# What's New in ADMS-Urban 5?

## February 2020

ADMS-Urban 5 is the latest general release of CERC's state of the art model for the dispersion of pollutants in urban areas. ADMS-Urban 5 contains a number of major new features and options, most notably:

- the ability to split large model files up into a number of smaller spatial regions, each of which can be run separately and potentially simultaneously, and/or the ability to exclude low-contribution sources from the model run, both allowing for significant reductions in run times and making it easier to stay within licence source limits;
- an option to output the contribution of each source to each receptor, along with a way to visualise this data in the Mapper;
- the latest UK emission factors from EFT 9.0, which include the effects of road gradients on emissions from heavy goods vehicles;
- improvements to the geometry of multi-segment/adjoining road and line sources;
- the ability to specify time-varying emission factors for a particular source-pollutant combination; and
- enhanced usability functions throughout the Mapper and interface.

This document contains details of the new features, scientific improvements and model corrections implemented since the previous version of ADMS-Urban (version 4.1.1, December 2017). Also contained in this document are instructions for installing ADMS-Urban 5 and upgrading from previous model versions.

## IMPORTANT NOTE FOR THE UPGRADE OF MODEL RUNS

Any additional input files (*.uai*) need to be upgraded before they can be used with ADMS-Urban 5. Full details of how to upgrade these files are given in this document.

# Installation

## Before installing ADMS-Urban 5

In this release, ADMS-Urban, ADMS-Roads and ADMS-Airport are installed using a single installation process. Therefore, if you have previous versions of any of these models installed on your computer, they will need to be uninstalled before installing any of the new versions.

Log on to your computer as Administrator, and uninstall any previous versions of ADMS-Urban, ADMS-Roads and ADMS-Airport by selecting **Programs and features** from the Windows Control Panel.

## Installing ADMS-Urban 5

If you have not already done so, log on to your computer as Administrator.

ADMS-Urban will have been supplied by download link. Extract the downloaded *.zip* file to a local directory. In Explorer, browse to this directory and double-click on the file '*setup.exe*'.

Follow the instructions on the screen. Further details are given in Section 2.2 of the User Guide, a copy of which can be found in the ADMS-Urban installation files in *.pdf* format.

You should also have been provided with a new licence file, which is required in order to run the model. To install the ADMS-Urban licence, copy the file (*ADMS-Urban.lic*) to the directory in which ADMS-Urban is installed.

The first time that you launch ADMS-Urban after installation, it is important that you are connected to the internet so that your licence can be registered.

Note that the installation procedure automatically puts a generic shortcut to ADMS-Urban, ADMS-Roads and ADMS-Airport on your desktop. The first time you double-click on this shortcut, a screen similar to that shown in Figure 1 will be displayed.

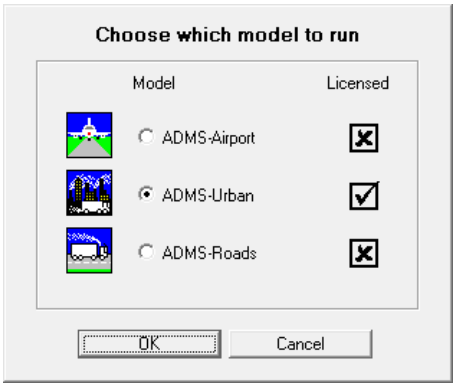


Figure 1 – Model selection screen

Select ADMS-Urban and click **OK**. (Subsequently, if you are using more than one of ADMS-Urban, ADMS-Roads and ADMS-Airport on your computer, then this generic shortcut will launch the most recently used model.)

You can also set up a specific shortcut to ADMS-Urban by browsing to the *\Support\Shortcuts* sub-directory under the ADMS-Urban install directory in Explorer, copying the ADMS-Urban shortcut and pasting it, for example, on to your desktop.

New versions of the GIS links you require (ArcGIS, MapInfo) can be installed by following the instructions in the ADMS-Urban User Guide.

