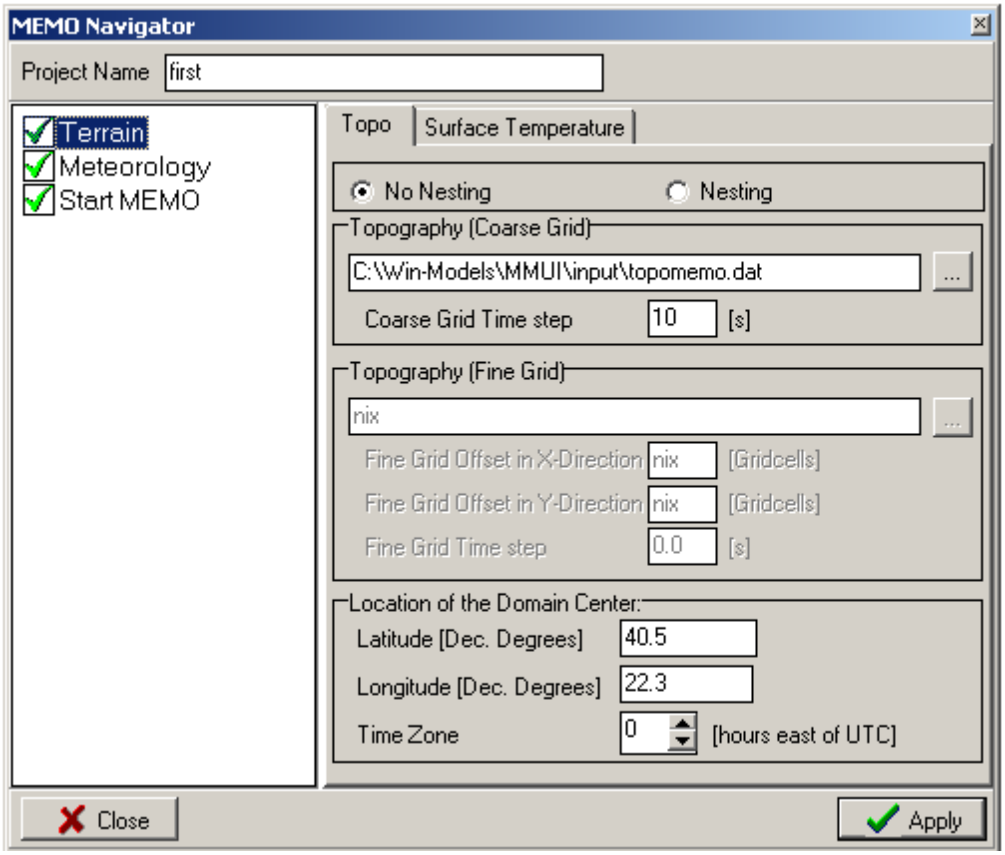
The MEMO and MARS/MUSE User Interface And Helper Applications

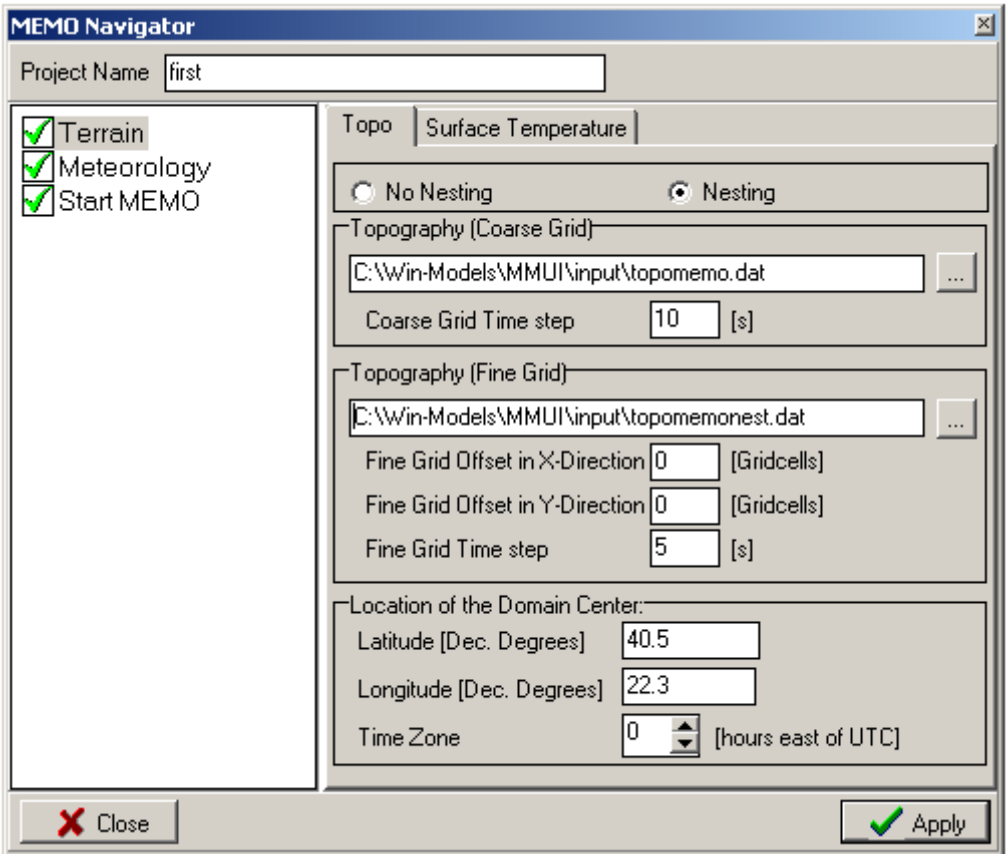
MEMO User interface description



TOPOGRAPHY INPUT FILE

For calculations with MEMO, a file must be provided which contains orographical data (elevation) and land use type for each grid location (i, j) in the computational domain. The x-axis (index i) is directed to the western direction and the y-axis (index j) to the northern direction, thus gridpoint (1,1) is in the SW-corner of the computational domain. The exact format of the file is described in the MEMO users Manual. The user has to provide also, the computational timestep for the run.

MEMO

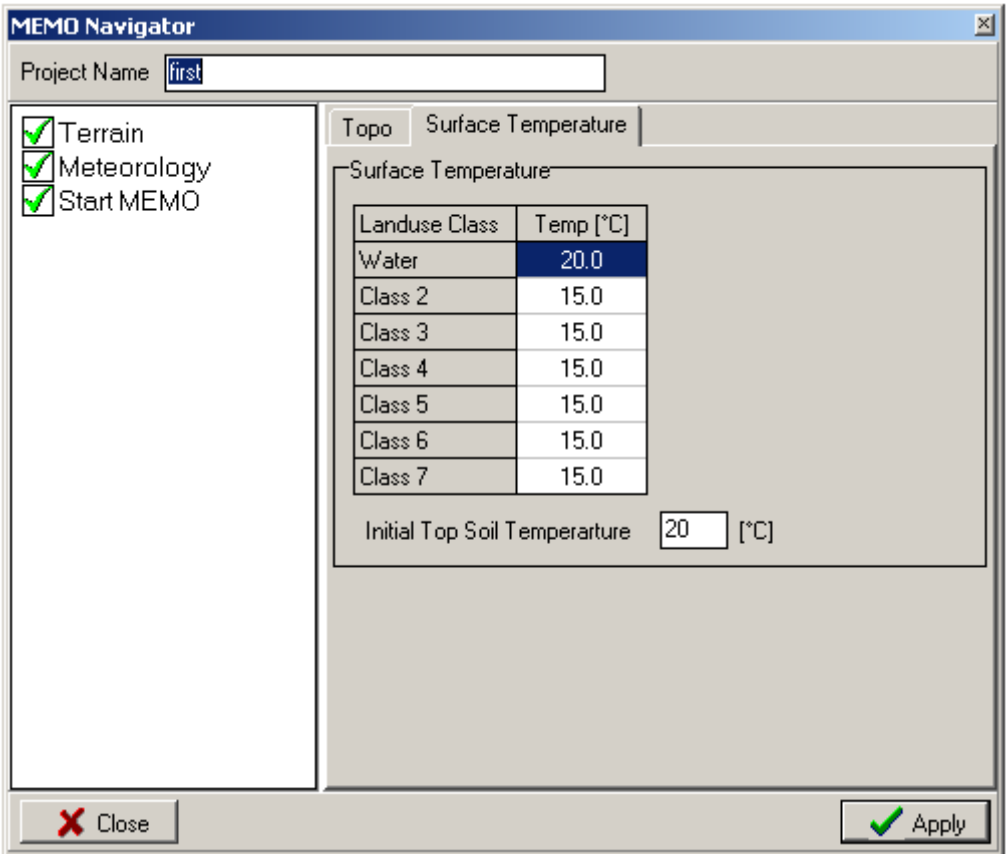


NESTING FACILITY

In MEMO a one-way interactive nesting scheme is implemented. With this nesting scheme a *fine grid* (FG) simulation can be nested in a *coarse grid* (CG) simulation. During the CG simulation, data is interpolated and written to a file. The FG simulation uses this data as lateral boundaries.

