CERC ADMS 5 & ADMS-Screen News Summer 2022

Contents

Latest model release: version 5.2.4, Aug 2018

News

Software releases

Development work on ADMS 6 is nearing completion and the updated model will be released this autumn. This will be a major release and will include an upgraded Mapper commensurate with that in ADMS-Urban. The most significant model developments will be advances in the modelling of buildings and complex terrain. The developments for buildings will include a new option for automatically selecting the main building, which will be source and met line dependent, improvements to the modelling of plumes that impact the upwind face of the effective building, and the ability to easily view the effective building(s) in the Mapper for a range of different wind directions. The release will also include many minor improvements.

ADMS-Urban and ADMS-Roads version 5.0.1 were released in February 2022. This version is a minor update that includes a new option for modelling flyovers, the latest UK emission factors (EFT 11) and is fully supported on Windows 11.

ADMS User Group meetings

The 2022 ADMS 6 User Group Meeting will take place on 16 November and will be held in person at IET Birmingham: Austin Court, and online. Tickets are available to book now. The draft agenda will be published soon.

The 2021 ADMS User Group Meetings were held online on 24 and 25 November due to COVID-19, but there was still the usual mix of talks by CERC and guest speakers containing news, tips and case studies. The presentations are available to download from the CERC website User Area.

### How does modelled meteorology affect dispersion modelling?

CERC are currently investigating the use of Numerical Weather Prediction (NWP) meteorological data in atmospheric dispersion modelling, funded by the UK Atmospheric Dispersion Modelling Liaison Committee (ADMLC). Following an initial review of NWP models and providers, NWP data from two models and three suppliers are being evaluated in comparison with measurement data at a range of sites across Great Britain, including sites with complex and coastal terrain as shown in the map. The influence of meteorological model resolution in relation to any local complex terrain modelling will also be investigated. In the latter stages of the project the UK Health Security Agency (UKHSA) will investigate the use of NWP data in probabilistic accident consequence assessments, using the PACE suite of models and the Met Office NAME model.
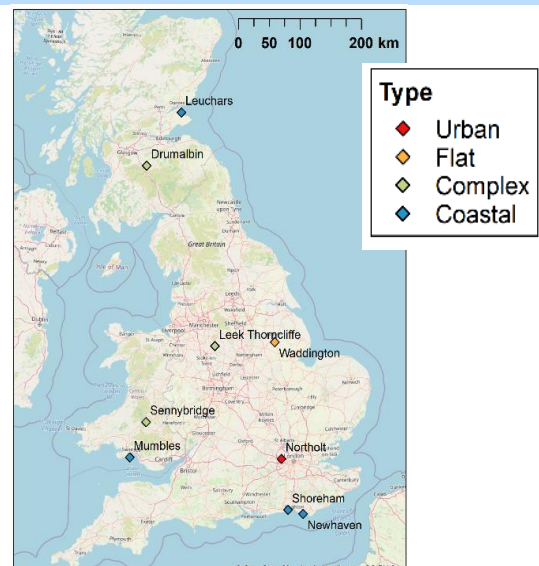
Sustainable OPEration of post-combustion Capture plants (SCOPE)

CERC are a partner in the ground-breaking SCOPE project to accelerate large scale CO2-capture projects by providing critical data, methodologies and tools, essential for plant owners and regulators engaged in managing emissions and permitting processes. CERC's role will be to further develop the chemistry model for amine degradation and formation of nitrosamines and nitramines in ADMS (see below), to allow for multiple sources, multiple amine species and uptake of amines into the aqueous phase. This will result in improved prediction of the impacts of amine emissions from CO2-capture solvents for the permitting process. SCOPE is led by SINTEF of Norway, and is an international consortium of key science, technology and policy experts, and stakeholders in Norway, UK, Netherlands, Germany, India and USA. In the UK, the project is led by the Imperial College Department of Earth Sciences and Engineering and funded by BEIS.

Amine chemistry modelling
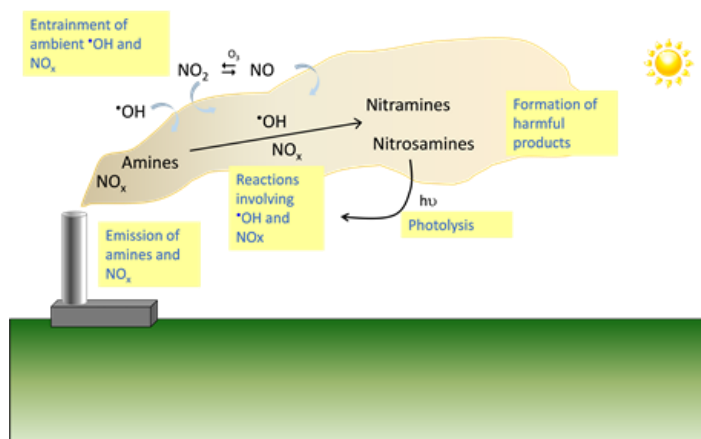
ADMS 5 contains an amine chemistry scheme as an extension to the NO_X chemistry scheme. The modelling of amine chemistry can be important in assessing the impacts of emissions due to amine-based carbon capture. These amines can react with other species in the exhaust gas and the atmosphere to produce degradation products (nitrosamines and nitramines) that can be harmful.