# Upgrading your input files

## Additional input (*.uai*) files

Any additional input (*.uai*) files must also be updated so that they are in file version 6 format. To do this:

1. If you wish, make a backup copy of the original *.uai* file in Explorer.
2. Open the **Additional Input file editor**, which can be accessed via the **Edit** button on the **Setup** screen of the ADMS-Urban interface.
3. **Open** the *.uai* file via the **File** menu.
4. Click **Yes** to the automatic upgrade message that appears to allow the editor to upgrade the file.
5. **Save** the *.uai* file via the **File** menu.
6. Reference the new *.uai* file in the **Setup** screen of the ADMS-Urban interface.

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.igp *files are no longer used by the model; the information previously contained in these files is now specified directly in new sections of the* .uai *file itself. If upgrading a file version 5* .uai *file that references an* .igp *file, these new sections will be automatically populated based on the information in the* .igp *file. Once the new file version 6* .uai *file has been saved, the user may wish to archive the* .igp *file, as it is no longer needed.*

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# New Features and Major Changes

## New features

1. A new ‘Spatial splitting’ option has been added to make it much easier and faster to run large model files and/or stay within licence source limits (see Section 4.19 of the User Guide for full details):

    a. A large modelling domain can be split into multiple contiguous smaller regions, each of which can be run separately and potentially simultaneously. Alternatively, a single smaller region can be defined so that only a spatial subset of the sources and/or output points in the full modelling domain are included in the run

    b. This option replaces and extends the now deprecated ‘Spatial truncation’ option, which can still be used but will be phased out in future releases

    c. Submitting a multi-region model file via Run Manager will automatically run as many simultaneous regions as possible (within licence constraints) across the available runs machines

    d. After all regions have been run, the concentration data within the resulting set of output files can be plotted simultaneously using a new ‘Plot all’ feature in the Contour Plotter utility

2. Two new ‘source exclusion’ options have been added to enable sources defined in the *.upl* file that would not significantly contribute to modelled concentrations to be excluded from the model run, thereby reducing the model run times and helping to stay within licence source limits (see Section 4.20 of the User Guide for full details):

    a. ‘Source exclusion by distance from receptors’ is available if using specified points output, and excludes all sources of a particular type that are greater than a user-specified distance away from all specified points

    b. ‘Source exclusion by emission rate’ excludes all sources of a particular type whose emission rate is less than a user-specified cut-off value, for a user-selected pollutant

3. A new ‘output per source’ option has been added to write the output contribution from each source to each receptor in a new set of output files. The data in these files can also be visualised in the Mapper; these ‘footprint’ plots indicate to what degree each source contributes to the concentration at the selected receptor for a selected met. line (or long-term average) by colour-coding the sources themselves. Instructions for using this new option and details of the new output file formats can be found in Section 3.6.5 and Section 6.1.4 of the User Guide, while details about the footprint plots can be found in Section 6.4.

4. The ability to define spatially varying dry and wet deposition parameters, as well as hourly varying dry deposition velocities, has now been added to ADMS-Urban. Note that the fixed deposition parameters are always applied to grid sources. See Sections 4.8.2, 4.8.3 and 4.9.2 of the User Guide for more details.

5. The Coastline option has now been added to ADMS-Urban. This models the effects of a coastline on the dispersion from elevation point sources in convectively unstable conditions. See Section 4.16 of the User Guide for more details.

## Sources

6. The UK EFT v9.0 emissions dataset has been added for the calculation of road traffic emissions. This dataset includes the effects of gradients on emissions from heavy goods vehicles. To fully utilise this dataset, the road gradient and the percentage of vehicles travelling uphill can be specified in the interface.

7. Traffic flows can now be entered alongside user-defined emission rates. In these cases the entered traffic flows are used to estimate the traffic induced turbulence rather than performing a back calculation from the emission rates.

