The following dialog for file licensing appears.



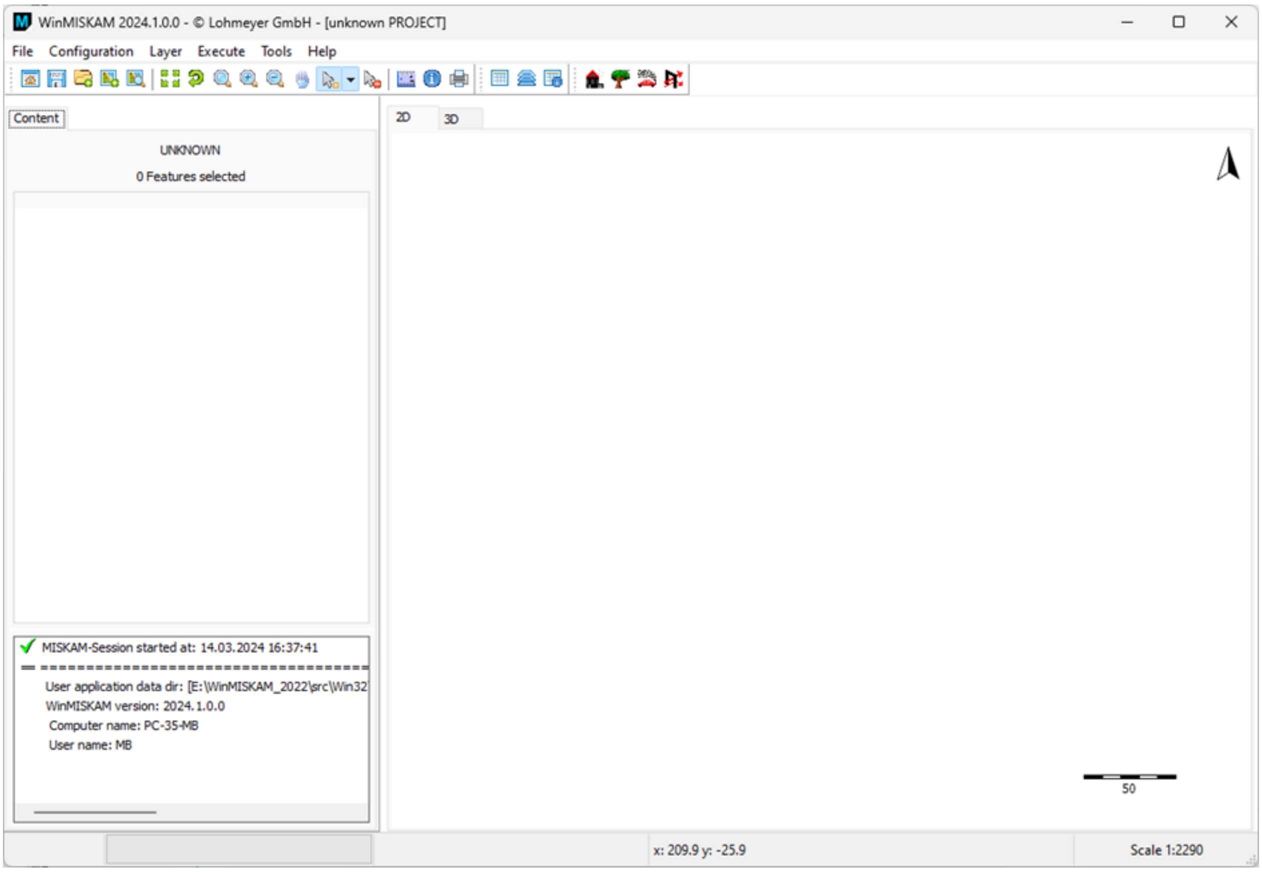
Fill in the fields and send us the complete text from the text window by e-mail to licence@Lohmeyer.de.

You will then receive a license file whose folder path you must enter in the same dialog box above. Click on the *Install*

button to install the license.

During installation, under Windows the file extension *.mip is linked to the WinMiskam program so that double-clicking on the file starts WinMiskam and loads the file.

If a valid program license is available, the following main window appears when the WinMISKAM program is started.



2.2 Preliminary remarks

The WinMISKAM program system is described using the available menu items and in the sequence of a new project to be processed.

In contrast to earlier WinMISKAM versions (up to version 1.94), calculations can also be carried out in other directories. More detailed descriptions can be found in Sect. 5.4.

The following files with the corresponding file extensions are required or generated by **MISKAM** (**Tab. 2.1**):

Files with file extension	**Input/Output**	**Contents**
*.inp	Input	Grid definition, building configuration, Source definition. **Central input file**, (ASCII)
*.ini	Input	Control parameters for MISKAM run (ASCII)
*.001	Input	Mesh boxes with air flow

Files with file extension	Input/Output	Contents
*.002	Input	Mesh boxes with vertical impulse
*.003	Input	Calculation boxes with vegetation definition
*.con	Output	Concentration field (ASCII)
*.prs	Output	Log file for MISKAM flow calculation
*.pra	Output	Log file for MISKAM dispersion calculation
*.tur	Output	Turbulence field (ASCII)
*.uvw	Output	Wind field (ASCII)
*.zwk	Output	Concentration field (binary)
*.zwt	Output	Turbulence field (binary)
*.zwu	Output	Wind field (binary)

Tab. 2.1: Input and output files of MISKAM

Files with the following file extensions are also required or generated by WinMISKAM (**Tab. 2.2**):

Files with file extension	Input/Output	Contents
*.bln	Input	Building inventory file (polygons) that can be imported into WinMISKAM. ASCII-file in Golden Software blanking format [3]
*.bxr	Input/Output	Grid definition and digitized buildings
*.egx	Input	Emission hydrograph files for the calculation of statistical parameters for vehicle traffic analyses
*.ezw	Output	Single value file, which can be optionally activated during the calculation of statistical parameters and serves as an interface to PROKAS
*.ini	Input/Output	Parameter file for flow/dispersion calculation
*.log	Output	Assignment file between file names and wind directions (required for the calculation of static parameters)
*.mip	Input/Output	Project file in which all settings, configurations and all references to the files loaded into the project are saved.
*.pkt	Output	Created during the calculation of statistical parameters and contains the midpoints of all lower boxes

[3] https://surferhelp.goldensoftware.com/subsys/subsys_gsibln_hid_gsibln_filedesc.htm

Files with file extension	**Input/Output**	**Contents**
*.prj	Input/Output	Contains information about the coordinate system of the shape file that is required for the correctly projected display together with other data
*.shp	Input/Output	ESRI shape file format for importing road, building or vegetation data, as well as for loading and displaying other data in the GIS interface
*.skw	Input/Output	Statistical parameters (annual mean value and percentile value)
*.skwcfg	Input/Output	Parameter file for the calculation of statistical parameters
*.ttkstyle	Input/Output	Parameter file for legend display
*.vgr	Input/Output	Parameter file for calculation grid definition
*.wfp	Input/Output	Parameter file for MISKAM-AUSTAL coupling
*.wnd *.aks *.akt / *.akterm	Input	Wind statistics (only for the calculation of statistical parameters)

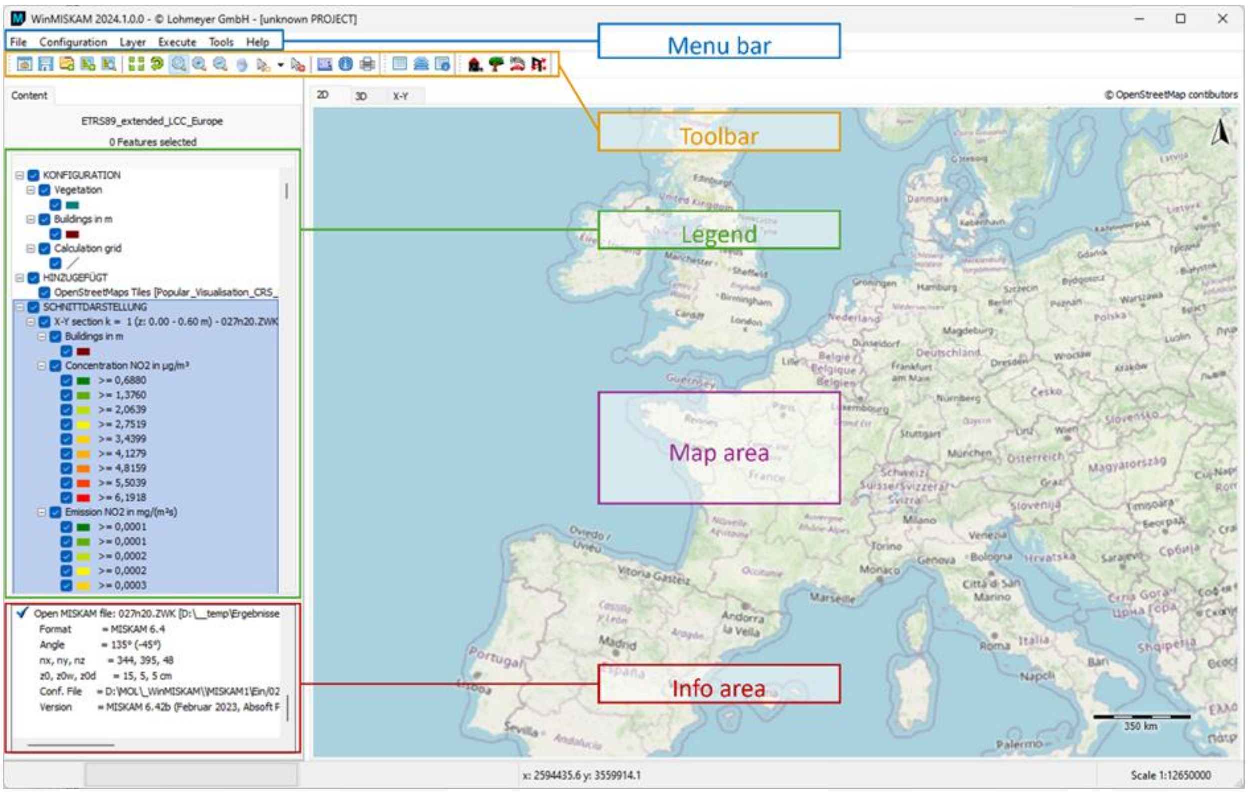
Tab. 2.2: Input and output files of WinMISKAM

3 THE MAIN COMPONENTS OF WINMISKAM

3.1 Program interface

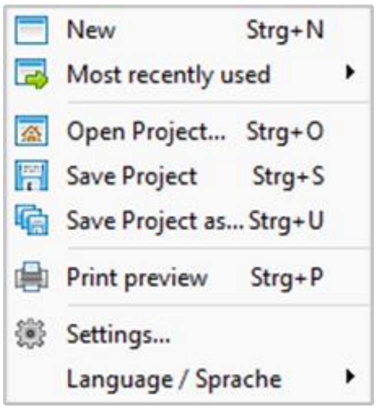
The following illustration shows the Windows program interface of WinMISKAM. This consists of the 5 main areas described in detail below:

- Menu bar
- Toolbar
- Legend
- Map area
- Info area.



3.2 Menu bar

3.2.1 File menu



New (Ctrl + N)
Starts a new empty project.

Most recently used
Shows the list of recently used projects. Click on the project to open it.

Open project... (Ctrl + O)
Opens an existing project (*.mip).

Save project (Ctrl + S)
Saves the current project (*.mip) for later use.

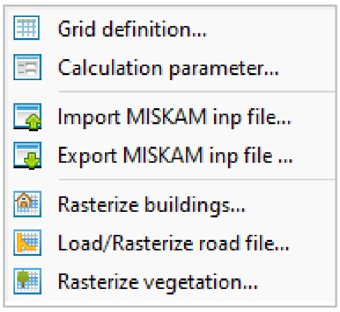
Save project as... (Ctrl + U)
Saves the current project (*.mip) under a different name.

Print preview (Ctrl + P)
Opens the print preview in the map area (click again to close the print preview, see Chap. 9).

Settings...
Opens the dialog for the program settings for WinMISKAM (see Chap. 11).

Language / Sprache
Opens the language selection as a submenu.

3.2.2 Configuration menu



Grid definition...

Opens the WinMISKAM computational grid dialog for defining the computational grid (see Sect. 4.2).

Calculation parameter…

Opens the calculation settings dialog for defining all relevant parameters for the MISKAM calculation (see Chap. 5).

Import MISKAM configuration (inp)...

Selection of a configuration file which is imported and displayed in WinMISKAM. The selected file is not edited. Only the data is read out (see Sect. 4.1).

Export MISKAM configuration (inp)...

Exports the current configuration to an inp file (see section 4.1).

Rasterize buildings...

Opens the building gridden dialog after selecting a file with building information (*.shp or *.bln). This dialog can be used to transfer buildings (location and height) from a file to the WinMISKAM box system (see section 4.4.1). 4.4.1).

Load/rasterize road file...

Opens the Load/grid road file dialog. In this dialog, the road shape is loaded and a column assignment is made to the required data of the shape file. The road file can only be loaded for further editing or gridded immediately (see section 4.4.2).

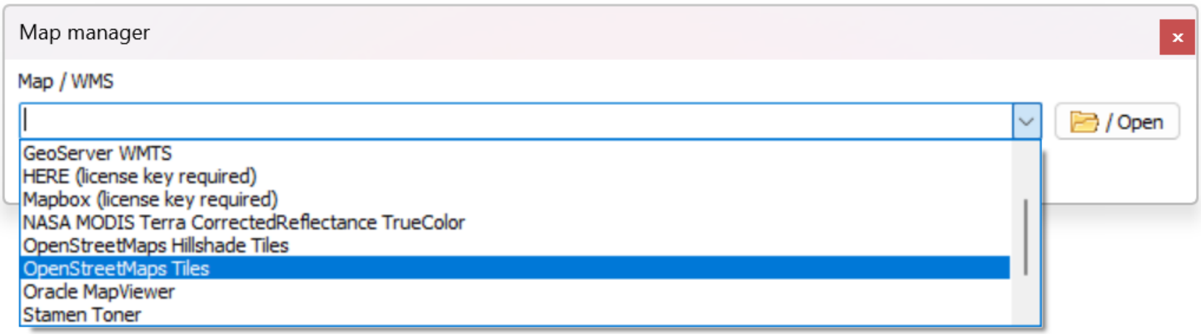
Rasterize Vegetation...

Opens the Import Vegetation dialog in which a vegetation shape can be selected, which is then gridded into the WinMISKAM box system (see Sect. 4.4.3).

3.2.3 Layer menu

Display sectional view…
Opens the display dialog after selecting a file (inp, zwk, zwu, zwt, skw). The settings required for the 2D section display are made in this dialog (see Chap. 8).

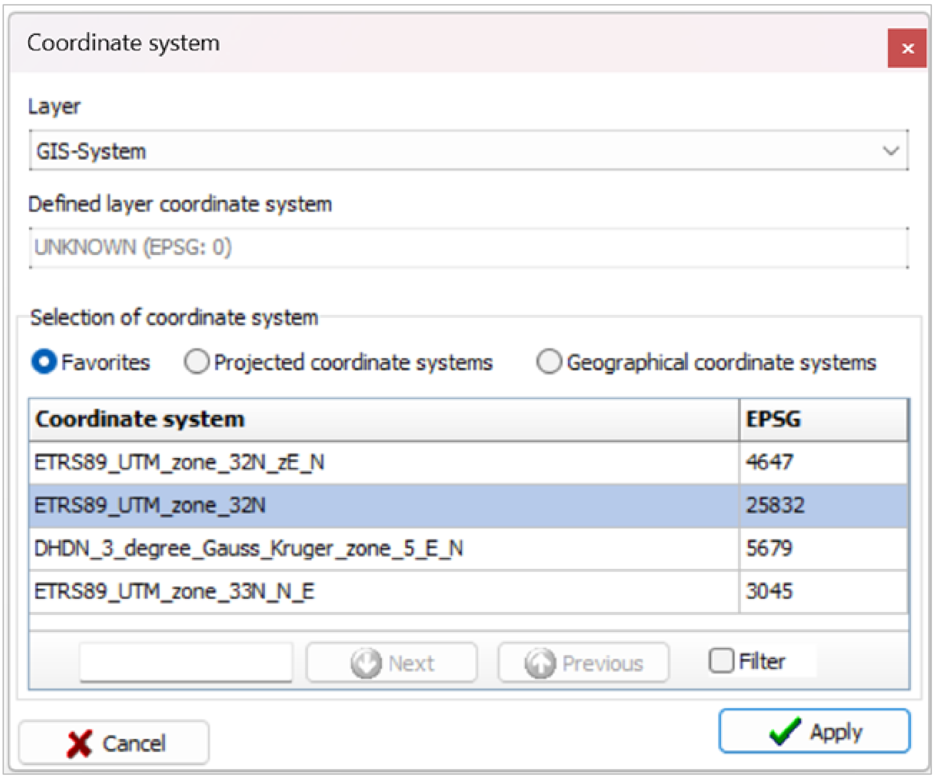
Add Map... (Ctrl + K)
Opens the map manager and allows you to load and display georeferenced image files (offline) and/or web map services (WMS/WMTS) [note licenses]. The maps loaded as GIS layers are for information purposes only and are not taken into account in any calculations.



Add layer... (Ctrl + D)
Enables the loading and display of additional vector-based and/or raster-based files. The files loaded as GIS layers are for information purposes only and are not taken into account in the incident calculation.

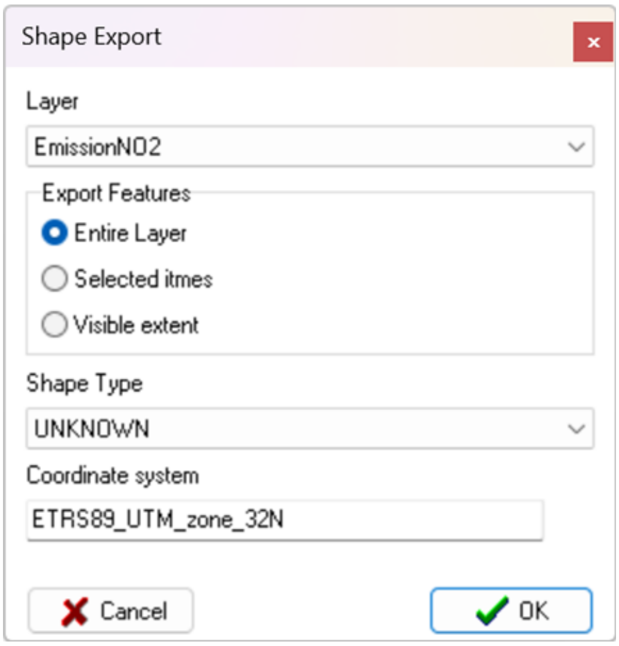
Georeferencing... (Ctrl + G)
Opens the Georeferencing dialog, which allows you to georeference an uploaded image (see section. 4.5).

Coordinate system... (Ctrl + P)
Opens the coordinate system dialog to define the coordinate system of a GIS layer or the map area. The *Layer* selection box is used to select the object for which the coordinate system is to be changed.

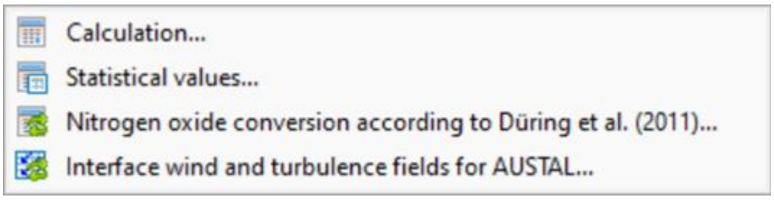


Export... (Ctrl + E)

Selected GIS layers can be exported in shape format (*.shp).



3.2.4 Execute menu



Calculation...

Opens the calculation settings dialog and allows you to start a MISKAM flow calculation and/or dispersion calculation for a single situation or for several angles of attack (see section 5.6.1). 5.6).

Statistical values...

Opens the Statistical characteristic values dialog. In this dialog, all settings for the calculation of the statistical characteristic values are made and the calculation is started (see Chap. 6).

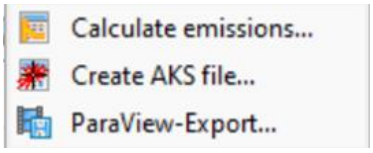
Nitrogen oxide conversion according to Düring et al. (2011)...

Opens the dialog for the calculation of the nitrogen oxide conversion according to Düring et al. (2011) (see Chap. 7).

Interface wind and turbulence fields for AUSTAL

Opens the dialog Interface wind and turbulence fields for AUSTAL (see Chap. 12).

3.2.5 Tools menu



Calculate emissions... (add-on module: PROKAS_E)

This menu item starts the additional module "Calculate emissions - PROKAS_E". For more information on the "Calculate emissions - PROKAS_E" program section, see PROKAS_E Help.

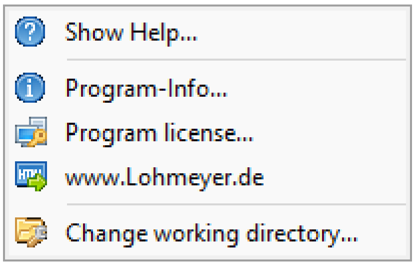
Create AKS file...

This menu item starts the "RosePlot" add-on module. For further information on the "RosePlot" program section, see RosePlot Help.

ParaView-Export...

In the "ParaView Export" window that opens, a MISKAM wind field file (*.zwu) or a MISKAM file with concentration values (*.zwk) can be specified as the input file. The storage location for the ParaView file (*.vtk) to be generated is selected in the "Output" field. The export to a *.vtk file under the menu item *Graphic|ParaView export* can also be carried out if no WinMISKAM project is open.

3.2.6 Help menu



Show help...

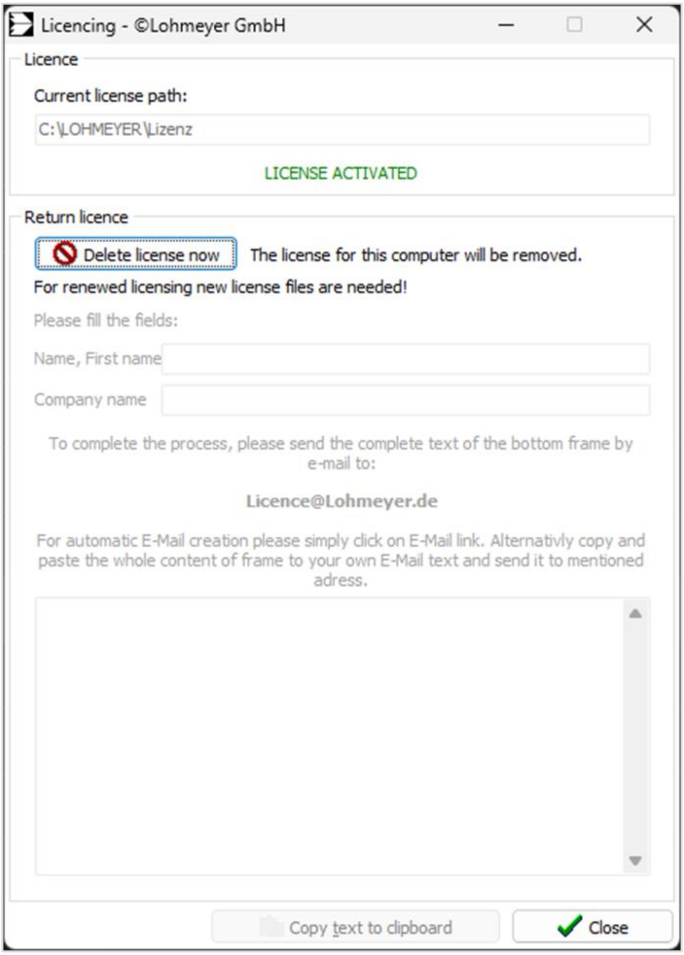
Opens this help.

Program-Info...

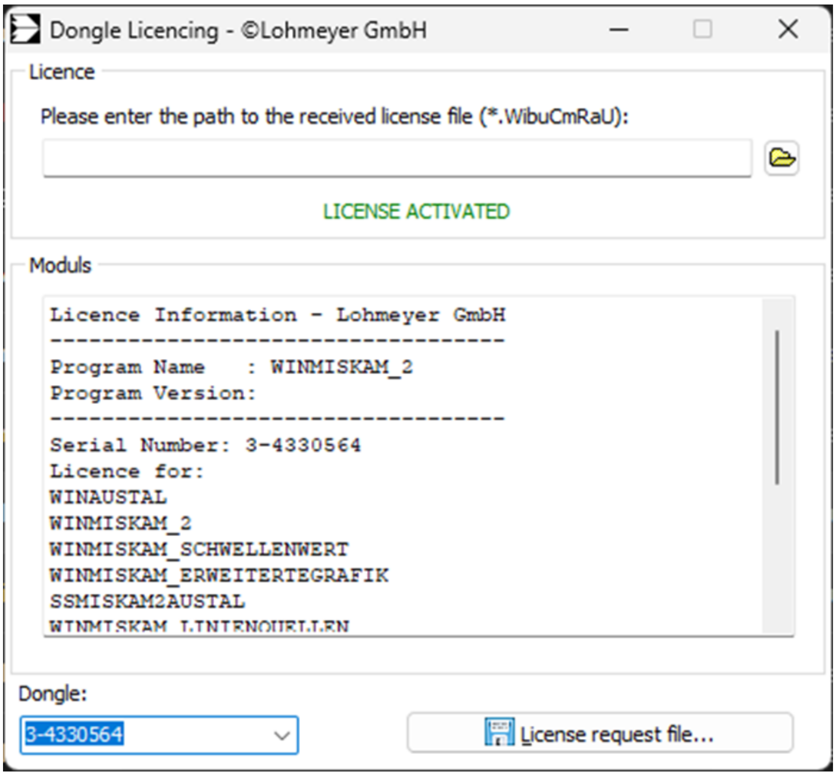
Shows information about WinMISKAM (version number, program directory, working directory, log file, etc.)

Program license...

Shows information on the WinMISKAM license and, in the case of file licensing, enables the return of the computer-bound license for subsequent relicensing on another PC.



If the program was started using a dongle license, the *Dongle Licensing* dialog appears.



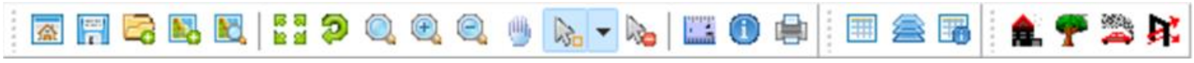
Via the selection list headed with *Dongle:,* the appropriate dongle can be selected using the serial number, a number combination imprinted on the dongle starting with "3-". The license information stored on the selected dongle appears in the *Modules* text field.

If you have purchased an additional program module or received a program update for which you need a new license for your dongle, you must first create a request file (*.WibuCmRaC). Click on the *License request file...* button to specify where this request file should be saved. Send it by e-mail to licence@lohmeyer.de. You will then receive a license update file (*.WibuCmRaU) from us, the path of which you can enter at a later date on the same form above. The update will then be installed automatically on the selected dongle.

www.Lohmeyer.de
Link to our website with useful additional information.

Change working directory...
Allows you to select the working directory used by WinMISKAM. By default, the working directory corresponds to the installation directory (for standard installation under C:\Lohmeyer\WinMISKAM). The working directory used must have write permissions. If the working directory has not been assigned write permissions by the operating system, a directory with write permissions must be selected.

3.3 Toolbar



3.3.1 Project management

Open project
Opens an existing project (corresponds to the function in the "File" menu).

Save project
Saves the current project for later use (corresponds to the function in the "File" menu). A "Save as" dialog opens to select the storage location and the project name and finally save it.

Open file
Adds data from a file on the computer to the project (building, terrain, etc., corresponds to the function in the "Visualization" menu).

Search
Searches for addresses or coordinates and zooms the map to the location. A map must have been loaded beforehand using the "Open map" command.

Open map
Opens the map manager to add map data that is on the PC or can be downloaded from various services on the Internet [note licenses] (corresponds to the function in the "File" menu).

3.3.2 Map view/info

Full expansion
Zooms the map area to the maximum extent .

Refresh display
Updates all GIS layers, maps and images displayed in the map area.

Zoom (tool remains activated until another tool is selected)
Enlarges the view to the area selected by dragging a rectangle in the map area (dragging from left to right = enlarge, dragging from right to left = reduce).

Enlarge (single action by clicking on the icon)
Enlarges the view in the map area by one zoom level per click. The reference point is the center of the image. The mouse wheel can also be used for zooming.

Reduce (single action by clicking on the icon)
Reduces the view in the map area by one zoom level per click. The reference point is the center of the image. The mouse wheel can also be used for zooming.

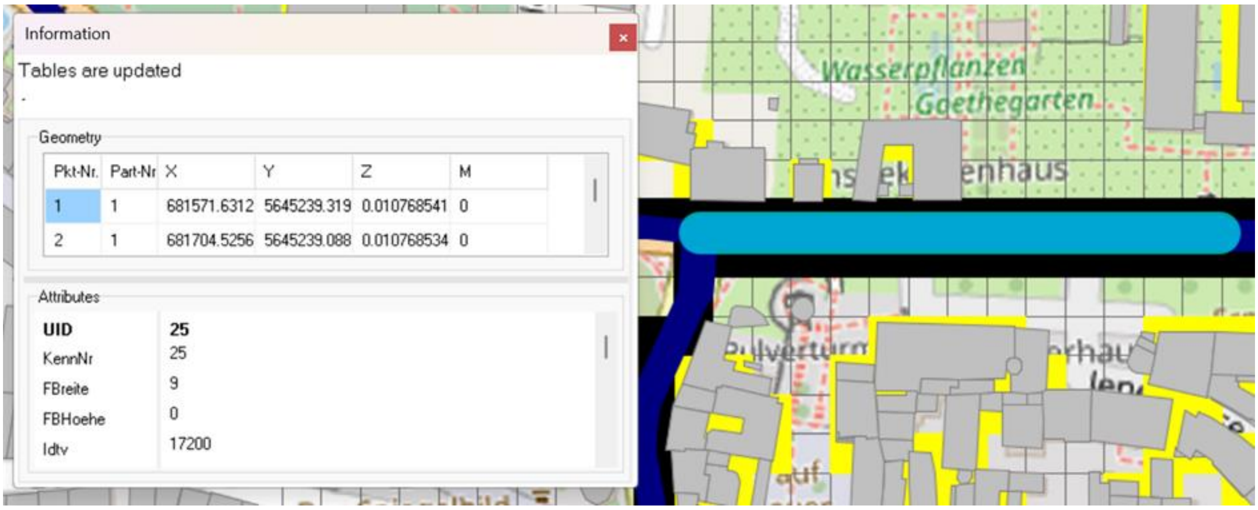
Move (tool remains activated until another tool is selected)
Moves the view in the map area by holding down the mouse button. When using map material from web services, data that is not yet available is automatically reloaded. Depending on the Internet connection and server load of the map service, this may result in delays.

Select (tool remains activated until another tool is selected)
Enables the selection of WinMISKAM boxes on the calculation grid.

Cancel selection
Deselects all elements in the map area.

Measure (tool remains activated until another tool is selected)
Allows you to measure the distance between two points.
The first point is defined
by clicking in the map area. When moving the mouse, a thin line indicates the distance being measured. The length of the measured distance is displayed in a small window at the top left of the map area. Clicking with the left mouse button on the end point completes the measurement of the distance between the two points clicked on.

Shape info (tool remains activated until another tool is selected)
Click on the info button and then click in the map area to display the attributes for the selected shape.



Print
Opens the print preview (see Chap. 9, corresponds to the function in the "File" menu). Click on this button again to exit the print preview and return to the map view.

