



# An air pollution model database on the World Wide Web

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## Abstract

A Model Documentation System (MDS) on atmospheric dispersion models has been created by the European Topic Centre on Air Quality containing information on various models and their properties. According to the query needs, the MDS allows users to search for specific models by using (i) the model name when this is available, (ii) predefined keywords for a structured search and (iii) text contained in the model descriptions for an unstructured search. Apart from fulfilling the main functional goal, which is to provide information on air quality models, the MDS structure fulfils also the main design goals, which are to create a lightweight, easily portable application, that works through the Common Gateway Interface and requires minimal changes in the configuration of the http server and the system files. The MDS is accessible through the World Wide Web, thus using a widely spread client-server technology.

## 1 Introduction

The European Topic Centre on Air Quality (ETC/AQ), one of the Topic Centres of the European Environmental Agency (EAA), is built as a consortium led by the Dutch RIVM with participation from NILU (Norwegian Institute of Air Research), DNMI (Norwegian Meteorological Institute) and NOA<sup>1</sup> (National Observatory of Athens). In the frame of its activities and as a

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<sup>1</sup> NOA is subcontracting the Aristotle University Thessaloniki and the University of Athens



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part of its work plan ETC/AQ undertakes three projects, one of which (MA3) is entitled "Harmonization in the use of models for ambient air quality and pollution dispersion/transport" [1]. Part of this project is the development of a Model Documentation System (MDS), as subproject MA3-3: Establish documentation centre and toolkits for testing relevant models. Aim of this task is the use of WWW based technology to allow dissemination and easy access to the informations included.

### 2 The database

The MDS was built with the aim to provide guidance to any user of air pollution dispersion models in the selection of the most appropriate model for his/her application. Inclusion of a model in the system is by no means associated with any form of recommendation while information on the individual models was provided by the model suppliers. The present version of the MDS was developed at the Aristotle University Thessaloniki, Greece, based on a proposal of NERI [2], while useful background information was derived from the model catalogue compiled in the frame of COST 615 programme [3]. The introductory page of the MDS is displayed in Figure 1, and can accessed directly through <http://aix.meng.auth.gr/lhtee/database.html> or through the home page of the ETC/AQ: <http://www.etcaq.rivm.nl/>. ETC-AQ would welcome any kind of comments on the Model Documentation System with emphasis on its usefulness and functionality. Such comments as well as suggestions for models to be included in future versions of the system should be sent via e-mail to either of the two first authors.

### 3 Structure of the system

In order to construct the MDS according to the functional specifications, a structured, object oriented approach was followed. The system had to possess certain characteristics concerning the simplicity of operation and the friendliness of the interface used [4] which was achieved by making extensive use of HTML forms. The use of Common Gateway Interface<sup>2</sup> (CGI) secured that the programs can be run on any Web server.

Although such CGI applications can be written in any language that can be executed on a Web server after having been compiled or interpreted, the needs of the application led to the selection of PERL<sup>3</sup> which has strong pattern-matching and string-manipulation properties and is very well suited for database application development [5]. The application is created by using multiple CGI scripts in a modular manner, thus being lightweight and easily portable while capable for fully object oriented functions.

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<sup>2</sup> See <http://hoohoo.ncsa.uiuc.edu/cgi/>

