CERC ADMS News Autumn 2023

Contents

Welcome

Welcome to the new format Autumn 2023 edition of ADMS News. This new format merges the old ADMS & ADMS-Screen News and ADMS-Urban & ADMS-Roads News into a single newsletter. There are modelling tips for ADMS 6, ADMS-Urban and ADMS-Roads in this newsletter, with the icons at the top right of each tip indicating which model(s) the tip is applicable to.

		
ADMS 6	ADMS-Urban	ADMS-Roads

News

Software releases

Version 6 of ADMS and ADMS-Screen was released in March 2023. Some of the new features in version 6 of ADMS include:

- **Buildings**: enhancements to the modelling of buildings, including the ability to automatically determine a main building. Easier plotting of the effective building and changes to the way the effects of buildings are modelled, particularly for upwind sources.
- **Source apportionment**: the new 'output per source' option will write the output contribution from each source to each receptor in a new set of output files. The data in these files can be visualised in the Mapper by colour-coding the sources depending on their contribution to the concentration at the selected receptor for a selected met. line.
- **Time-varying emissions**: the ability to specify time-varying emissions profiles per source and per pollutant, along with improvements to inputting time-varying emissions factors on screen.
- **New tools**: 'Layer statistics' to find and display the minimum, maximum and X, Y location for each numerical field in a layer. ‘Clip layer to polygons’ allows individual features from one layer to be ‘clipped’ to polygon(s) or polyline(s) from a separate layer. Easily create receptor point (.asp) files containing several different sets of 3D gridded output points, in polar, Cartesian or rotated Cartesian form. Open ADMS-Urban and ADMS-Roads model files (.upl files) directly in ADMS.
- **Much more**: Please view all the updates in detail in the What's New? guide.

A minor patch to ADMS 6 is available to download from the User Area. This patch fixes an issue when modelling buildings with releases where the molecular weight or specific heat capacity are not the default values.

EMIT 3.9.1 was released in April 2023. This release provides all of the updates since EMIT 3.4.1 in one install. These updates include several new road traffic emission factor datasets and the ability to output ADMS-Urban 3D grid files.

GASTAR version 4 will be released soon. We have reviewed all aspects of the product, and hope to add desirable new features and enhancements in instalments. The next release will include some usability

additions you have become accustomed to in ADMS such as drag-dropping files, quick access to features via context-sensitive pop-up menus, improved control of line plotting colours and symbols. For this release we are also reorganising and clarifying the model output, which includes adding ADMS-style .gtd and .gst model output for contouring.

The CERC development team are also working on new versions of ADMS-Urban and ADMS-Roads. This includes making versions of the Urban Canopy and Street Canyon tools which will not require ArcMap. More details on these upcoming versions will be provided at the ADMS-Urban & ADMS-Roads User Group Meeting on 30 November.

ADMS User Group meetings

You can book your tickets for the 2023 ADMS User Group Meetings, which will be held at Malmaison York on 29th and 30th November.

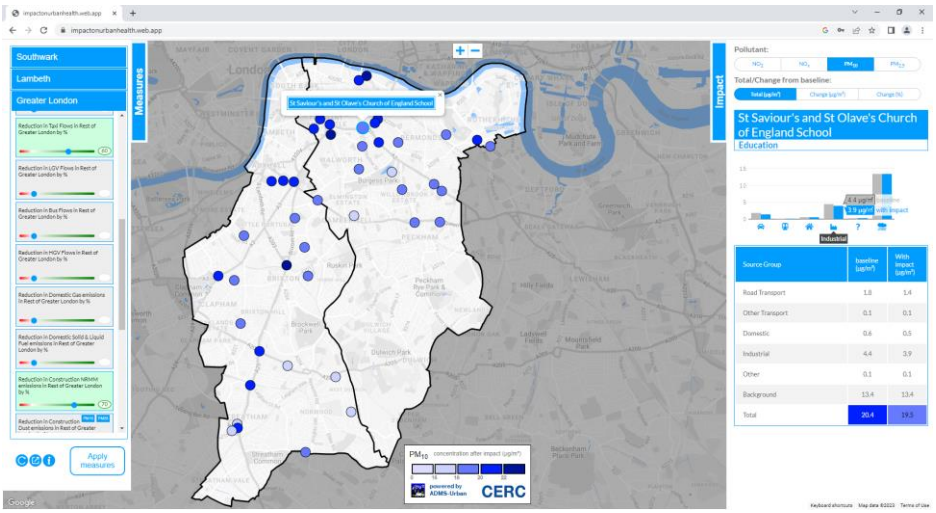
- ADMS 6 User Group Meeting, 29th November
- ADMS-Urban and ADMS-Roads, 30th November

The annual ADMS User Group Meetings are a great opportunity to hear the latest ADMS model news and advice from CERC consultants and model developers, to hear talks by model users about their own applications of the software, and to network with other model users.

