

Using MARS at ECMWF

EUMETCAL Workshop 2007

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User Support

Meteorological Archival & Retrieval System

- **Meteorological data (GRIB: fields, BUFR: observations)**
- **Analyses from 1980, Forecasts from 1985**
- **ERA40: analyses and observations since 1957**
- **Retrievals expressed in meteorological terms**
- **Post-processing facilities**
 - **Interpolation between various data representation**
 - **Sub-area extractions**
- **Data collocation**
 - **MARS tree**
 - **Archive objects (for OD data)**
 - **1 file per month of AN (1 level type, all times, levels, params)**

MARS components

- **Clients: workstations, supercomputers**
- **Servers: supercomputers, dedicated servers**
- **Several databases**
- **Tape library**

Content: Deterministic Forecasts

- **Atmospheric model (T799)**
 - Analysis (synoptic times: 00/06/12/18)
 - Forecast (00/12 UTC) to 10 days
- **Wave model**
 - Coupled with atmospheric: Analysis & Forecast
 - European shelf, Analysis & Forecast (to 5 days)
- **Boundary Conditions**
 - high resolution to 4 days, short cut-off

Content: Probabilistic Forecasts

- **Variable Resolution EPS (VarEPS): Atmospheric + waves**
 - 50 members; T399 to day 10, T255 from day 10 to 15
 - Derived probability & clustered products, Extreme Forecast Index, ...
- **Monthly Forecast: weekly run**
 - Atmospheric + wave + ocean, 51 members
 - To be linked with VarEPS
- **Multi-model Seasonal Forecast: once a month**
 - Models: ECMWF, MetOffice, MeteoFrance
 - Atmospheric + Wave (ECMWF) + ocean, 40 members
- **Multi-Analysis**
 - 4 Analysis: NCEP, MetOffice, DWD, MeteoFrance
 - 4+1 Forecasts to 10 days

Content: Observations & Feedback

- **Observations**
 - Surface data
 - Vertical soundings
 - Upper-air data
- **Satellite images**
- **Feedback**
- **Analysis Input**
- **Analysis Feedback**

Content: Special Datasets

- 15 Years Re-Analysis (ERA-15)
- 40 Years Re-Analysis (ERA-40)
- FGGE
- TOGA

Content: Co-operation with other projects

- **PROVOST**
 - EDF, Météo-France, Met Office, ECMWF
- **DEMETER**
 - LODYC, Météo-France, Met Office, ECMWF
- **ECSN**
 - Max Plank Institute, Météo-France, Met Office
- **ENSEMBLES**
 - 77 partners
- **TIGGE: EPS from 9 global models**
 - ECMWF, NCEP, CMC, KMA, JMA, CMA, UKMO, Météo France, CPTEC, BOM

Content: Other Data ...

- **IFS Research experiments**
 - ECMWF
 - Member States (PrepIFS)
- **Member State data**
 - COSMO-LEPS
 - SREPS (planned)
 - HIRLAM (planned)
- **Monthly datasets**
 - Climatologies
 - Monthly means

Retrieving data: Data access

- **Archived data**
 - Available to all registered users
- **Current (valid) data: verification time less than 24 h in the past**
 - Needs special registration: Contact your Computing Representative
- **Data is available according to production schedule**
 - see www.ecmwf.int/services/dissemination/3.1/
- **Some restrictions apply to BC, COSMO-LEPS, Observations**

Interface: Web-MARS

Available to all MS domain users (after self registration)!

- Real-time dynamic access to metadata
- Content browsing through various *views* on the archive
- Check availability of data
- Retrieval and/or plotting of a few fields
- **Create MARS requests** (without checking availability)
- Check for changes in the archive
- “Cost” evaluation
- Server activity
- URL based on MARS requests (can be edited & bookmarked)

Web access classes: Authorised domain

User class	Auth Method	Browse MARS data	Retrieve Data		Your Room	Real-time charts
			Archived	Current		
Unregistered	Domain	✓	✗	✗	✗	✓
Self registered	Domain + web password	✓	✓	✗	✓	✓
Fully registered	Domain + web password	✓	✓		✓	✓
	Roaming password	✓	✓		✓	✓
	Security Token	✓	✓		✓	✓

Interface: MARS batch request

- **Requires command of MARS language**
- **Allows more options/functionality**
 - **Manipulation of already retrieved fields**
 - **Computation**
- **Suitable for substantial retrievals (e.g. ERA-40)**
- **Retrievals can be automated (ecaccess event triggers)**
- **On Member State server “ecgate” or supercomputer**

Requires full computer user registration!