The offset (measured in grid cells) of the FG in relation to the CG must be specified. The FG timestep should be chosen as small as possible (usually half the CG timestep).

MEMO



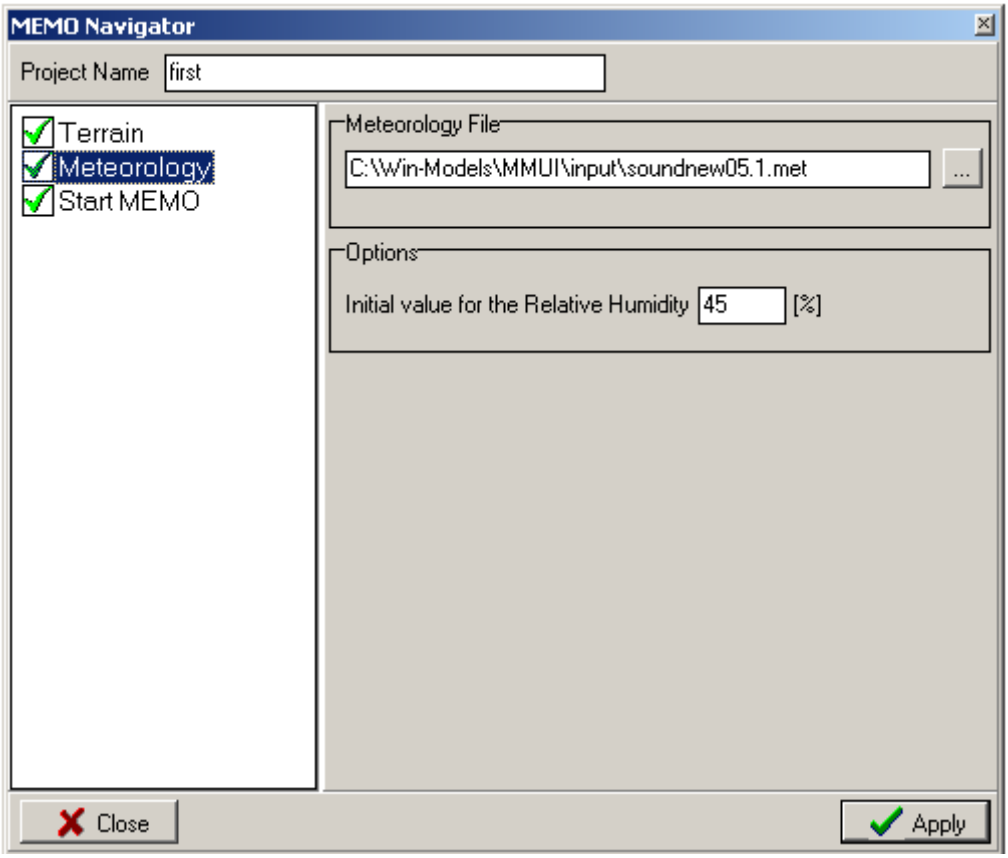
SURFACE TEMPERATURES

The following surface land use types are distinguished in the model:

1 water
2 arid land
3 few vegetation
4 farmland
5 forest
6 suburban area
7 urban area

Except for the case when detailed measurements are available, a single temperature close to the mean ambient temperature can be used as initial temperature for all land use types.
An estimate of the initial top soil temperature must also be provided.

MEMO



METEOROLOGY

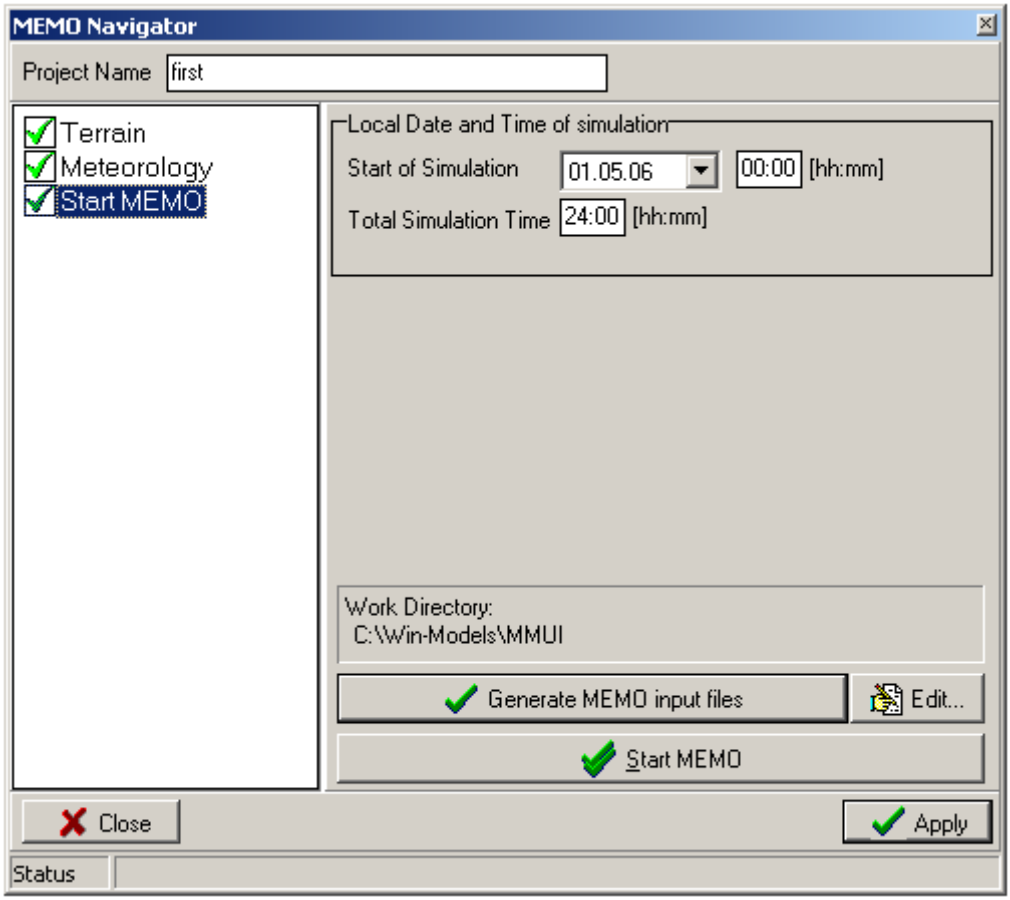
MEMO solves a set of partial differential equations in 3 spatial directions and in time. To solve these equations information about the initial state in the whole domain and about the development of all relevant quantities at the lateral boundaries is required.

To generate an initial state for the prognostic model a diagnostic sub-model is applied using measured temperature and wind data. Both, temperature and wind data can be provided as upper air soundings i.e. measurements that consist of several (at least two) measurements at different height levels at a constant geographical location (at least one sounding for temperature and wind velocity is necessary)

A sample file is given in Appendix E of the MEMO Manual.

The initial value for atmospheric relative humidity should be based on measurements. A guess around 50% is usually OK in most cases.