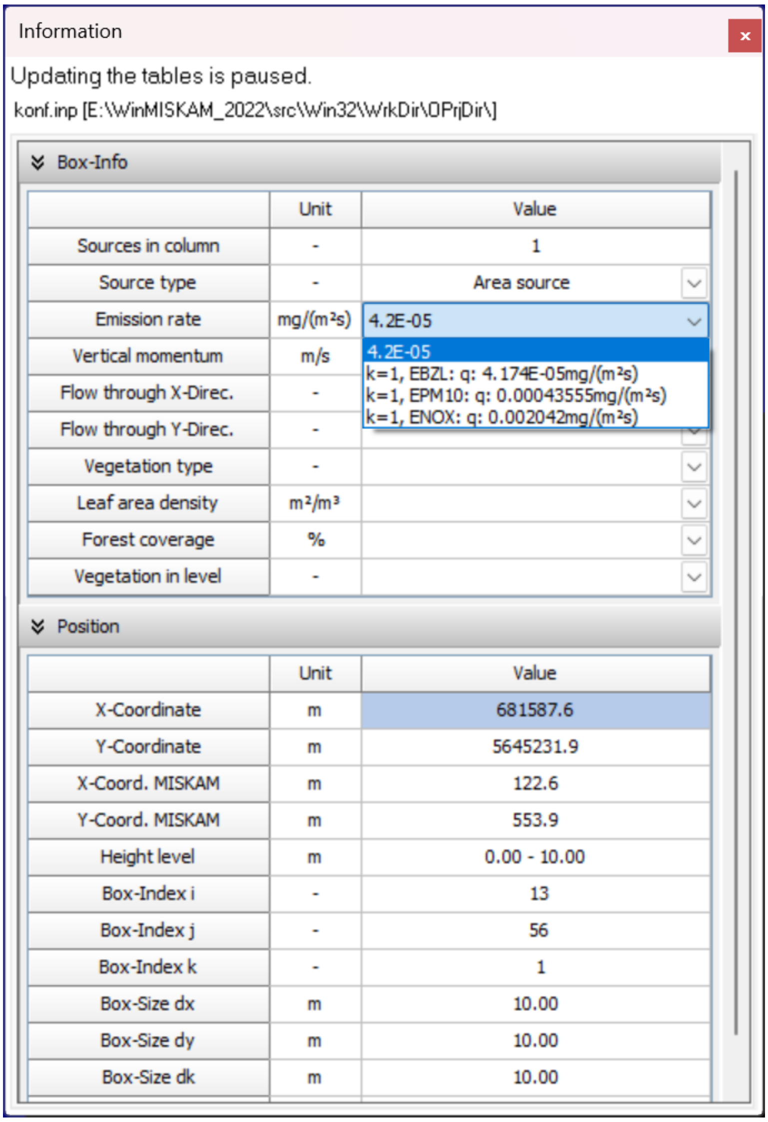
Screen grid
Opens the Define calculation grid dialog. (corresponds to the function in the "Calculation grid..." menu)

Sectional view

Allows you to load a file for 2D sectional view (corresponds to the 2D sectional view described in Chap. 8 function in the "Sectional view..." menu)

Info

Opens an information window in which detailed information on a MISKAM box is displayed. The information is automatically updated when the mouse is moved over the map area. Left click on the map area to pause the update and read out all the box values. Another click on the map area starts the update.



3.3.3 Digitization

Building

Opens the dialog for digitizing buildings (see Sect. 4.3.1).

Vegetation
Opens the dialog for digitizing vegetation (see Sect. 4.3.2).

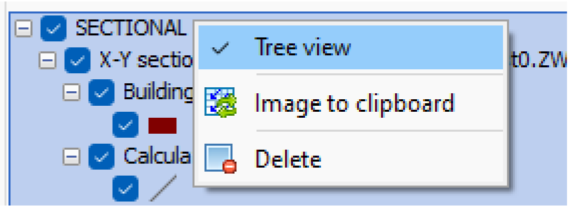
Sources
Opens the dialog for digitizing sources (see section 4.3.3).

Flow
Opens the dialog for digitizing flows (see section 4.3.4).

3.4 Legend

The legend contains all GIS layers that can be displayed in the map area. The legend structure adapts to the active map tab (2D, 3D, XY, ...). By clicking with the left mouse button on the checkbox in front of the layer, a legend category, a GIS layer or an entire GIS layer group can be made visible or invisible, recognizable by the checkmark or missing checkmark in the respective checkbox.
By default, the layers are displayed in the so-called *tree view*. The order of the GIS layers does not necessarily correspond to the display order in the map area. If the display sequence is to be changed, you must switch from the tree *view* to the *layer view* of the legend (see Chap. 10).

3.4.1 Context menu main group

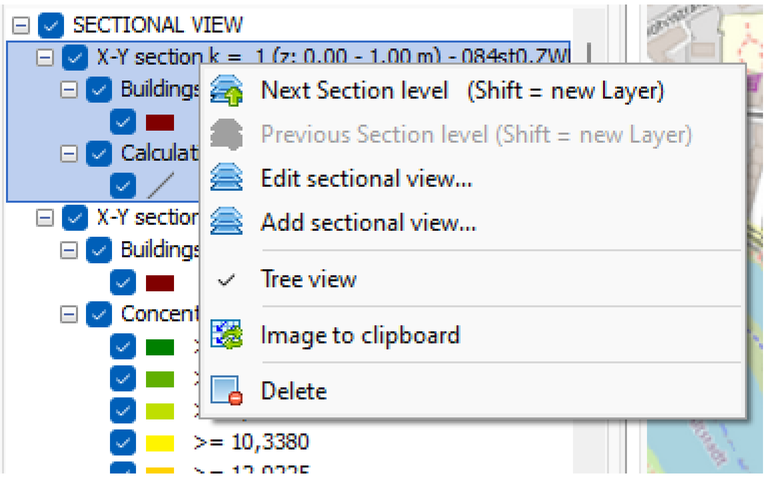


Tree view
Activates and deactivates the tree view of the legend. In the tree view, the GIS layers are grouped and a project structure is displayed. If the tree structure is deactivated, the GIS layers are displayed without grouping in the order in which they lie on top of each other in the map area (= *layer view*). The order of the layer display can only be changed in the *layer view.* To do this, the position of the GIS layer is moved up or down using drag and drop with the mouse.

Delete
Deletes the selected group with its subgroups and GIS layers.

Image to clipboard
Copies the legend as an image to the clipboard.

3.4.2 Context menu section display group



Next Section level
Increases the k-level of the selected cut and replaces the current cut display group.

Previous section level
Decreases the k-level of the selected cut and replaces the current cut display group.

Edit sectional view...
Opens the section display dialog in which all parameters for the display of the section can be edited. After confirming the entry, the selected group is recreated with the set parameters. More detailed explanations of the setting options are provided in Chap. 8 are given.

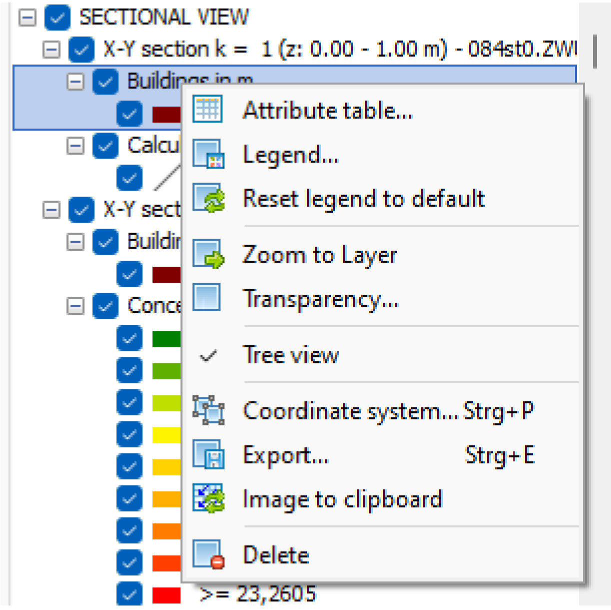
Add sectional view...
Opens the *Section view* dialog *to load* a new section from the selected file. More detailed explanations of the setting options are provided in Chap. 8 are given.

Tree view (see Sect. 3.4.1)

Image to clipboard
Copies the legend as an image to the clipboard.

Delete
Deletes the selected sectional view group with its GIS layers.

3.4.3 Context menu GIS layer



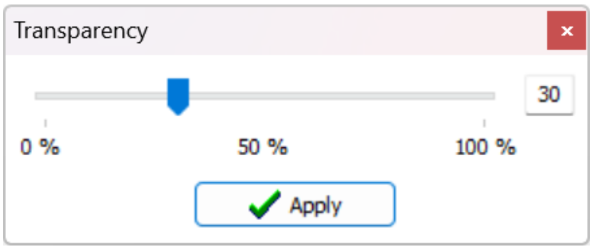
Attribute table...
Opens the attribute table of the selected GIS layer.

Legend...
Opens the Legend dialog. Used to adjust the legend settings for GIS layers (see Chap. 10).

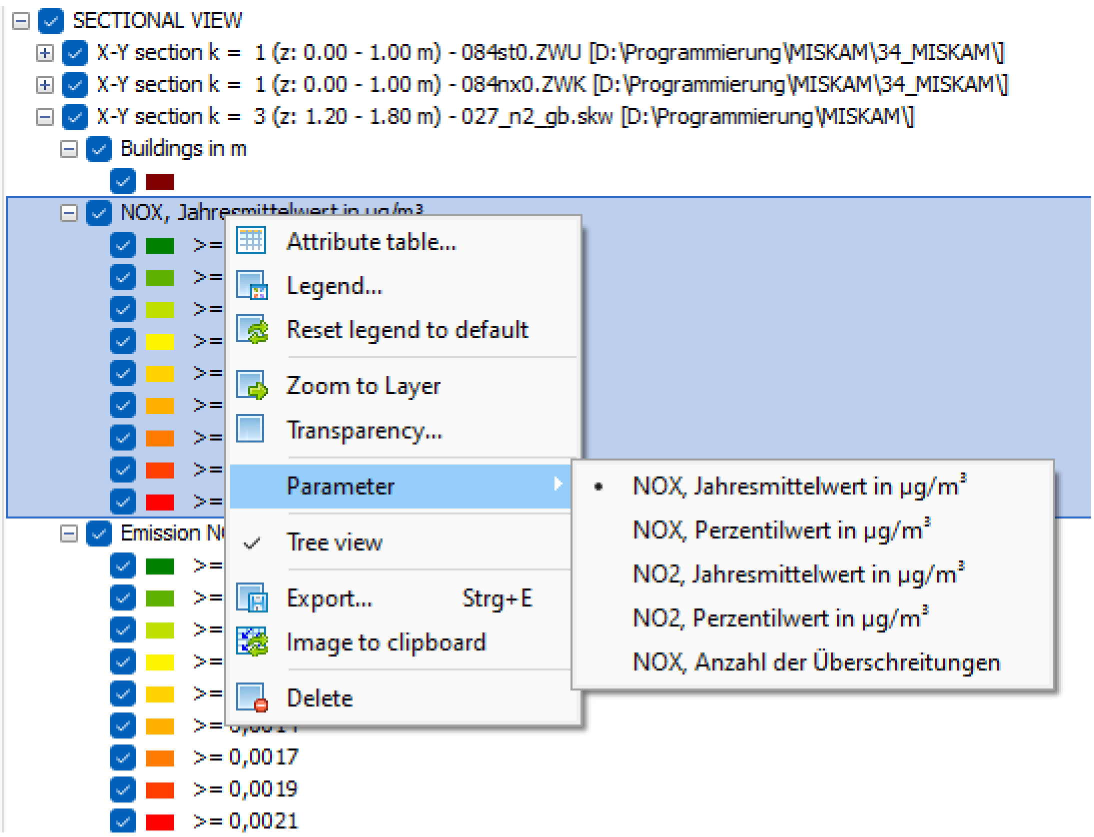
Reset legend to default
Resets the legend to the default settings of the program. The default settings can be specified by the user.

Zoom to Layer
Sets the section in the map area to the selected GIS layer.

Transparency
Opens a dialog box where the transparency of the selected GIS layer can be defined.



Parameter
This selection is only available in the case of a GIS layer that contains statistical characteristic values (data from an SKW file) and allows you to view and select a data set for the legend display



Tree view (see Sect. 3.4.1)

Coordinate system... (Ctrl + P) (see Sect. 3.2.3)

Export (Ctrl + E) (see section 3.2.3)

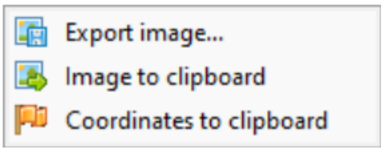
Image to clipboard
Copies the legend as an image to the clipboard.

Delete (see Sect. 3.4.1)
Deletes the selected GIS layer.

3.5 Map area

3.5.1 Context menu

Right-click in the map area to open the context menu with the following functions:



Export image...
Allows you to save the displayed map area in a standard image format (*.jpg, *.bmp, *.png).

Image to clipboard
Copies the displayed map area to the Windows clipboard.

Coordinates to clipboard
Copies the coordinates of the mouse position to the Windows clipboard.

3.5.2 Representation

You can switch between 5 tabs in the map area. The *2D* and *3D* tabs are always available by default. As soon as a section is loaded, the corresponding tab appears, e.g. if a horizontal section (X-Y section) is loaded, the X-Y tab appears.

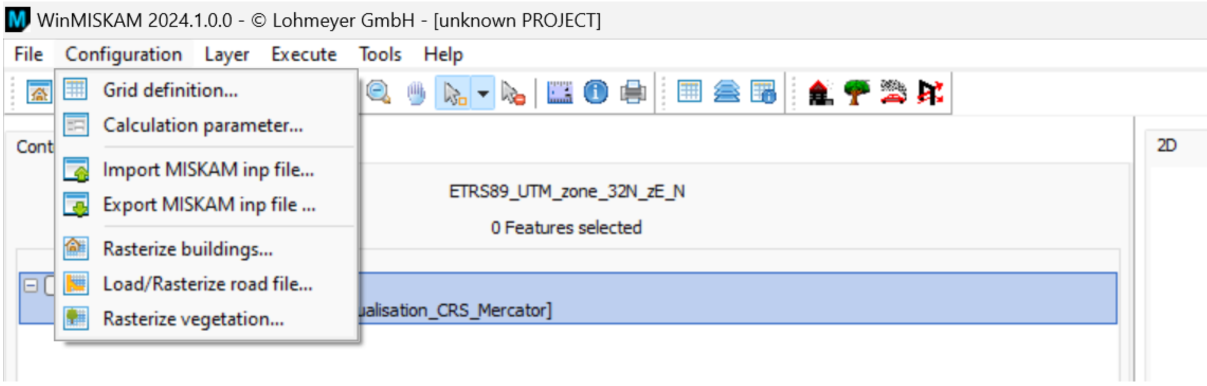
The 2D and 3D tabs contain the configuration sectional views and added GIS layers. The X-Y, X-Z and Y-Z tabs only contain the sectional views of the respective group. The selection of the tabs influences the display in the map area and the legend.

3.6 Info area

The program writes status messages in this area, similar to a log file.

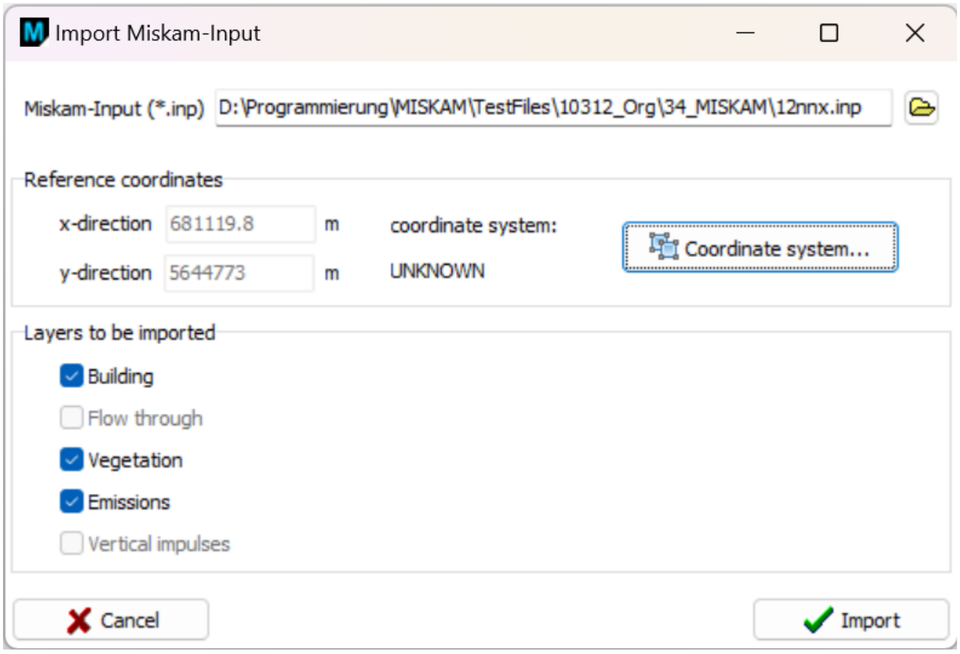
4 CONFIGURATION

Editing projects in WinMISKAM is only possible if a new configuration file is created or an existing one is loaded. Without a configuration file, most menu items are not functional. Creating or changing is done under the *Configuration* menu item. A configuration can be opened via the menu item *Open MISKAM configuration (inp)...* or newly created via the menu item *Grid definition....*



4.1 Import/export configuration

To open a configuration file, an INP file must be selected under the *Configuration|Import MISKAM inp file...* menu item. As soon as a file has been selected, the *Import Miskam input* dialog opens.

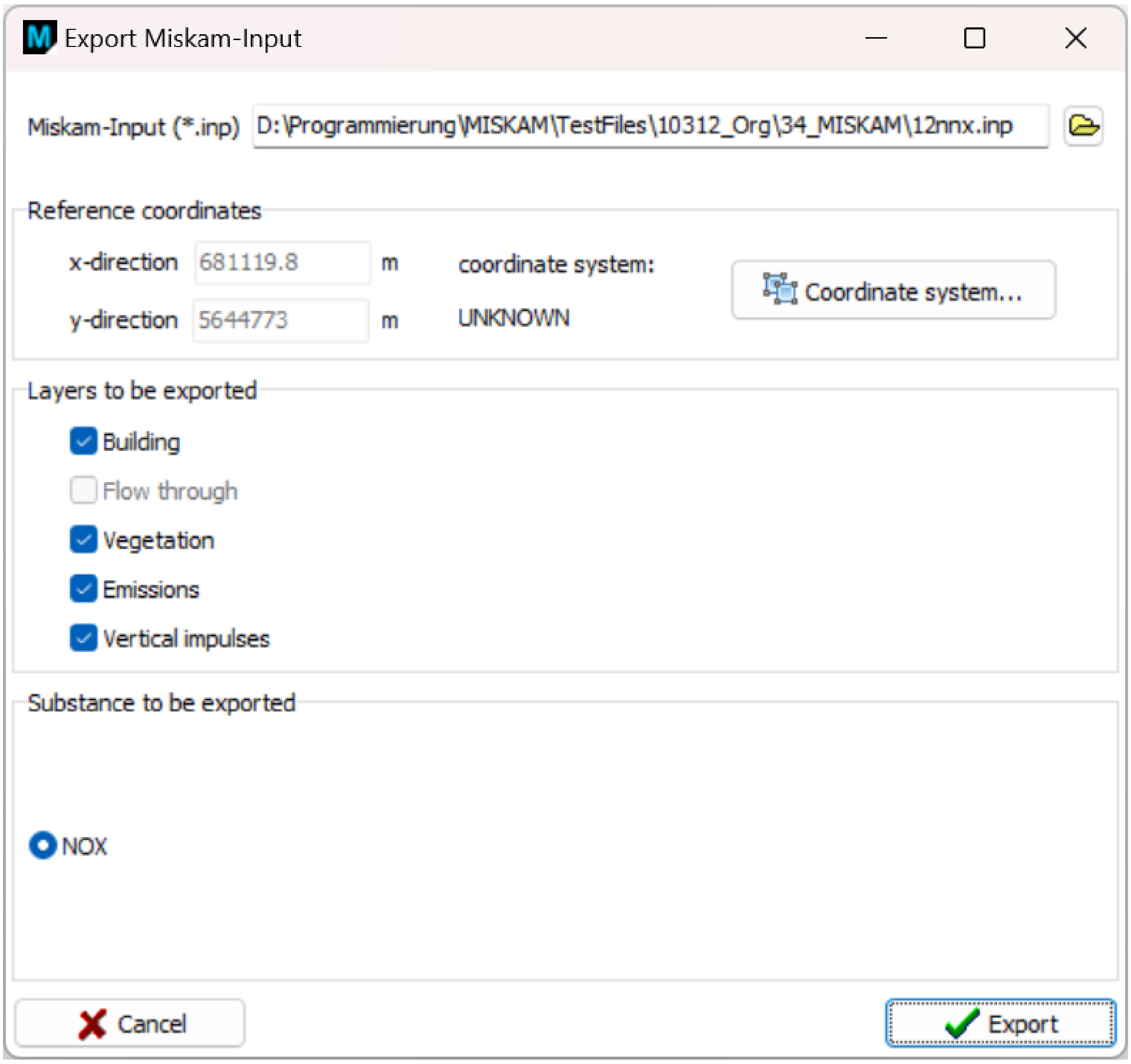


The reference coordinate of the INP file is displayed in the *Reference coordinates* group for checking purposes. The coordinate system is automatically set to the coordinate system of the map area. This must be checked and, if necessary, adjusted using the *Coordinate system...* button.

The *Layers to be imported* group contains several checkboxes which are used to import only certain data. In some cases, this can improve the performance of WinMISKAM if only the really required data is loaded.

The *Flow through, Vegetation and Vertical impulses* checkboxes are only activated if the corresponding (001, 002, 003) files have the same file name and are in the same folder as the INP file.

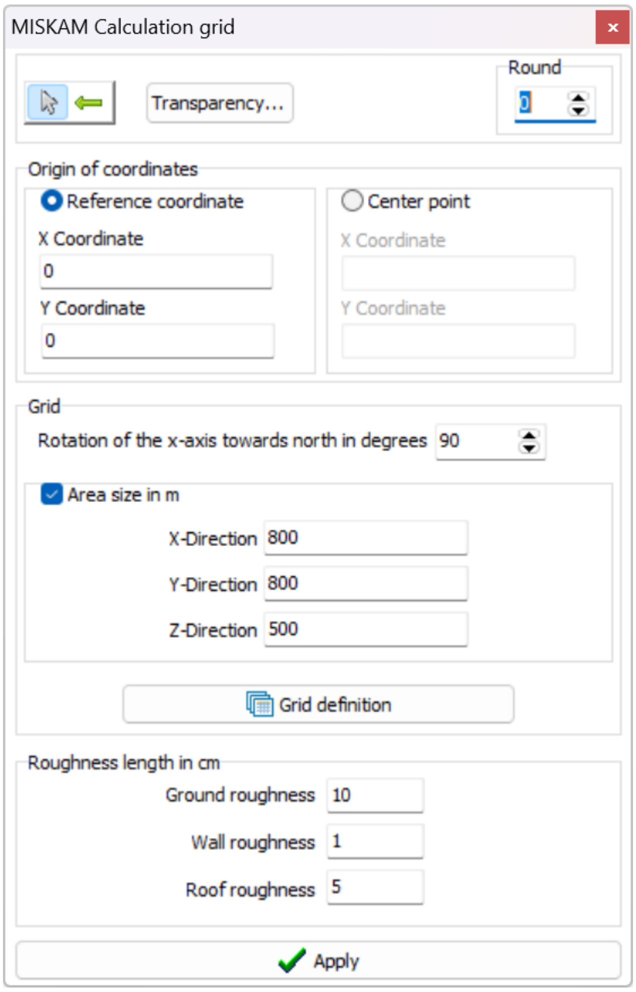
The dialog for exporting INP files is structured in the same way as the input dialog.

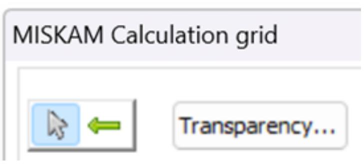


As a WinMISKAM project can contain several pollutants but an INP file can only contain one, you must select which pollutant is to be exported when exporting.

4.2 Screen grid

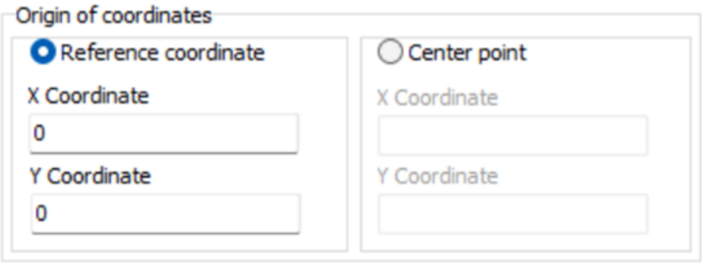
The calculation grid can be initialized and edited under the menu item *Calculation grid* or the icon  in the toolbar. When defining the area, please note that the number of grid points in the X, Y and Z directions should not be set arbitrarily high so that the computer's available memory is not exceeded. This would result in a drastic increase in calculation times. It is recommended to define a coordinate system before creating the calculation grid in order to establish a spatial reference.





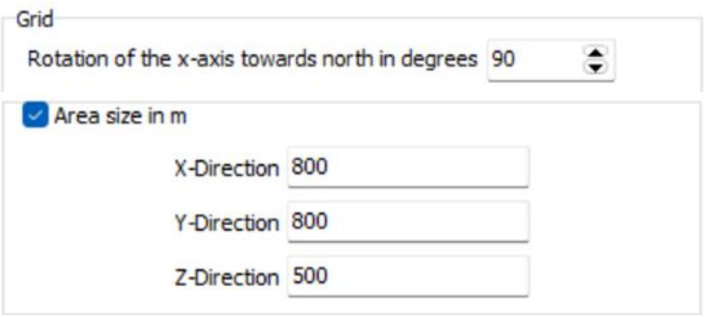
The active button with the mouse pointer symbol (selection tool) causes a grid to be drawn in the map area with a left click. To move the displayed grid, the button with the green arrow must be activated. Click on the calculation grid to move it using drag & drop.

The transparency of the grid can be set using the *Transparency* button.



The Origin of coordinates of the Miskam calculation grid can be defined via the reference coordinate or the center point. The coordinates are transferred to the calculation grid dialog by clicking in the map area (with the selection tool activated).

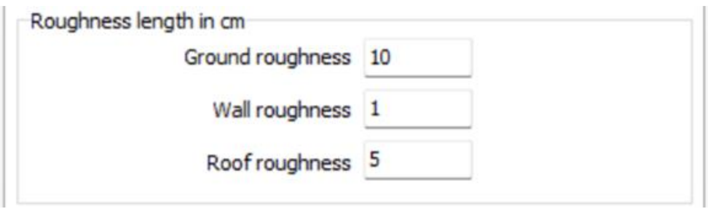
The orientation of the calculation grid is variable. It can be varied by making a change in 1 degree increments in the *Rotation of the X-axis against the north direction* button.



The entries for the *area size* indicate the size of the calculation area in meters in the respective direction.

After pressing the *Grid definition* button, the *Grid definition* dialog (see section 4.2.1) is displayed. This dialog is used to define the grid horizontally and vertically (mesh sizes, number of grid points).

The Ground, wall and roof roughness must be entered from a technical point of view. Information on this can be found in the MISKAM calculation kernel manual. Specifying the roughness in this dialog results in the application of a uniform roughness for all floor boxes or boxes with buildings.

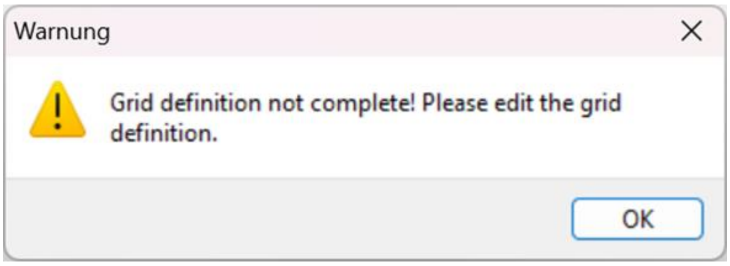


Note:

The value for ground roughness is generally **not** the value specified for urban structures in TA Luft, for example. A value should be selected for the ground roughness that describes the roughness of the study area **without the buildings explicitly resolved in MISKAM**[4] .

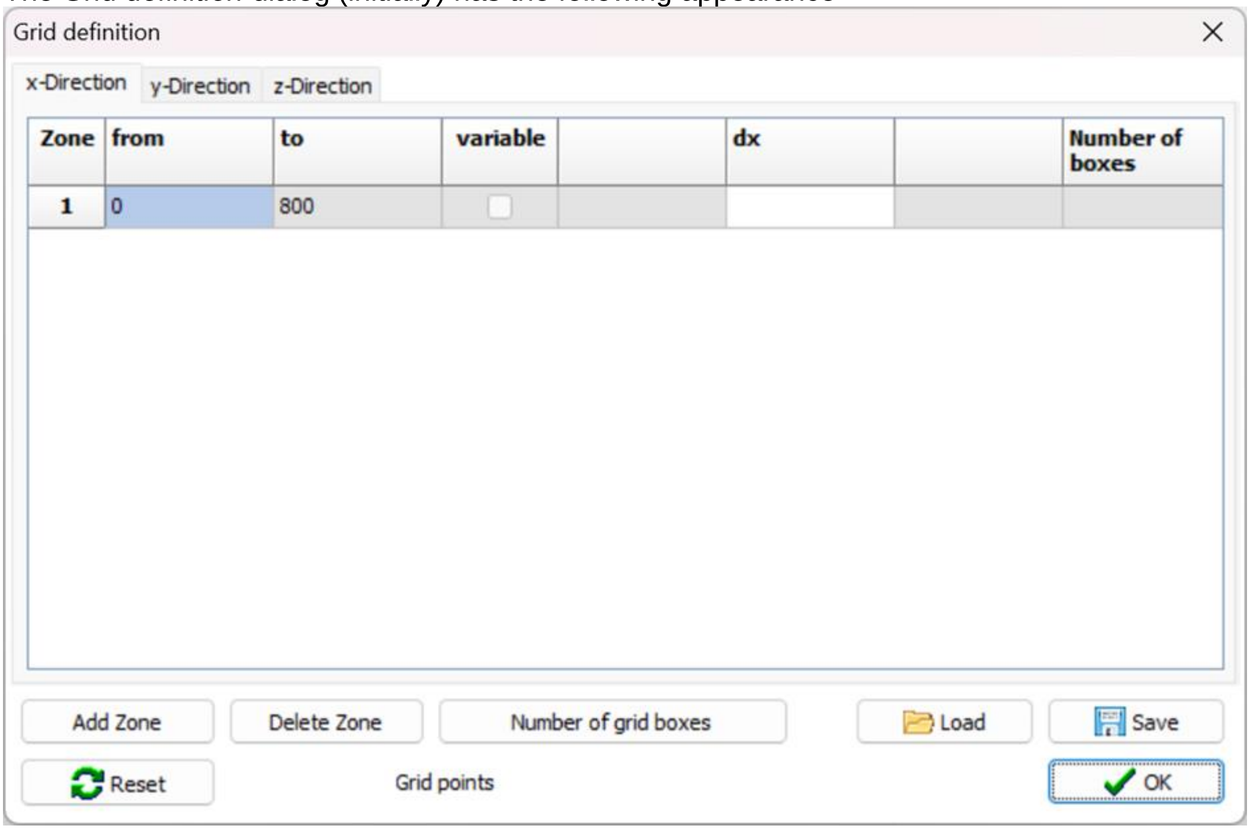
4 See also Guideline VDI 3783 Sheet 13 (VDI (2010), end of Section 4.9.2, page 28: "Buildings that are explicitly [...] taken into account in the dispersion calculation must not be included in the determination ...").

After entering the desired values, click on the *Apply* button to close the dialog. If the *grid definition* has not been edited, the following error message appears:



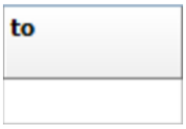
4.2.1 The grid definition dialog

The *Grid definition* dialog (initially) has the following appearance:[5]



With the help of this dialog *grid definition,* a grid can be generated that consists of **several equidistant and non-equidistant subzones.** The maximum spreading factor of 1.2 is observed for non-equidistant partial zones. A maximum mesh size can be specified to limit the size of the calculation meshes.

[5] The entry "800" in the "To" column and "Zone 1" row is an example. It is taken from the dialog Area definition, input field Area size, x-direction.

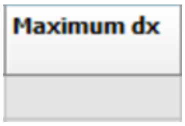


End of the respective sub-zone in meters (relative coordinates, i.e. start of zone 1 is always 0 m and all information refers to this). Input only possible if grids consisting of two or more subzones are to be defined.

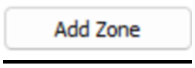
Ticked: Corresponding subzone has non-equidistant grid.

Tick not set: Corresponding subzone has equidistant grid.

Mesh size in meters (if grid is to be defined from only one subzone) or minimum mesh size in meters at the end of the zone (if grid is to be defined from two or more subzones).



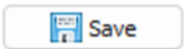
Maximum permissible mesh size in meters. Entry only possible if the check mark is set to "variable" for two or more subzones.



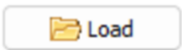
Press this button to add another subzone.

Press this button to delete the last sub-zone.

Press this button to specify the total number of mesh boxes and the number per zone and room direction. Please note that the number of mesh boxes Nx and Ny must not exceed 999 and Nz must not exceed 350.

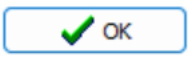


Grid definition can be saved under a freely selectable file name.



Saved grid definition is loaded. The current settings are overwritten.

All tables are reset to the default value.



Settings or changes are checked for consistency. If no errors are found, the settings are applied and the dialog is closed.

Meaning of the elements in the *Grid definition* dialog

The meaning of the dialog elements is only explained below for the x-direction; the same applies for the y- and z-directions.