Web-MARS: Archive views

The image displays two browser windows from Mozilla Firefox. The left window, titled '10 metre U wind component', shows the ECMWF website with a navigation menu and a sidebar containing a table of contents for parameter 165. The main content area includes a description of the parameter and a list of archived data points. The right window, titled 'Overview', shows the 'Chapter 3. Turbulent diffusion and interactions with the surface' page. It features a table of contents with sections for '3.8 Diagnostic computations for postprocessing' and '3.8.1 Diagnostic boundary layer height'. The main text describes the importance of boundary layer height in air pollution modelling and mentions the use of the parcel lifting method.

Web-MARS: Catalogue

The screenshot shows a Mozilla Firefox browser window with multiple tabs open. The active tab is 'request154 - Mozilla Firefox'. The browser's address bar shows the URL 'http://www.ecmwf.int/services/archive/d/'. The main content area displays the 'request154' page, which includes a navigation menu on the left and a search results section on the right. The search results section shows the estimated number of fields (29) and a list of parameters: retrieve, date=2007-08-01/2007-08-02/2007-08-03/2007-08-04/2007-08-05/2007-08-06/2007-08-07, stream=oper, levtype=pl, expver=1, type=an, class=od, param=130.128, levelist=500. The navigation menu includes links for 'Services', 'ECMWF', 'Personal', 'Archive', 'Overview', 'Catalogue', 'Data Finder', 'Last Update', and 'Server Activity'.

Web-MARS: Plot

The screenshot displays the Web-MARS interface in a Mozilla Firefox browser window. The address bar shows the URL: <http://www.ecmwf.int/services/archive/d/inspect/personal/results/plot50%2>. The page features a navigation menu with links for Home, Your Room, Login, Contact, Feedback, Site Map, and Search. Below the menu, there are sections for About Us, Products, Services, Research, Publications, and News&Events. The main content area is titled "Plots" and includes a date selector with options for 20070825, 20070826, 20070827, and 20070828. A "Download..." button is visible, with a "Postscript (91.1 Kbytes)" option. The plot itself is a map of Europe and the surrounding regions, showing 300hPa Temperature contours and color-coded areas. The plot title is "ECMWF Analysis FTuesday 21 August 2007 12UTC 300hPa Temperature".

Web-MARS: Tasks

- Supervised
- Asynchronous
- Persistence

availability149 - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.ecmwf.int/services/archive/c

ECMWF Home Your Room Login Contact Feedback Site Map Search:

About Us Products Services Research Publications News&Events

Overview Forecasts Computing Modelling Newsletters Calendar
Getting here Order Data Archive Reanalysis Manuals Employment
Committees Order PrepIFS Seasonal Library Open Tenders
Software

Personal > Results of your tasks > availability149>

availability149

..., 00:00:00, 06:00:00 2000-08-01 Atmospheric model Pressure levels 1 40 years reanalysis Analysis U velocity, V velocity ..., 1, 2 2000 complete

Results [View in catalogue](#)

Class: 40 years reanalysis
Stream: Atmospheric model
Version: 1
Type: Analysis
Type of level: Pressure levels
Date: 2000-08-01
Time: 00:00:00, 06:00:00, 12:00:00, 18:00:00
Parameter: Divergence, Vorticity (relative)
Level: 1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100 to 300 by 50, 400 to 700 by 100, 775 to 1000 by 75

29-08-2007 [ECMWF](#)

Done

status	
active	🗑️
complete	🗑️
complete	🗑️
complete	🗑️

Web-MARS: Activity

- System activity
- Queues
- Requests progress
- Instructive
 - Better usage

The screenshot shows the Web-MARS activity page in Mozilla Firefox. The browser address bar shows the URL: <http://www.ecmwf.int/services/archive/d/a>. The page features the ECMWF logo and navigation links: Home, Your Room, Login, Contact, Feedback, Site Map, and Search. A menu includes About Us, Products, Services, Research, Publications, and News&Events. The main content area displays a list of activity requests with the following data:

User	Status	Order ID	Name	Duration
arh	RETRIEVE	OD 20030604	ecgate	1 second
<i>On marsod, all 50 tasks are in use</i>				
<i>172 fields, 93.465 Mbytes online</i>				
nel	RETRIEVE	OD 20060530	bee15	1 second
<i>On marsod, all 50 tasks are in use</i>				
<i>20 fields, 24.4644 Mbytes online</i>				
hub	RETRIEVE	OD 20070814	hpce1906	2 seconds
<i>22 fields, 36.2345 Mbytes online</i>				
nel	RETRIEVE	OD 20060530	bee13	2 seconds
<i>On marsod, all 50 tasks are in use</i>				
<i>20 fields, 6.13857 Mbytes online</i>				
rdx	ARCHIVE	RD 20060807	hpce0407	2 seconds
<i>On marsrd, the total number of ARCHIVE requests is limited to 6</i>				
rdx	ARCHIVE	RD 20070621	hpcf0407	4 seconds
rdx	ARCHIVE	RD 20070614	hpcf0307	6 seconds

The sidebar on the left contains the following sections:

- Sort**
 - [Sort by user](#)
 - [Sort by status](#)
 - [Sort by age](#)
 - [Sort by tapes](#)
 - [Sort by fields](#)
 - [Sort by request](#)
- Archive**
 - [Overview](#)
 - [Catalogue](#)
 - [Data Finder](#)
 - [Last Update](#)
 - [Server Activity](#)
- Personal**
 - [Your Account](#)
 - [Your Results](#)

MARS request: A meteorological language

Mechanism to name archived fields

Request syntax:

```
verb,  
keyword1    = value1,  
...         = value2,  
keywordN    = valueN
```

- **verb:** action to be taken (e.g. retrieve, list, read)
- **keyword:** a known MARS variable, e.g. type or date
- **value:** value assigned to the keyword, e.g. Analysis or temperature

MARS language

- **verb** and **keyword=value** separated by commas, but last one
- Spaces and tab characters are ignored
- *****, **!** and **#** comment until end-of-line
- Directives are not case sensitive
- Values: predefined names, numeric values or strings (filenames)
- Abbreviations: enough letters to uniquely identify keyword or value
- Acronyms: usually initial letters of names
- **/** is used as list separator → specify pathnames in quotes

MARS language – Retrieve request

<code>retrieve,</code>		action
<code> class = od,</code>		identification
<code> stream = oper,</code>		
<code> expver = 1,</code>		
<code> date = -1,</code>		date & time related
<code> time = 12,</code>		
<code> type = analysis,</code>		data related
<code> levtype = model levels,</code>		
<code> levelist = 1/to/91,</code>		
<code> param = temperature/z,</code>		
<code> grid = 2.5/2.5,</code>		post-processing
<code> target = "/scratch/.../analysis"</code>		storage

Calling MARS in shell script

- directives from input stream

```
mars <<EOF
retrieve,
    type    = an,
    date    = -1
    target  = "$SCRATCH/my_an"
EOF
```

- directives from file

```
cat > my_request <<EOF
retrieve,
    type    = an,
    date    = -1
    target  = "$SCRATCH/my_an"
EOF
mars my_request
```

MARS: A Few Numbers

- ~1000 active users, at ECMWF and in the Member States
- Analysis from 1980, Forecasts from 1985
- ERA40: analysis and observations since 1957
- 3 PByte of data in $20 \cdot 10^9$ fields
- Growing daily by ~ 5 TB:
 - ~ 1 TB Operational data
 - ~ 4 TB Research + Projects
- More than 200 000 requests ($60 \cdot 10^6$ fields) per day

Additional resources

- Web-MARS

www.ecmwf.int/services/archive/

- MARS documentation

www.ecmwf.int/publications/manuals/mars/

- MARS training material

www.ecmwf.int/services/computing/training/material/

- Data Services documentation

www.ecmwf.int/products/data/archive/

- ECMWF forecast products

www.ecmwf.int/products/forecasts/

- EMOSLIB (GRIBEX) Documentation

www.ecmwf.int/publications/manuals/libraries/

- IFS Documentation

www.ecmwf.int/research/ifsdocs/