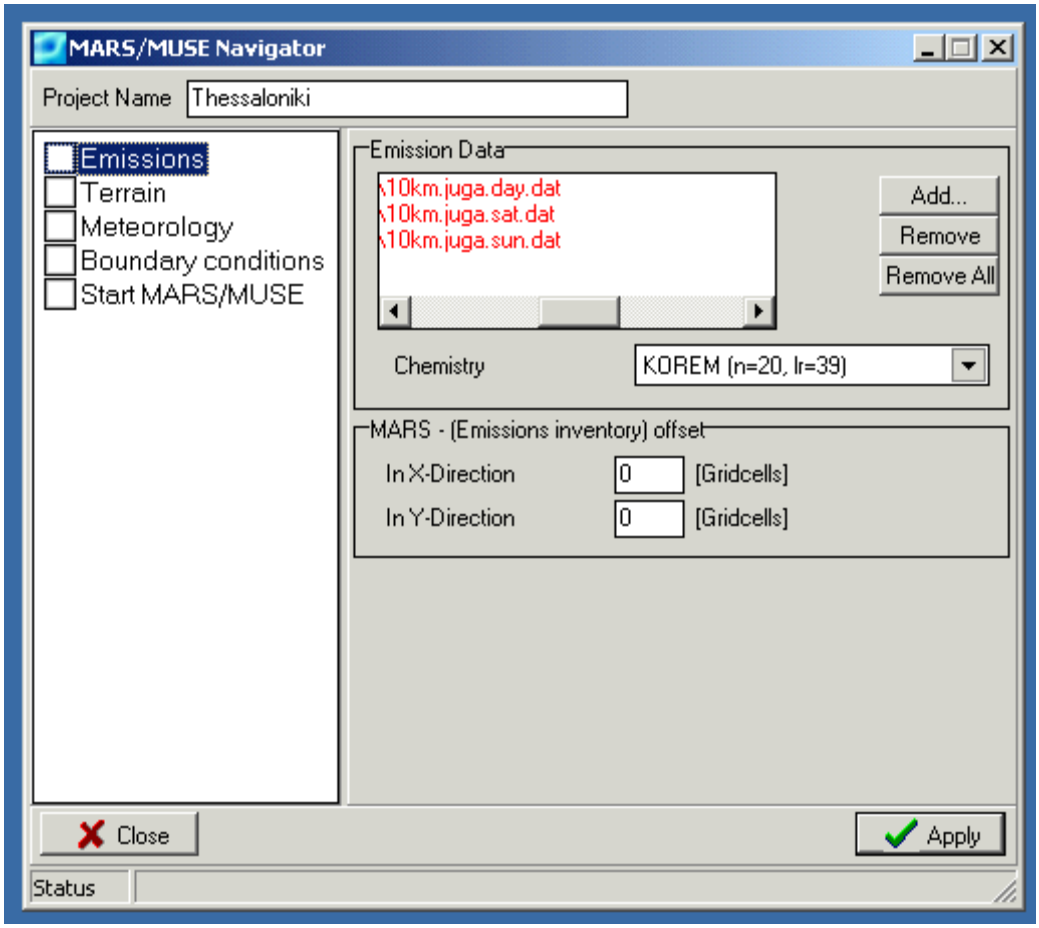
MEMO



Here, the **local** start date and hour of the simulation and the duration (in hours:minutes) of the run are specified.

After all the files and parameters have been provided, the user presses the 'Generate MEMO input files' in order to create all the files necessary for the model run and if these are created successfully the user may start the run by pressing 'Start MEMO'.

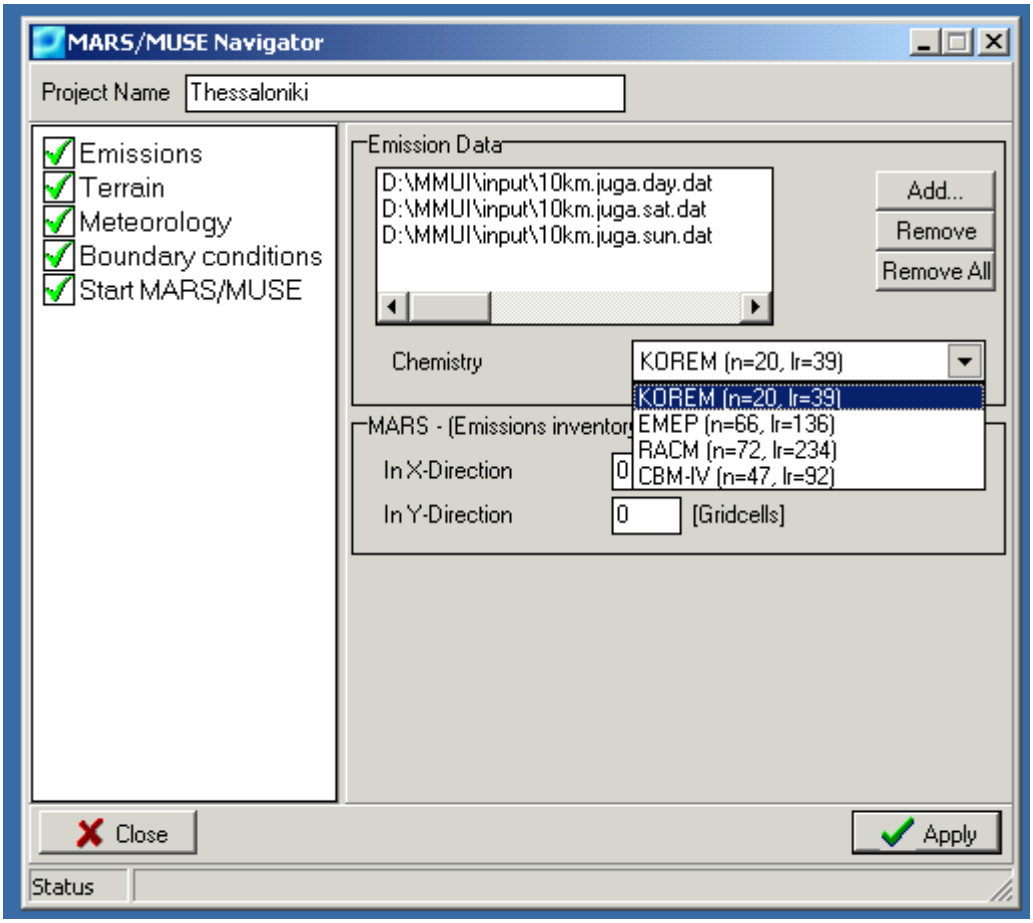
MARS/MUSE User interface description



EMISSION INVENTORY FILE

The emission inventory contains data concerning the emissions in the computational domain of MARS/MUSE. The emissions are in the form of hourly values (from 00 to 23) of 47 species (see following table) in kg/h/gridcell (ATTENTION!! The emission rates are not in kg/h/km^2)