Tickets are available to order through Eventbrite until 23:30 on **Tuesday 14 November**. Organisations with a valid software support contract are entitled to one or more tickets free of charge depending on the type of licence held. Draft agendas for both meetings are now available on the Eventbrite pages.

Presentations from previous years are available to download from the CERC website User Area.

Creation of an air pollution scenario impact tool



CERC has developed a digital air pollution impact tool to model the impacts of changes to air pollution sources and the adoption of mitigation measures on levels of air pollution exposure. The tool is potentially scalable to all London local authorities.

This is a joint commission by Impact on Urban Health (IoUH) and Southwark and Lambeth Councils, who have a shared ambition to reduce the harmful impact air pollution has on people's health, particularly those most at risk. CERC selected sensitive locations in Lambeth and Southwark according to the risk of air pollution exposure and the Index of Multiple Deprivation (IMD).

We used ADMS-Urban to calculate concentrations of NO_2, PM_{10} and $PM_{2.5}$ at these locations and calculated the contribution of different source groups.

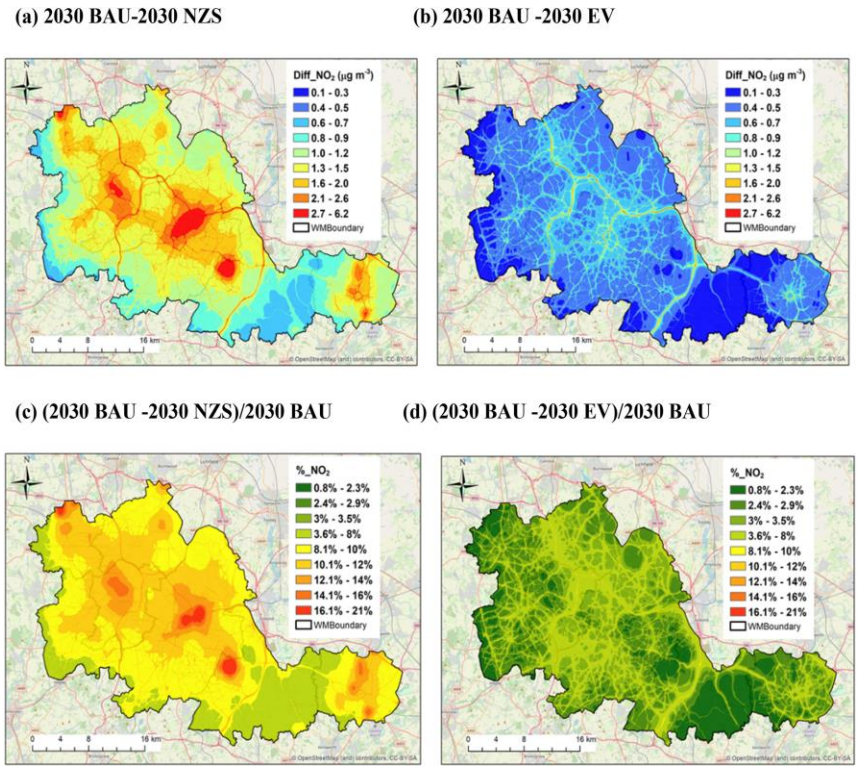
Our findings allowed us to identify measures that affect exposure to air pollution.

Our web-based interactive tool encapsulates the model results and allows the user to view the impact of different combinations of mitigation measures.

We assessed the health impact of the mitigation measures using the modelled concentrations and population, age and health data. More details can be found in our report. In two years' time, CERC will review the model, checking usability and updating inputs where new data has become available.