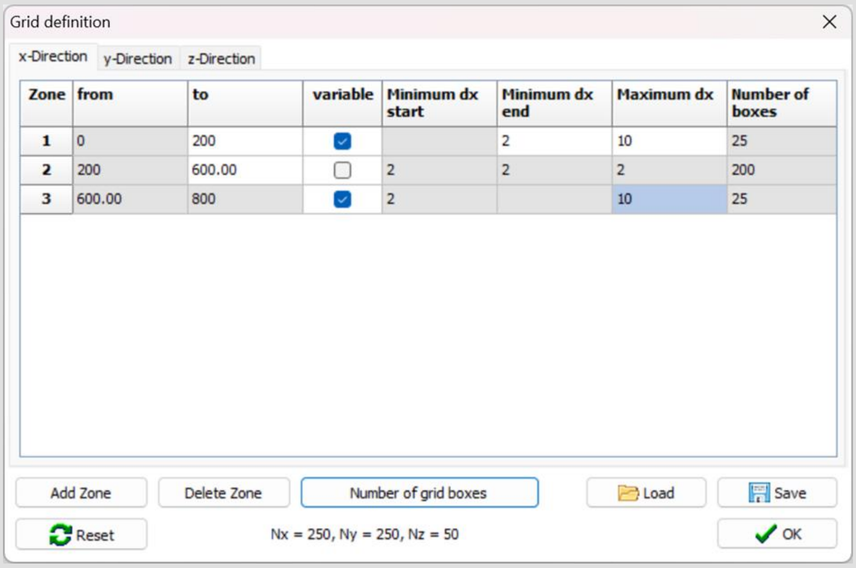
For reasons of continuity, the following applies to 2 or more subzones:

- The value of "to" is equal to the value "from" of the subsequent zone.
- The value of "Minimum dx zone end" is equal to the value of "Minimum dx zone start" of the following zone.

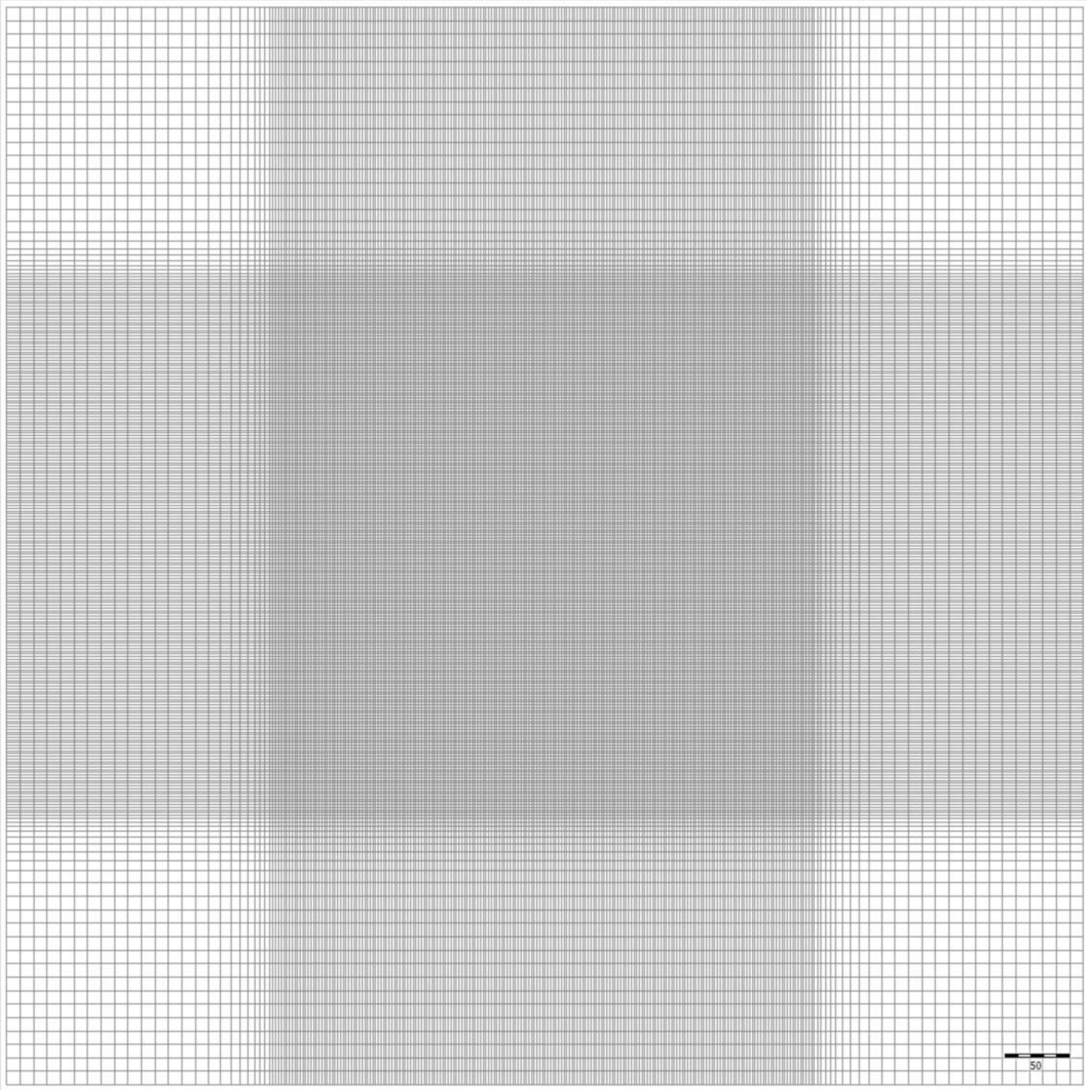
If there are more than 2 partial zones, not the first and last partial zone and a partial zone with a constant mesh size (i.e. no check mark for "variable"), all input fields for the mesh size are blocked. In this case, all 3 mesh size specifications are the same, i.e. "Minimum dx zone start" = "Minimum dx zone end" = "Maximum dx". The value of "Minimum dx zone start" results from "Minimum dx zone end" **of the zone above.**

Example: Generation of a grid with 3 subzones with a constant mesh size of 2 m in the x and y directions in a 400 m inner subzone. Outside of this, the mesh size should increase by a factor of 1.2 until a maximum mesh size of 10 m is reached. The area size is 800 m.

To create this grid, enter the value 800 m for *area size, x and y direction* in the **Grid definition** dialog and select the following settings (analog entries must be made for the y direction):



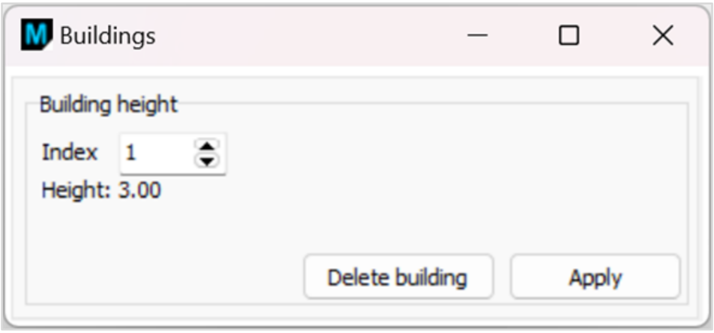
If the parameters are selected as above, the result is a grid with 250 grid boxes in the x and y directions. The automatically generated grid has the following appearance:



4.3 Digitize

4.3.1 Digitize/edit buildings

The Select tool on the toolbar can be used to select the grid boxes on the grid to be defined, edited or deleted as buildings. The *building* dialog is then opened via the *Digitize building* icon in the *toolbar*.



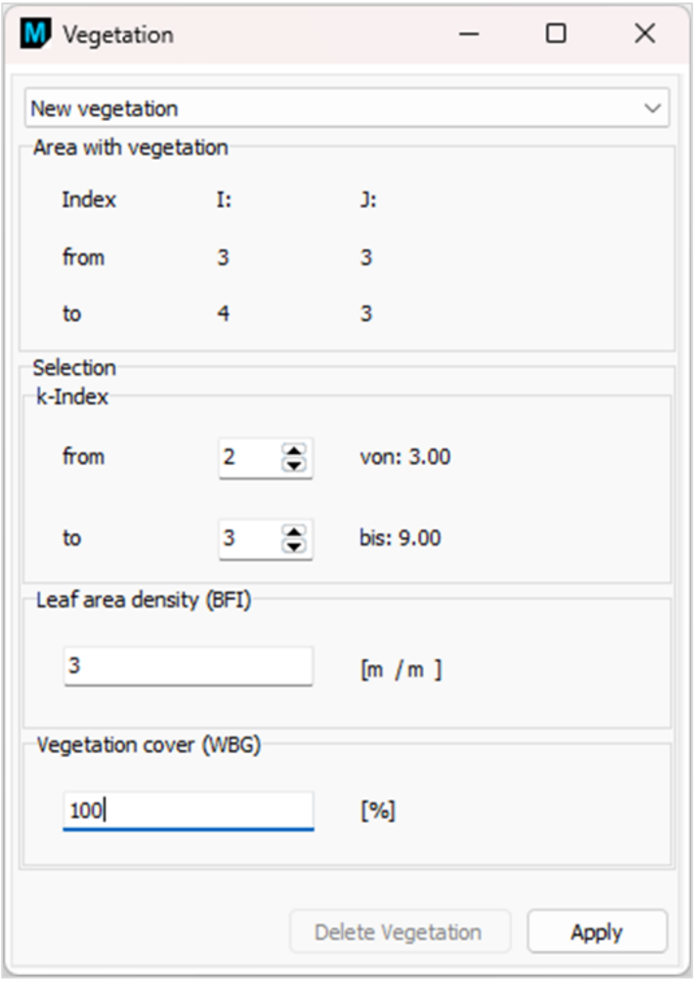
The Index button is used to specify the number of boxes in the vertical direction that are to be counted as buildings in the configuration file. Below the input to be varied, the height of the top edge of the box above the ground is specified in meters for orientation. The buildings are drawn on the calculation grid using the *Apply* button. The *Delete building* button deletes all buildings in the selected area. If there are already buildings in the selected area, these will be overwritten with the newly selected height.

4.3.2 Digitize/edit vegetation [6] (supplementary module)

With MISKAM calculations, it is possible to take vegetation into account. An additional configuration file is created for this purpose, which has the same name as the configuration file "[Name].INP", but has the file extension ".003". This file is located in the same directory as the configuration file "[Name].INP".

The Select tool in the toolbar can be used to select the grid boxes on the calculation grid in which vegetation is to be added, edited or deleted. Then use the icon *Digitize vegetation* in the *toolbar to* open the *Vegetation* dialog.

6 Only available if the "Vegetation" add-on module is licensed. Not included in the scope of delivery of the WinMISKAM basic version.

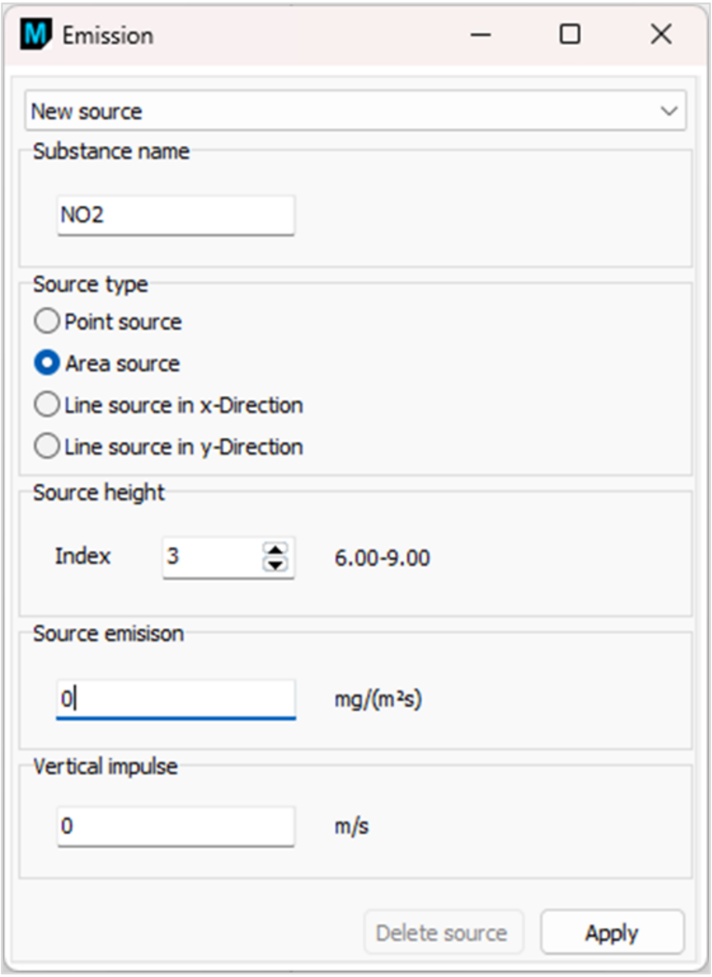


The defined area is indicated with the box indices "I" (for the X direction) and "J" (for the Y direction). If there is vegetation in the defined area, it can be selected and edited via the selection list. The *New vegetation* entry creates a new vegetation. Newly defined vegetation must not overlap with existing vegetation . The vertical extension of the vegetation area from a lower box to an upper box must be specified with the *K-index.* In addition, the leaf area *density* and the *degree of vegetation cover* must be specified. The leaf area density indicates the leaf surface area in m^2 per volume in m^3. The degree of vegetation cover indicates the percentage of a grid box that is "filled" with vegetation.

The *Apply* button is used to enter the vegetation in the calculation grid. The *Delete vegetation* button deletes the vegetation selected in the drop-down menu.

4.3.3 Digitize/edit sources

The Select tool on the toolbar can be used to select the grid boxes on the calculation grid in which sources are to be added, edited or deleted. Then click on the icon *Digitize sources* in the *toolbar to* open the *Emission* dialog.



If there are already sources in the defined area, they can be selected and edited via the drop-down menu. The *New source* entry creates a new source.

Notes:

- A maximum of one source can be digitized per box. However, a source can contain several pollutants. To add a new pollutant to an existing source, select *New source* in the selection list. The height of the source that is to contain the new pollutant is selected as the *source height.* ***Source type*** and ***vertical impulse*** are always changed for the entire source and not just for one pollutant. If *New source* is selected in the selection list, but there is already a source in the selected box of the calculation grid, a warning appears when you click on *Apply* that a source already exists.
- The *substance name* of the emitting substance must be entered for information purposes, but must **not** be **ENDE.**
- It should be noted that when entering the substance $_{NOx,}$ the NO2 $_{concentrations}$ are also calculated when calculating statistical parameters.

In the *Source type* input area, select an option by clicking on it. The unit of the source strength to be entered changes depending on the source selected. Internally, the source strength is converted to the volume of the grid box. The units of source strength associated with the individual source types are shown in **Tab. 4.1** listed.

Source type	Unit of source strength
Point source	mg/s
Area source	mg/(m^2 s)
Line source	mg/(m s)

Tab. 4.1: Source type and unit of source strength

Line sources are differentiated according to direction. As the grid boxes of the sources do not necessarily have to be square, differences in the linear expansions in the X and Y directions must be taken into account.

The *source height* indicates the grid box in which the source is located above ground. This allows swelling configurations close to the ground and above the ground. The swelling *strength* must be specified for each substance and according to the type of swelling.

The vertical impulse [7] (supplementary module) is used to specify how high the upward velocity in the boxes of the source area should be that is imposed on the wind field. This input is useful if an emission emerges from a stack with an outflow velocity.

The Apply button transfers the sources to the selected boxes of the calculation grid. The *Delete source button* deletes the source selected in the selection list.

Notes:
By imposing a vertical velocity, the wind field is no longer scalable. For this reason, it is not permissible in this case to use statistical characteristic values after the calculation of flow and concentration fields (see Chap. 6) after the calculation.

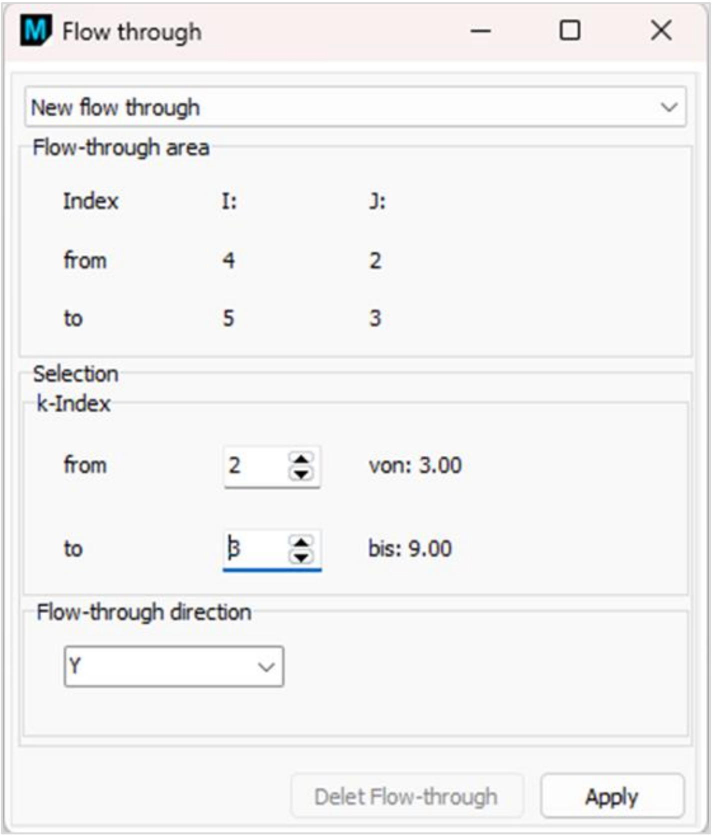
In MISKAM dispersion calculations, it is possible to consider sedimentation and deposition along the dispersion path; the creation of these inputs is currently not supported by WinMISKAM. Explanations and instructions can be found in the corresponding explanations in the MISKAM calculation kernel manual.

[7] Only available if the "Vertical beam" add-on module is licensed. Not included in the scope of delivery of the WinMISKAM basic version.

4.3.4 Digitize/edit flow (supplementary flow module)

With MISKAM calculations, it is possible to take into account the flow through buildings (bridges, culverts, gateways, etc.). An additional configuration file is created for this purpose, which has the same name as the configuration file "[Name].INP", but has the file extension ".001". This file is located in the same directory as the configuration file "[Name].INP".

The Select tool on the toolbar can be used to select the grid boxes on the calculation grid in which flow areas are to be added, edited or deleted. The *Digitize flow* icon in the *toolbar* then opens the *Flow through* dialog.



The flow area is specified with the box indices I (for the X direction) and J (for the Y direction). The *K index* is used to specify the vertical extent of the flow area from a lower box to an upper box. In addition, it must be decided in the *flow direction* input area whether the area is to be flowed through in the X direction or in the Y direction.

The *Apply* button transfers the flow to the calculation grid. The *Delete flow* button deletes the flow selected in the selection list.

Notes:

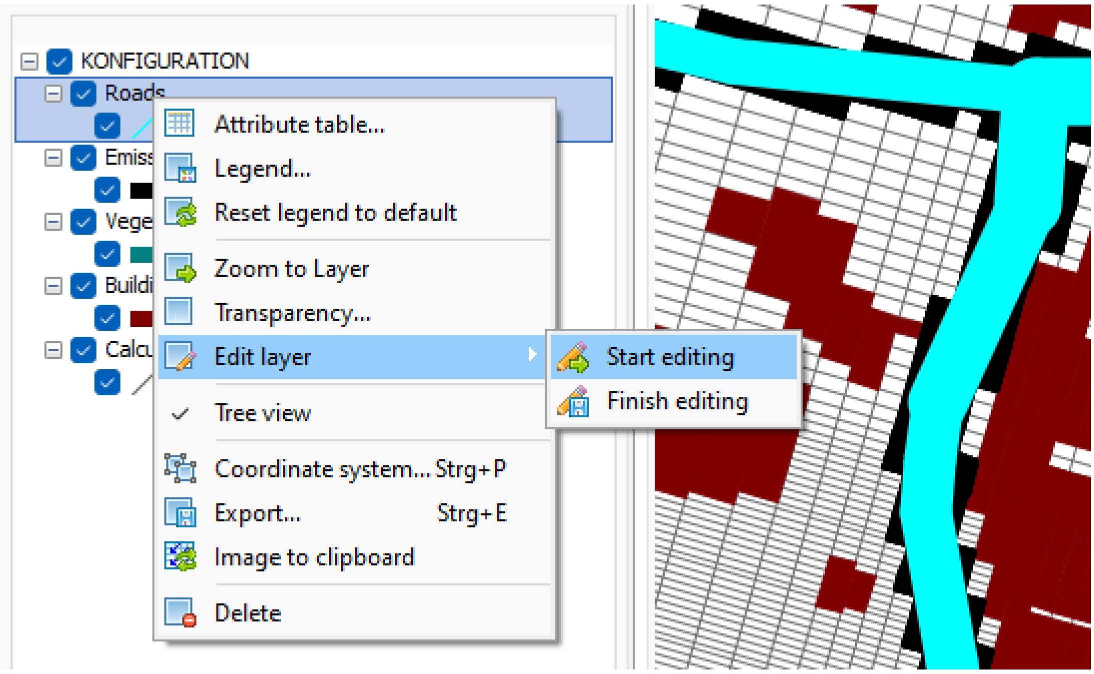
- When specifying the flow areas, boxes that have already been defined as buildings are "cleared" again.

- Specifying the flow direction directly influences which boxes are cleared and which walls are left standing.
- To understand this, it is advisable to visualize a bulldozer with the corresponding width and height driving through the three-dimensionally defined area in the direction of flow and clearing away all the walls inside. The first and last walls through which the bulldozer passes are also removed. This leaves the side walls to the right and left of the lane and the walls at the top and bottom.

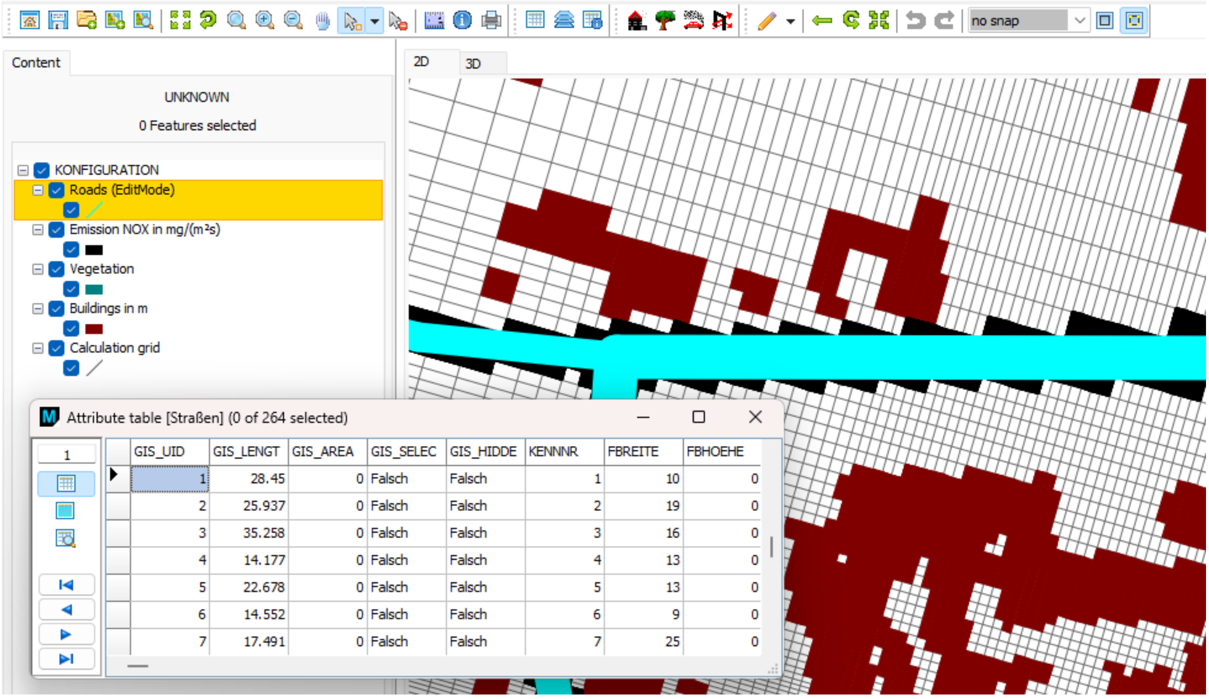
  Further explanations can be found in the manual for the MISKAM calculation core.

4.3.5 Edit road file (supplementary module line sources)

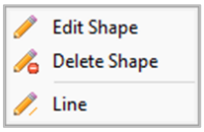
To be able to edit a road file, it must first be loaded via *Configuration* | *Load/grid road file* (see section 4.4.2). The loaded road file is displayed as a *road layer* in the *legend area* in the configuration group. It can be edited by right-clicking on this layer in the legend area via *Edit layer* | *Start editing.*



When editing is started, the road layer is highlighted in yellow. The *Edit shape* option appears in the toolbar in the form of a button with a pencil icon and the *attribute table* of the road layer opens.



After pressing the button  , a menu opens in which tools are available for digitizing new line sources (roads), for deleting lines and for editing the line support points in sketch mode.



Add line

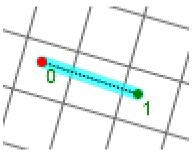
A new line is inserted using the *Line* tool by defining the starting point and interpolation points on the map with the mouse and double-clicking the end point of the line.

Move and rotate line

The position of an already digitized line can be changed using the *Move* and *Rotate* tools.

Delete line

A line can be deleted by activating the *Delete shape* tool and marking the line to be deleted on the map with the mouse by drawing a square.

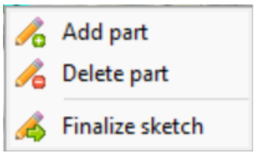


Start sketch mode

Support points of a line can be moved or added afterwards using the Edit *shape tool.* To do this, activate sketch mode by clicking with the mouse on the line to be edited when the Edit *shape* tool is activated. The support points are displayed on the line.

Move / add support points

A support point is moved using drag & drop. A new support point is added by clicking anywhere with the mouse. A support point can be deleted with a double-click.



Exit sketch mode

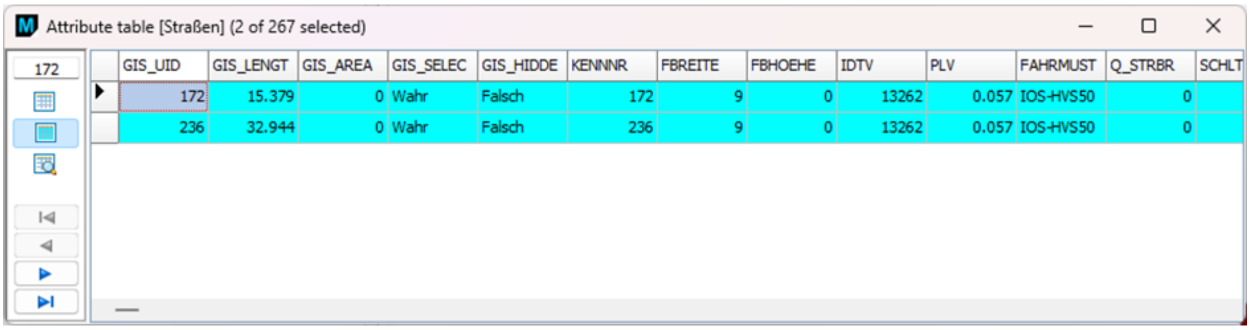
The sketch mode is activated with the *Exit sketch* menu item, which is opened by right-clicking on the map.

Catch points

If several lines are digitized, it is necessary that the end point of a line lies exactly on the start point of a following line. This can be ensured if the Snap to lines or Snap to interpolation points button is activated. The Snap function is also taken into account when editing interpolation points in sketch mode.

Attribute table

The *Attribute table* contains the attributes of all shapes in a layer.



GIS_UID	GIS_LENGT	GIS_AREA	GIS_SELEC	GIS_HIDDE	KENNNR	FBREITE	FBHOEHE	IDTV	PLV	FAHRMUST	Q_STRBR	SCHLT
172	15.379	0	Wahr	Falsch	172	9	0	13262	0.057	IOS-HVS50	0	
236	32.944	0	Wahr	Falsch	236	9	0	13262	0.057	IOS-HVS50	0	

The following views can be selected.

 All shapes in the layer are listed in the table.

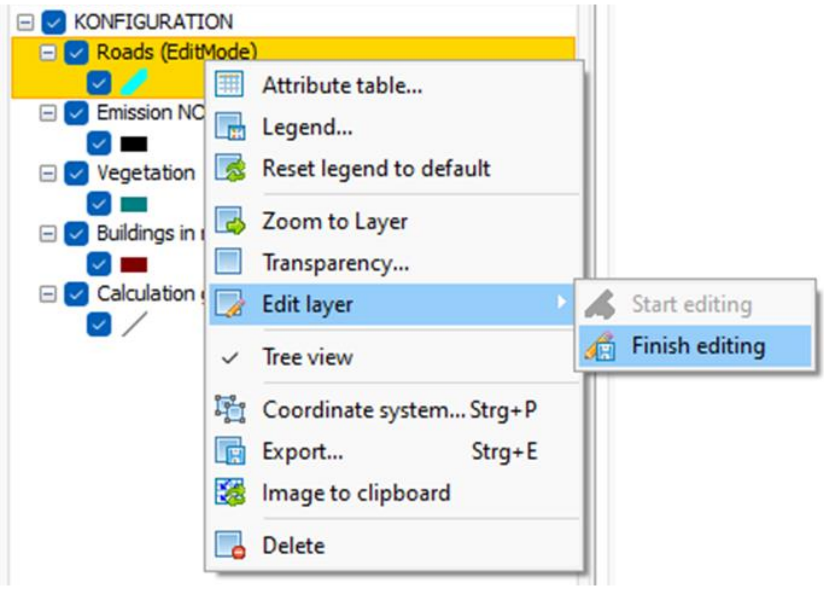
 Only the selected shapes are listed in the table.

 Opens a search mask and lists all shapes that match the search.

The attributes of a shape can be edited by double-clicking.

KennNr	FBreite	FBHoehe
1	10	0

Once all sources have been digitized and attributes entered, editing can be terminated via the context menu of the road layer *Edit layer|Finish editing.*



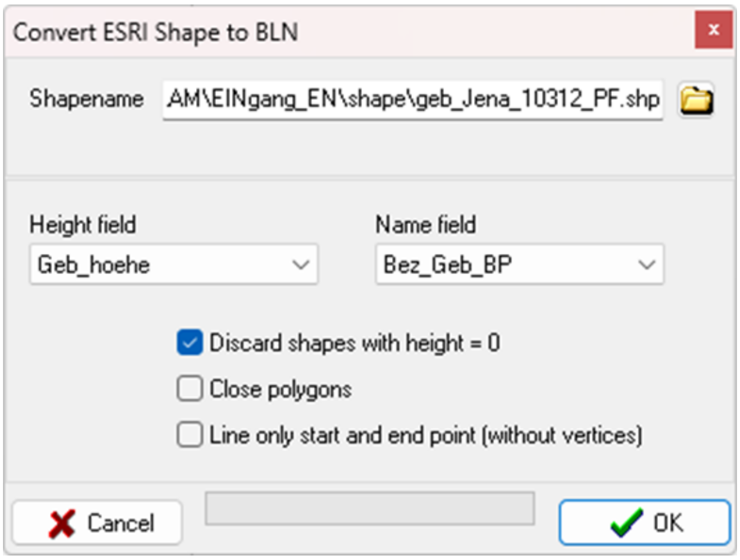
After you have finished editing, you will be prompted to confirm that you want to save the data.

4.4 Import shape files

4.4.1 Building gridden

With the menu item *Configuration|Building gridded...* a building file is "gridded" onto the calculation grid. The files *.shp and *.bln are possible.

Please note that the file must have the same coordinate system as the project configuration. Otherwise no overlaps can be found. A warning appears if the coordinate systems differ. After a shape file has been loaded, it must be converted to a BLN file. The *Convert ESRI Shape to BLN dialog appears* for this purpose.



The columns from which the building height and designation are to be loaded are specified here in the selection lists.

Three checkboxes are used to define whether the loaded data in the shape file should be adjusted.

Meaning

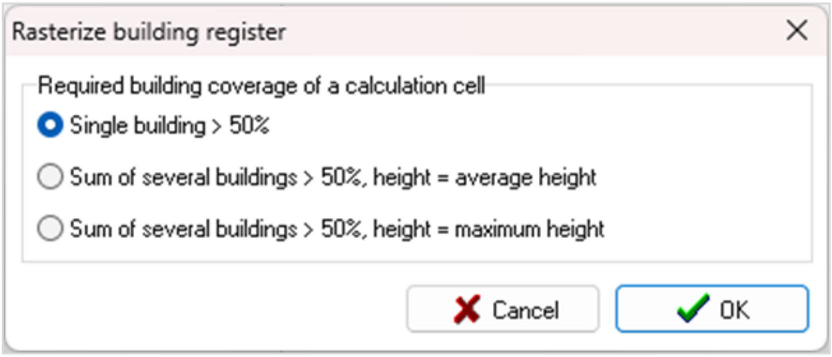
Discard shapes with height = 0: All shapes with a building height of 0 or less are not taken into account.