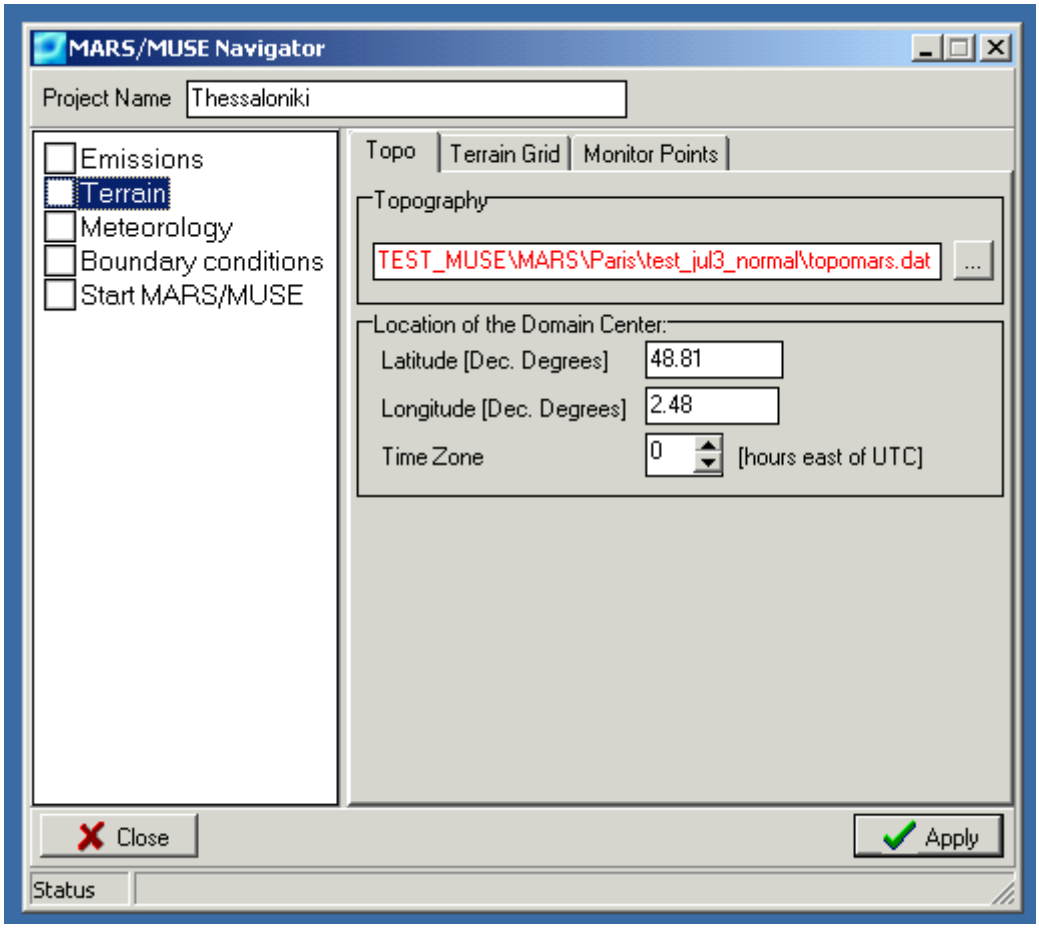
MARS/MUSE



The modular structure of MARS/MUSE allows its use in conjunction with any chemical reaction mechanism. In the current version KOREM, EMEP, RACM reaction mechanisms are implemented.
The *KOREM* reaction mechanism consists of 20 reactive species in 39 reactions. The species as well as the reactions are given in the tables below.
The *EMEP* chemical mechanism uses a lumped molecule approach to represent organic compounds. Each species in the EMEP mechanism represents a range of species of similar structure and reactivity. The mechanism describes the tropospheric gas-phase chemistry with 66 species.
The *RACM* mechanism includes reactions for 17 stable inorganic species, 4 reactive inorganic intermediates and 32 abundant stable species (oxygen, nitrogen and water) and 24 intermediate organic radicals. In addition, the reaction rates and product yields have been updated with recent laboratory measurements.

The offset of the emissions inventory grid with regard to the MARS/MUSE computational grid must also be provided. This gives information on the relative position of the two grids.

MARS/MUSE

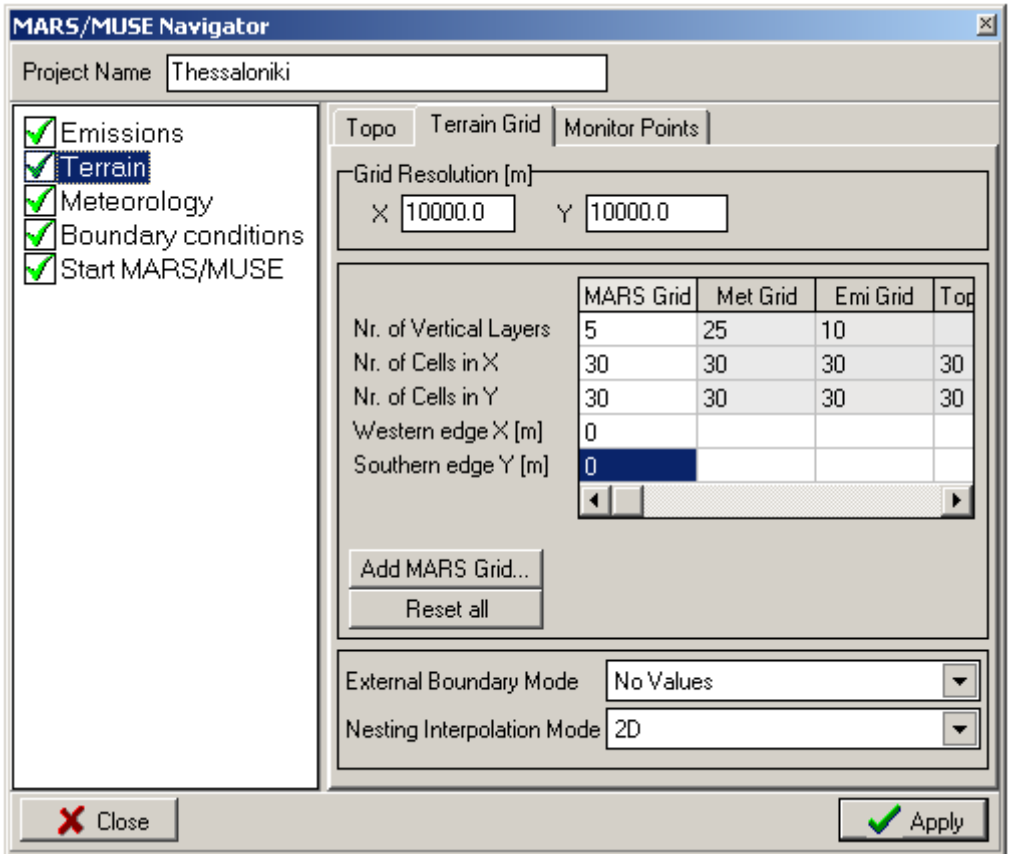


TOPOGRAPHY INPUT FILE

For calculations with MARS/MUSE, a file must be provided which contains orographical data (elevation) and land use type for each grid location (i, j) in the computational domain. The x-axis (index i) is directed to the western direction and the y-axis (index j) to the northern direction, thus gridpoint (1,1) is in the SW-corner of the computational domain. The exact format of the file is in essence the same one used for the MEMO topography file

The location of the domain centre and time zone of the area of interest must also be specified

MARS/MUSE



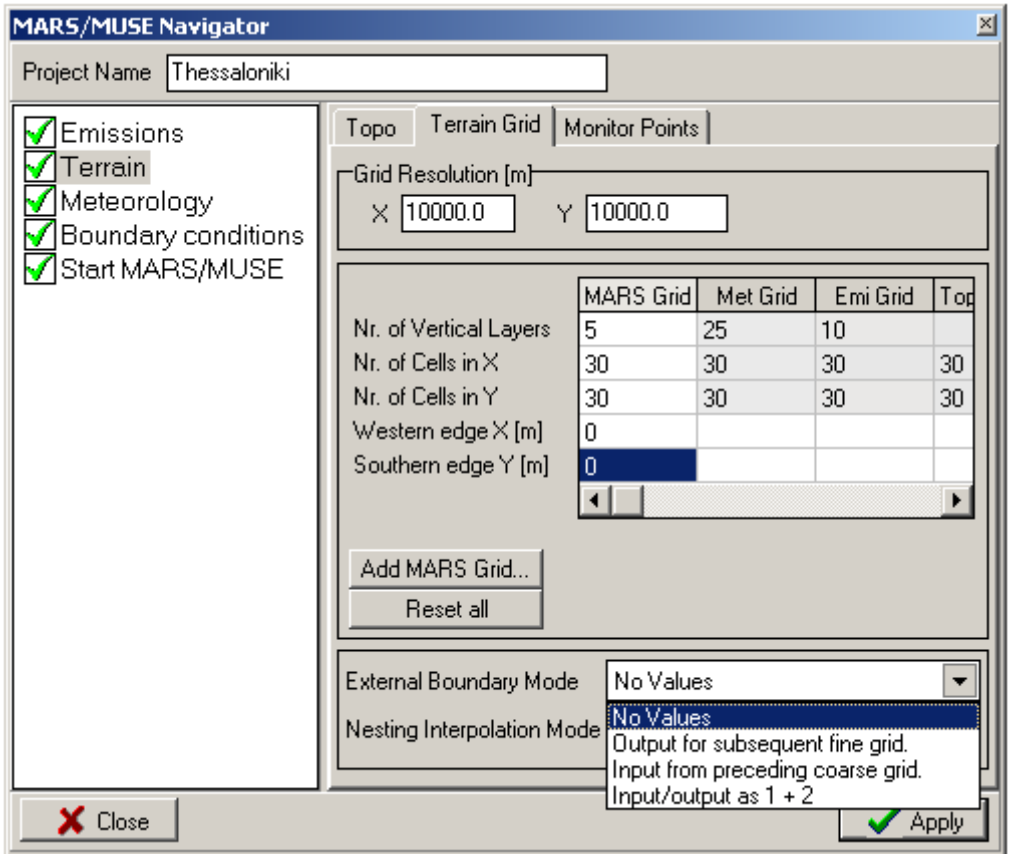
The dimensions of the grids involved in the MARS/MUSE calculations have to be defined here. The dimensions of each grid may differ, however the dimensions of the Met(eorology) grid coming from the MEMO run can not be “smaller” than the MARS grid.
It I susually helpful to define the paths of all the input files before filling in this table, as these parameters are read from the headers of these files when possible.