New Wellcome Trust-funded health-centred West Midlands study

CERC are pleased to be collaborating with a multi-disciplined team on a new Wellcome Trust funded, West Midlands based project: "A Health-centred Systems Approach towards Net-Zero: Transforming regional climate mitigation policies". The overall aim of WM-Net Zero is to transform regional Net-Zero policy solutions by adopting a health-centred systems approach.



This shows the reduction in annual mean NO2 (µg.m^{-3}) for (a) 2030 Net Zero Scenario (NZS) and (b) 2030 Electric Vehicles (EV) (transport decarbonisation) scenario relative to 2030 Business-As-Usual (BAU) scenario; and percentage change for (c) 2030 NZS and (d) 2030 EV scenario relative to 2030 BAU scenario.

WM-Net Zero brings together scientists from a range of disciplines (including social science, climate, air quality, data, health and economics) from the Universities of Birmingham, Surrey, and York, and stakeholders from West Midlands Combined Authority, Defra, Birmingham City Council, Clean Air Fund, Sandwell Metropolitan Borough Council, Coventry City Council, Solihull Council and WSP in the UK to develop new tools and science understanding.

This work builds on CERC's previous collaborations with the University of Birmingham, for example the successful West Midlands Air Quality Improvement Programme (WM-Air). Dr Jian Zhong, from the School of Geography, Earth and Environmental Sciences, has published papers demonstrating how ADMS-Urban can be used to model baseline air quality over a large metropolitan domain and, of particular relevance to this new project, an investigation into impacts of net zero policies on air quality.

CERC awarded DfT aviation air quality modelling contract for ICAO CAEP

The UK Department for Transport (DfT) has awarded CERC a two year contract to carry out local air quality modelling of aviation emissions for the International Civil Aviation Organization Committee on Aviation Environmental Protection (ICAO CAEP).

One of ICAO's environmental goals is to limit or reduce the impact of aviation emissions on Local Air Quality. Since the late 1970s, ICAO has been developing measures to address emissions from aircraft engines and other airport sources.

CERC's work under this contract will be under the auspices of the CAEP Modelling and Databases Group (MDG). Our work will include modelling test cases of the local air quality impacts of aircraft emissions for a range of airports. We will also investigate ways in which the modelling process might be streamlined and improved.

CERC's model ADMS-Airport will be used for this project. ADMS-Airport is one of the approved models for the ICAO CAEP MDG; it is listed in the ICAO Airport Air Quality Manual as a typical model used in the advanced and sophisticated approaches.

New research projects for improved regulatory modelling

Organisations which protect air quality need rapid and robust ways to assess the pollution impacts of industrial activities. The UK Department for Environment, Food & Rural Affairs (Defra) and the Environment Agency (EA) commission research to improve regulatory modelling techniques. CERC are working on several research projects for both organisations as part of Defra's Research Development & Evidence Framework Agreement, in collaboration with Air Quality Consultants (AQC).

It is important to quantify landfill emissions of methane, but difficult to make accurate and representative emissions measurements. In two linked projects for the EA, CERC are exploring inverse modelling methods for estimating landfill methane emissions from concentration measurements

CERC and AQC are collaborating on an EA funded study of established and developing air quality assessment methods which use modelling, monitoring and integrated techniques. The aim is to identify aspects of air quality assessment where new research would be valuable. The project team investigated the opinions of key experts in the field through recent workshops and individual interviews.

Amine chemicals can be used to remove carbon dioxide from exhaust gases, but they can be released to the atmosphere in small quantities, potentially creating harmful products (nitramines and nitrosamines) through chemical reactions. CERC previously developed ADMS to model amine chemistry. For ADMS 6 this module has been extended to model multiple types of amine and associated products simultaneously. With support from Defra, CERC are investigating sensitivities of the ADMS amine modelling and developing a tool to calculate the chemical properties for a wide range of amines.

Air pollution screening methods use simple estimates of impacts to assess whether more detailed modelling is needed. CERC have a leading technical role in an EA funded project to improve screening techniques for small industrial sources. These sources have release heights up to 20 m above ground and are often affected by nearby buildings. CERC are also reviewers in a project for the EA assessing air quality impacts from intermittent generator testing activity.

We look forward to sharing project outcomes with the air quality modelling community.

Training Information

CERC training courses focus on giving users the knowledge and expertise to efficiently apply CERC software to real-life air quality problems.