Close polygons: If the polygons of the individual shapes do not return to the starting point, i.e. are closed, the affected polygons are closed before the grid.

Line only start and end point (without vertices): Removes all support points and connects the start and end points directly. This is not recommended for a building shape.

Click on *Execute* to convert the shape file and close the dialog.

In the next settings dialog that opens, *Building register gridden,* 3 options are available, one of which must be selected.



Significance:

- *Individual buildings > 50 %:* Calculation boxes are marked as buildings if a single building covers more than 50 % of the calculation box.
- *Sum of several buildings > 50 %, height = average height*: Calculation box is marked as a building if all buildings **that** intersect the calculation box cover the calculation box by more than 50 % in total. An **average** building height is calculated as the height.
- *Sum of several buildings > 50 %, height = maximum height*: like *sum of several buildings > 50 %, height = average height*, but the **maximum** building height of the buildings that intersect the calculation box is used as the height.

After pressing the *OK* button, a DOS box is opened and the conversion is carried out. Once the conversion and the DOS box have been completed, the buildings are integrated into the configuration file and appear in the calculation grid as colored boxes.

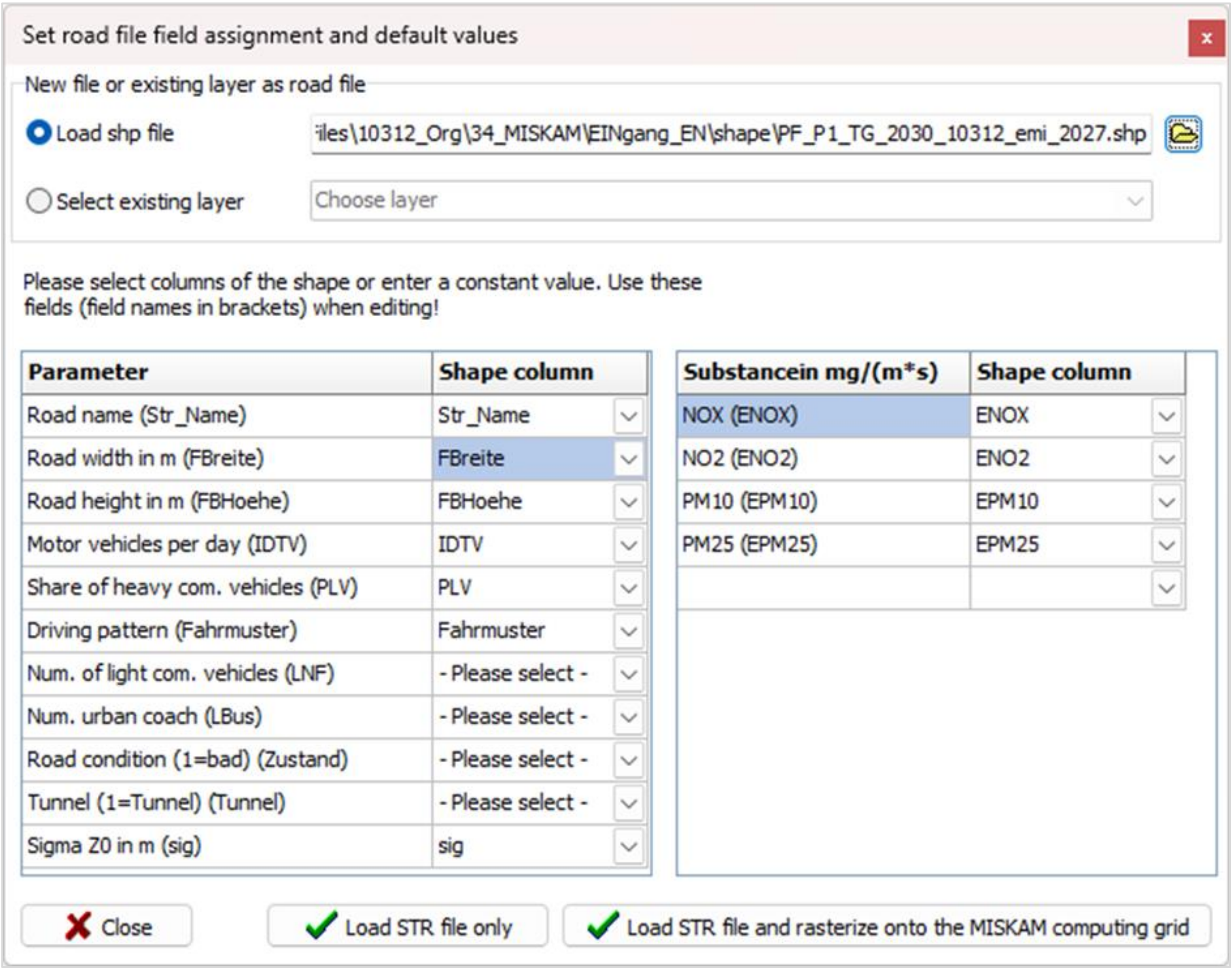
Note:
It should be noted that, as a rule, the building height stored in the building register is not exactly reproduced in the MISKAM calculation grid. The reason for this is that the "true" building heights are mapped to the discrete heights of the MISKAM calculation grid in the z-direction. If necessary, the number of grid cells in the z-direction must be increased and/or the grid heights in the z-direction must be adjusted.

4.4.2 Load/grid road file (supplementary module line sources)

With the menu item *Configuration|Load road file/gridden*, a road shape is loaded into the configuration or gridded in the same step.

Please note that the file must have the same coordinate system as the project configuration. Otherwise, no overlaps with the calculation grid can be found. A warning appears if the coordinate systems differ.

After loading a road file, the *Road file field assignment and set default values* dialog opens.



This dialog is used to assign the shape columns to the parameters required by WinMISKAM. A shape file can be loaded via the *Load shp file* selection. If a shape file with road information has already been added to the WinMISKAM project, it can be selected via *Select existing layer.*

The following parameters are required for the road shape grid: road name, lane width, lane height, Sigma Z0 and the emission of at least one pollutant.

The other parameters are only to be defined for the PROKAS_E connection.

Columns from the shape file can be assigned to the *shape column* or default parameters can be entered manually.

The meaning of the parameters is described in **Tab. 4.2**.

Parameters	Meaning
Street name	Name of the road segments. If this name does not exist as a field name in the shape file, this field is empty.
Lane width in m (FBwidth)	The lane width is specified in meters. There is no default value in MISKAM.
Roadway height in m (FBHeight)	The roadway height is specified in meters. The default value in MISKAM is 0 meters.
DTV (IDTV)	Average daily traffic. If no column is selected, the value zero is used.
Share of heavy goods traffic (PLV)	Number of daily trucks divided by DTV
Driving pattern (driving pattern)	The driving pattern must include the longitudinal gradient. No longitudinal slope = 7
Number of LNF (LNF)	Number of daily light commercial vehicles
Number of L-buses (LBus)	Number of daily buses
Road condition (1=bad) (condition)	Road condition. If no value is specified, the column is ignored in the PROKAS calculation.
Tunnel (1=tunnel) (tunnel)	Tunnel. If no value is specified, the column is ignored in the PROKAS calculation.
Sigma Z0 (sig)	The sigma Z0 is specified in meters. The default value in MISKAM is 1.5 meters.

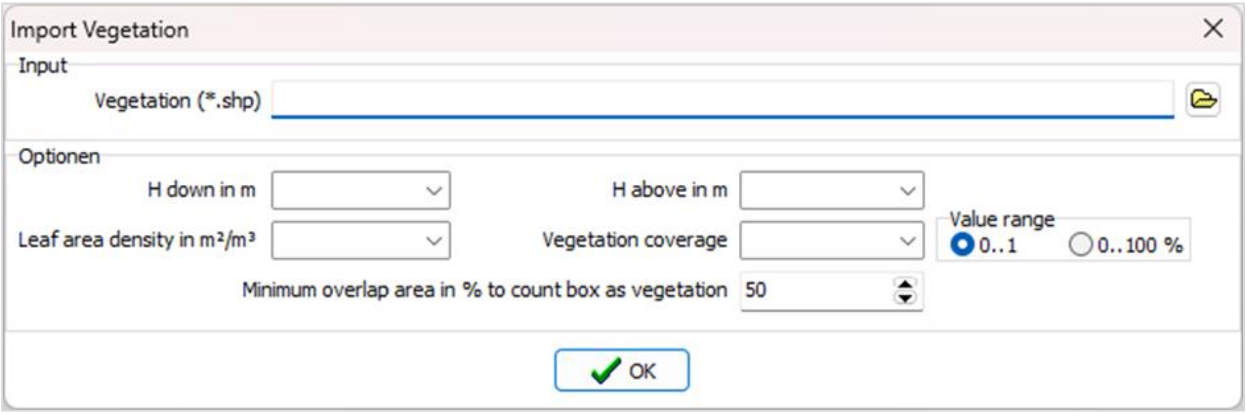
Tab. 4.2: Table of parameters required for a MISKAM or PROKAS_E calculation.

The pollutant fields to be gridded are specified in the right-hand table of the *Road file field assignment and set default values* dialog. If no column is selected, this pollutant is ignored. However, the emission of at least one pollutant must be defined. By double-clicking on the empty cell in the *pollutant column,* up to 6 additional pollutants can be added . The pollutants are expected in mg/(m*s).

The *Load STR file only button* adds the road file to the configuration and displays it, but it is not yet gridded on the calculation grid. The Load STR file *and grid onto the MISKAM calculation grid button* also loads the road file and then grids it directly onto the calculation grid.

4.4.3 Vegetation gridden (supplementary module vegetation)

The *Import vegetation* dialog is opened via the *Configuration* | *Vegetation grid...* menu item. If vegetation is already defined in the calculation grid, a warning appears that existing vegetation definitions will be overwritten.



The shape file with the vegetation is selected via the "*Import Vegetation"* dialog. The 4 selection lists are used to assign columns to the shape file. 4 values are required from the shape file. The *Minimum overlap area in %* specifies the percentage of a MISKAM box that must overlap with a vegetation shape for the box to count as vegetation.

H down in m

Indicates the height at which the vegetation starts.

H above in m

Indicates the highest point of the vegetation.

Leaf area density in m^2/m^3

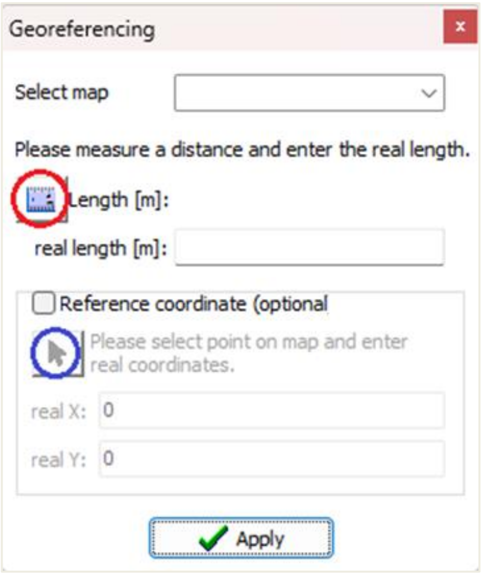
Indicates the leaf area density in m^2/m^3.

Vegetation coverage

Specifies the degree of vegetation cover. The value range must be defined for this field. Either decimal from 0 to 1 or percentage from 0 % to 100 %.

Click *OK* to grid the shape onto the MISKAM calculation grid.

4.5 Georeferencing



Georeferences a map that is available as an image file. The map must first be opened with the "select map" command. If the map has not yet been georeferenced, a prompt appears asking whether this should be done now.

The "Georeferencing" dialog appears, in which the loaded map is already preselected. Click on the "Measure" icon (highlighted in red) to start measuring a reference route.

Click on the start and end points to define the route on the map. The actual length of the route is entered in the "Real length" field and confirmed with the "Apply" button.

Optionally, a reference coordinate can also be defined. To do this, activate the "Reference coordinate" option and click on the "Reference point" icon (highlighted in blue) to start the recording. A point is then marked by clicking on the map and the real coordinates are entered in the corresponding fields "real X" and "real Y" (right mouse button on map -> Coordinates in clipboard -> Paste).

Once georeferencing is complete, the map is reloaded and can now be used for digitization.

Notes:

- the map must be undistorted
- the reference distance should be as long as possible to minimize deviations and errors.

4.6 Calculate emissions (supplementary module) PROKAS_E

The additional module "Calculate emissions - PROKAS_E" is started via the menu item *Tools | Calculate emissions....*

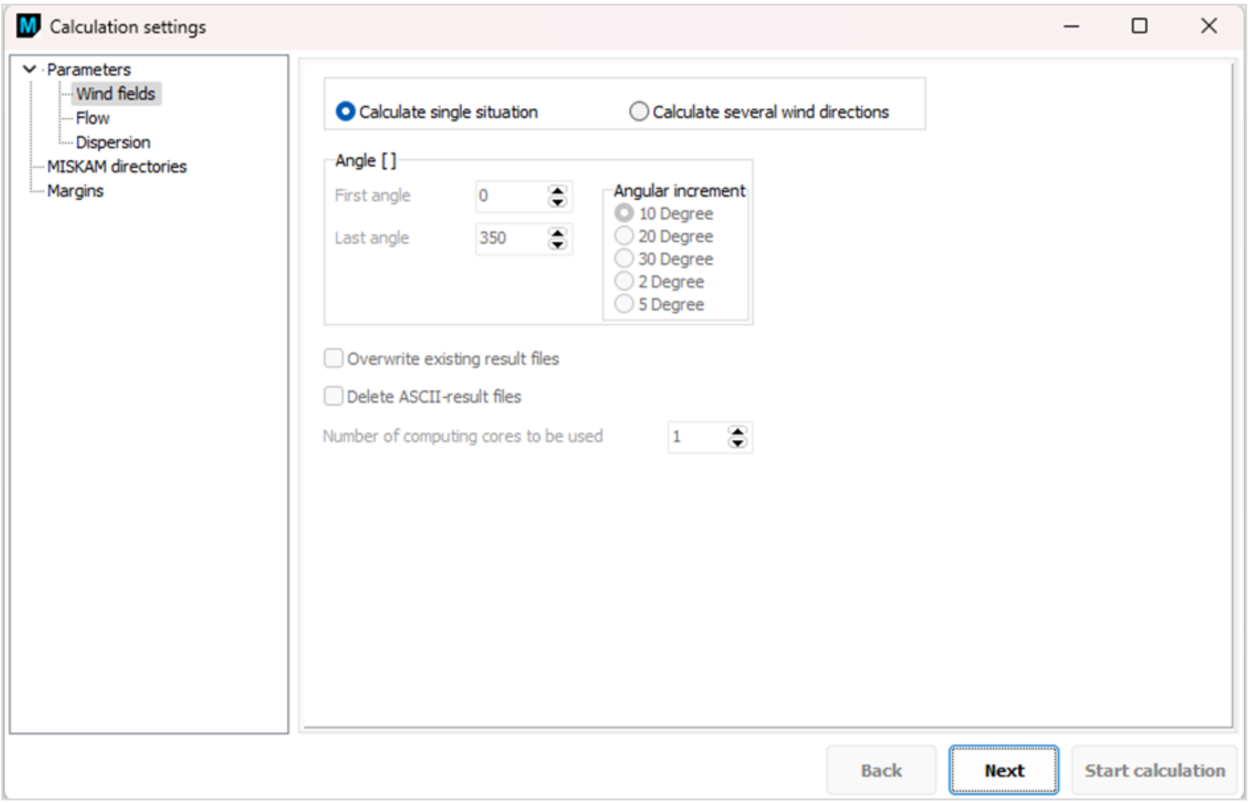
For more information on the "Calculate emissions - PROKAS_E" program section, see PROKAS_E Help.

5 MISKAM CALCULATION

The calculation processes consist of flow calculations and dispersion calculations based on the results of the flow calculations. Before a MISKAM calculation can be started, initialization files must be created. When WinMISKAM is restarted, the parameters are preset. To prepare a simulation calculation, it is necessary to adapt the parameter file to the case to be processed. These can be created directly before starting the calculation under the menu item *Execute* | *Calculation...* or in advance via the *Configuration* | *Calculation parameters...* menu. Flow and dispersion calculations can be started simultaneously. MISKAM first calculates the flow calculations and then the dispersion calculations.

Both of the above menu items open the *Calculation settings* dialog. On the left-hand side, there is an overview of all settings that are relevant for flow and dispersion calculations. Use the *Next* and *Back* buttons to navigate through the settings dialog. It is also possible to open the dialog boxes directly via the tree structure of the navigation area.

5.1 Wind fields



On the first page, a distinction can be made between single situations and multiple flow angles. If several angles of attack are to be calculated, it is necessary to specify a first and last angle and an angle increment.

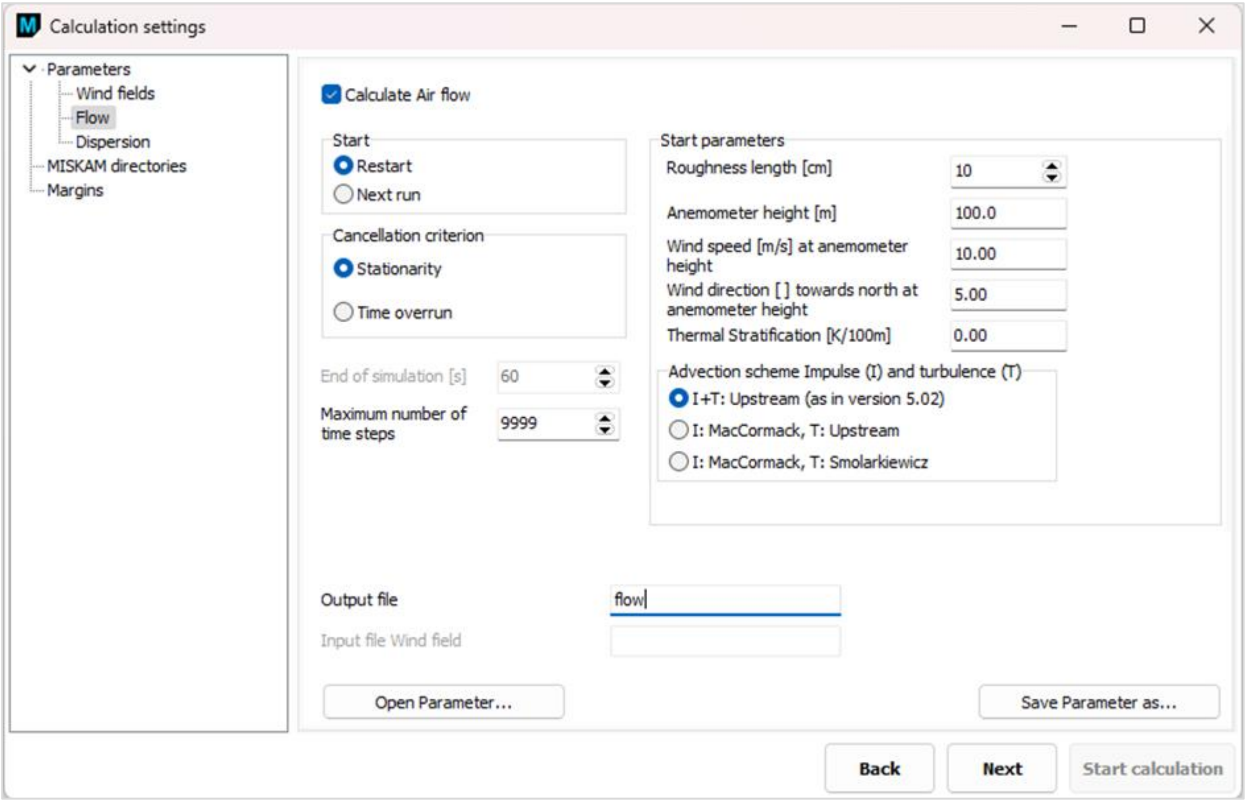
For example:
With a first angle of 0 degrees and a last angle of 350 degrees with an angle increment of 10 degrees, 36 flow calculations and 36 dispersion calculations are started one after the other if flow and dispersion are to be calculated.

The calculation creates binary files ("[Name].ZWU", "[Name].ZWT", "[Name].ZWK"), which are required for further processing in WinMISKAM. In addition, files are created in ASCII format ("[Name].UVW", "[Name].TUR", "[Name].KON"), which are not required for further processing in WinMISKAM and take up a lot of memory space. The creation of these files in ASCII format can be prevented with the *Delete ASCII result files* button.

Multicore capability for MISKAM calculations
If the PC on which the MISKAM calculations are carried out has several calculation cores, the number of calculation cores used for the MISKAM calculations can be determined. If sufficient main memory is available, the total computing time for all MISKAM calculations to be performed in the "Batch mode" dialog is reduced almost linearly according to the number of available computing cores. However, the system does not check whether the selected number of computing cores is greater than the available number of computing cores. If this is the case, the total computing time is not reduced according to the selected number of computing cores. The maximum number of usable computing cores is currently set internally to 16. Only one calculation can be started per calculation core. In the above example with 36 angles of attack, this would mean that with 36 calculation cores, all flow calculations run in parallel and when these are completed, all 36 dispersion calculations are started in parallel.

5.2 Flow calculation

The settings for the flow calculation are made on the next page.



The *Calculate Air flow* checkbox indicates whether a flow break should be started.

Note:
It is not necessary to specify emissions and source distributions for the flow calculation. However, if emissions are subsequently entered into the calculation grid, neither the box width, number of boxes nor the building boxes may be changed.

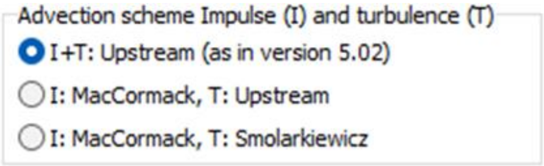
In the *Start input area*, specify whether a *restart* or a subsequent *run* is to be performed. The *Start parameter input* area cannot be changed during a subsequent run and is not taken into account during a calculation. The name of the existing wind field file must be entered in the lower area of the window.

The choice of termination criterion must be made from a technical point of view. More detailed explanations can be found in the MISKAM manual. For the *timeout,* MISKAM allows the maximum input of 99999 s and the *maximum number of time steps* of 9999.

The configuration loaded in WinMISKAM is used as the *configuration file* and generated automatically. The name of the *output file* for the wind field must be assigned.

From a technical point of view, the *start parameters* for the flow simulation must be defined in accordance with the specifications in the MISKAM manual. If several flow directions are calculated, it is not possible to enter the *wind direction towards north*. For individual case calculations, the *angle* must be entered in degrees.

Selection field Advection scheme Impulse (I) and Turbulence (T):



If "I+T Upstream" is selected, an upstream advection method (first-order method) is used as in MISKAM version 5.02 and earlier. This method is numerically very robust, but contains an increased degree of "numerical diffusion".

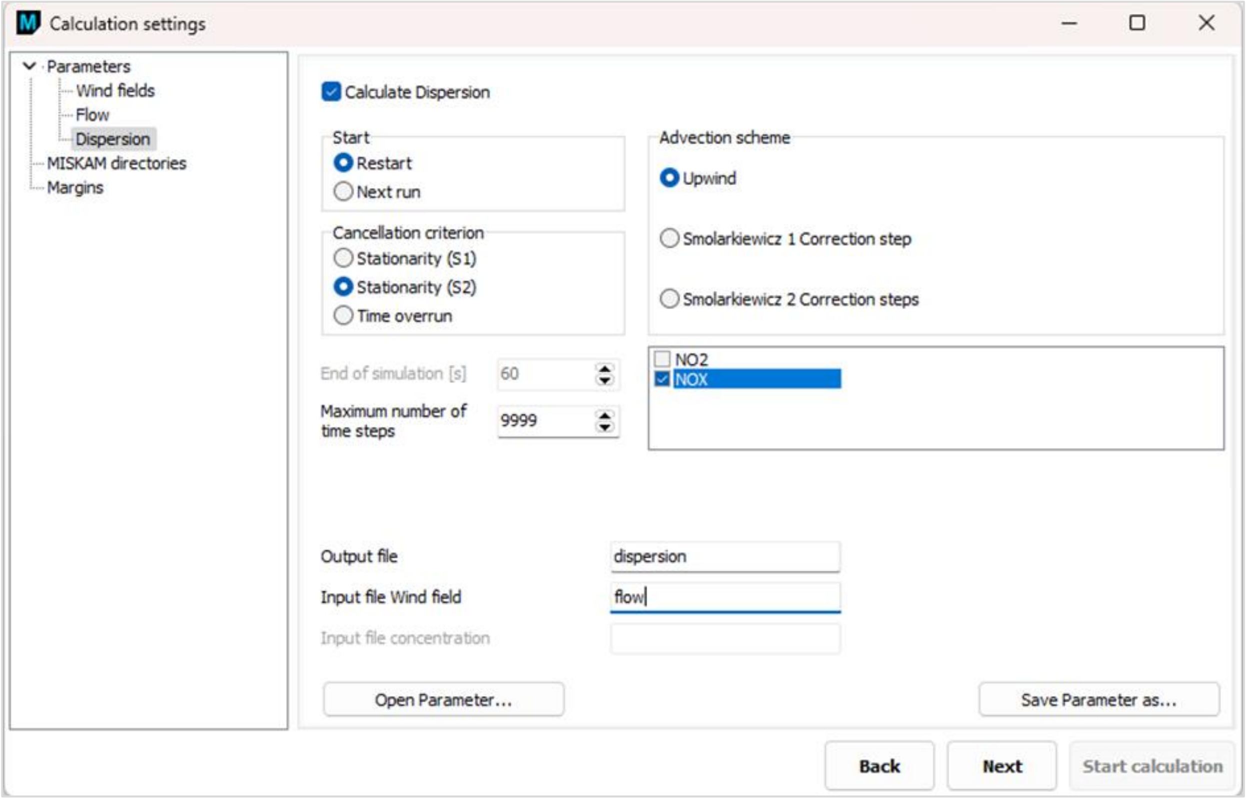
If "I: MacCormack, T: Upstream" or "I: MacCormack, T: Smolarkiewicz" is selected, a numerically more accurate second-order method is used for momentum advection or for momentum and turbulence advection.

The setting "I: MacCormack, T: Smolarkiewicz" is the default setting. If a MISKAM case does not converge with this setting, the setting "I: MacCormack, T: Upstream" should be used first or the setting "I+T Upstream" if convergence problems continue to occur.

An ini file with settings for a flow calculation can be loaded and saved via Open parameters... and Save parameters as....

5.3 Dispersion calculation

The settings for a dispersion calculation are made on the following page.

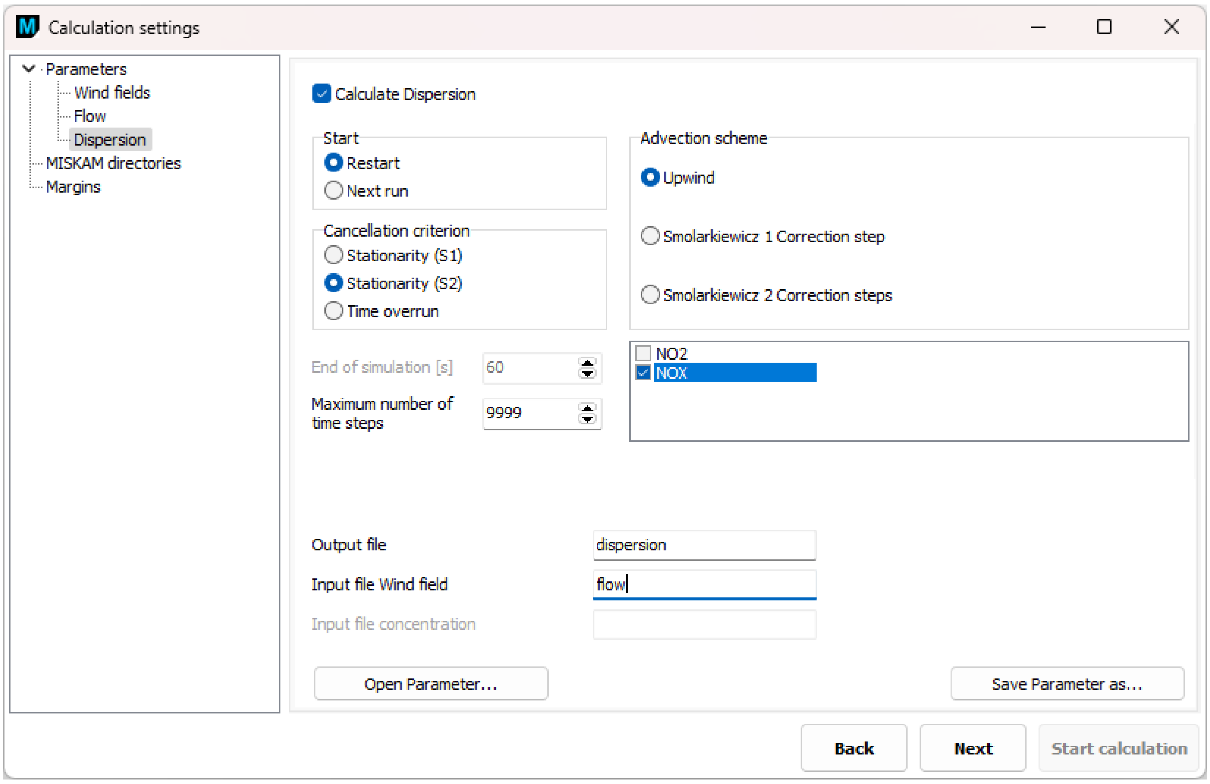


Some settings apply in the same way as for the flow calculation. The parameters can also be opened and saved on this page.

In contrast to flow calculations, the *wind field input file is* required. For a *subsequent run,* the name of the existing concentration file must be entered under *Concentration input file.* The name of the concentration file to be created does not have to be the same as that of the wind field. Three termination criteria are available for the dispersion calculations: *Stationarity (S1),* which is intended for road networks or line sources and leads relatively quickly to stationarity, i.e. involves relatively short calculation times. Stationarity *(S2)*, which is intended for point sources and involves longer calculation times. *Timeout*, which can be entered freely. The choice of termination criterion must be made from a technical point of view. More detailed explanations can be found in the MISKAM manual. For the *timeout,* MISKAM allows the maximum input of 99999 s and the *maximum number of time steps* of 9999.

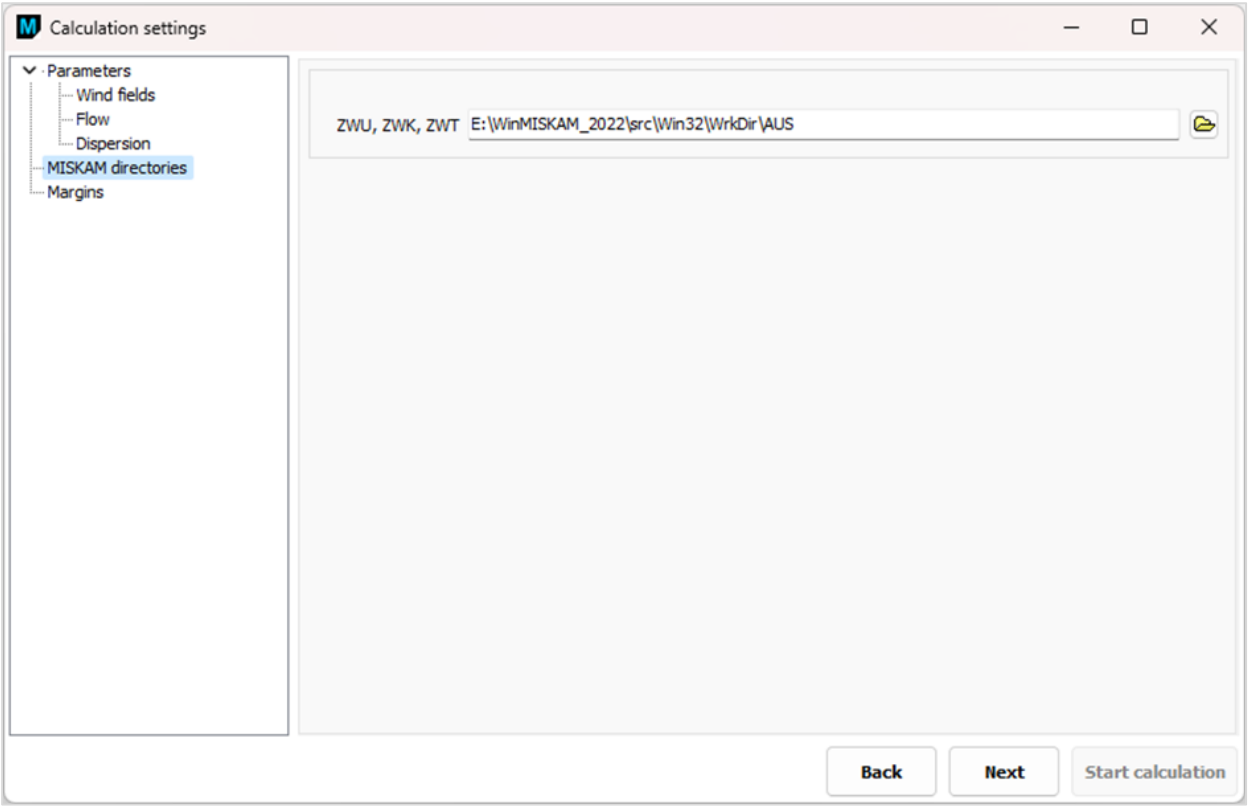
For dispersion calculations, an option must be selected in the *advection scheme* input area according to the specifications of the MISKAM manual.