8. There have been various changes to the advanced street canyons module (see Section 4.2 of the User Guide for full details):

    a. The advanced street canyon input file format has been simplified by removing redundant columns, namely the ID, CanyonLength and EndLength columns. The model can still read the old file format.

    b. A new column has also been added that allows the user to specify the covered fraction of each street canyon (due to balconies, curved noise barriers, etc.). Increasing the covered fraction leads to lower wind speeds inside the canyon, which affects the within-canyon concentrations

    c. There is a new option under the Utilities menu to create a template advanced street canyon input file based on the roads currently defined in the Source screen

    d. The number of recirculation cells within tall canyons is now limited to three cells

9. Line and road source segments are now modelled as trapezia rather than rectangles, **Figure 2**. The shared edge of two adjoining trapezia is the bisector of the two segment centrelines of the road or line source. A similar process is also applied between adjoining pairs of roads or lines. If more than two road or line sources meet at a point the standard rectangular ends are used for each of these sources.

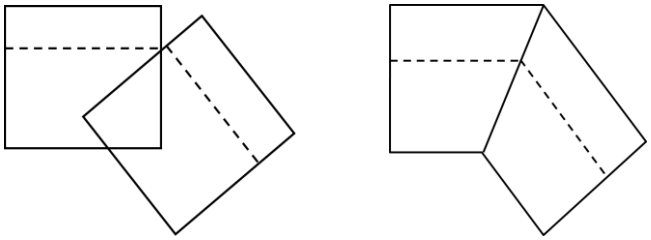

**Figure 2**: Road geometry between two segments in version 4.1.1 (left) and version 5 (right).

10. A new additional input file option has also been added to output the road geometry to a *.rds* file, which can then be plotted in the Mapper to allow the visualisation of road and street canyon positions. See Section 4.5 of the User Guide for more details.

11. It is now possible to specify the release from a point, line or area source as ambient, in which case the exit temperature (and density) is recalculated on a per met. line basis as the ambient temperature at the relevant source height.

12. A new additional input file option has been added that makes it possible to disable grid source disaggregation, in which case the supplied grid-cell emission rates are treated as residuals. See section 3.2.3 of the User Guide for more details.

13. It is now possible to model a 3D grid source in place of the standard 2D grid source. The 3D grid source allows for a 3D grid of cells to be specified, with emission rates specified per cell per hour for each pollutant. This allows for much greater flexibility than the standard 2D grid source. The 3D grid source is a netCDF format file (or set of files). See Section 4.6 of the User Guide for more details.

## Time-varying emission factors

14. There are various new features if entering on-screen time varying emission factors (see Section 4.1.3 of the User Guide for full details):

    a. The sum and average of each diurnal profile (Weekdays, Saturdays, Sundays) is displayed, as well as the overall sum and average

    b. There is a Normalise button that adjusts the factors so that the overall average equals one

    c. There is a graph that plots the time-series of each diurnal profile

    d. There is a Save button that generates a *.fac* file from the on-screen data, which can then be modified further in a text editor if desired

    e. The on-screen factors can also be imported from/exported to a simple *.csv* file

    f. It is possible to copy the factors from one profile to another by right-clicking on the header

    g. Values can also be pasted from Excel or a tab-separated text file into the table

15. Time-varying emission factor profiles in the *.fac* and *.hfc* files can now be applied to a particular source-pollutant combination. See Section 4.1 of the User Guide for more details.

## Chemistry

16. The Trajectory Model will now always use the ozone deposition parameters defined in the palette of pollutants, whether deposition modelling has been selected or not, to avoid unrealistically large ozone concentrations at night. Users should therefore ensure that sensible values are entered for these parameters.

17. The reaction coefficient for the photolysis of ROC has been made consistent with the reaction coefficient for the photolysis of $NO_2$. As a result of this and further validation work the default value for AROC has also been reduced from 0.1 to 0.05. However, this value can be modified via a new additional input file option. See Section 4.10.5 of the User Guide for more details.