We hold regular online courses, which are very popular and extremely useful for participants going forward with their work.

Courses are hosted on an online training platform alongside real-time communication, with an experienced CERC trainer.

As well as running courses online in the UK, recently sessions have been run in India, Singapore, Malaysia, Ireland, Norway, The Netherlands, Spain and Malta.

Course	2023	2024					
	Dec	Jan	Feb	Mar	Apr	May	Jun
ADMS 6		30-31	20-21	19-20	16-17	14-15	
ADMS-Urban	5-6			5-6	30-	1	
ADMS-Roads			6-7		2-3		4-5

Courses can also be customised for particular user requirements.

A **10% discount** applies to scheduled CERC training courses, if purchased at the same time as a software annual licence or support renewal. Training must be booked within 12 months of purchase.

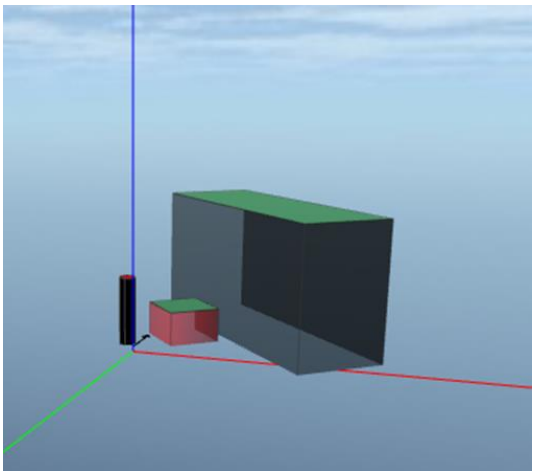
For more information on specific courses and dates and prices, visit the CERC website www.cerc.co.uk/training or contact CERC.

Modelling Tips

Choosing the main building for each source

When modelling buildings effects in ADMS, it is necessary to select a 'main building' for each point source, which determines the height of the wind-aligned effective building used in the buildings module. This should be set to the building that is likely to have the most effect on dispersion from that source. There are no hard and fast rules for selecting the main building for a given source and professional judgement is often necessary. However, the following guidance can be useful:

- For sources that are on the roof of, or attached to the side of, a particular building, that building is often likely to be the most influential on dispersion.
- For sources that are equally close to a number of buildings, the tallest and/or largest (in terms of footprint) building is often likely to have the largest effect on dispersion.
- At sites with a strong prevailing wind direction, those buildings that are directly upwind or downwind of a source should be given greater consideration when choosing the main building.
- Sources that are far from any building or significantly taller than the buildings around them are unlikely to be significantly affected by buildings effects; in this case the main building should be set to "(None)", which will also speed up the run slightly.



ADMS 6 also includes an "(Auto)" option, which will automatically select the main building for that point source. (This option will be included in the next general release of ADMS-Roads Extra/ADMS-Urban). This option will select the closest building to the source that is deemed tall enough (typically at least one third of the source height) and is within the region of influence, which extends out from the source in the upwind and downwind direction (the selected main building is thus met-line dependent). The same selection process is also used if the user-selected main building is deemed to not influence a given source for a particular met line. While the "(Auto)" option is likely to select an appropriate main building in many cases, it is important to retain professional judgement for your particular modelling setup. For example, the image shows a setup with two buildings close to a point source. The most appropriate main building in this case is the larger building that is further away from the point source.

Modelling road tunnels

Tunnel structures limit the dispersion of traffic emissions, which by default will be transported through the tunnel with the vehicle movements and will leave from the exit portal. This can lead to high concentrations around the exit portal. Tunnels with active ventilation can alternatively extract emissions to a chimney stack to reduce the local concentration impact. ADMS-Urban and ADMS-Roads includes an option to model road tunnels by moving the road source emissions to volume sources outside the exit portal. If a connecting outflow road is specified, the volume sources are overlaid on the outflow road, representing the entrainment of emissions in vehicle wakes leaving the tunnel. Section 4.4 of the ADMS-Urban User Guide explains how to set up road tunnel

modelling. Further technical information about the modelling approach is given in the Road tunnels Technical Specification document.