<sup>3</sup> See <http://www.perl.com>

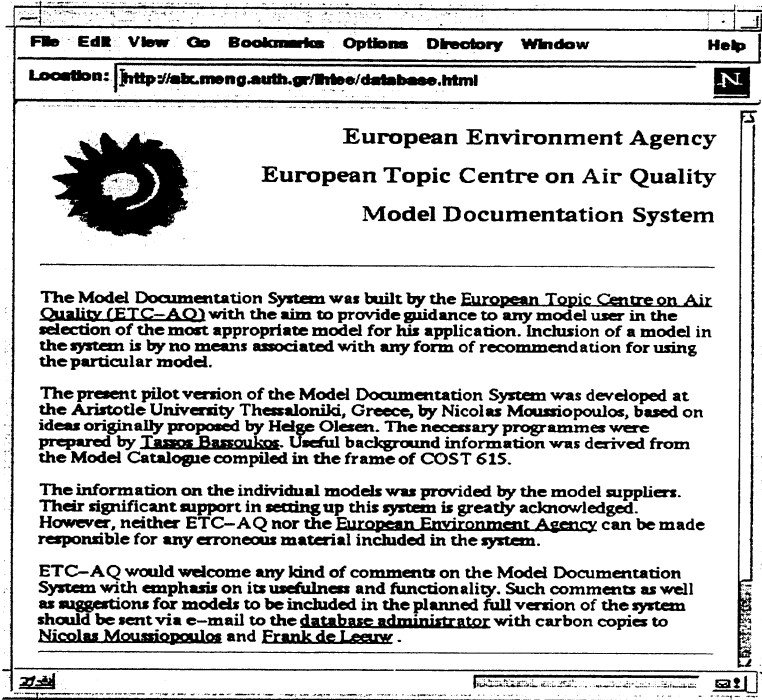


Figure 1: Introductory page of the MDS as seen by the user.

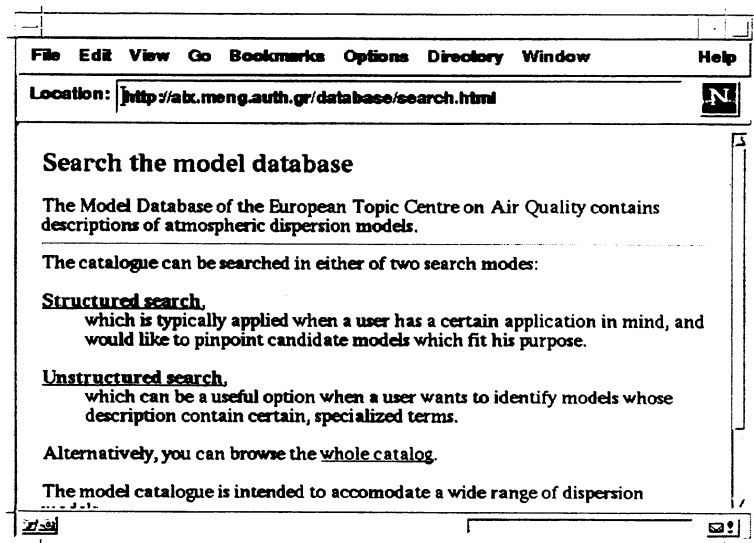


Figure 2: Selection between two search modes.

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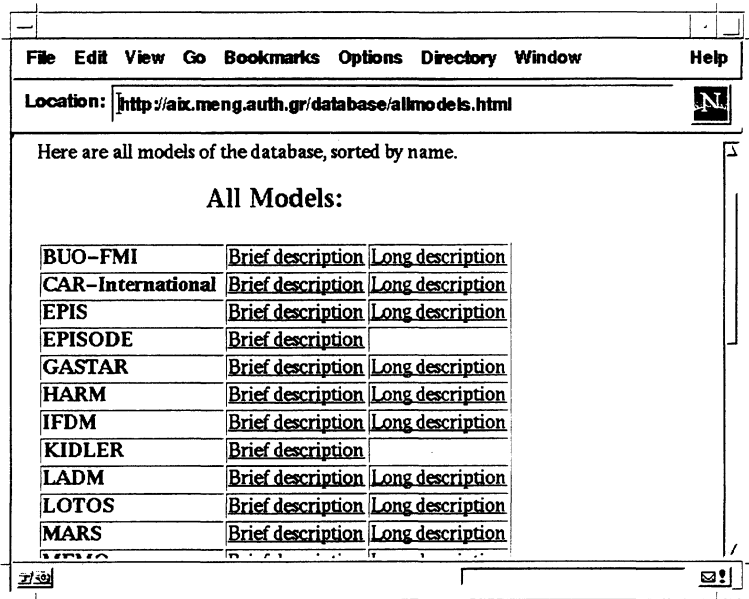


Figure 3: Part of the total model list as it can be accessed by the user, leading to brief and long model descriptions.

#### 4 Search in the MDS

Two search modes can be used to access information from the MDS, *structured* and *unstructured*, as demonstrated in Figure 2. When the user queries the database through the structured search, he/she defines the criteria by selecting some properties, as grouped by category from the fields definition file (see section 5 and 6 below) that he/she wants the resulting models to have. The use of unstructured search scans the contents of the model datafile according to some search strings defined by the user, restricted by a combinational rule. This rule defines the behavior of the search engine according to three choices:

**any word** makes the search engine to select any model description that contains at least *one* of the words given by the user,

**all words** defines that the model description is selected only if it contains *all* the words given by the user and

**adjacent** selects a model description only if it contains *all* the words given by the user *in the same order* he/she has given it.