## Output

18. A new 'validity threshold (%)' column has been added in the Output screen. This specifies the threshold percentage of met. lines that need to be valid within a given averaging period for that averaging period to be considered valid. See Section 3.6.1 of the User Guide for more details.

19. Year/Day/Hour and wind direction have been added to the boundary layer profile output (*.pro*) file. If only one height is defined in the *.pro* file, this means it can be plotted using the Wind Rose Viewer utility, allowing a dispersion site wind rose to be plotted.

20. There have been various changes to the location of source-oriented grid points for road and line sources (see Section 3.5.2 of the User Guide for full details):

    a. The most significant change is for cases where the advanced canyon module is used. Previously for all road sources two source-oriented grid points were placed on each side of the road centreline, one just inside the road source and the other at four times this distance. For an advanced canyon source there will now be up to three points placed on each side of the road centreline, one just inside the road carriageway and then a pair of points either side of the canyon wall

    b. A new additional input file option has been added that allows the user to alter the across-source locations of the source-oriented grid points for standard road sources, advanced canyons and line sources

    c. The *.igp* file has been replaced by directly entering the data into two new sections of the additional input (*.uai*) file, one for controlling the along-source locations of the source-oriented grid points and the other for controlling which sources should have source-oriented grid points added to them. These two new sections will be automatically populated based on the data in the *.igp* file when

upgrading any old *.uai* file that references an *.igp* file (see the '*Upgrading your input files*' section near the beginning of this document). The new sections also provide additional functionality compared with the *.igp* file, namely you can now specify that *all but* the provided list of sources should have source-oriented grid points added to them, and you can also control which line sources should have source-oriented grid points added to them

d. The changes to the road and line source geometry have also altered the locations of the source-oriented grid points, which now span the trapezium edges

21. A new additional input file option has been added to create an *.asp* file containing all of the output points (regular grid points, source-oriented grid points and specified points). See Section 4.22 of the User Guide for more details.

## Usability

22. There have been various changes to the format of the *.spt* file (and related files) for data import/export (see Section 5 of the User Guide for full details):

    a. Additional information to support gradients with EFT v9.0

    b. Parameters which are not required can now be left blank (or 'n/a' or 'na')

    c. Old format files can still be imported, and data can still be exported in the old format, allowing import into ADMS 5

    d. Sources with more than the maximum number of allowed vertices can still be imported, but the *.upl* cannot be saved until the number of vertices have been reduced accordingly (see also #31).

23. Various limits have been increased:

    a. The maximum length of all names (sources, buildings, groups, pollutants, receptors, profiles) has increased from 20 to 30 characters

    b. The maximum number of pollutants in the palette has increased from 31 to 80

    c. The maximum number of pollutants emitted per source has increased from 12 to 80

    d. The maximum number of entries in the pollutant output table has increased from 30 to 80

    e. The maximum number of outputs per run has increased from 12 to 25

    f. The maximum number of specified points in the interface has increased from 50 to 100

g. The maximum number of vertices for road and line sources has increased from 50 to 51 (to allow for 50 segments)

24. There have been various changes to the menus, including:

    a. There is now a dedicated Mapper menu item to launch the Mapper quickly

    b. The Emissions Inventory menu item has been moved to under the File menu (Import/Export using plain-text *.spt* files is now the preferred method)

25. The table columns in the Source screen and Output screen are now resizable. The order of the columns in the industrial sources table has also changed.

26. ADMS 5 model files (*.apl* files) can now be opened directly in the ADMS-Urban interface. Warnings will be issued about any model incompatibilities resulting in disabled options. The file can then be saved as a regular *.upl* file.

27. Specified points in an *.asp* file can now be imported directly into the specified points table, and vice-versa.

## Mapper

28. Layers containing source information, e.g. a shape file of point or road source data, can be exported for *.spt* format so that they can be easily imported into ADMS-Urban. See Section 5.12.2 of the Mapper User Guide for more details.