Rounding issue when using Excel to edit ADMS files

Source, pollutant, buildings and terrain data can be imported as CSV files. A full list and description of the files that can be imported can be found in Section 5.1 of the ADMS, ADMS-Urban and ADMS-Roads User Guides. When editing these files using Microsoft Excel, it is important to be careful since Excel will, by default, round numbers. This can lead to floating invalid errors if ADMS default values get rounded. To avoid this problem, it is possible to set the rounding precision in Excel. Go to **File** > **Options** > **Advanced** and under **When calculating this workbook** tick **Set precision as displayed**.

Links with other software: Surfer, ArcGIS and MapInfo

The ADMS family of models all have links with the above-named third-party software, but this is changing.

Surfer: The contour or flow-field plotter, which you can start from the interface or the Mapper, supports the use of Surfer for gridding. You do not need to use Surfer because we supply our own gridding library (referred to as the 'interpolator'), but if you have Surfer installed, then you can choose to use the gridding options it offers instead. You will notice that if you choose to plot a contour, say, via the Results menu of the interface, you can choose between 'Mapper' and 'Surfer' as the target application. If you choose 'Mapper', this is the same as starting the Contour Plotter from the Mapper, and the gridding options will depend on your Mapper gridding preference. However, if you choose 'Surfer', then you will always get to use the Surfer gridding options, and the resulting contour plot will appear in Surfer.

Surfer has been supported for use by the Contour Plotter for more than 20 years, and we still support back to version 10 of Surfer. This reflects the stability and backward-compatibility of Surfer across many versions. Over the past decade, new Surfer releases have worked seamlessly with the Plotter, and we would expect this to continue with the latest release versions, which may not yet be listed as supported on our website. If you should find any issue with the latest Surfer, please report it to Helpdesk and we can look into it straight away.

ArcGIS: CERC's ADMS and Emissions Inventory links to ESRI's ArcMap software (also called ArcGIS Desktop) are still provided on the latest product installs, but are no longer in development by CERC. This reflects the status of ESRI's ArcMap software, which is at its final release version, with ESRI support terminating in March 2026. CERC has no plan to write new links for ESRI's replacement product, ArcGIS Pro, which is not compatible with CERC's current links. CERC will be developing the Mapper further to add useful features that are in the links.

MapInfo: Like the ArcGIS links above, CERC is no longer actively developing the MapInfo equivalents. We still supply them on the latest ADMS-family releases, and they have been tested with latest MapInfo 2021 release. The MapInfo links have comparable features to the ArcGIS links, so will be replaced by the Mapper updates.

How to obtain terrain data

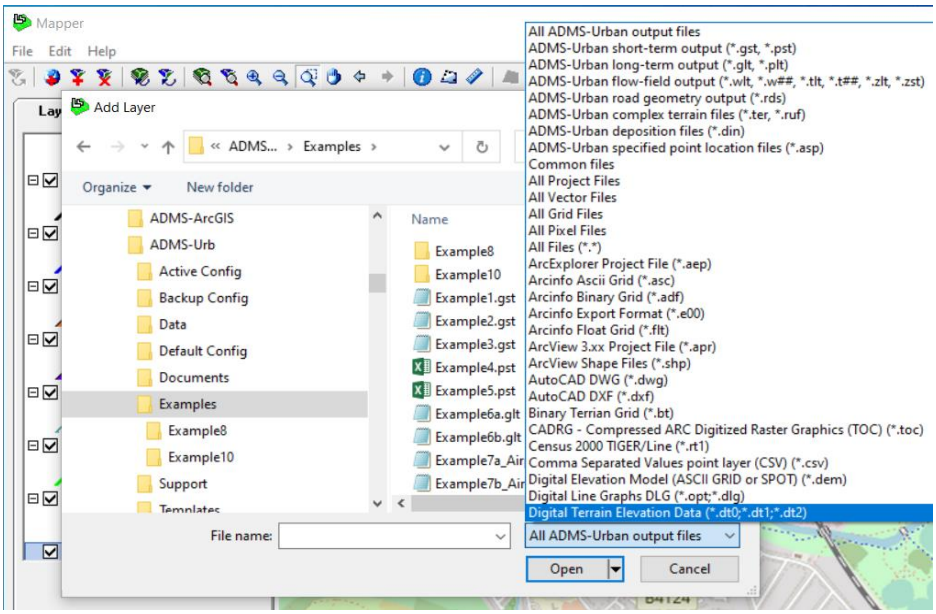
When modelling hills in CERC models, terrain data are entered via a .ter file. Terrain data for Great Britain can be obtained from OS Terrain 50, and global terrain data can be obtained from the CGIAR Consortium for Spatial Information. Both of these can be obtained as ASCII Grid (.asc) files. These data can then be extracted to .ter format for use in ADMS models. Details on where to get these data and how to extract them are given in helpdesk note 111.