All pollutants present in the configuration are displayed on the right-hand side.



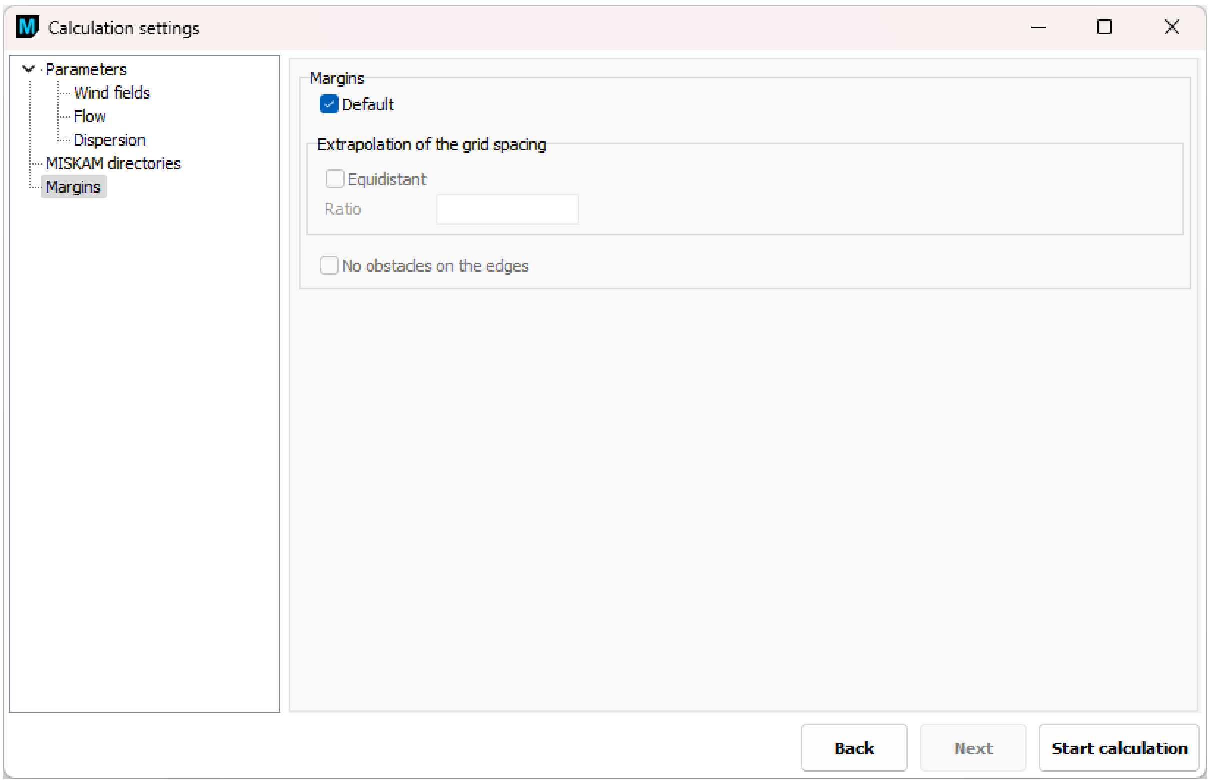
A selection must be made here as to which pollutants are to be calculated.

5.4 MISKAM directories



The directory for the ZWX files must be specified on this page. MISKAM saves the result files of the calculations in this directory. The wind field files for the dispersion calculation are also searched for in this folder.

5.5 Margins



Settings for the margins are made on the last page.

1. Use of the default settings
By ticking the *Default* box, the following settings apply:

- 5 additional edge boxes
- Grid spread: The factor for the grid spread is determined from the quotient of the mesh widths of the last two grid boxes, but is given a maximum value of 2. The mesh widths of the edge boxes are thus calculated as follows:
  - I. Edge box: Mesh size = factor * mesh size of last mesh box
  - II. Edge box: Mesh size = factor * mesh size of first edge box
  - III. to V. Edge box: Mesh size = factor * mesh size second edge box

With a spreading factor of e.g. 2, the first edge box has twice the mesh size compared to the last mesh box, the second edge box has four times the mesh size and the edge boxes 3 to 5 have eight times the mesh size.

2. Extrapolation of the grid spacing
If the *Default* checkbox is unchecked, you have the option of selecting the mesh size of the edge boxes by setting a checkmark in the Equidistant checkbox. On the other hand, the mesh size of the additional edge boxes can be selected variably by specifying the ratio of the grid spacing between

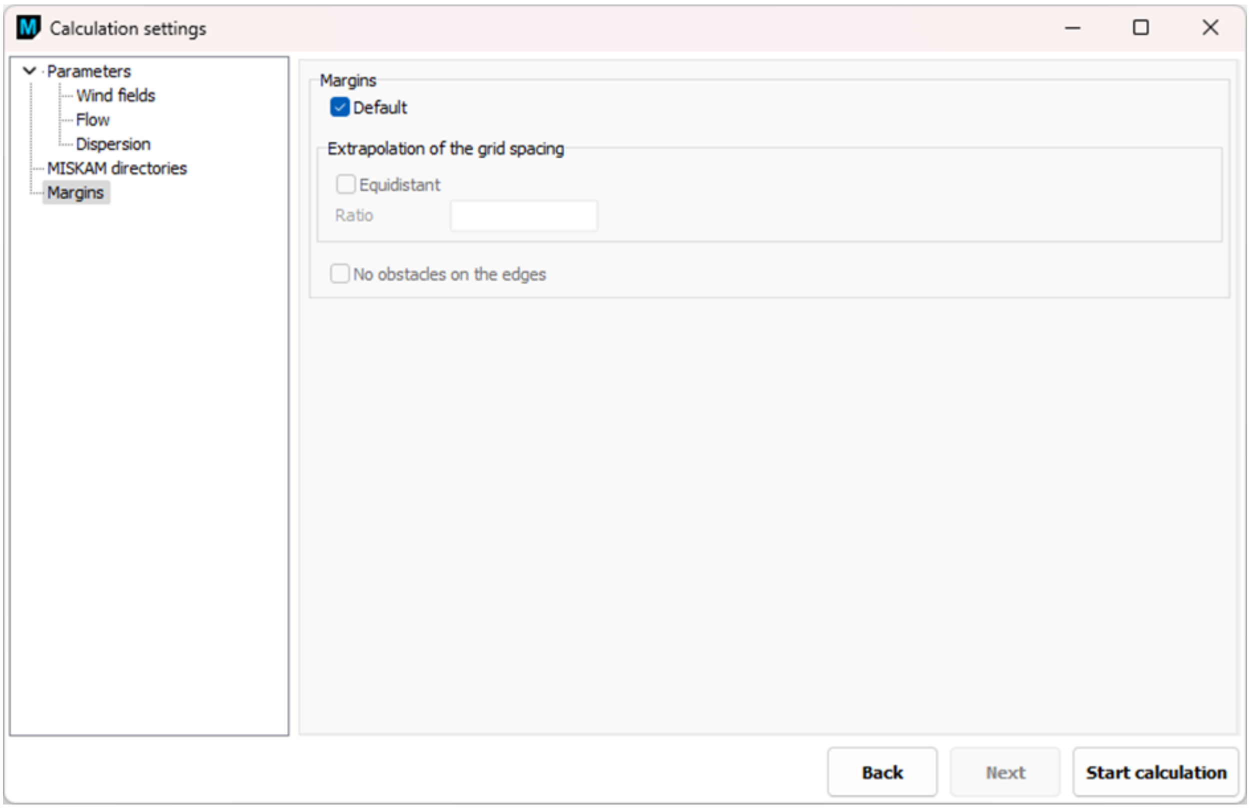
two neighboring grid boxes. For example, a ratio of 1.2 with a mesh width of 5 m results in the neighboring box having a mesh width of 6 m. This ratio must be specified from a technical point of view.

3. No obstacles on the edges

The checkbox *No obstacles on the edges ensures that* the additional side edge boxes are free of obstacles even if there are obstacles in the outermost grid boxes of the model area.

5.6 Start calculation

A calculation can be prepared and started in WinMISKAM via the menu item *Execute | Calculation...*. The *Calculation settings* dialog opens (see Sect. 5.1 to 5.5). Once all the necessary settings have been made, the calculation can be started by clicking on *Start calculation* on the last page.



If there are no setting errors, the *MISKAM-Calculation...* dialog opens.

WinMISKAM cannot be operated during a MISKAM calculation, as input files are generated during the calculation. The progress of the calculation is displayed in the Status information window. In addition, a MISKAM DOS window opens for the individual calculation of an inflow direction. This can be called up by clicking on the DOS application in the taskbar or by pressing the Alt key and Tab key combination in the foreground of the screen. The first calculation step often takes a long time, so that no current entries may appear in the MISKAM window within a few minutes. The calculation status then appears line by line on the screen in the MISKAM window.

It is possible to open several instances of WinMISKAM so that you can also work in another instance of WinMISKAM while a calculation is in progress. The elapsed time of the calculation is displayed in the *MISKAM calculation* dialog. The calculation can be canceled with the button *Controlled cancel and* the results calculated so far are written to the output directory. These results can later be used to start a subsequent calculation. The *Cancel immediately button cancels* the calculation immediately. When calculating an individual situation, all results calculated so far are discarded. A subsequent run is then no longer possible. The completed calculations for several angles of attack can still be found in the output directory even after immediate cancelation. Only the calculation of the current angle of attack is lost.

When the flow calculation is performed, the following files are created in the specified results directory: "[Name].ZWU", "[Name].ZWT", "[Name].UVW", "[Name].TUR", "[Name].PRS". The recognition of an existing result of the flow calculation is based on the existence of the "[Name].ZWU" files. The "[Name].PRS" file describes the course of the calculation.

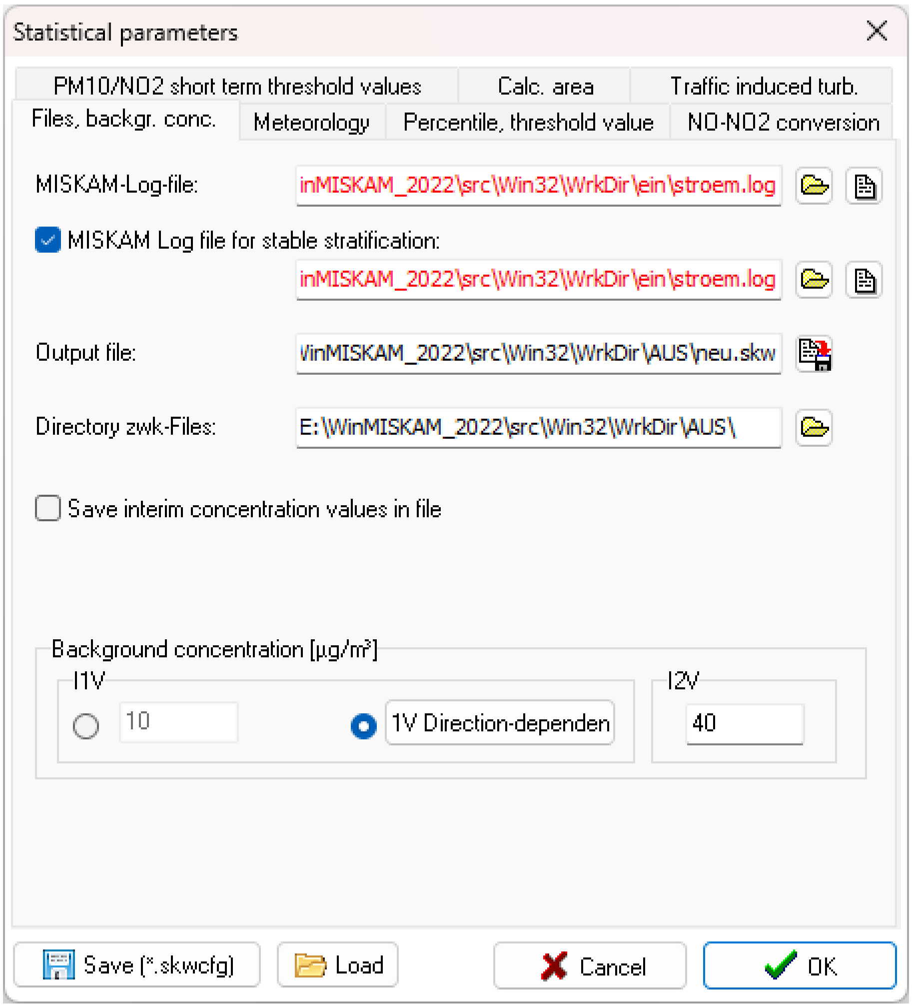
When the dispersion calculation is performed, the following files are created in the specified results directory: "[Name].ZWK", "[Name].KON", "[Name].PRA". The recognition of an existing dispersion calculation result is based on the existence of the "[Name].ZWK" file. The "[Name].PRS" file documents the progress of the calculation.

The name of the result file is supplemented by the angle of attack if there are several angles of attack (e.g. *****210.ZWU, *****_10.ZWU etc.).

6 CALCULATION OF STATISTICAL PARAMETERS

Once the calculated concentration fields are available for all wind directions taken into account in the wind statistics, the menu item *Execute | Statistical parameters...* can be called up and the *Statistical parameters* dialog appears. The dialog contains the seven tabs: *Files/backgr. conc., Meteorology, Percentile/Threshold value, NO-NO2 conversion, PM10/NO2 Short-term treshold values, Calc. area* and *Traffic induced turb.*.

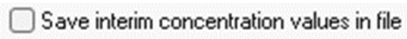
Confirming the entries in the *Statistical parameters* dialog by clicking the *OK* button starts the calculation of the statistical characteristic values. The concentration fields are read in one after the other and then all grid boxes are calculated. The reading in and calculation of the individual points is displayed in the footer of WinMISKAM.



6.1 Files/preload

The paths for input and output files required for the calculation of the statistical characteristic values are defined under the *Files/preload* tab. The input fields *MISKAM log file* and *Path for ZWK files* and the field for the output file must be filled in accordingly. By default, the output file has the file extension *SKW*.

The file "[Name].LOG" was created with the calculation of the concentration fields for all wind fields (Sect. 5.3) of the directory specified by the user for the result files (Sect. 5.4) of WinMISKAM. If the name of the flow files matches the name of the concentration file, only one "[Name].LOG file" exists. If different names have been selected, the "[Name].LOG file" of the dispersion calculation must be entered in the *MISKAM log file* input field for the calculation of the statistical characteristic values.



If the *Save interim concentration values in file* checkbox is checked, a "[Name].EZW" file is created in the selected output directory. The preload functionality is deactivated, i.e. the values entered in the Preload fields are ignored.

If there are also separate concentration fields for stable stratifications that are to be integrated into the calculation of the statistical characteristic values, the *MISKAM-LOG file for stable stratifications* checkbox must be checked.

The dispersion calculation in WinMISKAM is used to calculate additional pollution from the sources taken into account. The concentrations that would prevail in the study area without these sources can be entered in the input fields of the *background concentration* input area. These values are superimposed on the additional pollution. If the pollutant NO_x is entered in the source definition, the NO_2 pre-pollution data from measured data must be entered in the background concentration input fields in the *Statistical parameters* dialog box. This allows the NO-NO_2 conversion to be taken into account in the calculation of the statistical parameters. For the NO_X values calculated and output in the "[Name].SKW", the corresponding NO_X background concentration is calculated internally from the NO values.$_2$

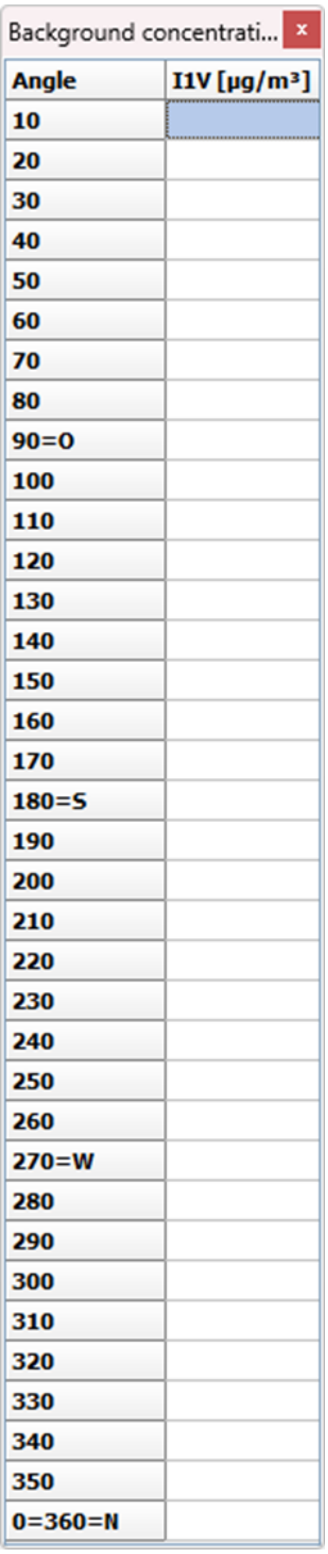
In the *background concentration* input area *(S.o. µg/m³)*[8] , the annual mean value of the pre-pollution must be entered in the *I1V* input field and the 98th percentile of the pre-pollution of the pollutant under consideration in the *I2V* input field.

Important note:
For the evaluation of the NO_X additional load, the corresponding background concentration values for NO_2 must be entered in the two input fields I1V and I2V.

---

[8] If statistical characteristic values for NOx are calculated and "Düring et al. (2011)" is selected as the nitrogen oxide conversion, the *preload* input area *(in µg/m³) is* deactivated. The entry is made at a later time under the menu item Execute|Nitrogen oxide conversion according to Düring et al. (2011).

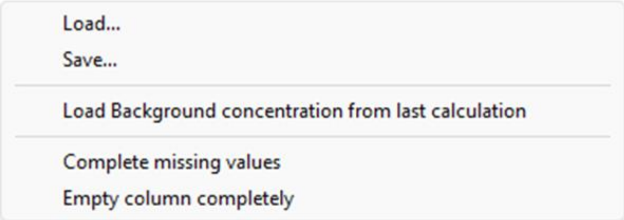
For *I1V,* it is possible to specify a fixed or a direction-dependent annual average value. Selecting the right-hand option *Direction-dependent* and clicking the *Direction-dependent* button opens the *Background concentration* dialog.



Angle	I1V [µg/m³]
10	
20	
30	
40	
50	
60	
70	
80	
90=O	
100	
110	
120	
130	
140	
150	
160	
170	
180=S	
190	
200	
210	
220	
230	
240	
250	
260	
270=W	
280	
290	
300	
310	
320	
330	
340	
350	
0=360=N	

The values can be entered manually here for each wind direction. For NO_X , enter the corresponding values from NO_2 in the I1V input field.

The entry can be saved (in the pop-up menu, after pressing the right mouse button).



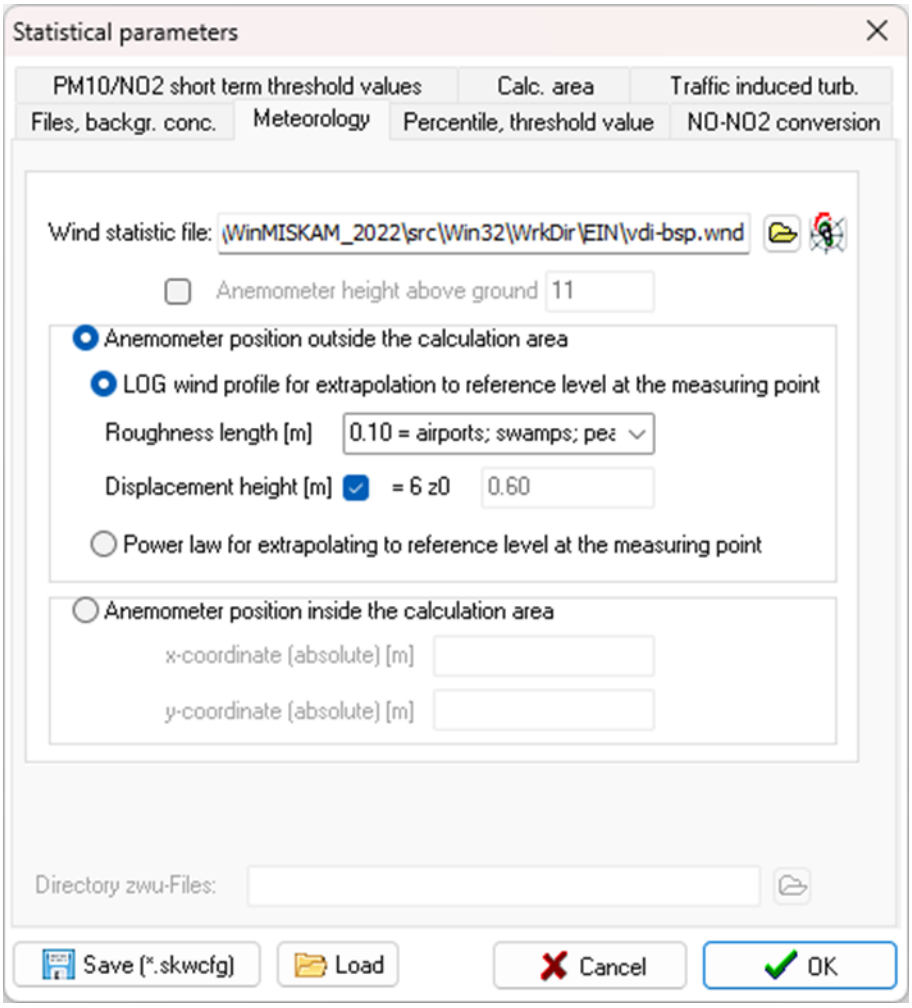
Once a wind direction-dependent preload has been saved, it can be called up again using the *Load* button. The preload from the last calculation can also be reloaded in the pop-up *menu* (from the program's working directory). The *Complete missing values* function in the pop-up *menu* assigns a preload to the missing wind directions, provided that a value has been entered for at least one wind direction. The missing values are interpolated linearly between two preloads. All direction-dependent preloads are removed using *Empty column completely*.

6.2 Meteorology

The wind statistics required for the calculation of the statistical characteristic values are defined under the *Meteorology* tab.

WinMISKAM is able to read meteorological data in the three different formats *.wnd and *.aks. In addition, WinMISKAM can read meteorological time series (= AKT) in the format for AUSTAL. Internally, this meteorological time series is converted into dispersion class statistics.

In addition, the **RosePlot** module integrated in WinMISKAM offers the option of generating corresponding formats from measured meteorological time series. Further information on this and the file formats can be found in the RosePlot help.



The anemometer height and the anemometer position (in or outside the calculation area) can be specified. If the anemometer position is outside the calculation area, the wind speed can be extrapolated from the measurement height to the reference height of 100 m either using the logarithmic wind profile and specifying the roughness length and the displacement height[9] or using the power law.

The wind statistics to be used (in WND or AKS format, see RosePlot Help) or dispersion class time series (in AKT format, see RosePlot Help) must be entered in the *Wind statistics* input field. Checking the box in front of *Anemometer height above ground [m] allows you* to explicitly specify the anemometer height associated with the wind statistics. If the check mark is not set, the anemometer height in the first line of a wind statistic in WND format (see RosePlot Help) is read out and otherwise an anemometer height of 10 m is assumed. After pressing the button  , a window appears in which the wind distribution is displayed as a percentage.

[9] Extrapolation using the logarithmic wind profile with specification of the roughness length and the displacement height is preferable to extrapolation using the power law.

Further information can be found in the RosePlot help, which also describes how wind statistics can be created from measured time series.

6.2.1 Anemometer position is outside the MISKAM calculation area

Annual mean value

The annual mean value of the concentration of a passive pollutant is calculated for a point of interest using the three-dimensional dispersion class statistic Φ.[10]

The annual mean value is calculated as follows:

$$\bar{c} = \sum_{k=1}^{K}\sum_{j=1}^{J}\sum_{i=1}^{I}\Phi\left(v_i,\varphi_j,d_k\right)\cdot c\left(\varphi_j,d_k\right)\cdot u_{100}\cdot\min\left(\frac{1}{u_i\left(d_k\right)},\frac{1}{u_s}\left(\frac{u_s}{u_i\left(d_k\right)}\right)^n\right)+\bar{c}_V \quad (1)$$

Here is

Φ:	Frequency of the three-dimensional dispersion class statistics
K:	Number of stability classes (usually K = 6)
J:	Number of incoming wind directions (usually J = 36)
I:	Number of wind speed levels (usually I = 9)
u_{100}	Approach velocity at 100 m above ground in m/s
u_s	Threshold speed in m/s
	nExponent (-) (e.g. 0.35)
u_i	Calculated value of the wind speed of the i-th stage converted to 100 m height above ground in m/s
v_i	Calculated value of the wind speed of the i-th stage in m/s
φ_j	:j-th incoming wind direction
d_k	:k-th stability class
$\bar{c}_V$	Pre-pollution concentration in µg/m³
$c\left(\varphi_j,d_k\right)$	three-dimensional concentration field (in µg/m³) calculated for an inflow velocity u_{100} at 100 m above ground for the direction of inflow jj and for the k-th stability class dk

If WinMISKAM is used for a building situation with a **predominantly street canyon character, it can be assumed** that there is neutral stratification due to the building-induced turbulence in the MISKAM calculation area. It is therefore sufficient to use MISKAM only to calculate concentrations

[10] For nitrogen oxides, equation (1) is evaluated for NOx.

for neutral stratification. In Eq. (1), it is therefore also sufficient to describe the three-dimensional concentration field only as a function of the direction of flow, i.e. $c(\varphi_j)$, instead of . $c(\varphi_j, d_k)$

If there are only **a few buildings in the MISKAM calculation area** (e.g. resettlement farm), the building-induced turbulence is not dominant and non-neutral stratification may also be present. With MISKAM, it is possible to calculate the concentration distribution not only for neutral stratification but also for stable stratification. If calculations have been carried out with MISKAM for neutral and stable stratification and the three-dimensional concentration fields calculated in this way are labeled $c_{neutral}(\varphi_j)$ and $c_{stabil}(\varphi_j)$, the following assignment of $c_{neutral}(\varphi_j)$ and $c_{stabil}(\varphi_j)$ to $c(\varphi_j, d_k)$ is implemented in WinMISKAM:

Stability class dk	$c(\varphi_j, d_k)$
I	$c_{stabil}(\varphi_j)$
II	$c_{stabil}(\varphi_j)$
III/1	$c_{neutral}(\varphi_j)$
III/2	$c_{neutral}(\varphi_j)$
IV	$c_{neutral}(\varphi_j)$
V	$c_{neutral}(\varphi_j)$

Tab. 6.1: Assignment of the three-dimensional concentration fields $c_{neutral}(\varphi_j)$ and $c_{stabil}(\varphi_j)$ to $c(\varphi_j, d_k)$ as a function of the stability classes dk

To activate this stability-dependent concentration assignment, the "MISKAM log file for stable stratification" checkbox, i.e.

be set.

The calculation value of the wind speed of the i-th stage converted to 100 m height above ground is calculated either with the profile from the power law or with the logarithmic profile.

a. Wind profile from the power law

$$u_i(d_k) = v_i \left(\frac{100m}{h_a} \right)^{m(d_k)} \quad (2)$$

The 9 calculated values of the wind speed of the i-th level v_{i} at the measurement height h_a of the wind statistics are 1, 1.5, 2, 3, 4.5, 6, 7.5, 9 and 12 m/s. If the wind statistics were measured in **aerodynamically rough terrain (open land)**, the following values are used for the **stability class-dependent exponent** m(dk):

Stability class dk	**Exponent m(dk)**
I	0.37
II	0.32
III/1	0.26
III/2	0.18
IV	0.14
V	0.12

Tab. 6.2: Stability classes and corresponding exponents

If, however, the wind statistics are measured in **aerodynamically rough terrain (urban areas),** then the **exponent** for rough terrain and stability classes III/1 according to VDI 3782 Sheet 1, i.e. **0.31**, is used for all stability classes.

b. Logarithmic wind profile

Based on the method used to determine the substitute anemometer height used in AUSTAL2000, the measurement height can be extrapolated to the reference height of 100 m using the logarithmic wind profile:

$$u_i = v_i \frac{\ln\left(\frac{100m - d_{0,s}}{z_{0,s}}\right)}{\ln\left(\frac{h_a - d_{0,s}}{z_{0,s}}\right)} \qquad (3)$$

Here is

$d_{0,s}$	Displacement height at the anemometer location
$z_{0,s}$	Roughness length at the anemometer location

With this approach, the extrapolation to a reference height of 100 m does not depend on the stability.

Both methods are implemented in WinMISKAM. Extrapolation using the logarithmic wind profile with specification of the roughness length and the displacement height is preferable to extrapolation using the power law, as explained below.

Wind profiles according to the power law originate from inflow wind profile measurements in the **wind tunnel**. The logarithmic wind profile, on the other hand, results as an **exact solution near the ground** from the momentum conservation equations under the assumption of horizontal homogeneity and for certain assumptions for the turbulent flows. Since MISKAM is based on the same assumptions, a logarithmic profile is also obtained at an inflow edge in MISKAM, for example. Therefore, if the value $d_{0,s} = 0\,m$ is set for the displacement height at the anemometer location and the same value is set for the roughness length at the anemometer location $z_{0,s}$ as in the INI file or via the "Parameters" menu item (cf. section 5.2) for roughness length in the "Start parameters" area, i.e.

This would be equivalent to the idea that the anemometer location is located **directly at the MISKAM inflow edge**. It should be noted here that the inflow edge is located on different sides of the MISKAM calculation area for different inflow directions.

Percentile

Determining the percentile values is more complex than the annual mean values, as the daily variation in emissions must be taken into account.

If, for example, daily and weekly traffic volumes are known in hourly resolution, the emission density and thus the immission concentration can in principle be calculated for all 168 hours of the week. This procedure would require too much computational effort. By aggregating the 168 hourly values in this case into 5 classes, the effort is reduced.

The following procedure is used for aggregation: The 168 hourly mean emission density values are first sorted by size and then aggregated by class formation. A possible and in practice proven division of the 168 sorted hourly emission values is, for example, the division into "drawers" of width 25, 25, 25, 25 and 68 hours. The resulting distribution function P_l for the emissions (i.e. "content of the drawers") must still be normalized so that the sum of the product of the value of the relative emission intensity P_l and class widths b_l is one, i.e:

$$\sum_{l=1}^{L} P_l \cdot b_l = 1 \qquad (4)$$

here is

L: Number of classes of relative emission strength (here: L = 5)

P_l: Relative emission density of class l

b_l: Relative frequency of class l

With the aid of the relative emission strength Pl, individual concentration values $c_{i,j,k,l}$ and individual probabilities $w_{i,j,k,l}$ can be determined for the point of interest for the range i = 1,...,I, j = 1,...,J, k = 1,...,K and l = 1,...,L:

$$c_{i,j,k,l} = P_l \cdot c(\varphi_j, d_k) \cdot u_{100} \cdot \min\left(\frac{1}{u_i(d_k)}, \frac{1}{u_s}\left(\frac{u_s}{u_i(d_k)}\right)^n \right), \quad w_{i,j,k,l} = b_l \cdot \Phi(v_i, \varphi_j, d_k) \qquad (5)$$

The percentile value is now determined as follows: If the individual concentration values $ci_{,j,k,l}$ are sorted according to size, the percentile value is the individual concentration value at which the sum of the individual probabilities (summation begins with the smallest concentration value) exceeds the desired percentage (e.g. 98 %) for the first time.

To calculate the percentile value of the total pollution, the pre-pollution and the additional pollution must be superimposed in a suitable form. In WinMISKAM, the percentile value of the pre-pollution and the percentile value of the additional pollution are combined using the procedure according to TA Luft.

An alternative procedure is a much more precise method and is implemented in PROKAS. For each individual value of the additional load, a suitable[11] value of the preload is also calculated and these individual concentration values of the preload and additional load are added directly, i.e. $ci_{,j,k,l} = cV_{,i,j,k,l} + cZ_{,i,j,k,l}$.

The MISKAM single values of the concentration are imported into PROKAS via the single value file. If the single value file is to be generated during the calculation of the statistical parameters, the *Write single values to file* checkbox must be activated in the **Statistical parameters** dialog under *Files/Preload*.