The chemistry scheme can be applied to a variety of amines, including primary, secondary and tertiary amines and is based on the Atmospheric Degradation of Amines (ADA) report*.

The reaction rates and kinetic parameters required are specified by the model user and each can be varied independently. In addition to the implementation of the amine chemistry reactions, there is an option to improve the way that the chemistry module takes into account the effects of the dilution of pollutant species and the entrainment of background pollutants.

Please contact us if you would like more information on the ADMS 5 amine module.

*Nielson et al, "Atmospheric Degradation of Amines (ADA). Summary Report: Photo-oxidation of Methylamine, Dimethylamine and Trimethylamine". Climit project no. 201604. Norwegian Institute for Air Research. January, 2011

Calculation of the heat impacts of a biogas flare

The CERC consultancy team recently completed a heat impact assessment for an enclosed biogas flare using ADMS 5. Results from the possible worst-case heat impacts on adjacent site buildings informed the choice of a safe combustion chamber height for the flare installation.

We used plume temperature output from the ADMS 5 temperature and humidity output option to calculate the convective heat impact. We used standard fire safety methods from the SFPE Handbook of Fire Protection Engineering to calculate radiative heat impact.

We tested a range of scenarios for typical biogas minimum and maximum methane contents, a range of combustion conditions and sensitivity for stack downwash assumptions.

The results, which showed that the height of the flare had the greatest effect on the heat impact at nearby buildings, were used in the safety design considerations.

Defra 2021 Air Quality Model Intercomparison Exercise

Defra commissioned CERC, in partnership with modelling teams from the Met Office, the UK Centre for Ecology and Hydrology (UKCEH), the Environmental Research Group at Imperial College London and Ricardo, to carry out an intercomparison study between models that have the potential to be used for Defra's compliance reporting commitments. CERC's role was to undertake the model evaluation. Models were configured to calculate pollutant concentrations over the whole of the UK, for 2018, at a sufficiently high resolution to allow quantification of air quality at background and roadside locations.

CERC assessed the formulations of the meteorological, chemistry and pollutant dispersion components of the modelling systems. Modelled concentrations were evaluated in comparison with hourly measured data from over 400 monitors from multiple networks, using CERC's Model Evaluation Toolkit to assess a wide range of short- and long-term metrics. The metrics associated with Air Quality Directive reporting were derived from each model dataset and compared. Common themes were identified including data quality and availability, calibration approaches and potential for future development. CERC's final project report is currently being prepared for publication by Defra and will inform Defra's modelling strategy for the future.

Training Information

Discount on CERC training courses

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

Upcoming training courses

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

Course	Oct 22	Dec 22	Jan 23	Mar 23	Apr 23	Jun 23
ADMS 5	11 - 12	6 - 7	24-25	7-8	18-19	6-7

CERC holds regular online courses, which are extremely successful. Courses can also be customised to particular user requirements.

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

Modelling Tips

**Use of ADMS 5 for explosion / hazard assessments**

In addition to well-known pollutants such as combustion gases, ADMS 5 is regularly used to model the dispersion of less familiar types of substances, including toxic gases, infectious/disease-causing agents, asphyxiants and flammable gases. See, for example, the "Source Terms: How to Model Almost Anything" UGM presentation 2019.

One increasingly important example of flammable gas applications is the dispersion modelling of possible emissions from the production, transport, storage and use of hydrogen fuels. In addition, production of hydrogen can be coupled with carbon capture and, where the carbon capture solvents are amines, ADMS 5 can be used to model the atmospheric degradation of the emitted amines to form nitrosamines and nitramines.

Exporting layers in .spt format

When using the Mapper, if you select a layer in the Mapper legend and right-click with the mouse you will see a long list of actions you can take on the layer. For vector layers, as opposed to raster layers, you can choose to Export them in a choice of formats. One of the export options introduced in ADMS-Urban 5 (and in ADMS 6 when released) is 'for SPT…'

This can be extremely useful when data you need to import has been supplied in a vector format such as an ESRI shape. Add the layer to the Mapper and export 'for SPT'. Details on how to do this are in Section 5.12.2 of the Mapper User Guide.
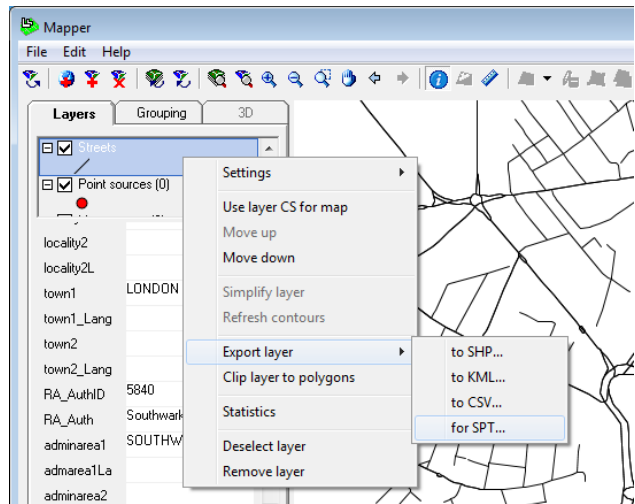
Mapper vs ArcMap and ArcPro

We recommend using the Mapper rather than the CERC ArcGIS links for its ease-of-use and integration with CERC products.