If you get "Unexpected error" when you try to add .asc raster data files to the Mapper, you may need to adjust the settings in the INI file. See the following tip "Adjusting the .ini file to include extended file types" for more information.

Adjusting .ini settings to include extended file types

Many of CERC's interfaces and utilities will use INI files to store settings between sessions. These files are in Windows **INI**tialisation file format with the extension .ini. We do not generally advocate editing these by hand.

However, if you encounter an issue opening a file in the Mapper, you may be able to resolve it by editing the **INI** file. For example, you may need to do this if you wish to display terrain data from OS terrain 50 (.asc) format files. In the last release of ADMS-Urban and ADMS-Roads, opening an .asc file in the Mapper opened the data selection wizard rather than simply adding it as a new layer.



*Mapper **Open** dialog*

Detailed instructions on how to do this can be found in helpdesk note 121. The helpdesk note also explains how to add additional file extensions into the common file types filter.

Plume grounding

ADMS can model plumes that are neutrally buoyant when they impact the ground; it cannot accurately model plumes that are too dense when they reach the ground.

A gas may be dense due to a high molecular mass, or if it is released from low temperature and/or pressurised conditions.

The plume is 'too dense' if plume spread is determined by gravity effects instead of atmospheric mixing. The model run stops, with a message: "WARNING: Met line [line number]: Release from source [source name] is too dense to model - Unable to calculate concentrations of [pollutant]".

A plume is defined as having 'grounded' when the centreline height is less than the plume spread due to relative motion, and the trajectory of the plume is directed downwards.

The .cen file can be useful for investigating plume behaviour. It can be generated by running the model in short term mode, using Pasquill-Gifford A-G categories. You'll often find that warning messages only occur for stable conditions, but you can plot the plume centreline for different stability categories to see what's happening.

You might consider other options for modelling elevated dense gas clouds in ADMS: including additional input information (changing the model defaults) to account for the fact that the release is not mainly air; modelling the release as a jet source; or using the puff module.

If you wish to continue modelling when a dense plume impacts the ground, you can use the 'Allow grounded plumes' option in the .aai file; see Section 4.23 of the ADMS 6 User Guide. This sets the grounded plume to passive for the remainder of the dispersion calculation.

Note that this option should be used with caution only for near-passive plumes that only ground occasionally. Dense gases behave differently to neutrally-buoyant (passive) gases at ground level. Their dispersion is governed by gravity effects, which gives them a tendency to 'slump' into a 'pancake-shaped' cloud. Dense gases released at or close to ground level should therefore be modelled using a dedicated dense plume model such as GASTAR.

Minimum turbulence

A minimum turbulence value is applied during the dispersion calculations to prevent the turbulent velocities σ_u, σ_v and σ_w from ever becoming unphysically small. In flat terrain, this value varies between 0.01 m/s and 0.2 m/s depending on the minimum value of the Monin-Obukhov length L_{MO}. This accounts for the fact that where minimum L_{MO} is large (e.g. urban areas) and thus conditions never become very stable, there is always a base level of turbulence. In complex terrain, a further minimum value is applied; in ADMS-Roads/ADMS-Urban a fixed minimum of 0.1 m/s is currently used, while in ADMS 6 the minimum value is based on the variation of height within the terrain file (see Section 9.2.1 of the ADMS 6 User Guide). The ADMS 6 approach improves consistency between flat terrain and 'almost flat' terrain runs. A similar approach will be adopted in the next general release of ADMS-Roads/ADMS-Urban. Note that with all models, a user-defined minimum turbulence can also be specified via the additional input file, which will supersede the model-calculated value – this can be used to override the fixed minimum of 0.1 m/s in ADMS-Roads/ADMS-Urban when complex terrain is being modelled but terrain height gradients are shallow.