29. A new 'Clip layer to polygons' tool allows individual features from one layer to be 'clipped' to the polygon(s) from a separate layer. The resulting set of clipped features are saved to a new shape file rather than replacing the original layer. See Section 5.13 of the Mapper User Guide for more details.

30. Statistics about a particular layer can be viewed using the new 'Layer statistics' tool. Namely, the minimum, maximum and X, Y location of each are reported for each numerical field in the layer. Up to five filters can also be applied to the layer to constrain the number of features/data points on which to calculate the statistics. See Section 5.14 of the Mapper User Guide for more details.

31. The geometry of all features in a particular polyline/polygon layer can be simplified simultaneously using a new 'Simplify layer' option. This can help to reduce vertex counts to within model limits.

32. Two new gridding methods have been added to the Interpolator – triangulation and natural neighbour.

33. When a contour layer is created, a separate layer that displays the contour lines is also added.

34. The transparency of individual contour levels can now be altered. This can be useful for 'seeing through' certain regions of a contour plot.

35. Information tool:

    a. Holding down **AltGr** ensures that only features in the currently selected layer can be clicked.

    b. Raster layer (e.g. contour plot) values are now displayed in the status bar as you move your cursor across the layer, or displayed in the attributes table if you click on a particular point.

36. There have been various changes to improve usability:

    a. There have been several changes to the main and right-click menus.

    b. It is now possible to move the output grid and rotate a source or building.

    c. There are now three tabs in the layer panel; the Layers tab shows the layer order hierarchy while the Grouping tab shows which group each layer belongs to.

# Minor Changes

37. Nitric oxide (NO) is now included in the pollutant palette and can be output directly if chemistry is being modelled.

38. It is now much easier to enter percentiles and exceedance thresholds in the Output screen.

39. A small correction has been made to the vertical concentration profile used for volume sources in convective conditions.

40. Improvements have been made to speed up the initial processing of various options. This is likely to be most noticeable with the advanced canyon option when modelling large numbers of sources.

41. Calculations within the trajectory model are now consistent in linking a fractional time to a meteorological data line.

42. Spatial truncation will now be correctly applied in cases where only the output points were being truncated – previously all of the sources may also have been truncated in these cases.

43. A correction has been made when modelling buildings with dry deposition, in which concentrations outside the cavity region could be inconsistent, particularly when release was fully entrained.

44. A correction has been made to the location of the well mixed region in complex terrain, in cases where the recirculation is shallow compared to its width and the source is near the downwind edge of the recirculation region.

45. The time used in the calculation of solar elevation, and hence the solar radiation, has been altered to use the time in the middle of the hour rather than at the end.

46. A correction has been made when using volume sources with wet deposition, in which the depth was not correctly taken into account in the calculation.

47. A correction has been made when using chemistry and the buildings module together, in which calculated concentrations could be too high.

48. The model can now cope with mixing the hour number convention used for midnight (hour 0 or hour 24) in different input files.

49. If there are missing/invalid background values for the first modelled hour, the first valid values after this hour will be used providing they are within 24 hours.

50. Right-click menus have been added to various screens in the ADMS-Urban interface and utilities to allow for the following additional functionality:

a. Set the start date and time to that of the met. file or to the end date and time, and vice versa, when using a subset of met. data.

b. Choose the application with which to open an input file (Notepad, Wordpad, Excel, Other) on the View buttons

c. Create a copy of a specified point

d. Delete all but the selected entry in various tables (sources, buildings, specified points)

e. Invert the selection of variable grid coordinates

f. Refresh the list of files in the 2-D Output Plotter

51. A higher grid resolution of 512 x 512 has been added for the internal flow field calculations when using complex terrain.

52. The page numbering in the various User Guides have been altered so that the printed page numbers match up with those displayed in electronic PDF viewing applications.

53. The user can now select the vector gridding method in the 2-D Output Plotter when using the Surfer gridding option.