The ADMS ArcGIS link can be used with ADMS 5, ADMS-Urban and ADMS-Roads from ArcMap. It is no longer being developed by CERC and it will not be updated to work with ESRI ArcPro.

ADMS ArcGIS link feature	Mapper capability	Notes for Mapper
Add sources	✓	Supports add, edit & delete. Edit includes rotation, translation and simplification. Allows panning whilst editing.
Add receptor points	✓	
Define model output grid	✓	Supports add, edit & delete. Edit includes translation
Add contour plot	✓	
Import ADMS output	✓	Simply drag-drop the file onto the legend. Does not require shape file generation
Clip to boundary	✓	Clip to lines or polygons. Create a shape file or directly export points to an ASP file
Report max values	✓	Use layer statistics, which is much more powerful
Save shape file with aliases	✓	Also saves the Mapper layer settings
Adjust transparency	✓	
Save current symbology as default	✓	Save layer settings either as default or for the current session

Viewing large file layers in the Mapper

The Mapper can display many formats of geospatial data. See Section 5.5 of the Mapper User Guide for more details.

There is a threshold of 100,000 lines of data, after which the attributes are reduced. Similarly, you will find the number of items displayed will be limited to the first 500,000. If you find yourself wanting to view much larger files you must edit the product interface's initialisation file (ADMS.ini or ADMS-Urban.ini). The required settings are found under the **[MapperInterface]** section. To increase the number of lines of data with full attributes, increase the limit for **FileLayerAutofieldThreshold** and to increase the number of items displayed, increase the limit for **FileLayerItems**.

```
[MapperInterface]
mnuHUserGuide=%InstallDir%\Documents\Mapper User Guide.p
MapperName=Mapper
ContourButtonTooltip=10049
ContourButtonStatusLine=10050
SyncCSWithParent=True
BackgroundMap=C:\Program Files (x86)\CERC\ADMS-Urb\Data\
AttributeUnitsEPSG=9001
SnapToLayer=True
DisplayNorthArrow=True
UseSurferGrid=False
GeometryLowerBound=1
FileLayerAutofieldThreshold=100000  <—
GridInterpolatorMethod=5
ReuseContourConfigFile=False
FileLayerItems=500000  <—
CSVExportNameField=name
NumExtractedPoints=500000
```

An extract from ADMS-Urban.ini

Contacting the helpdesk

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

- From the ADMS 5 interface, select Help, Email CERC
- Email help@cerc.co.uk
- Phone +44 1223 357773

Recent Publications

Price CS, Stocker J, Johnson K, Patel R, Strickland S, Doktarova J and Rubinis J, 2021: *A review of approaches to dispersion modelling of odour emissions and intercomparison of models and odour nuisance assessment criteria.* Atmospheric Dispersion Modelling Liaison Committee, ADMLC/2021/4 Report. Article online

Biggart M, Stocker J, Doherty RM, Wild O, Carruthers D, Grimmond S, Han Y, Fu P and Kotthaus S, 2021: *Modelling spatiotemporal variations of the canopy layer urban heat island in Beijing at the neighbourhood scale.* Atmos. Chem. Phys., vol. 21, pp. 13687–13711, DOI: 10.5194/acp-21-13687-2021. Article online

Stocker J, Johnson K, Forsyth E, Smith S, Gray S, Carruthers D and Chan PW, 2022: *Derivation of High-Resolution Meteorological Parameters for Use in Airport Wind Shear Now-Casting Applications.* Atmosphere, vol. 13, issue 2, 328, DOI: 10.3390/atmos13020328. Article online

Stettler MEJ, Nishida RT, de Oliveira PM, Mesquita LCC, Johnson TJ, Galea ER, Grandison A, Ewer J, Carruthers D, Sykes D, Kumar P, Avital E, Obeysekara AIB, Boorly D, Hardalupas Y, Green DC, Coldrick S, Parker S and Boies AM, 2022: *Source terms for benchmarking models of SARS-CoV-2 transmission via aerosols and droplets.* Royal Society Open Science., vol. 9, 212022, DOI: 10.1098/rsos.212022. 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.

Other software solutions

ADMS-Roads and Roads-Extra

Local scale air quality modelling including road and industrial sources

ADMS-Urban

Urban scale modelling including roads, industrial and diffuse sources

ADMS-Airport

Urban scale modelling with detailed treatment of aircraft emissions

GASTAR

Modelling emergency releases of dense gases

FLOWSTAR-Energy

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

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, e.g. odours, LAQM, planning and permitting
- Specialised modelling, e.g. dioxins, accidental releases, wind energy
- Compilation of emissions inventories and forecasting for large 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.