The user may may also import a MARS/MUSE Grid created with the help of the ‘Terrain Factory’ of SELMA^{GIS}.

For reference purposes related to the visualisation of the results, the user may also provide the coordinates of the Southwestern corner of the domain in the projection of his choice.

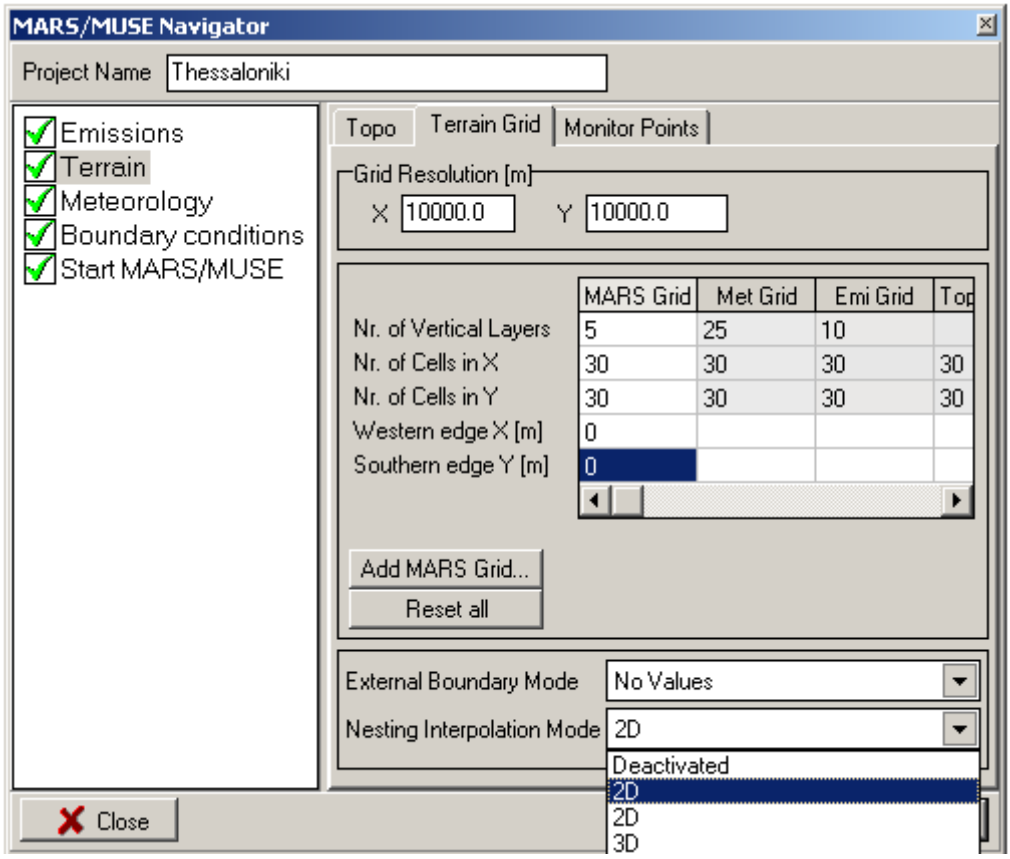
The resolutions of all the grids should be the same. This resolution should be provided for the x and y directions (in meters)

MARS/MUSE



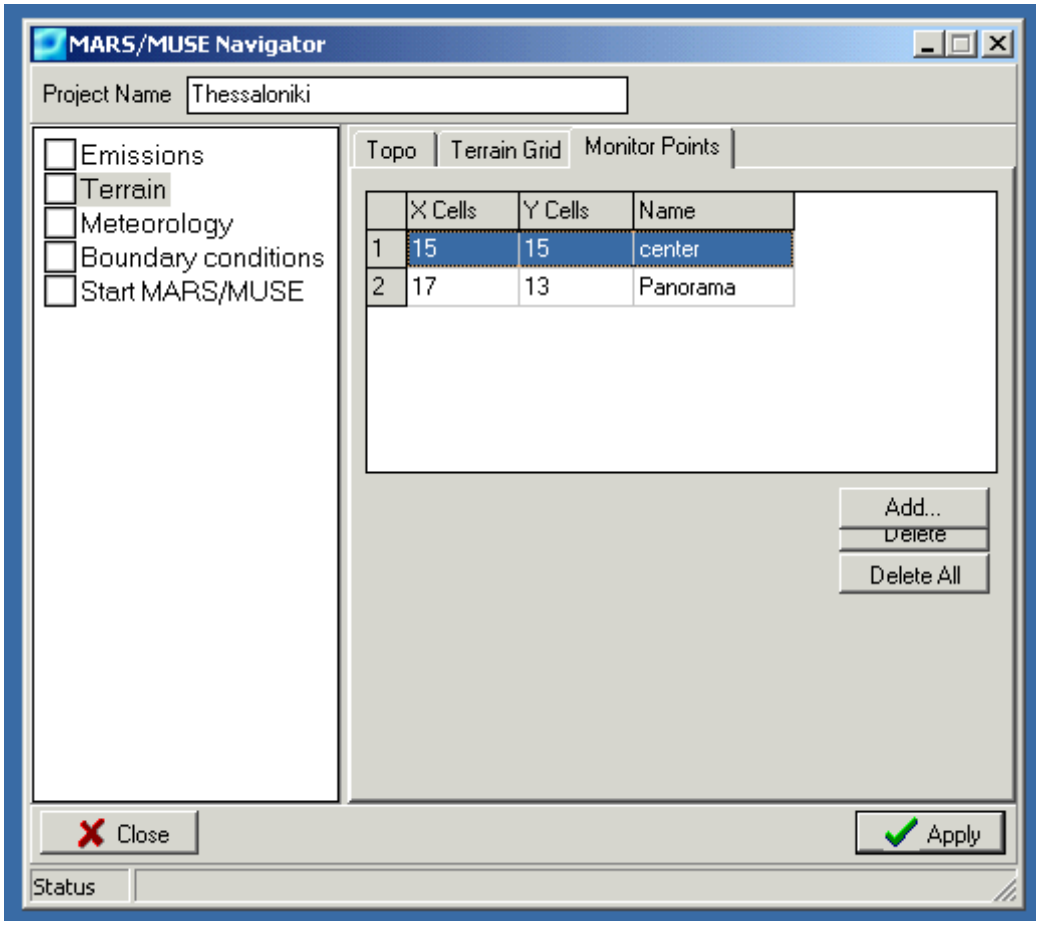
The “External Boundary Mode” refers to the capability of using MARS/MUSE boundary conditions from other photochemical models or for performing nested runs. ‘No values’ is the default value for non-nested runs.