Both search modes use the same presentation routine, which gives a list of all model names found matching the criteria of the user and gives him/her a number of choices: The user can see a brief description of all models, containing any of the defined keywords of each model, a brief description of a particular model, again containing only the defined keywords of the model,



The screenshot shows a web browser window with the following content:

- Location:** <http://ak.meng.auth.gr/database/stsform.html>
- Search form - structured search**
- Instructions:** In each of the boxes below, select any number of terms that describe your needs. To choose more than one term, use Ctrl while clicking your mouse.
- Policy Issue:**
  - Any
  - climate change
  - ozone depletion
  - tropospheric ozone**Operator:** and
- Application type:**
  - air quality assessment
  - regulatory purposes and compliance
  - policy support
  - emergency planning**Operator:** or
- Model output:**
  - Any
  - concentration
  - deposition
  - source-receptor relationships**Operator:** or
- Air pollution source:**
  - Any
  - stack / single
  - stack / multiple
  - line source**Operator:** or
- Release type:**
  - Any
  - continuous
  - intermittent**Operator:** or
- Reset search form** button

Figure 4: Part of the predefined term selection form.

or a more detailed long description of a particular model. In addition, the user can bypass the search mode and ask for direct access to the whole model catalogue, to retrieve short or detailed model information (Figure 3).

## 5 Elements of the system

The MDS contains one record for each model while using fields of two types:

**Basic keyword fields;** These fields contain only predefined terms. They are used when performing a structured search in the database (see section 4), by browsing through a list of predefined terms and selecting, according to their properties, the appropriate to describe user needs. These key terms can be used in combination, according to logical operators, which specify the way they will be interpreted. For a full list of predefined terms and these properties see Table 1, while the selection of user defined combination of fields is demonstrated in Figure 4.

File Edit View Go Bookmarks Options Directory Window Help

Location:

can use pre-defined keywords to specify a few key features of the desired model.

View [Introduction to the model catalogue](#)

[Help \(hints on searching\)](#)

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**Search form - unstructured search**

Word(s):

Operand:

Figure 5: Unstructured search form.

**Additional fields;** The additional fields used in the unstructured search (Figure 5), contain an extensive description of the model concerning predefined information categories. The user can define a rule to search for by using two elements: the words to search for and the operand describing how the multiple words will be searched. In both cases information is provided in a form-based format, providing additional info-links when available.

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Table 1: Catalogue of predefined term fields with their properties.

Predefined term fields	Field variables
Policy issue	climate change, ozone depletion, tropospheric ozone, tropospheric change, acidification, eutrophication, summer smog, winter smog, air toxics, urban air quality, industrial pollutants, nuclear emergencies, chemical emergencies
Application type	air quality assessment, regulatory purposes and compliance, policy support, emergency planning, public information, scientific research
Model output	concentration, deposition, source-receptor relationships
Air pollution source	stack / single, stack / multiple, line source, array of line sources, area / general, area / gridded
Release type	continuous, intermittent, accidental
Spatial scale	local, local to regional, regional to continental, global
Simulation character	statistical, episodic, real time
Pollutants modeled	passive / generic buoyant / generic dense / generic particulates / generic SO <sub>2</sub> , CO, NO <sub>x</sub> , VOCs, ozone benzene, NH <sub>3</sub> , lead, PM10
Processes considered	complex meteorology, vertical structure, complex terrain, deposition, chemical transformation
Computer platform	PC, workstation, mainframe, supercomputer



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### 6 Data presentation

The type of fields used in the MDS is text, line and selection. Each field type defines its own read-write format method through the overloading of some functions, so that it is possible to add new types easily and clearly:

**Text fields;** this field type is a section of text (or html) extending to one ore multiple lines.

**Line fields;** this field type contains a single line of text, used mostly for personal information (names etc.).

**Selection fields;** this field type combines several Boolean properties (having common parts) under a single title. The structured search scans only the fields that are of this type. Each property of this datatype has a description and the property can be either true or false.

### 7 Conclusions

The use of WWW based technology for constructing and maintaining a MDS has proven to be both efficient and user friendly. Future extensions of the existing database system in combination with the use of tools more advanced in WWW-based object oriented programming (like JAVA) are expected to lead to a highly modular and user friendly MDS.

### Acknowledgement

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