6.2.2 Anemometer position is within the MISKAM calculation area

If it is specified that the anemometer position is located in the MISKAM calculation area, the annual mean value is calculated as follows:

$$\bar{c} = \sum_{k=1}^{K}\sum_{j=1}^{J}\sum_{i=1}^{I} \Phi(v_i, \varphi_j, d_k) \cdot c(\varphi_j, d_k) \cdot u_A(\varphi_j) \cdot \min\left(\frac{1}{v_i}, \frac{1}{u_s}\left(\frac{u_s}{v_i}\right)^n \right) + \bar{c}_V \qquad (6)$$

Here is

Φ:	Frequency of the three-dimensional dispersion class statistics
K:	Number of stability classes (usually K = 6)
J:	Number of wind directions on the anemometer (usually J = 36)

11 i.e. for the corresponding wind direction, wind speed and stability.

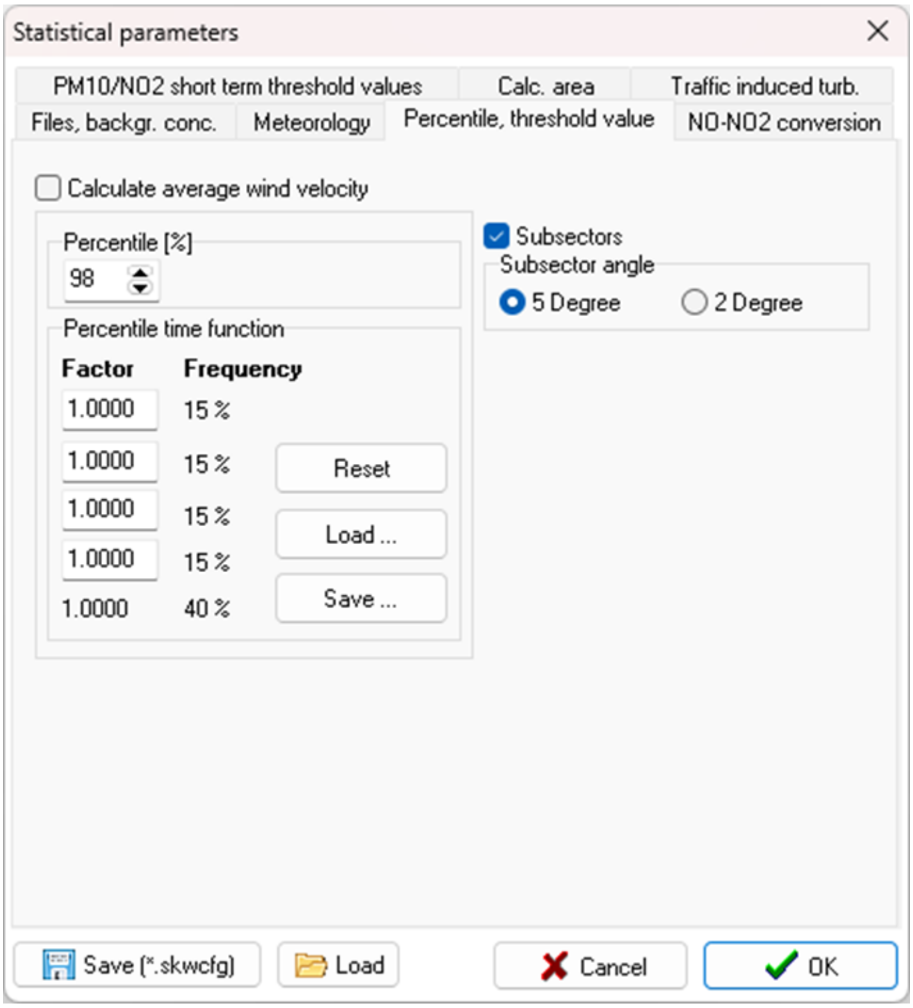
l:	Number of wind speed levels (usually l = 9)
$u_A(\varphi_j)$	Amount of velocity interpolated from MISKAM velocity fields at the anemometer location for the j-th wind direction at anemometer φ_j in m/s
u_s	Threshold speed (in m/s)
	nExponent (-) (e.g. 0.35)
v_i	Calculated value of the wind speed of the i-th stage (in m/s)
φ_j	:j-th wind direction on the anemometer
d_k	:k-th stability class
$\bar{c}_V$	Pre-exposure concentration (in µg/m³)
$c(\varphi_j, d_k)$	interpolated three-dimensional concentration field (in µg/m³) for the j-th wind direction at anemometer jj and for the k-th stability class dk

For the percentile calculation, instead of equation (5) in Sect. 6.2.1 the following equation is used with the meanings of the variables given in this chapter:

$$c_{i,j,k,l} = P_l \cdot c(\varphi_j, d_k) \cdot u_A(\varphi_j) \cdot \min\left(\frac{1}{v_i}, \frac{1}{u_s}\left(\frac{u_s}{v_i}\right)^n\right), \quad w_{i,j,k,l} = b_l \cdot \Phi(v_i, \varphi_j, d_k) \qquad (7)$$

6.3 Percentile/threshold value

Under the Percentile/Threshold value tab, enter the percentage value to be calculated as the short-term exposure in the *Percentile* input field.

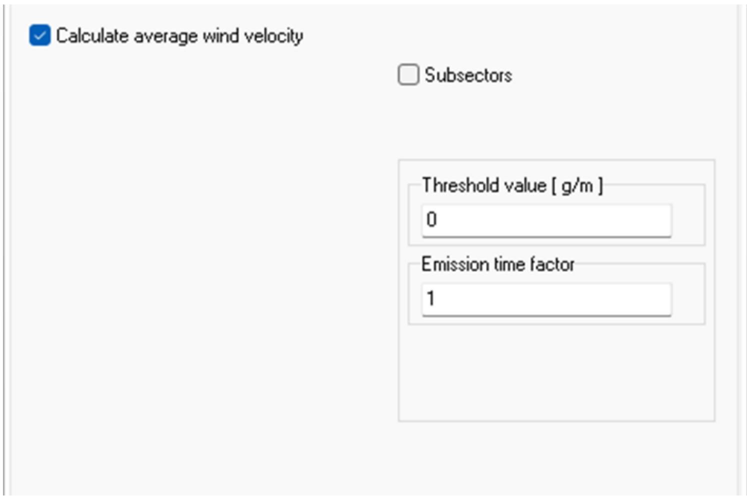


This describes the value that is not exceeded in the specified percentage of time. In addition, the emission curve in the form of a 5-stage time function must be entered or loaded under *percentile time function so that* the daily variation in emissions is taken into account in the immission calculation.

The time function allows emissions from the sources to be taken into account over the course of the day. If 1 is entered in all four input fields, a uniform distribution over the day is assumed. The entries can be saved as an egx file using the *Save* as egx file button (see Sect. 6.3.1) to save the entries. The *Load* button can be used to load existing egx files (see section 6.3.1) with the daily schedule can be loaded. The *Reset* button resets the changed factors of the average emission to a uniform distribution.

By ticking the *Subsectors* checkbox, you have the option of refining the 10-degree wind sectors to 5 degree or 2-degree wind sectors.

Checking the *Calculate average wind velocity* checkbox activates this option and the input fields for the threshold value and the emission time factor are displayed.



6.3.1 EGX file

The emission hydrograph files describe the distribution of emissions for a pollutant (e.g. $_{NOx}$, benzene, PM10 or soot) aggregated into five classes. These files are required for the calculation of the percentile value, but not for the calculation of the annual mean value. The "[Name].EGX files" contain the five values of the relative emission strength $_{Pl}$ and the relative frequency of the class $_{bl}$. EGX stands for EGR, EGB, EGP and EGN. The extents EGR, EGB, EGP and EGN denote corresponding files for the pollutants soot, benzene, PM10 and $_{NOx}$.

The five values of the relative emission intensity $_{Pl}$ are usually derived from the traffic aisles for a selected road segment. The relative emission levels refer to the average emission densities.

The "[Name].EGX files" are structured as follows. The first line consists of comments. Lines 2 to 6 indicate the relative emission intensity (1st number in each line) and the frequency of the 5 emission classes (2nd number in each line). The relative emission strengths are multiples of the mean value of the emission density; the first 4 frequency classes are present here 14.881 % of the time, the last class 40.476 % of the time.

An emission of the specified example file for $_{NOx}$ of 1.9782 times the weekly mean value occurs 14.881 % of the time, an emission of 1.7622 times the weekly mean value occurs 14.881 % of the time, etc. This classification has proven itself in sensitivity tests. However, other classifications may also be used, provided that the sum of the frequencies is 1. The seventh line consists of a comment line. This is followed by 168 lines corresponding to the number of hours per week with the emissions per hour. These lines are sorted according to the size of the emissions.

[Name].EGN		[Name].EGB		[Name].EGR	
NO_x EmgFile from :		BenzeneEmgFile from:		RussEmgFile from:	
1.9782	0.14881	1.9947	0.14881	2.0812	0.14881
1.7622	0.14881	1.5684	0.14881	1.9401	0.14881
1.3307	0.14881	1.3663	0.14881	1.2038	0.14881
0.7389	0.14881	0.9089	0.14881	0.6554	0.14881
0.3345	0.40476	0.3242	0.40476	0.3086	0.40476
Emission frequency distribution		Emission frequency distribution		Emission frequency distribution	
1	1.5029	1	0.0179	1	0.0224
2	1.5029	2	0.0179	2	0.0224
3	1.5029	3	0.0179	3	0.0224
.	.	.	.	.	.
168	0.0423	168	0.0007	168	0.0004

Tab. 6.3: Extracts from the files "[Name].EGN", "[Name].EGB" and "[Name].EGR"

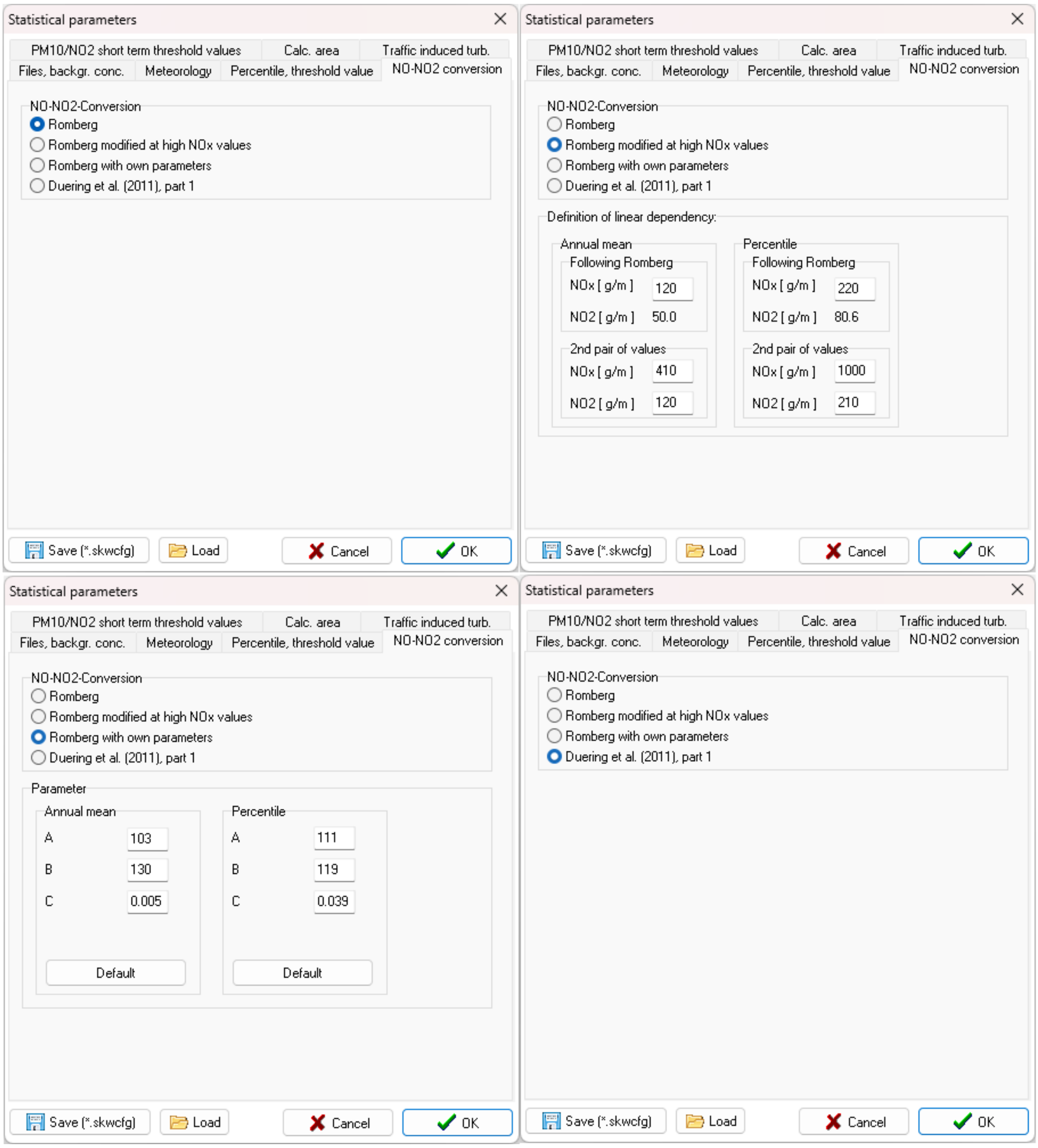
The data from line 7 onwards is for information purposes and is not processed by WinMISKAM.

6.4 NO-NO_2 -conversion

Four different approaches for calculating NO-NO_2 conversion are available under the *NO-NO_2 conversion* tab:

1. Romberg et al. (1996)
2. Romberg et al. (1996) modified for high NO $values_X$
3. Romberg et al. (1996) with own parameters and
4. Düring et al. (2012)

With "Romberg et al. (1996) modified for high NO_X values", it is possible to leave the formulaic relationship according to Romberg et al. (1996) continuously from a specified NO_X value (entered in the dialog under "Connection to Romberg") and replace it with a linear relationship for higher NO_X or NO_2 values. The linear equation passes through the pair of values that can be entered in the dialog under "2nd pair of values". The user is responsible for selecting suitable values for the NO_X or NO_2 concentrations that can be entered in the dialog under "Connection to Romberg" and "2nd pair of values". Default values are not given.



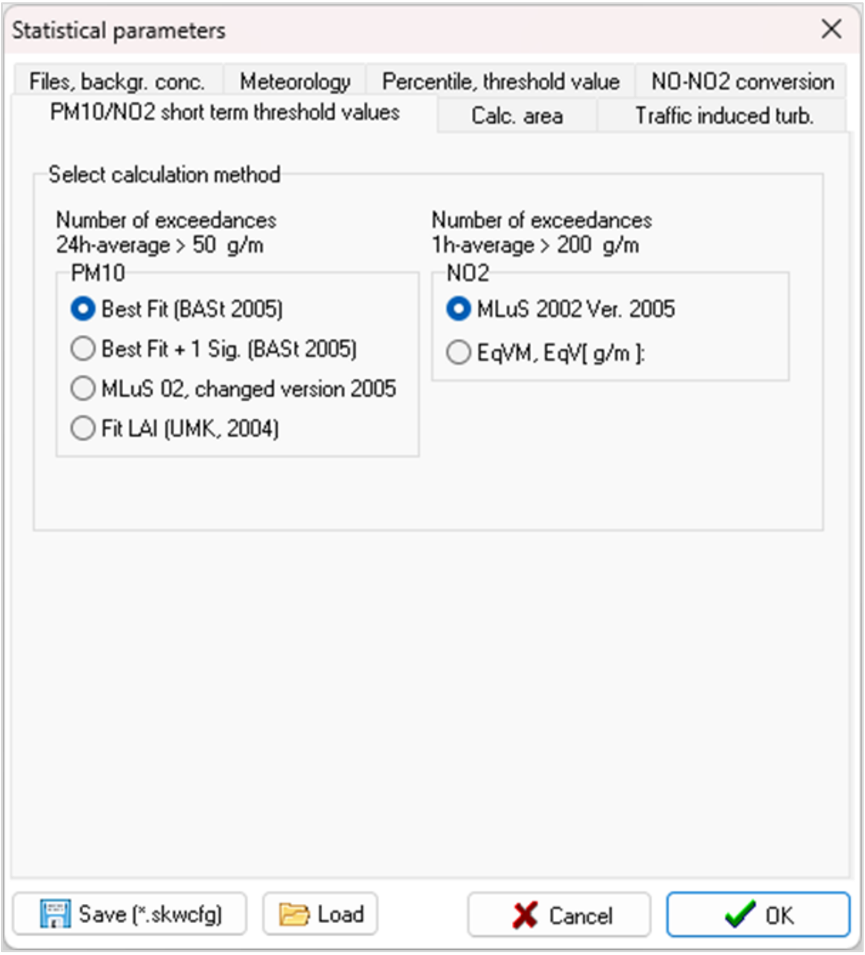
With "Romberg et al. (1996) with own parameters" it is possible to change the standard parameters according to Romberg et al. (1996). Suitable parameter sets can be obtained, for example, by statistically evaluating NO /NO_{x2} measurement data sets. The user is responsible for selecting suitable parameters. Pressing the "Default" button resets the parameters according to Romberg et al. (1996).

Calculations when selecting (1.) Romberg et al. (1996) and (3.) Romberg et al. (1996) with own parameters and pressing the "Default" button give identical results.

The calculation method "Düring et al. (2012)" is described in Chap. 7 is explained. If this calculation method is selected, the annual mean value of the NO_X additional pollution and not the NO_X total pollution is calculated in this step. For this reason, if this calculation method is selected, the input area for the pre-pollution is deactivated and the pre-pollution is set to zero within the program.

6.5 PM10 short-term characteristic value

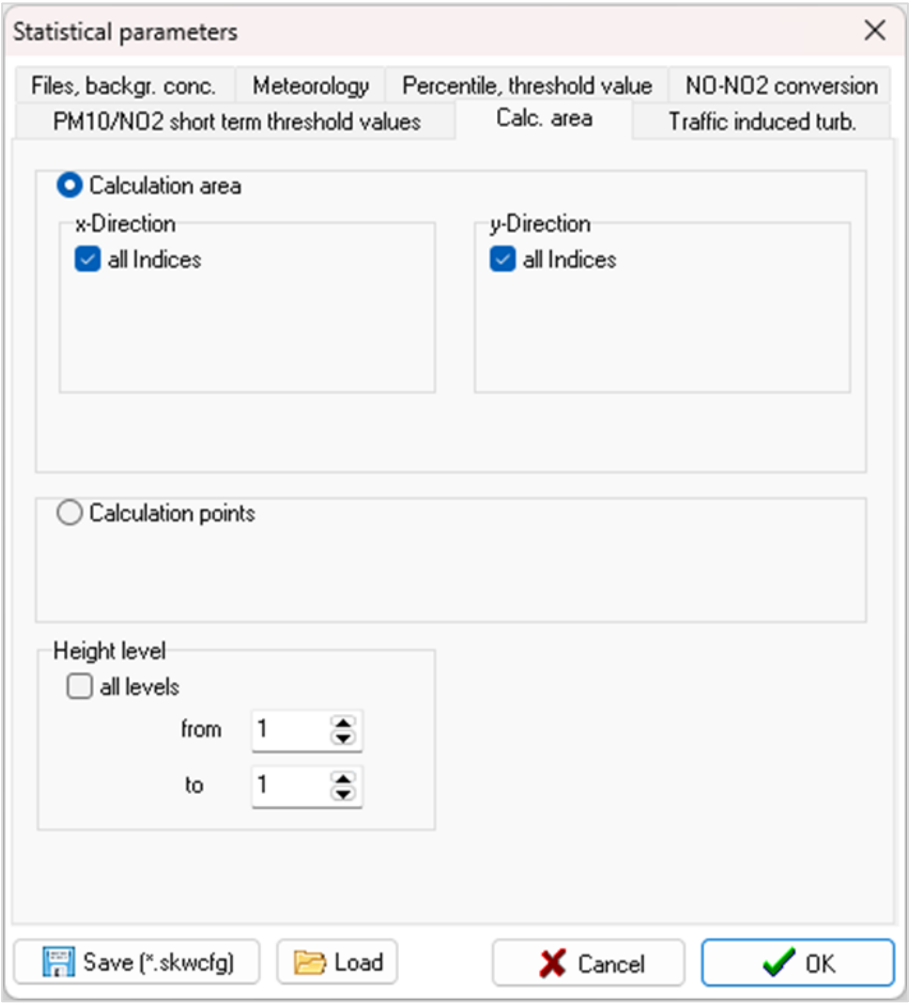
Four different approaches for the calculation of PM10 short-term characteristic values are available under the *PM10/NO2 short-term treshold values* tab.



PM10 short-term exceedance occurs when the daily average exceeds the value of 50 µm/m³. The theoretical background to the various calculation methods is described in the appendix.

6.6 Calculation area

The *Calculation area* tab enables the calculation of the statistical characteristic values for the entire calculation grid or for a selection thereof.

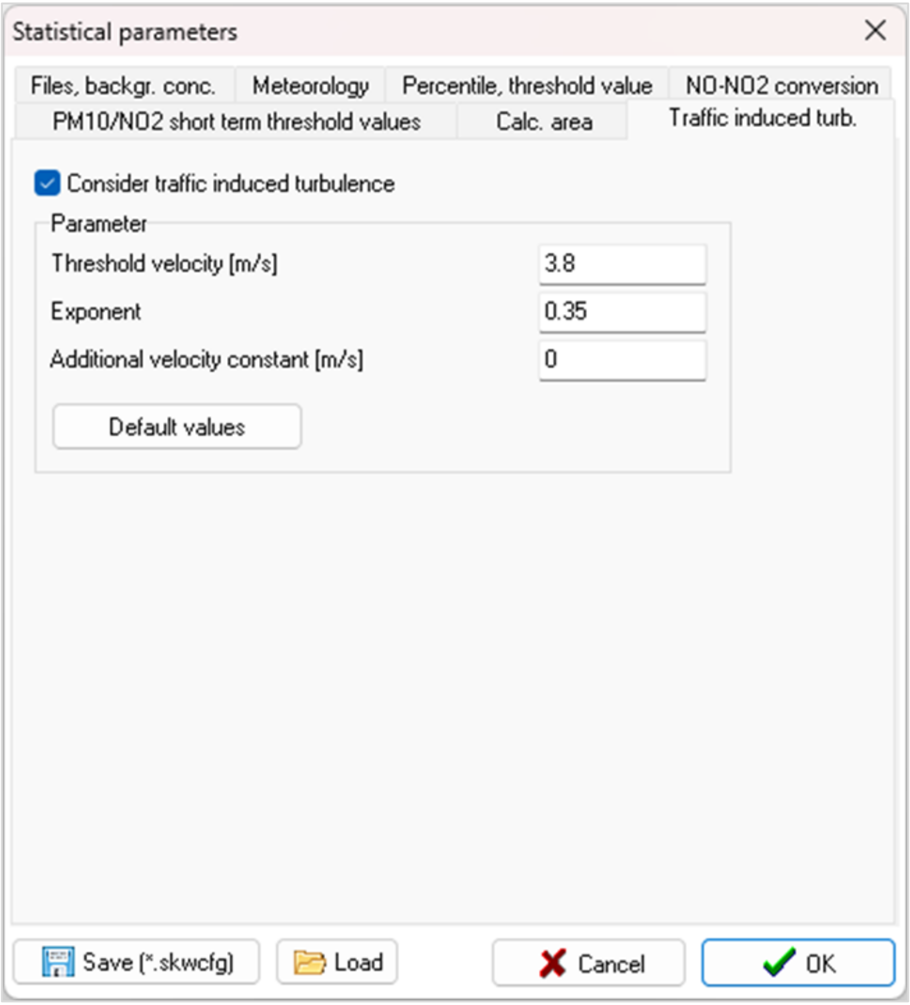


If the square checkbox is ticked, the entire calculation grid is calculated. Clicking on the *all indices* within the *x-direction* or *y-direction* input area checkbox gives you the option of entering the smallest and largest desired index of the calculation grid. Alternatively, a file can be created in which the i- and j-indices of the boxes of the calculation grid for which the statistical characteristic values are to be calculated are listed line by line and separated by spaces. Clicking on the *Read i-, j- indices from file* checkbox opens an input field in which the path and name of the file with the listed indices is entered.

The *height level* determines the box above ground in which the statistical characteristic values of the immissions are calculated. On the one hand, it is possible to check *all levels* so that the statistical characteristic values are calculated vertically over the entire calculation area. On the other hand, the lower and upper limit values of the area over which the calculation is to be made can be entered in the *From* and *To* buttons.

6.7 Traffic-induced turbulence

The *Traffic-induced turbulence* tab contains a checkbox with which this function can be initialized.



If the button is not checked, the concentration is scaled inversely proportional to the wind speed (for an explanation, see Sect. 6.7.1).

The settings in the *Parameters* input area can be varied if this is necessary for a dispersion calculation from a technical and content-related point of view. The default values, which also appear in the input fields, correspond to the current state of knowledge (see Sect. 6.7.1). The variation is left to the user. The *Default values* button resets any changes made to the default values.

6.7.1 Parameter file VDI_FREI.PAR

In WinMISKAM, only the last line of the "VDI_FREI.PAR" file is used. It contains information on how the concentration is scaled via the wind speed by default (default values) for situations where traffic-generated turbulence is taken into account (see Sect. 6.2). The default settings are set:

- Threshold wind speed u_S = 3.8 m/s
- Exponent n = 0.35
- Additive speed constant Δu = 0.0 m/s

These default settings can be varied by ticking the checkbox *Consider traffic-generated turbulence* under *Execute|Statistical parameters|Traffic-generated turbulence. Turbulence, if* this is required for a dispersion calculation from a technical and content-related point of view. If the button is not checked, the concentration is scaled inversely proportional to the wind speed (i.e. exponent n = 1).

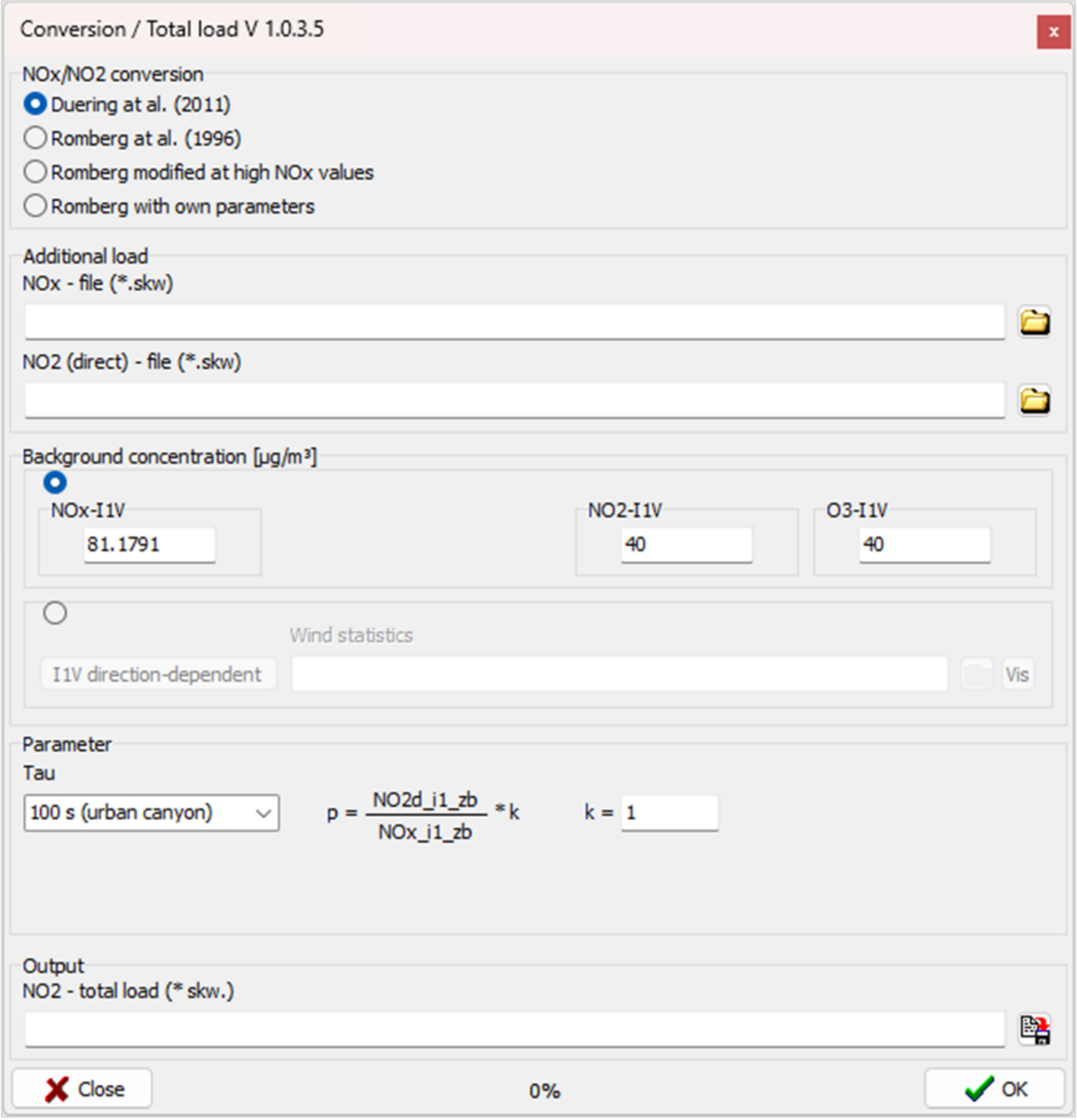
TA Luft:	Class	No	G	g	F	f	m
I	F	1	0.241	0.662	1.294	0.718	0.37
II	E	2	0.264	0.774	0.801	0.754	0.32
III/1	D	3	0.215	0.885	0.640	0.784	0.26
III/2	C	4	0.165	0.996	0.659	0.807	0.18
IV	B	5	0.127	1.108	0.876	0.823	0.14
V	A	6	0.151	1.219	1.503	0.833	0.12
Vehicle_turbulence_parameters	Exponent	delta_u	Threshold speed	Constant			
	0.35	0	3.8	1			

Tab. 6.4: File "VDI_FREI.PAR" with standard content

For street areas with consideration of traffic-generated turbulence, the concentration scaling above the threshold wind speed of 3.8 m/s at a height of 100 m is inversely proportional to the wind speed, and below this threshold wind speed it is proportional to the wind speed $u^{-0.35}$. This takes into account the influence of traffic-generated turbulence in street canyons (Schädler et al., 1996). The immissions calculated with the scaling $u^{-0.35}$ with MISKAM only apply in the near field of the source; in the far field, the scaling would have to be inversely proportional to the wind speed. The determination of the influence of vehicle-generated turbulence and its consideration in dispersion models is currently the subject of research. It is currently not known at what distance from the road the transition from scaling with u to $u^{-0.35}$ has to take place.

7 NITROGEN OXIDE CONVERSION ACCORDING TO DÜRING ET AL. (2011)

After selecting the menu *Execute|Nitrogen oxide conversion* according to Düring et al. (2011)... in the menu bar of the WinMISKAM main window, the dialog *Conversion/Total load* appears.



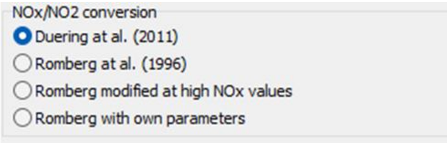
For the calculation of the nitrogen oxide conversion according to Düring et al. (2011), two .skw files are required, one for the

1. annual mean value of the NO_X -additional load and the other for the
2. Annual mean value of the additional NO_2 pollution caused by NO_2 emitted directly by motor vehicles.

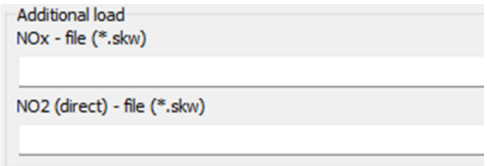
For the last-mentioned skw file, separate concentration calculations must generally be carried out with MISKAM. The NO_2 directly emitted by motor vehicles is to be used as the emission for this.

After selecting the menu item *Execute* | *Nitrogen oxide conversion* according to Düring et al. (2011), the following dialog opens:

Significance of the elements of the *conversion/total load* dialog

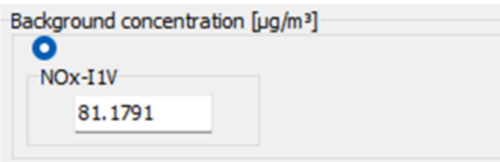


Selection of the method for nitrogen oxide conversion. The methods Romberg et al. (1996), Romberg modified for high NO_x values and Romberg with own parameters are repeated here for the sake of completeness, see menu item "Execute | Calculate statistical parameters.

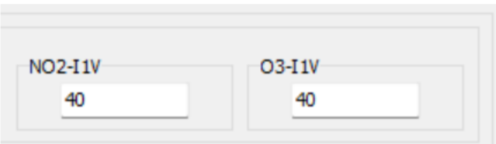


Name of the skw file[12] for the

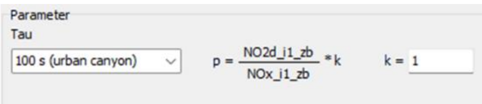
- NO_x -additional load or
- NO_2 -Background concentration caused by NO_2 emitted directly by motor vehicles



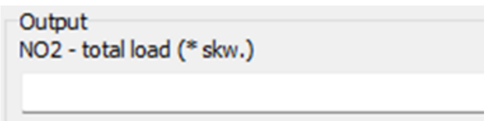
Annual mean value of the pre-pollution for the pollutants NO_x ,



NO_2 and O $_3$[13]



Parameters for the chemistry model according to Düring et al. (2011). Two parameters are offered, one for applications in street canyons and one for free dispersion.