MARS/MUSE



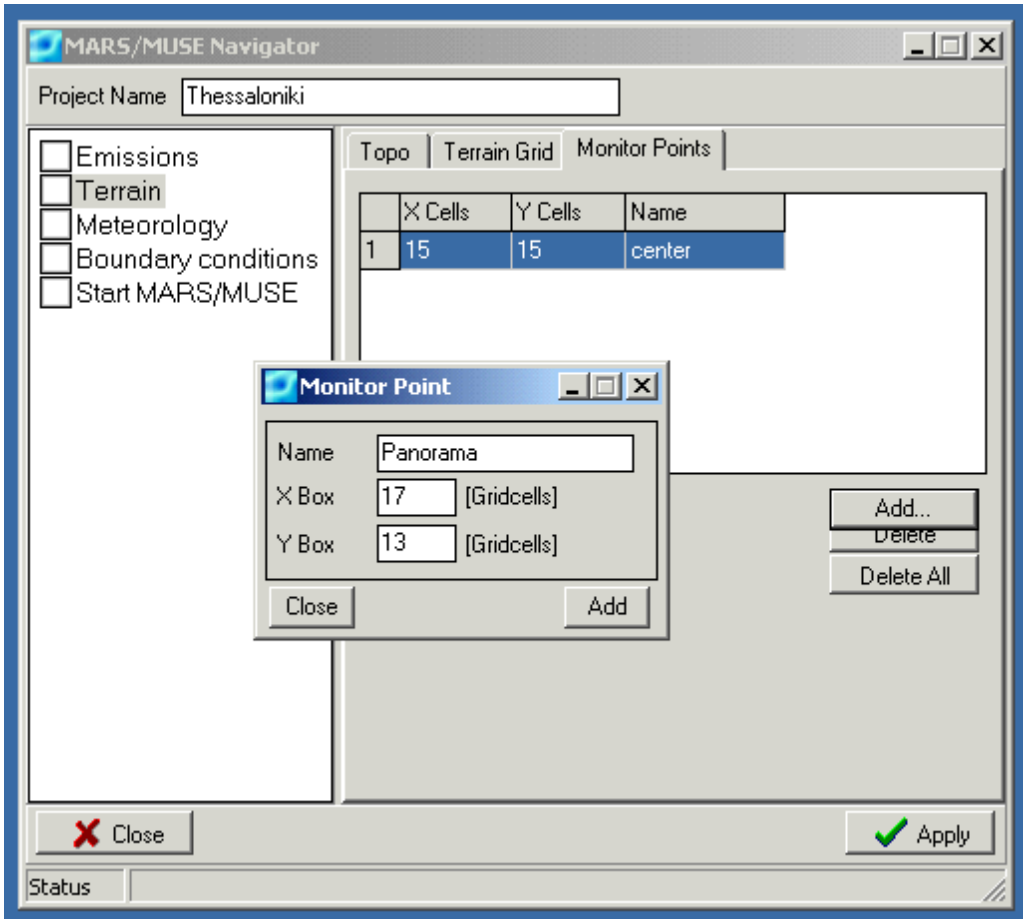
The “Nesting Interpolation Mode” refers to the interpolation scheme used when producing output files to be used later as boundary conditions for nested runs. The most safe and well tested choice here is to use a 2D interpolation.

MARS/MUSE



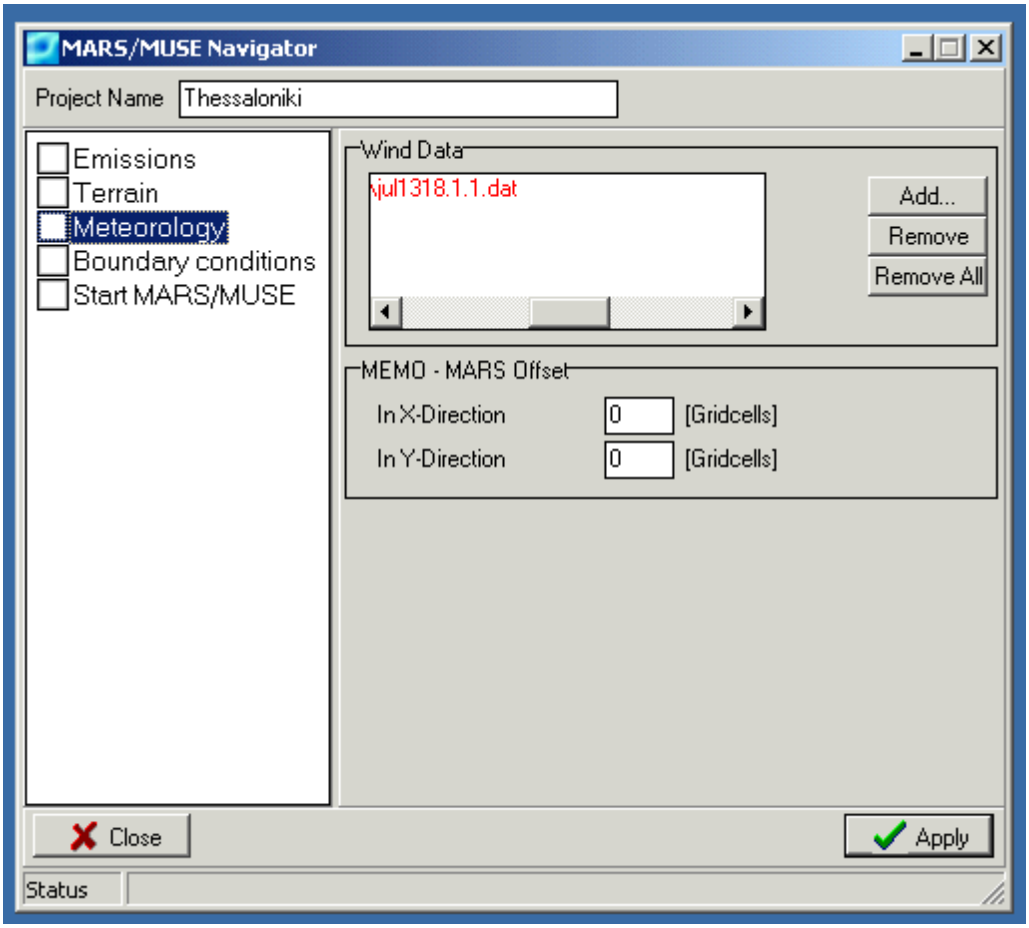
The user may define the locations of several monitoring points (in gridcells of the MARS/MUSE domain). These may be added or deleted accordingly.

MARS/MUSE



An example of the ‘Edit’ window for the monitoring sites.