Horizontal releases

ADMS 6 can model releases with cross-wind and upstream or downstream components of emission velocity as well as a vertical component. Such a source is defined as a 'jet' source in ADMS 6. Section 9.5.3 of the ADMS 6 User Guide explains how to model directional releases, where that's appropriate.

However, some thought should be given to how best to represent a non-vertical source in the model. This is because some effects cannot be modelled in conjunction with a jet source; perhaps most significantly, building effects will be ignored, which may be significant for such sources.

As a rule of thumb, a jet source could be used for a high velocity non-vertical release, whereas a point source could be used for a low velocity non-vertical release.

You can model a covered stack, horizontal stack or vent as a point source, and the treatment for doing so is similar for all of these source types. Set the momentum to be low, i.e. use a low velocity / volume flow rate. However, DON'T set the velocity to zero, as this switches off buoyancy effects (plume rise); instead, set the velocity to a very low value, such as 0.1 m/s.

Contacting the helpdesk

The CERC helpdesk is available to provide model support. Contact us:

- From the ADMS interface, select Help, Email CERC
- Email help@cerc.co.uk
- Phone +44 1223 357773

Recent Publications

Carruthers D, Stidworthy A, Oades M, McCosh G, Jones R, Popoola O and Mills J, 2023: *CO2 emission inventory verification through assimilation of network data*. Envirotech Online, September 2023. Article online

Stocker J, Seaton M, O'Neill J, Johnson K, Jackson R, Rabideau C, Paine R, Warren C and Carruthers D, 2023: *Development and Evaluation of GRSM for NO2 Conversion in AERMOD*. EM Magazine, February 2023. Article online (requires AWMA subscription)

Stocker J, Johnson K, Jackson R, Smith S, Connolly D, Carruthers D and Chan PW, 2022: *Hong Kong Airport Wind Shear Now-Casting System Development and Evaluation*. Atmosphere, vol. 13, issue 12, DOI: 10.3390/atmos13122094. Article online

Thibault I, Jones R, Mills J, Popoola O and Stidworthy A, 2023: *The suitability of a mobile communications network to deliver high-resolution air quality measurements*. Envirotech Online, September 2023. Article online

Zhong J, Hood C, Johnson K, Stocker J, Handley J, Wolstencroft M, Mazzeo A, Cai X and Bloss WJ, 2022: *Modelling Street-Scale Resolution Air Quality for the West Midlands (UK) Using the ADMS-Urban RML System.* In: Mensink, C., Jorba, O. (eds) Air Pollution Modeling and its Application XXVIII. ITM 2021. Springer Proceedings in Complexity. Springer, Cham., DOI: 10.1007/978-3-031-12786-1_10. Article online

A comprehensive list of all our publications may be found on the publications section of our website.

Products and Services

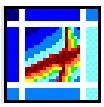
CERC has been developing world-leading air dispersion and complex flow modelling solutions since 1985. Our consultancy team was established to apply our expertise to a wide variety of applications for a diverse client base.

CERC software solutions

ADMS 6
Local scale air quality modelling for industrial sources

ADMS-Urban
Urban scale modelling including roads, industrial and diffuse sources

ADMS-Roads and Roads-Extra
Local scale air quality modelling including road and industrial sources



ADMS-Urban Regional Model Link
Automated nesting of ADMS-Urban within a regional air quality model

ADMS-Airport
Urban scale modelling with detailed treatment of aircraft emissions

FLOWSTAR-Energy
Modelling wind energy and airflow at high spatial resolution for wind farm planning and other airflow-related applications

GASTAR
Modelling emergency releases of dense gases

ADMS-STAR
Short-term accidental release modelling

For custom-made software solutions, visit www.cerc.co.uk/research or email CERC.

Consultancy services

Our consultancy services include:

- Air quality assessments: planning and permitting, odours, LAQM, policy studies, impacts of traffic schemes (e.g. clean air zones)
- Net Zero and greenhouse gas emissions: amine carbon capture degradation products, abnormal emissions of CO_2, hydrogen and ammonia, inverse modelling to determine emissions
- Specialised modelling: dioxins, accidental releases, wind energy
- Compilation of emissions inventories and forecasting for urban areas
- Project support and review services
- Research related to complex atmospheric flows and air quality

For more details, visit www.cerc.co.uk/consultancy or email CERC.