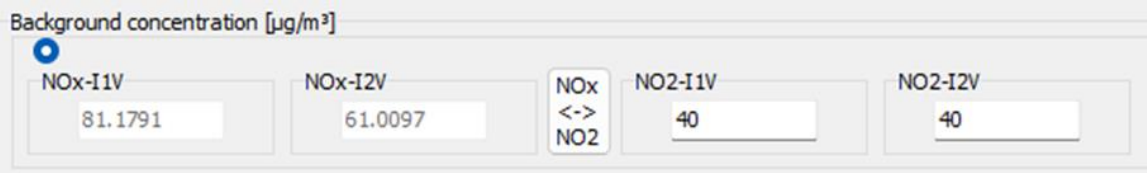


Name of the skw file containing the NO total load $_2$ contains

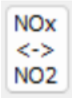
[12] If a method based on "Romberg" is selected for the nitrogen oxide conversion, the input field "NO2 (direct) - file (*.skw)" is hidden.

[13] If a method based on "Romberg" is selected for the nitrogen oxide conversion, the "O3-I1V" input field is hidden.

When selecting a method based on "Romberg" for nitrogen oxide conversion, it is possible to enter the preload either as NO_x or as NO_2.



By clicking on the button



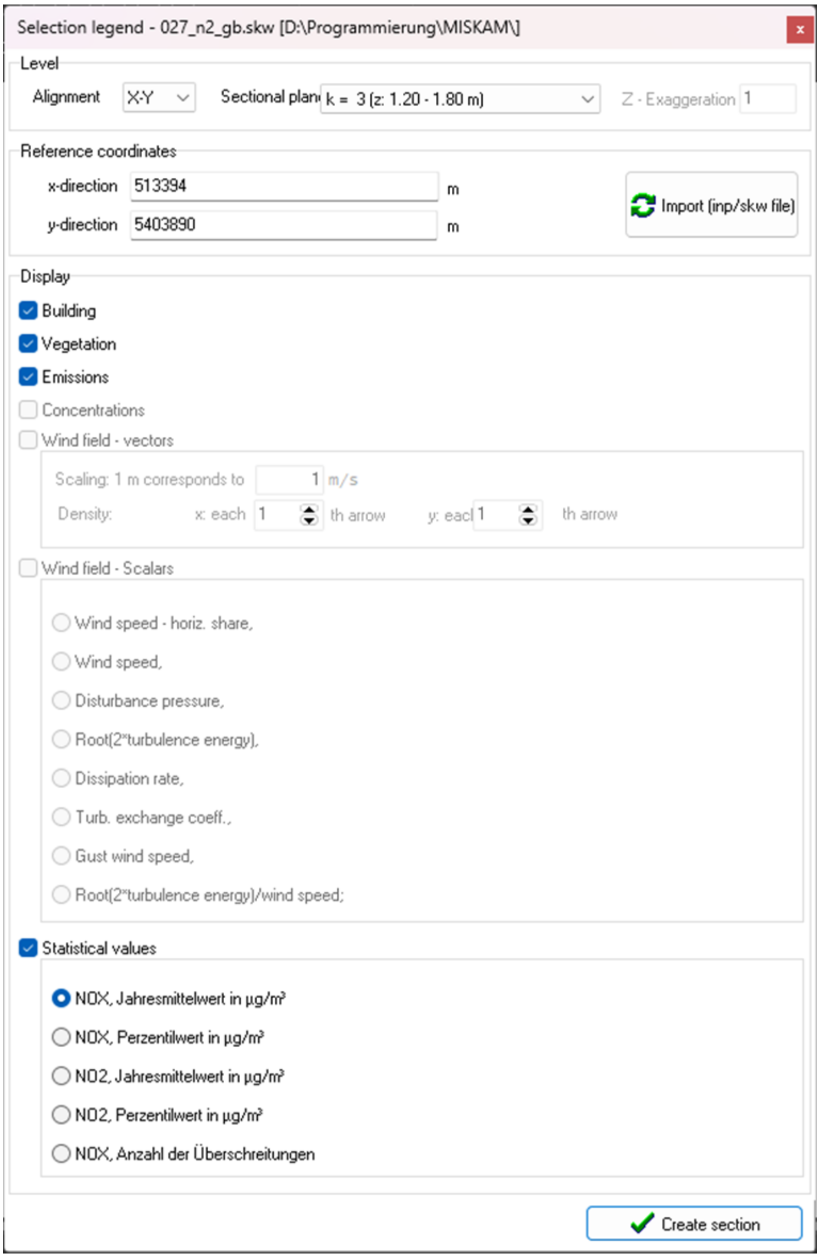
is switched between the input option of the preload either as NO_x or as NO_2.

Analogous to the options in the dialog "Calculate statistical parameters ..." dialog (see Chap. 6), you can specify a direction-dependent annual mean value of the pre-pollution.

More detailed explanations on the input of a direction-dependent annual mean value of the pre-pollution can be found in Chap. 6. can be found. If "Düring et al. (2011)" is selected as the method for nitrogen oxide conversion, the direction-dependent annual mean value of the pre-pollution for NO_2 and O_3 must also be entered in addition to NO_x.

8 SECTIONAL VIEW

Both MISKAM configuration files (*.inp) and result files (*.zwu, *.zwt., *.zwk, *.skw) can be generated in WinMISKAM and optionally saved in the project. It is not absolutely necessary to load a configuration file to display the results. After selecting the Sectional *view...* submenu item under the *GIS layer* menu (or clicking on the corresponding button in the toolbar), a file with the above-mentioned extension must be selected in the *Open file* dialog for which a sectional view is to be created. This opens the Sectional *view* window, the operation of which is described in more detail below.



In the *Alignment selection list, you can* specify whether a horizontal section (*X-Y*) or a vertical section (*X-Z* or *Y-Z*)[14] should be created. The position of the section is selected in the *Section plane* selection list*,* which always changes when a new alignment is defined. In the case of a vertical section, it is also possible to specify an exaggeration factor for the Z-coordinate, which is noticeable when the section is displayed under the X-Z tab.

The specification of the MISKAM reference coordinates (= zero point coordinates of the calculation grid) is not mandatory, but is required if the layplan is to be displayed together with a configuration or on the basis of a map. For the sectional view of a configuration file (*.inp) or a results file with statistical characteristic values (*.skw), the reference coordinates are automatically read in from the file and displayed. In all other cases, the reference coordinates are initially set to zero, but can be imported from a file belonging to the MISKAM project (*.inp or *.skw) by clicking the *Import* button, or entered manually in the corresponding input fields.

Under *Display,* you can select which data records from the file are to be displayed. These selection options differ in this area depending on the file type and are described in more detail below. Certain entries cannot be selected and are grayed out if the corresponding data records are not available for this file type. For the vectorial wind field representation from the data of a ZWU file, the scaling factor of the arrow length and information on the arrow density can be entered in the corresponding input fields.

After pressing the *OK* button, the window closes automatically and the corresponding data from the file is loaded and the selected GIS layers are created. Depending on the number and size of the GIS layers to be displayed, this may take some time.

After creating a new layplan, the individual GIS layers are displayed in standard coloring or with standard categories. These default colors can be configured in the *File* menu under *Settings...* when the layers are created for the first time. The categorized legend coloring can be edited in the context menu after selecting the corresponding GIS layer under the *Legend... entry*.

The parameters of an already loaded sectional view can be viewed and edited again at any time by selecting the group in the legend and opening the context menu by left-clicking under the entry *Sectional view... and* edit them again. The same Sectional *view* window then opens as when creating a new layplan.

[14] Only available if the "Extended graphics" add-on module is licensed. Not included in the scope of delivery of the WinMISKAM basic version.

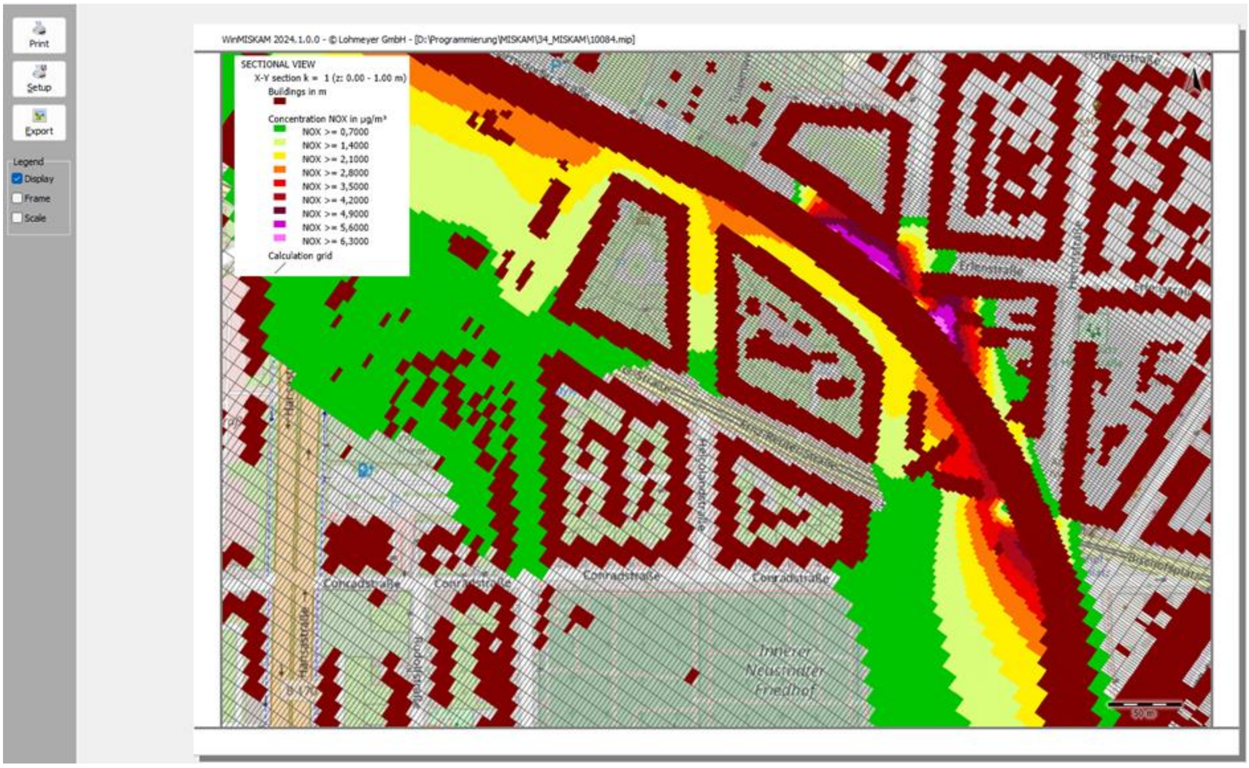
The Show legend menu item displays the color legend in a separate window on the screen. This is particularly useful if the legend of the results display is outside the screen for enlarged display sections.

With the menu item *Show maximum value*, a small flag is displayed when a concentration file "[Name].ZWK" is displayed, which points to the box with the highest concentration in the displayed level.

If, when opening a concentration file "[Name].ZWK" in the results directory, there is a corresponding flow file or vertical flow file or vegetation file with the name of the configuration file as a prefix "[KonfName].001" or "[KonfName].002" or "[KonfName].003", these will be read. In this case, the flow-through areas are displayed as free areas (without buildings), the boxes with vegetation as colored areas and the source boxes with a vertical jet with a dot.

9 PRINT VIEW

The print view can be opened by clicking on the menu item *File|Print view*.



When switching from the map view to the print view, only entries that are actually displayed in the map area (i.e. activated in the legend area with a tick) are transferred to the legend.

The map section in the print area can be changed at any time by zooming in or out with the mouse scroll wheel above the image. The *Legend|Display* selection box can be used to make the legend visible or invisible.

The legend frame can be made visible or invisible via the *Legend|Frame* selection box. Both the position and the selected section of the legend can be changed with the mouse using drag & drop over the rectangular area or over the edge of the rectangle. If the Scale option is selected using the *Legend* | *Scale* selection box, the legend display can also be stretched or compressed by dragging and dropping over the edge of the rectangle.

Clicking on the *Print* button opens the standard Windows print dialog with the options for selecting the printer and initiating the printing process. The framed image section is then printed.

The printer settings can be changed by selecting the *Setup* button.

The displayed graphic can be exported in the image formats "[Name].PNG", "[Name].BMP" or "[Name].JPG" by selecting the *Export* button. These files can be read by Windows programs (e.g. Word for Windows) and can be loaded and further processed there.

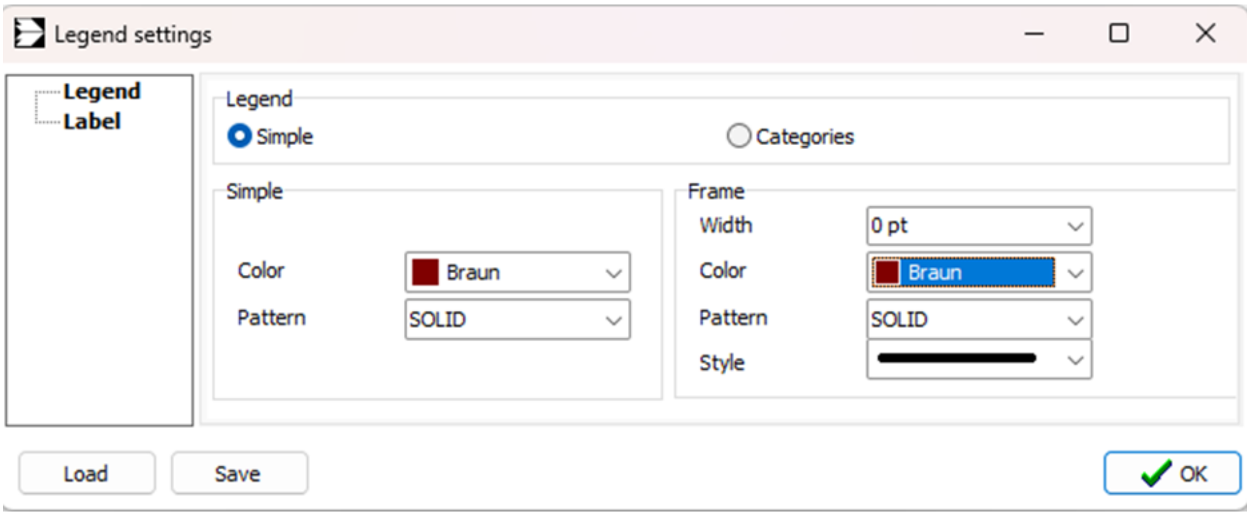
You can return to the map view by clicking on the menu item *File|Close print view.*

10 LEGEND SETTINGS

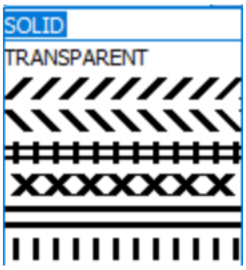
To adjust the legend of GIS layers, right-click on a GIS layer to open the *Legend settings* dialog (see section. 3.4.3).

Here you can choose between a monochrome and categorized colouring. The coloring selected in the *Legend* selection group is used for the GIS layer. The individual shapes of the GIS layers can be provided with *labels* that display the information of an attribute of the shape. Legend colorings are saved by WinMISKAM in ttkstyle files. These files can be saved via a *load* and a *save* button and loaded for further GIS layers.

10.1 Monochrome coloring



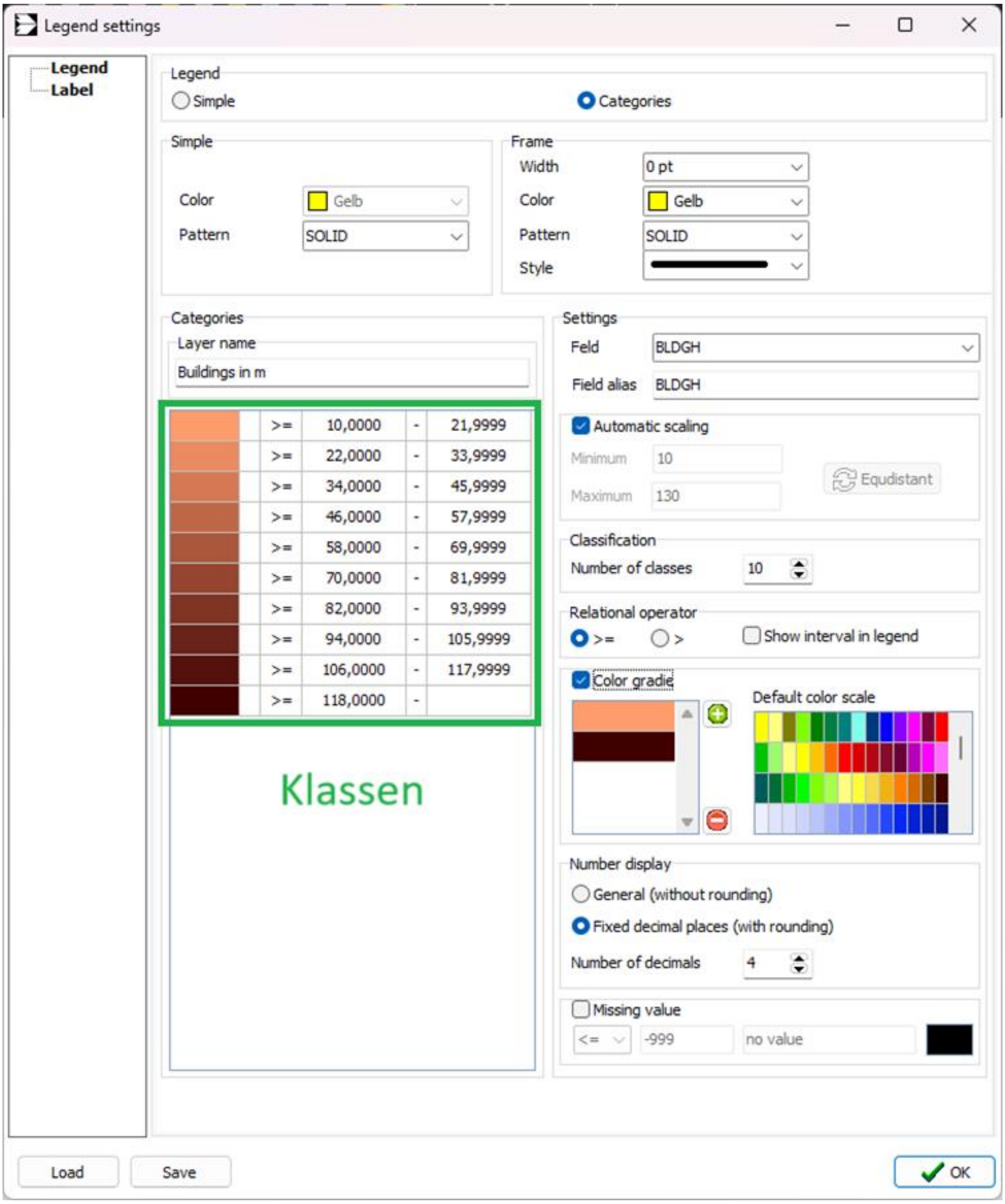
The color of the fill and frame is set via the *Simple* selection. The color is selected via the *Color* selection list, in which a standard color or an individual color is selected. The pattern of the fill and frame is selected via the *Pattern* selection list.



SOLID here means a flat color. *TRANSPARENT* means transparent. The transparency value is 100% and cannot be changed. To obtain a transparent color, the transparency of the GIS layer must be adjusted (see section 3.4.3). The other entries in the selection list represent the color pattern.

A frame width and a style can also be specified for the frame.

10.2 Categories



Similar to the monochrome coloring, the pattern of the filling and the frame settings can be made here.

The following elements are available in the *Legend Settings* selection group.

Field

A column is selected here from the shape file of the GIS layer from which the values for the categorization are read.

Flied alias

The field alias is later displayed in the legend area for the individual categories. This is the name of the selected field by default, but can be freely selected.

Automatic scaling

If the *Automatic scaling checkbox* is activated, the *minimum* and maximum values of the selected field are read from the shape file and distributed to the *classes.* A user-defined minimum and maximum can be set by deactivating the Automatic *scaling* checkbox. The *Equidistant* button is then used to distribute the values to the *classes*.

Classification | Number of classes

The number of classes can be defined here.

Relational operator

The comparison operator is used to set how the limits of the individual classes are handled. If the *Show interval in legend* checkbox is activated, the minimum and maximum of a class are displayed in the legend area. If the checkbox is deactivated, only the minimum of the class is displayed.

Color gradient

The color gradient for the classes is set in the *color gradient* selection group. A standard color gradient can be selected here or you can define your own. More colors can be added to the gradient using the green *plus* and red *minus* buttons*.* Double-click on a color field to open the color selection.

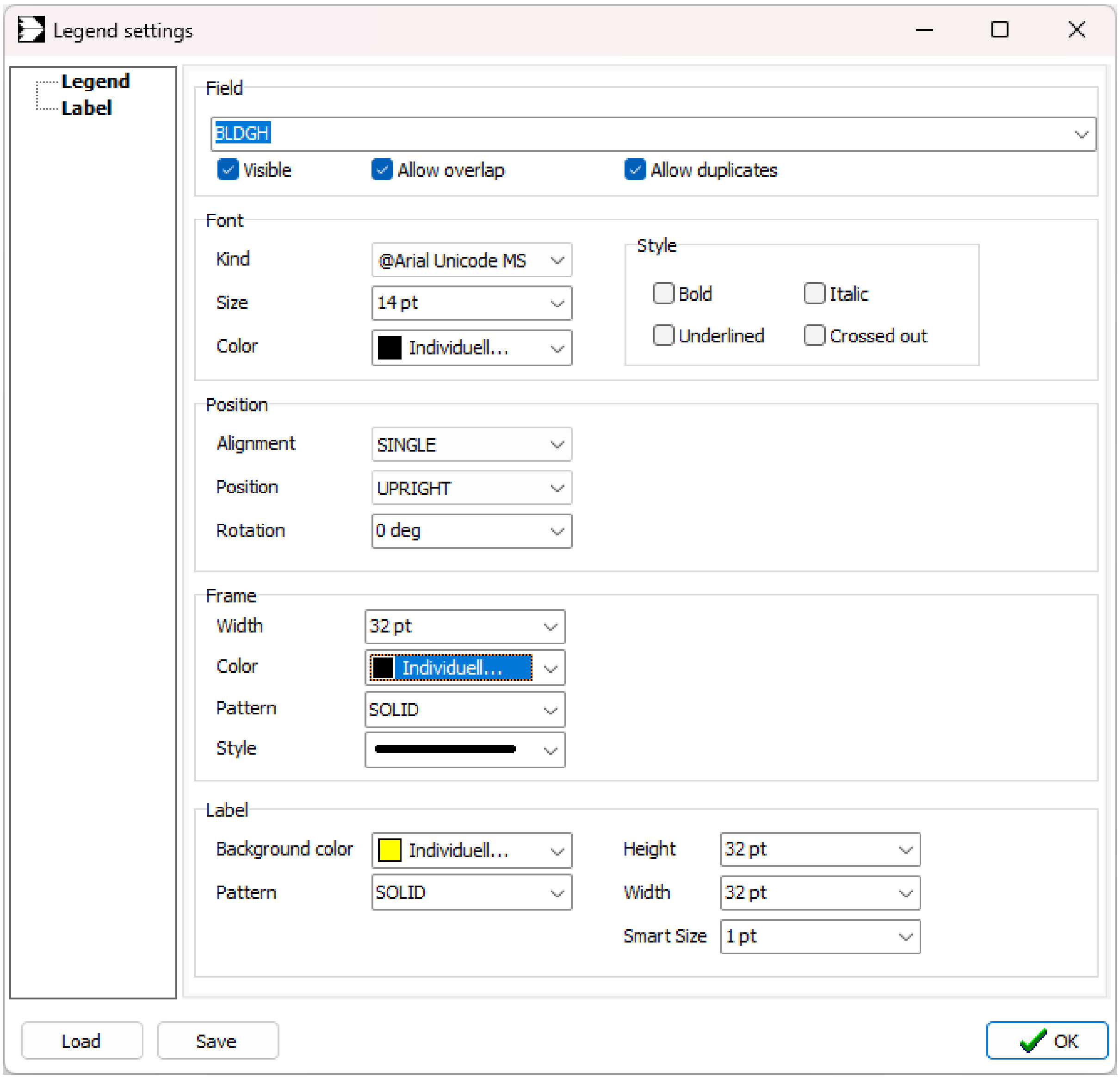
Number display

Rounding and the number of decimal places are defined in the *Number display* group.

Missing value

To mark incorrect values in the shape file differently, you can activate the *Incorrect value* checkbox and define an incorrect value. A description of the missing value is set via the text field next to the value. The color can be adjusted by double-clicking.

10.3 Label



The shapes of the GIS layers can be labeled with values. The *Label* section on the left-hand side is used for this purpose. The following settings can be made.

Field

The shape column containing the values to be displayed is selected in the selection list. The three checkboxes are used to specify whether the label is visible, whether overlapping of the labels is permitted and whether several labels may have the same value.

Font

Settings for the font of the label text can be made here.

Position

The position affects the entire label, i.e. text and background.

Frame

The frame of the label can be set in the same way as the frame of the monochrome coloring (see. Sect. 10.1)

Label

The background and the size of the label are defined in the *Label* group. For the height and width, please note that the text in the label will disappear if the label is too small. It is therefore recommended to leave the height and width set to automatic.

11 PROGRAM SETTINGS

The program settings can be accessed via the *File* | *Settings...* menu item.

The following settings can be made for WinMISKAM.

Save file paths

This setting determines whether file paths should be saved in absolute or relative terms in the WinMISKAM project file. This applies, for example, to the files for sectional views, background maps, added shapes and so on.

Legend

The default coloring of the layers can be defined via the *Legend* group. The coloring applies to the configuration and to the sectional view. For roads and wind arrows, the line width can also be specified, whereby for roads it is also possible to read the actual road width from the "FBreite" shape column.

Navigation

Reverse mouse wheel direction causes the zoom in the map area to be inverted.

The program settings are saved with the *OK* button.

12 MISKAM WIND AND TURBULENCE FIELDS FOR AUSTAL

The "Interface MISKAM wind and turbulence fields for AUSTAL" is a supplementary module of the WinMISKAM software series. The interface is integrated directly into the user interface of the basic version of WinMISKAM and can be called up via the menu item *Execute / Interface wind and turbulence fields for AUSTAL....*

The interface makes it possible to take into account the influence of buildings on the flow and turbulence field in AUSTAL. The interface works on a project-specific basis and enables the conversion of existing MISKAM flow and turbulence fields into a wind field library for AUSTAL.

12.1 Preliminary remark

The add-on module "Interface MISKAM wind and turbulence fields for AUSTAL" is integrated into the Windows interface of the basic software "WinMISKAM". With the help of a "WIZARD", you are guided through six steps to convert the flow and turbulence fields into the format readable by AUSTAL.

All necessary data and parameters are saved in a project file [Name].WFP so that the conversion steps can be reproduced later. The interface enables the conversion of already calculated (existing) flow and turbulence fields (calculated with version MISKAM 4.x or higher). The interface works exclusively with files in binary format. This means that the files [Name].ZWU and [Name].ZWT are used to convert the MISKAM flow fields. The converted wind field library consists of the files [Name].DMNA with a file header in ASCII format and the files [Name].DMNB with the actual value fields in binary format. It is not possible to save the wind field library in ASCII format within this interface.

When calculating flow and turbulence fields with MISKAM, 5 additional boundary boxes are used by default. When converting the flow and turbulence fields into a wind field library for AUSTAL, at least these 5 additional boundary boxes are cut off again.

In contrast to earlier versions, the MISKAM calculation grid can consist of an **inner equidistant** and an **outer non-equidistant** area in the horizontal direction. When converting the flow and turbulence fields into a wind field library for AUSTAL, the inner equidistant region is automatically found and the outer non-equidistant region is cut off.

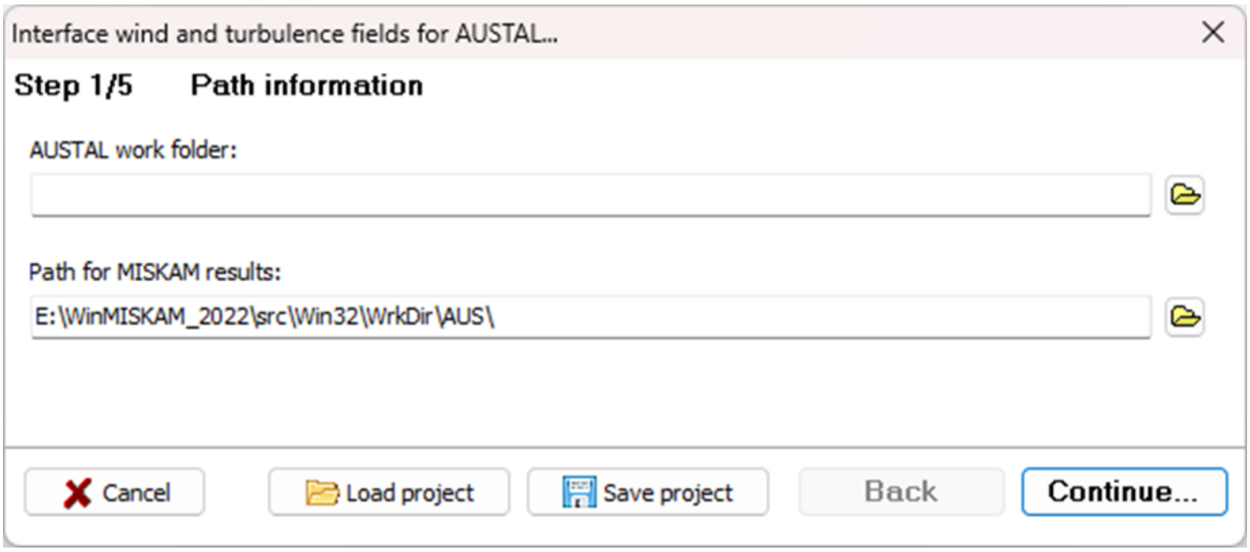
12.2 Conversion of MISKAM turbulence fields

MISKAM flow and turbulence fields can be converted directly into an AUSTAL wind field library. It must be noted that the "rotation of the x-axis towards north" must be specified as 90°. The **inner equidistant MISKAM grid** must also be used for the subsequent AUSTAL calculation.

By selecting the menu item *Execute / Interface wind and turbulence fields for AUSTAL ...* the wizard opens, which helps with the conversion of MISKAM flow and turbulence fields and must be run through completely. The wizard consists of five steps. You can switch back and forth between the individual steps as required. This is done using the *Next...* and *Back* buttons.... The *Cancel* button closes the wizard without performing a calculation and without saving the last project data entered. The *Save project button* opens a save dialog in which a path can be selected and any project name can be entered.

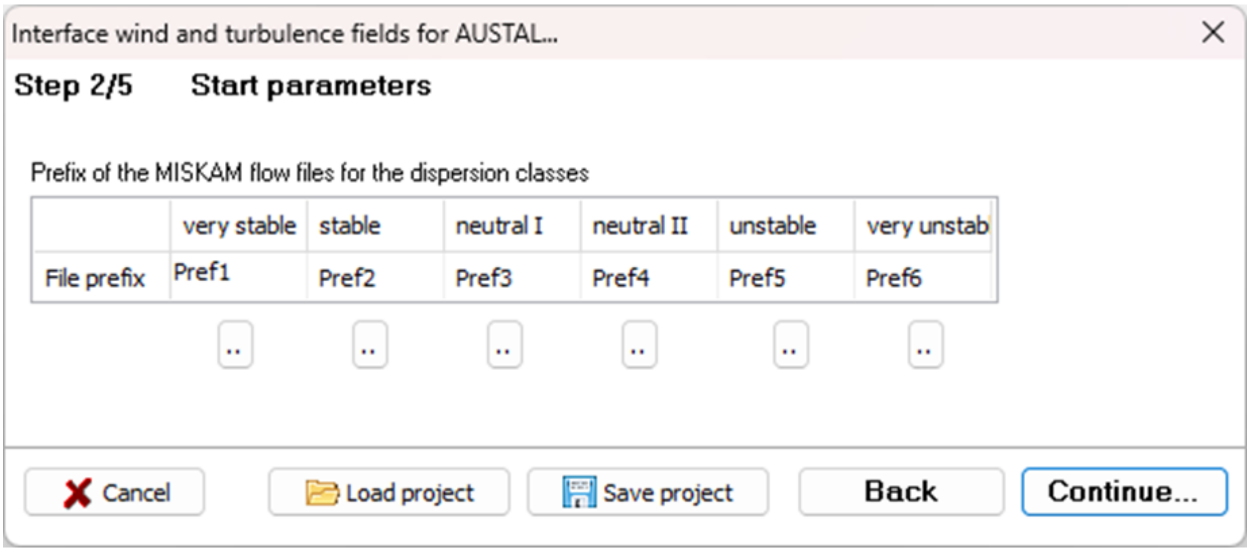
Step 1 Path details:
For the AUSTAL working folder, the directory path of the project folder in which the AUSTAL calculation is to be carried out later must be entered. The interface will create a subfolder "\lib\" in this folder, in which the wind field library for AUSTAL is stored.