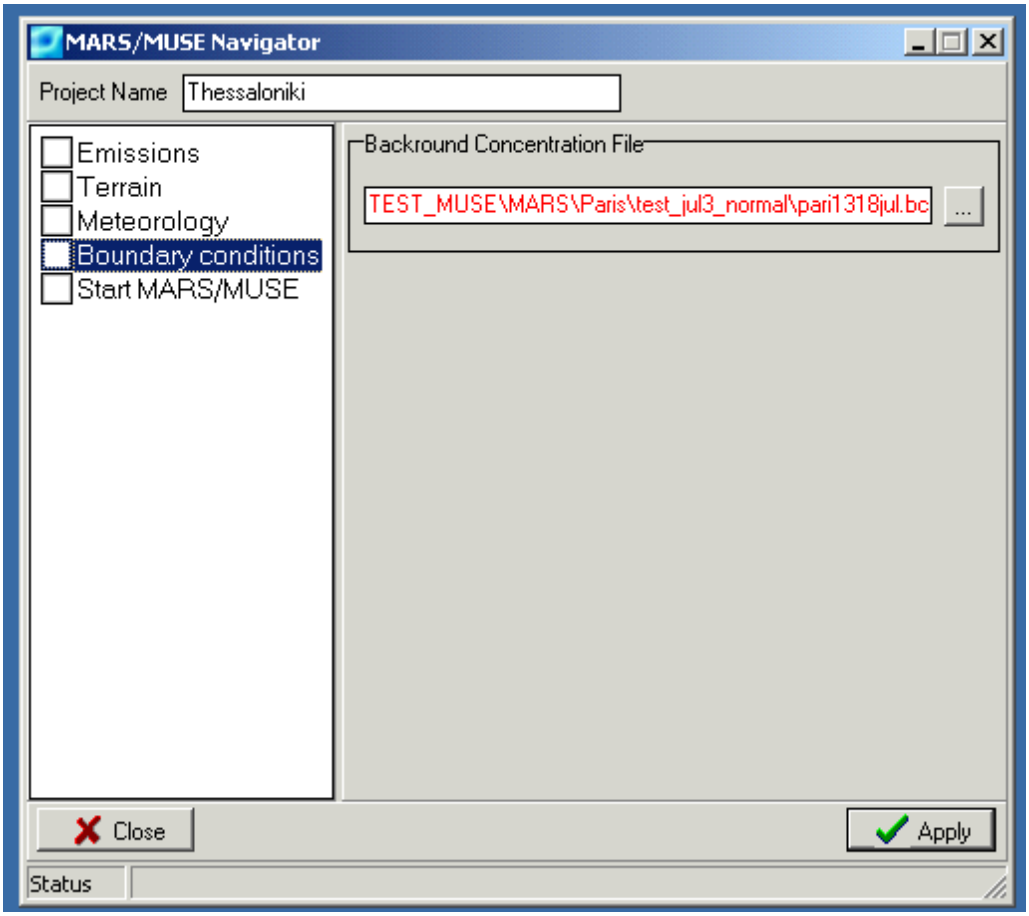
MARS/MUSE



METEOROLOGY INPUT FILE

The wind field for a MARS/MUSE run is provided by the meteorological model MEMO (preferably the one corresponding to the nested area, if MEMO has run with the nesting scheme).
It is possible that the size of the grid of the meteorological data does not coincide with the gridsize of the MARS/MUSE grid. More specifically, the meteorological data grid may be larger than the MARS/MUSE grid, but the reverse is not realisable. In case the grid sizes differ, the offset of the two grids must be specified (in gridcells).

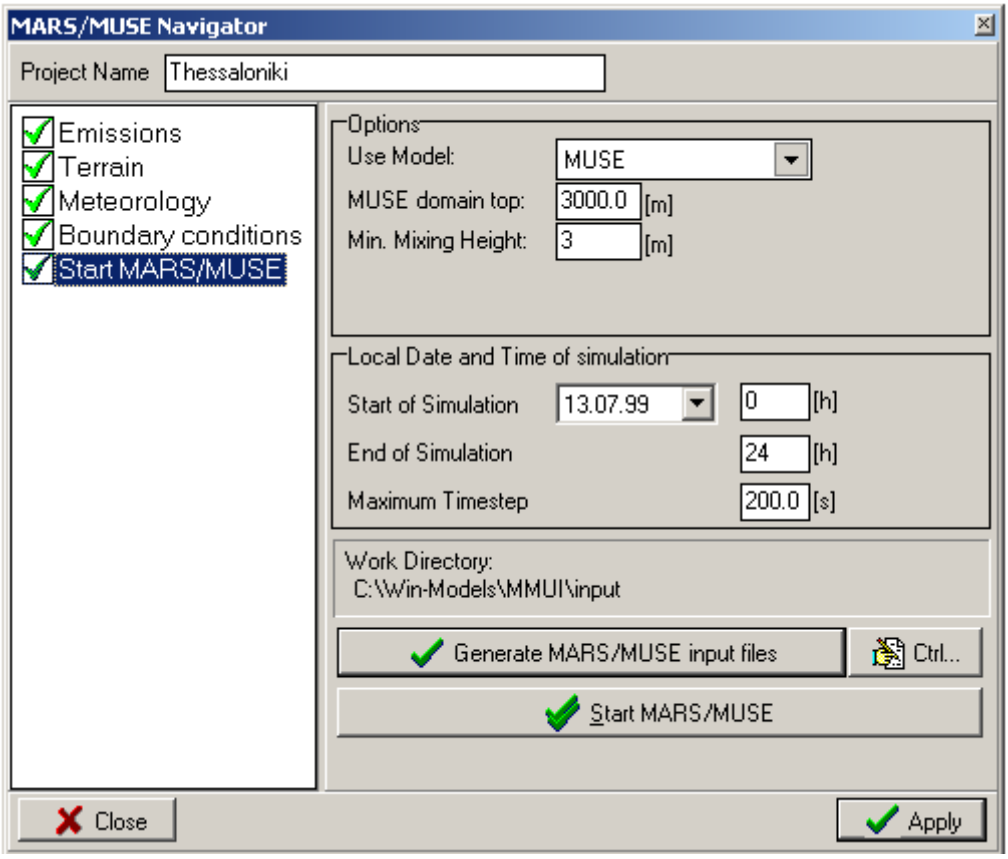
MARS/MUSE



BACKGROUND CONCENTRATIONS FILE

The background concentrations (BCs) file contains the boundary conditions regarding concentrations in and around the MARS/MUSE domain. The format of this file is described into the main MARS/MUSE manual.

MARS/MUSE

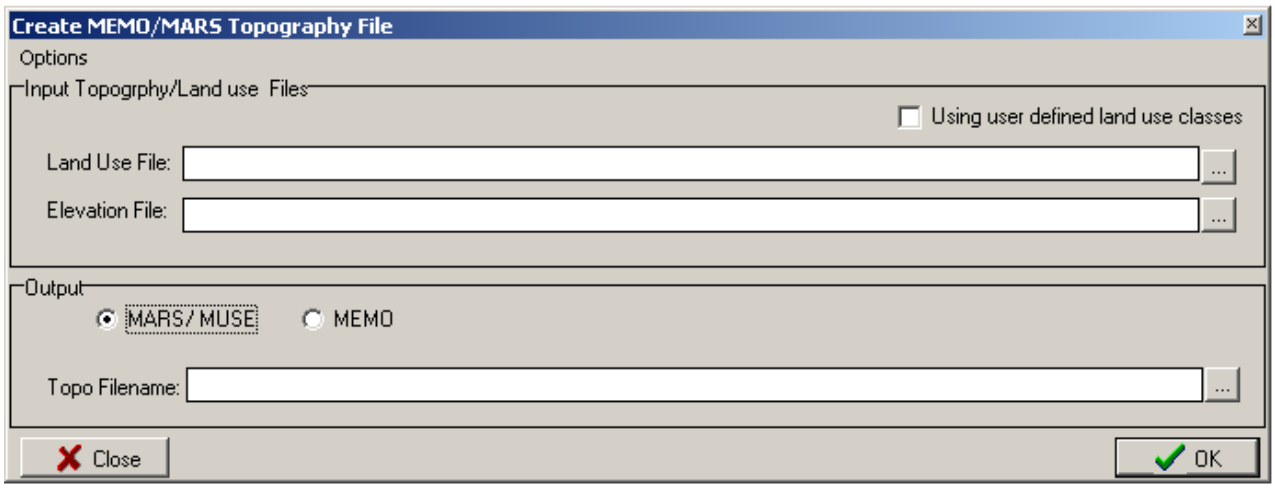


A number of essential parameters of the run are specified here:

- The exact model used (MARS or MUSE)
- The MUSE domain top (in meters)
- The minimum mixing height allowed (in meters)
- The local date and time of the start of the simulation, as well as the duration of the run (in hours)
- The maximum allowed timestep (the timestep in MARS/MUSE is variable, so, an upper bound is necessary)

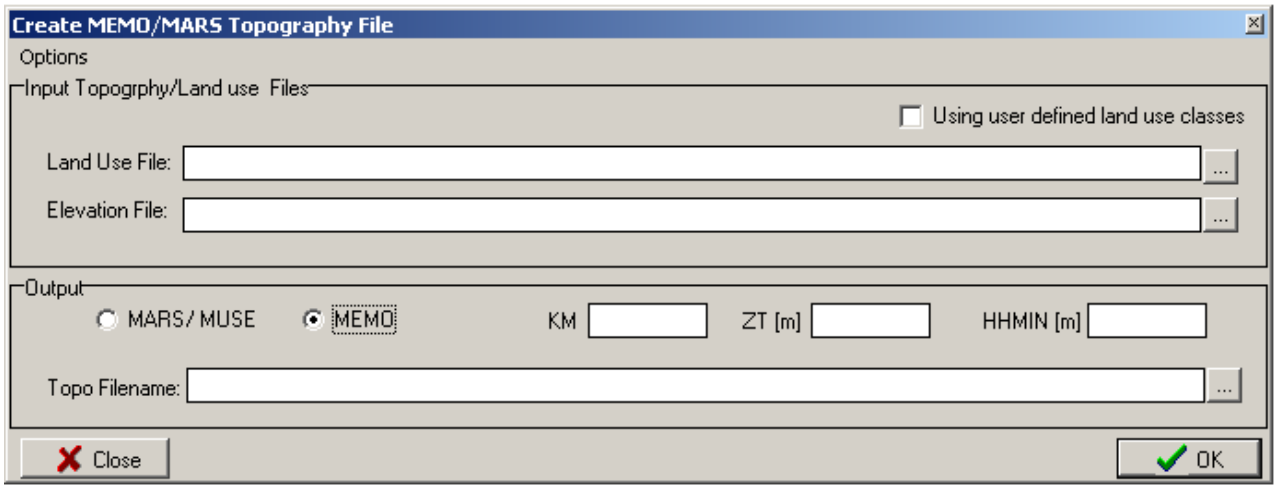
After all the files and parameters have been provided, the user presses the 'Generate MARS/MUSE input files' in order to create all the files necessary for the model run and if these are created successfully the user may start the run by pressing 'Start MARS/MUSE.

Terrain Factory



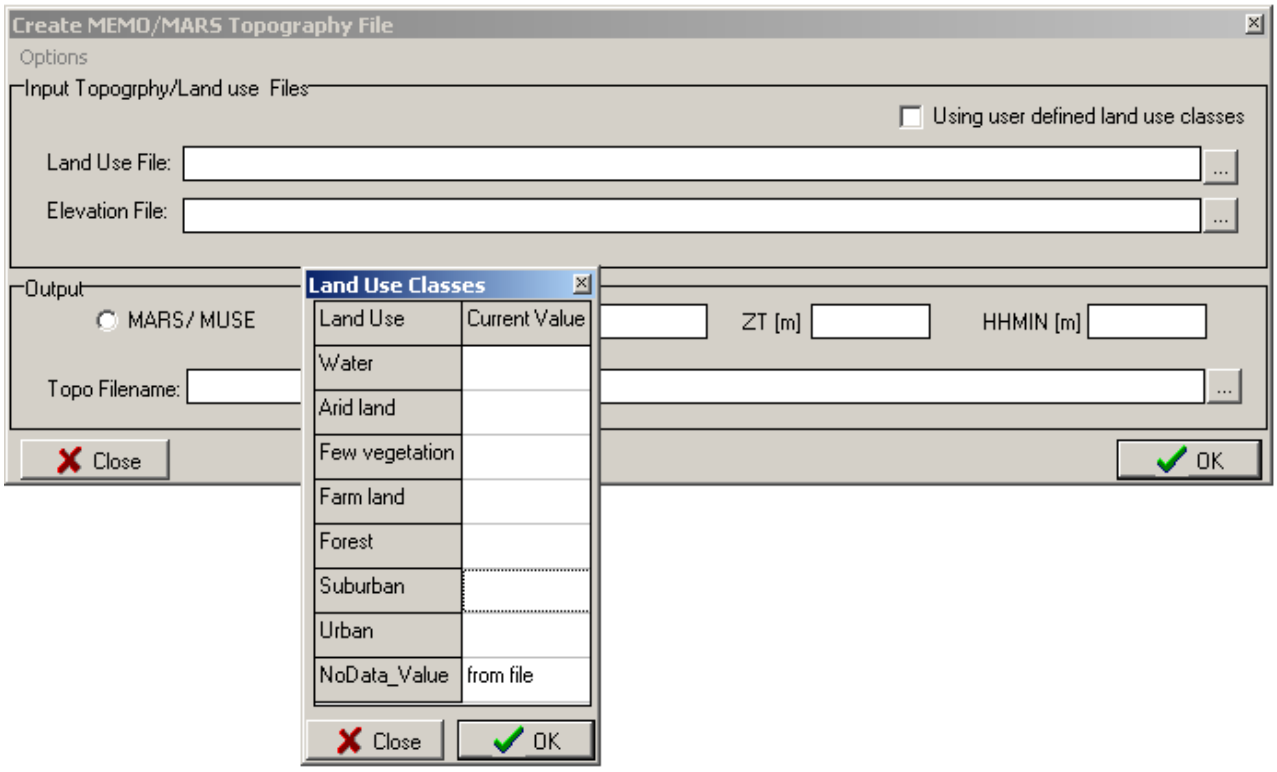
The ‘Terrain factory’ is an application to help the user create a MARS/MUSE file by using ASCII files produced by a GIS program. Two separate files for the land use and elevations should be used.
The ‘Topo filename’ should be provided by the user.

Terrain Factory



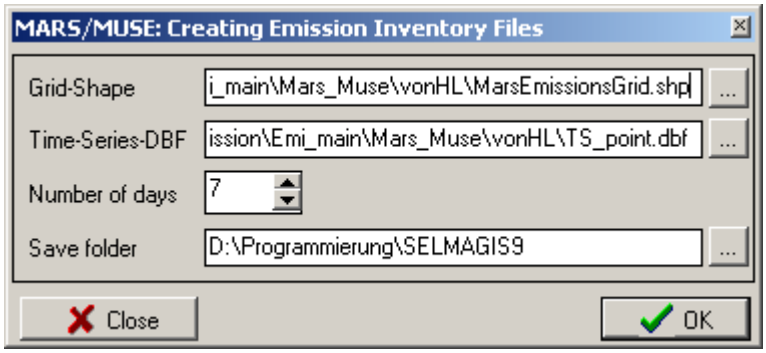
When a MEMO topography file should be created, three additional parameters must be defined. KM corresponds to the number of vertical layers of MEMO, ZT is the height of the top layer, while HHMIN is the thickness of the first layer.

Terrain Factory



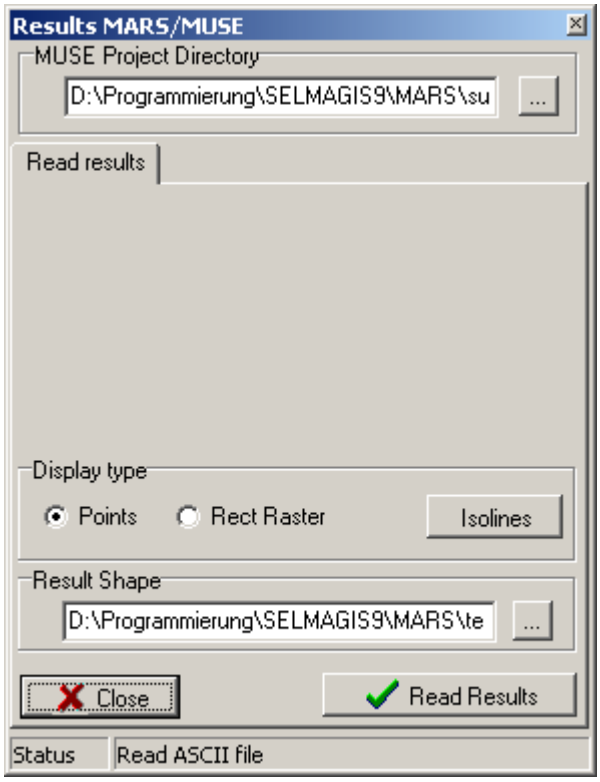
The land use classes can be defined from the options menu. This is a utility to make a correspondence between the land use classes used by the models (either MEMO of MARS/MUSE) shown on the left hand side of the window, and the land use classes of the original data (as label numbers). The ‘Using user defined land use values’ tick-box indicates a departure from a one-on-one correspondence of land use classes.

Emissions Inventory Creator



The Emissions Inventory Creator is a utility used to create an emissions inventory for use in the MARS/MUSE photochemical dispersion model by using a grid shape and a time-series-DBF file. The Emission grid shape must be created by the SELMA^{GIS} digitizing tool (see Manual). The time-series-DBF file is created in the Emission Factory of SELMA^{GIS} (see Manual)
The save folder of the newly created emissions inventory should also be defined.

MARS/MUSE Visualization utility



The user may visualize results produced by MARS/MUSE using this utility.
The MARS/MUSE results file path should be provided. The utility lets the user define the display type (see SELMA^{GIS} Manual). The output resulting shape is stored in a file also defined by the user.