The folder for the MISKAM flow and turbulence fields is defined in the *Path for MISKAM results* field. The ZWU and ZWT files that are to be converted must be located there.



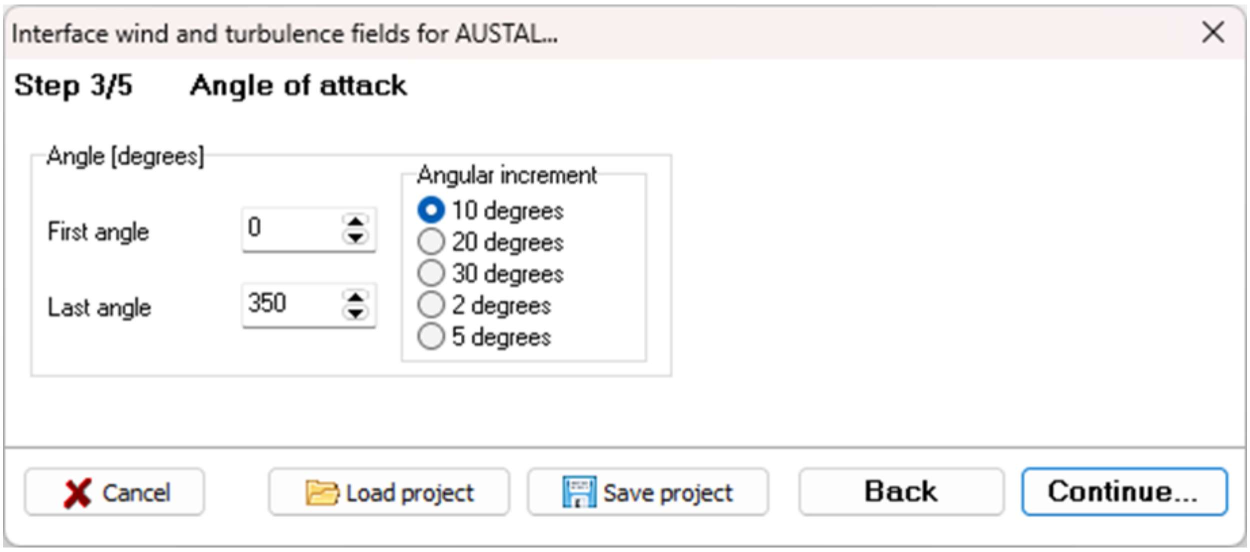
WIZARD Step 2 MISKAM flow files:
The prefixes of the file names of the wind and turbulence fields that are to be converted for the six different dispersion classes "Very stable", "Stable", "Neutral I", "Neutral II", "Unstable" and "Very unstable" must be specified in the table. The prefix is the file name without the file extension and without the number of the wind direction. By clicking on the "..." button, it is possible to select a single file [Name].ZWU or [Name].ZWT to apply the prefix.

Note:
The MISKAM flow files to be converted must be located in the project directory "Path for MISKAM results". **A prefix** must be specified for **each case**, even if the prefixes are the same.



WIZARD Step 3 Angle of attack

The angle of attack for the flow calculation must be specified here.

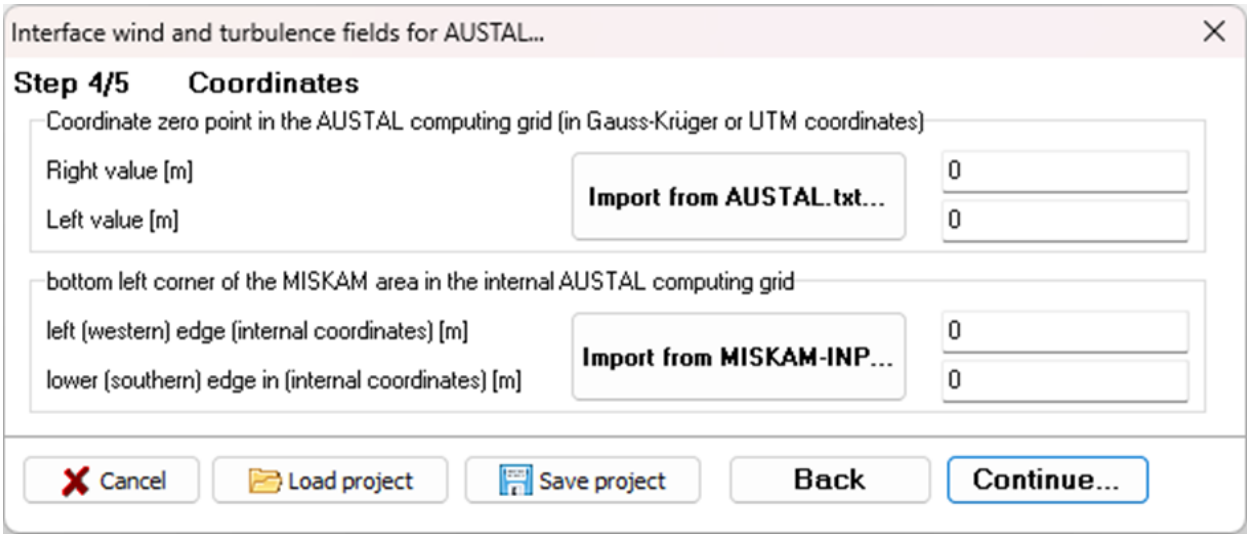


The first and last angles for which a flow calculation was carried out must be specified. The selected angle increment is used to determine the increment of the wind flow directions of the calculated flow fields between the first and last angle. For the AUSTAL calculation, it is recommended to calculate all possible flow angles from 0° to 360° with the specified angle increment.

WIZARD Step 4 Coordinates:

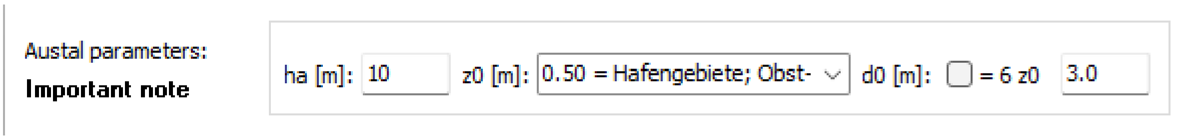
On the one hand, the **coordinate zero point of the AUSTAL computing grid** must be entered in Gauss-Krüger or UTM coordinates. The same values must be entered later in the "Austal.TXT" configuration file as parameters gx and gy (or ux and uy). If the Austal.TXT file already exists, the coordinate zero point can also be imported from the Austal.TXT file.

Furthermore, the coordinates of the **bottom left** (i.e. south-western) **corner of the MISKAM area** must be specified **in the internal AUSTAL computing grid**[15]. If the MISKAM input file is georeferenced, the coordinates of the lower left corner in the internal calculation grid of the AUSTAL calculation can also be calculated by the program. To do this, click on the "Import from MISKAM INP file" button and select the corresponding MISKAM INP file.



WIZARD Step 5 Calculation data:

The AUSTAL parameters anemometer height ha, the roughness length z0 and the displacement height d0 must be specified in the following input fields.



This is used to calculate the layer-dependent horizontal homogeneous 1D turbulence profiles with AUSTAL. Suitable values must be selected for z0 and d0. As a rule, these are **not** the values specified in TA Luft. For the roughness length z0, values lower than those specified in TA Luft should be selected, as the building-induced additional turbulence is calculated explicitly and is therefore included in the AUSTAL turbulence fields. Thus, for the roughness length z0 to be specified here, a value should rather be selected that describes the roughness of the study area **without the buildings explicitly resolved in MISKAM**[16] . The default value 6z0 appears suitable for the displacement height d0 to be selected.

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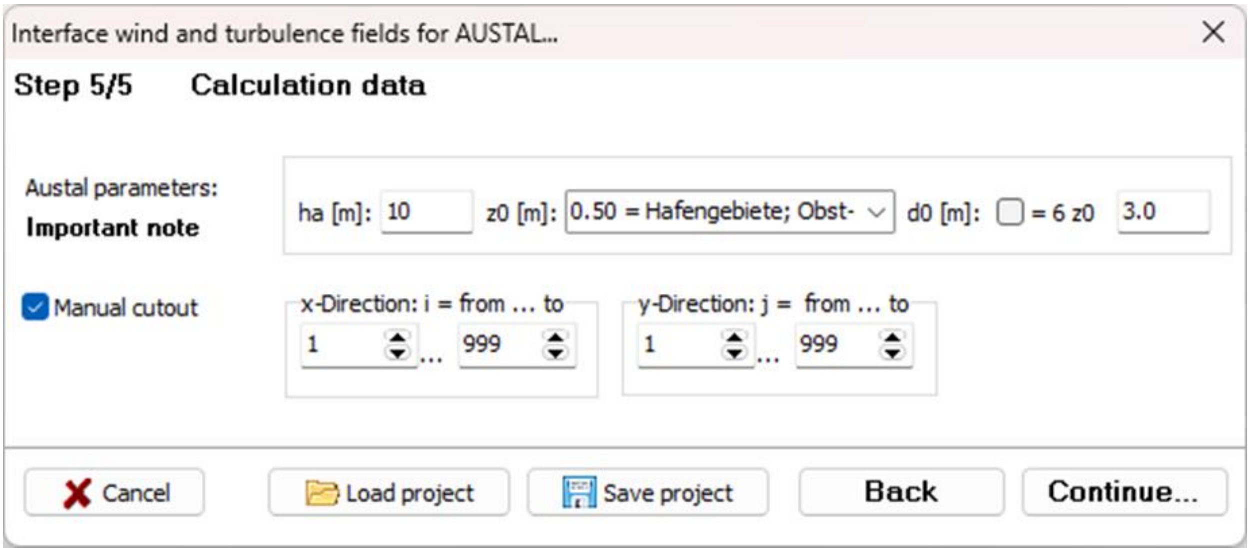
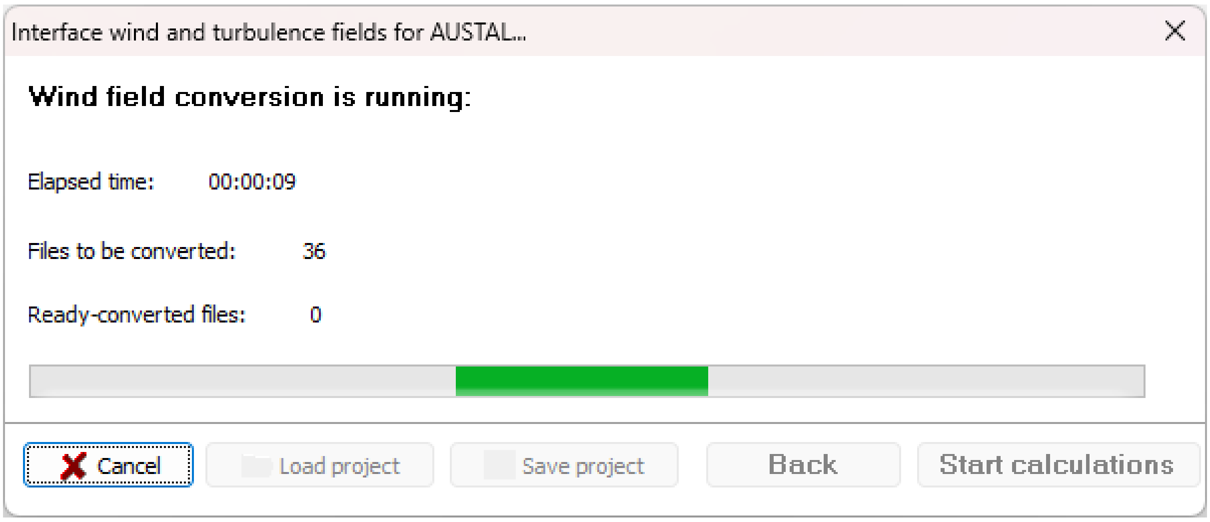
15 These values may differ from the parameters `X0` and `Y0` in the configuration file "Austal2000.TXT". The parameters `X0` and `Y0` must match the parameters `xmin` and `ymin` in the dmna files in the lib subfolder.

16 See also Guideline VDI 3783 Sheet 13 (VDI (2010), end of Section 4.9.2, page 28: "Buildings that are explicitly [...] taken into account in the dispersion calculation must not be included in the determination ...").



By clicking the "*Start calculation*" button, all project data is first checked for completeness and consistency. The project must then be saved. Once this has been done, the existing flow and turbulence fields are converted and stored in the wind field library.



13 PROKAS_E

PROKAS_E Help

14 ROSEPLOT

RosePlot Help

15 LITERATURE

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16 ANNEXES

Additional information on NO -NO_{X2} conversion and PM-10 short-term limit values.

ANO -NO_{X2} CONVERSION according to Romberg et al. (1996)

The NO -NO_{x2} conversion is carried out in MISKAM on the basis of the Romberg formula [Romberg et al., 1996].

$$NO2 = f(NOx) * NOx \quad (8)$$

$$f(NOx) = A/(B + NOx) + C \quad (9)$$

This allows the NO_2 concentration resulting from the conversion of NO_x to be calculated from known annual mean values (I1 values) or 98th percentile values (I2 values). Depending on whether the calculation is based on the annual mean values or 98th percentile values, the values listed in Table i must be used for the constants A, B and C.

Table i: Values for the constants A, B and C for calculation of the NO_2 concentration

		A	B	C
I2 values	98-percentile values	111	119	0,039
I1 values	Annual averages	103	130	0,005

The conversion rate is determined by the NO /NO_{2x} ratio. This is dependent on the NO_x emission (Figure i).

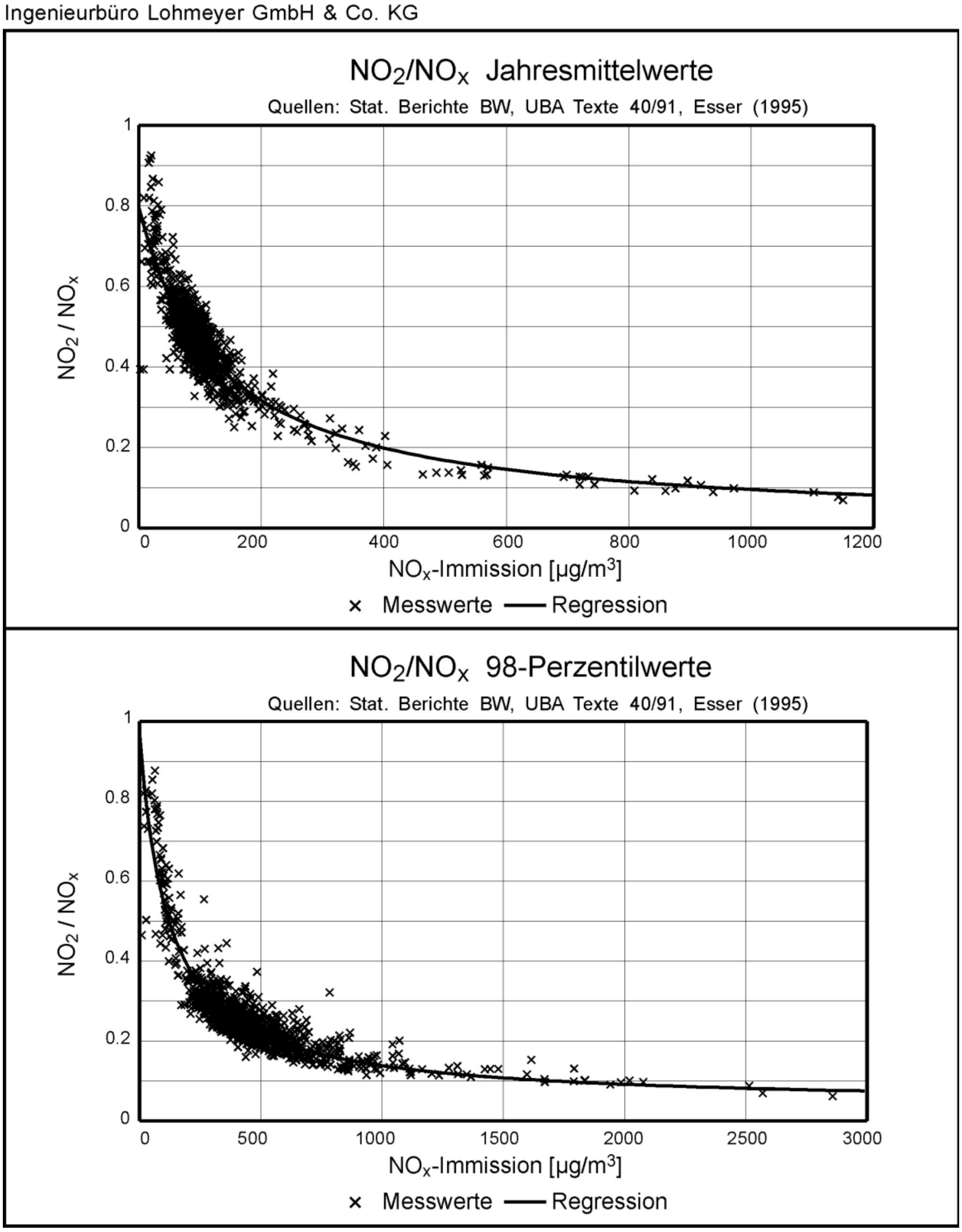

Figure i: NO /NO$_{2x}$ ratio (conversation rate) as a function of NOx immission for annual mean values (top) and 98th percentile values (bottom)

BNO -NO$_{X2}$ CONVERSION according to Düring et al. (2011)

Nitrogen oxides are mostly emitted by vehicles as NO and to a lesser extent as NO_2. On the dispersion path, the NO converts to NO_2 . The conversion rate depends on time and other influences.

Currently, simple statistical models, e.g. according to Romberg et al. (1996) or their update according to Bächlin et al. (2008), are generally used for the calculation of this conversion. More realistic conversion rates can be obtained using downstream chemistry models. A simplified relationship is often used to describe the chemical conversion in the equilibrium of the substances NO_2 , NO and ozone.

The assumptions that lead to the simplifications are:

- An equilibrium is quickly established in the NO -NO-O_{23} system
- Conversion with OGD (organic gases and vapors) are not considered
- Mixing processes and sinks (i.e. advection, turbulent diffusion, influence of boundary conditions, deposition) are parameterized via a mixing time τ
- The contribution of traffic emissions is estimated from the difference between the measured NO_x concentrations of two air monitoring stations
- The influence of wind direction is not considered

The reactions considered are

NO + O_3 àNO_2 + O_2 (k) (1)

NO_2 + O_2 →☠⚐ + O_3 (J) (2)

J is the photolysis frequency of NO_2 , k is the reaction rate. In the atmosphere, equilibrium is quickly established between the three substances. Photochemical equilibrium is the state in which the three differential quotients (see below) are identical to zero, i.e. the build-up and decomposition of a substance are equal and the sum is zero. The differential expressions that describe the decomposition of NO_2 , NO and O_3 when considering this reaction alone are:

$$\frac{d[NO_2]}{dt} = k \cdot [NO] \cdot [O_3] - \mathrm{J} \cdot [\mathrm{NO_2}] + \frac{[NO_2]_{VV}}{\tau} + \frac{[NO_2]_B - [\mathrm{NO_2}]}{\tau} \quad (3)$$

$$\frac{d[NO]}{dt} = k \cdot [NO] \cdot [O_3] + \mathrm{J} \cdot [\mathrm{NO_2}] + \frac{[NO]_{VV}}{\tau} + \frac{[NO]_B - [NO]}{\tau} \quad (4)$$

$$\frac{d[O_3]}{dt} = - k \cdot [NO] \cdot [O_3] + \mathrm{J} \cdot [\mathrm{NO_2}] + \frac{[O_3]_B - [\mathrm{O_3}]}{\tau} \quad (5)$$

The first two terms on the right-hand side describe the chemical conversion by thermal and photochemical reaction. The next term in equations 3 and 4 describes the effect of the emission (index VV). The last term describes the mixing as a function of the concentration difference between the background station (index B) and the receptor point at which the concentration is to be calculated, in this case the traffic station (index V): if the concentration at the receptor point is higher than that of the background, this term is negative and the concentration is reduced by mixing air with a lower concentration into the imaginary volume.

The concentrations $[NO]_{VV}$ and $[NO]_{2VV}$ are the contribution generated by traffic emissions as an increase in the concentration above the background concentration. $[NO_x]$ is the concentration at the traffic station, $[NO]_B$ and $[NO_2]_B$ are the measured background concentrations. $[NO_2]_{VV}$ is calculated from the NO_x difference between the values at the traffic station and at the background station as

$$[NO_2]_{VV} = p([NO_x]_V - [NO_x]_B)$$

(6)

With p = NO_2/NO_x (given) and $[NO_x]_V$ as the concentration measured at the traffic station. The unknown variables are [NO], $[NO_2]$, $[O_3]$. Assuming that equilibrium is reached quickly, the three differential equations (Eqs. 3 to 5) become three algebraic equations of determination. Their solution yields the analytical formula for the concentration:

$$[NO_2] = 0.5\left(B - \sqrt{B^2 - 4([NO_x]_V [NO_2]_O + [NO_2]_n / k\tau)}\right) \quad (7)$$

With the sizes

$$[NO_2]_n = [NO_2]_{VV} + [NO_2]_B$$

$$[NO_2]_O = [NO_2]_n + [O_3]_B$$

$$B = [NO_x]_V + [NO_2]_O + \frac{1}{k}\left(J + \frac{1}{\tau}\right)$$

This equation is used in the OSPM dispersion model for the calculation of NO_2 formation (Palmgren et al., 2007; Berkowicz, 2000), where the parameter τ is calculated from meteorological values (e.g. wind speed and turbulence) and the road geometry.

Strictly speaking, these equations can only be used in time series calculations, as the parameters J and k, for example, are dependent on meteorological parameters. Based on adjustments in various research projects for the BASt and the Brandenburg State Environmental Agency, these are applied using annual mean values (simplified chemical model).

The parameters were set uniformly as follows:

J = 0.0045 per second

k = 0.00039 $(ppb\ s)^{-1}$

τ = 100 seconds (street canyon) or 40 seconds (free dispersion).

The input variables are:

NO_x -JM at traffic station (in the model = calculated value)

NO_x -JM to background station

NO_2 -JM at background station and

Ozone JM at background station

p = Share of primary NO_2 emissions in NO emissions.$_x$

In accordance with the results of a research project for the Ministry for Rural Development, Environment and Consumer Protection of the State of Brandenburg[17] and the current discussion in the VDI Working Group 3783, Sheet 19, the simplified chemical model presented above was used in the present study.

The reason for the better reproduction of the trend in conversion rates with the simplified chemical model compared to the statistical models is due in particular to the explicit inclusion of the proportion of primary NO_2 emissions in the NO_x in the exhaust gas. This is illustrated in **Fig. ii**. It shows the NO_2 annual mean values as a function of the NO_x annual mean values for the simplified chemical model with 6 %, 16 % and 25 % primary NO_2 content in NO_x and, in comparison, the parameterizations according to Romberg et al. (1996) and Bächlin et al. (2008). It can be seen that the Romberg parameterization can be reproduced at p = 6 %. This was to be expected, as this was adapted to measurement data prior to 1996 and at that time p was around 5 % to 10 %. With a p of 16 %, the parameterization according to Bächlin et al. (2008) can be reproduced. This was adjusted to measurement data between 2003 and 2006. The average NO_2 emission share here is between 12 % and 17 %. Further increases in NO_2 levels can be expected in the coming years. This will lead to a further increase in the conversion rate (see example p = 25 % in **Fig. ii**). Conversely, this means the following: The higher the proportion of primary NO_2 emissions, the more the NO_x emissions must be reduced in order to comply with the NO_2 limit value of 40 µg/m³.

[17] http://www.mugv.brandenburg.de/cms/media.php/lbm1.a.2328.de/lang_no2.pdf

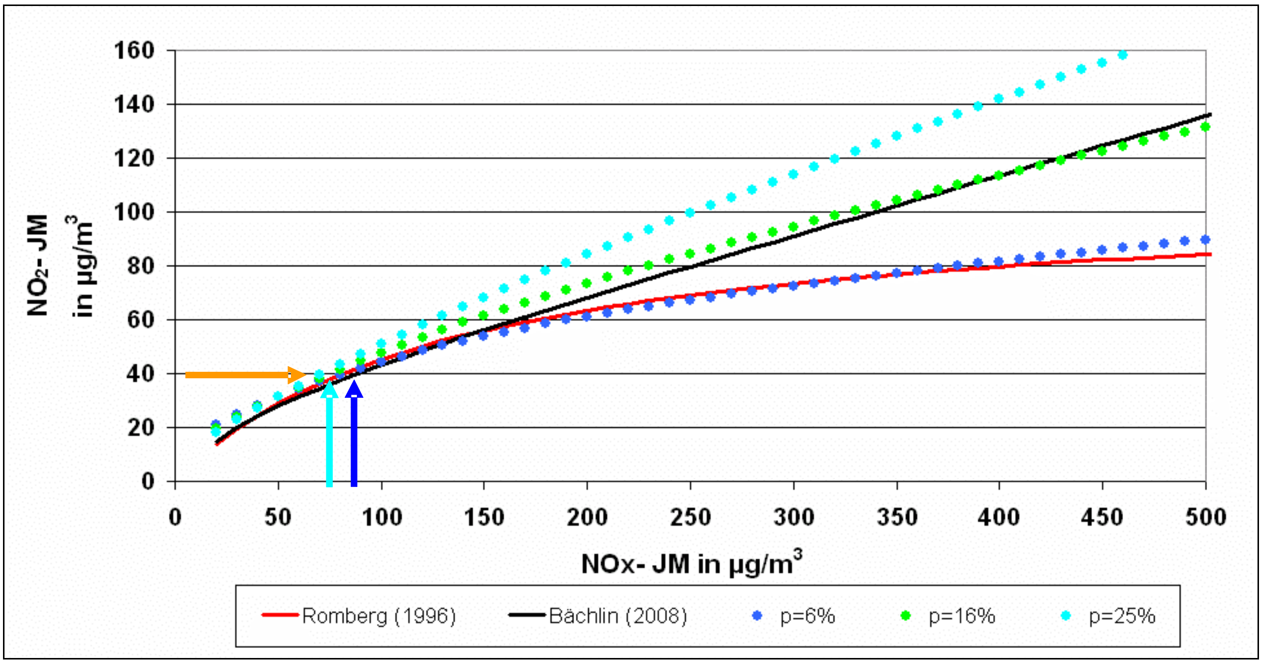

Fig. ii: Dependence of the NO_2 annual mean values modeled with different approaches on the NO_x annual mean values. See text for explanation.

CPM-10 Short-term limit value

Four approaches are available in MISKAM to determine the number of exceedances of a daily average PM10 concentration of 50 µg/m³ as defined in the 22nd BImSchV.

As part of a research project for the Federal Highway Research Institute, a good correlation was found between the number of days with PM10 daily mean values greater than 50 µg/m³ and the PM10 annual mean value from 914 measurement data sets from the years 1999 to 2003 (see **Fig. iii**). From this, a functional dependence of the PM10 exceedance frequency on the PM10 annual mean value was derived (BASt, 2005). Also shown are the regression curves according to the least squares method ("best fit"), the function increased with a safety margin of one standard deviation ("best fit + 1 sigma"), the function increased with a safety margin of two times the standard deviation (MLuS, amended version 05) and the function according to the UMK report 2004 ("fit LAI") (Figure ii).

A "best fit" regression curve was developed from the available data. The function for the number of exceedances is as follows:

$$\ddot{U}B = -0.000065*(JM)4 +0.00694*(JM)^3-0.15*(JM)^2 +1.1064*(JM) \qquad (10)$$

For the "best fit+ 1 sigma" regression curve, an addition of the simple annual mean-dependent standard deviation is added to this "best fit" function.

$$\ddot{U}B = -0.000065*(JM)4 +0.00694*(JM)^3-0.15*(JM)^2 +1.1064*(JM)+0.23*JM \qquad (11)$$

The report "PM10-Emissionen an Außerortsstraßen" by the Federal Highway Research Institute (BASt) (2005) proposes the application of a safety margin of two sigma (depending on the annual mean value) for the conversion of PM10 annual mean values to exceedance frequencies (MLuS, amended version05). The function is

$$ÜB = -0.000065*(JM)4 + 0.00694*(JM)^3 - 0.15*(JM)^2 + 1.1064*(JM) + 2*(0.23*JM) \quad (12)$$

In October 2004, the working group "Environment and Transport" of the Conference of Environment Ministers (UMK) presented a corresponding function for a "best fit" from the measured values available to it for the years 2001 to 2003 [UMK, 2004]. The regression curve for the number of exceedances is as follows:

$$ÜB = 0.0003*JM3.392 \quad (13)$$

Up to an annual mean value of approx. 40 µg/m³ , this function shows an almost identical curve to the above-mentioned "best fit" according to BASt (2005). On a statistical average, the PM10 short-term limit value is therefore expected to be exceeded at an annual mean PM10 value of 31 µg/m³ for both data evaluations.

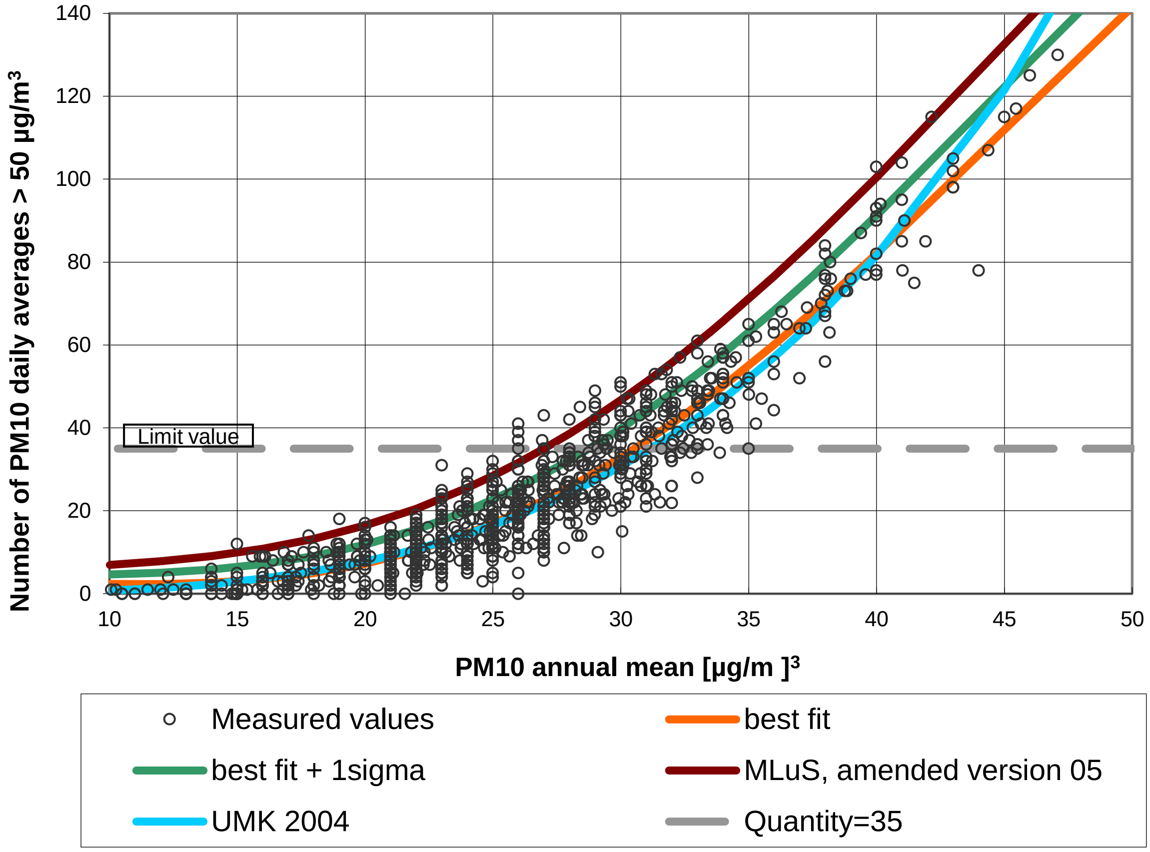

Fig. iii: Number of days with a daily average of more than 50 µg PM10/m³ as a function of the annual average PM10 value for monitoring stations of the federal states and the Federal Environment Agency (1999-2003) and the functions "best fit", "best fit+ 1sigma", MLus (amended version 05) and UMK 2004