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

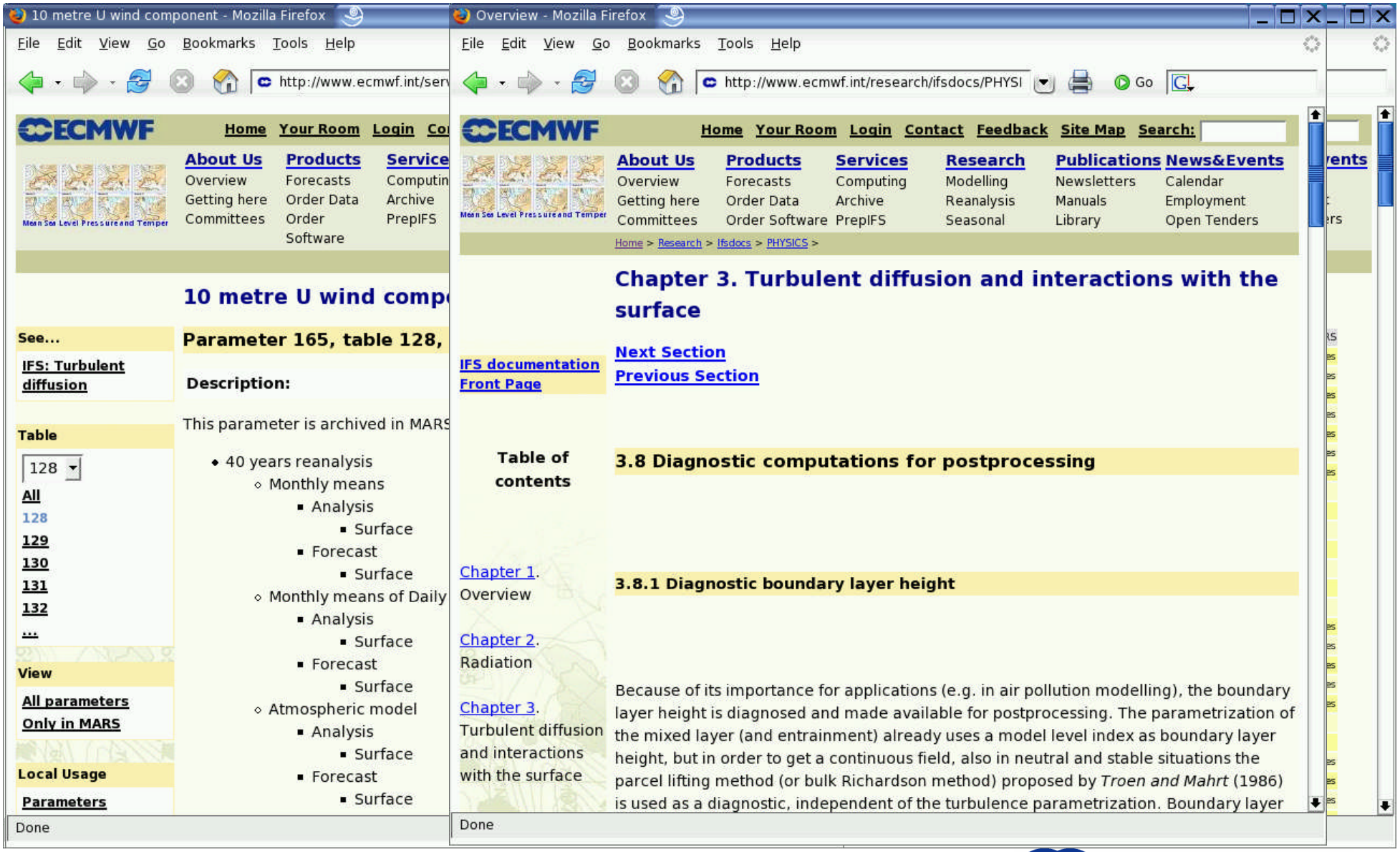
User class	Auth Method	Browse MARS data	Retrieve Data		Your Room	Real-time charts
			Archived	Current		
Unregistered	Domain	✓	✗	✗	✗	✓
Self registered	Domain + web password	✓	✓	✗	✓	✓
Fully registered	Domain + web password	✓	✓		✓	✓
	Roaming password	✓	✓		✓	✓
	Security Token	✓	✓		✓	✓

Interface: MARS batch request

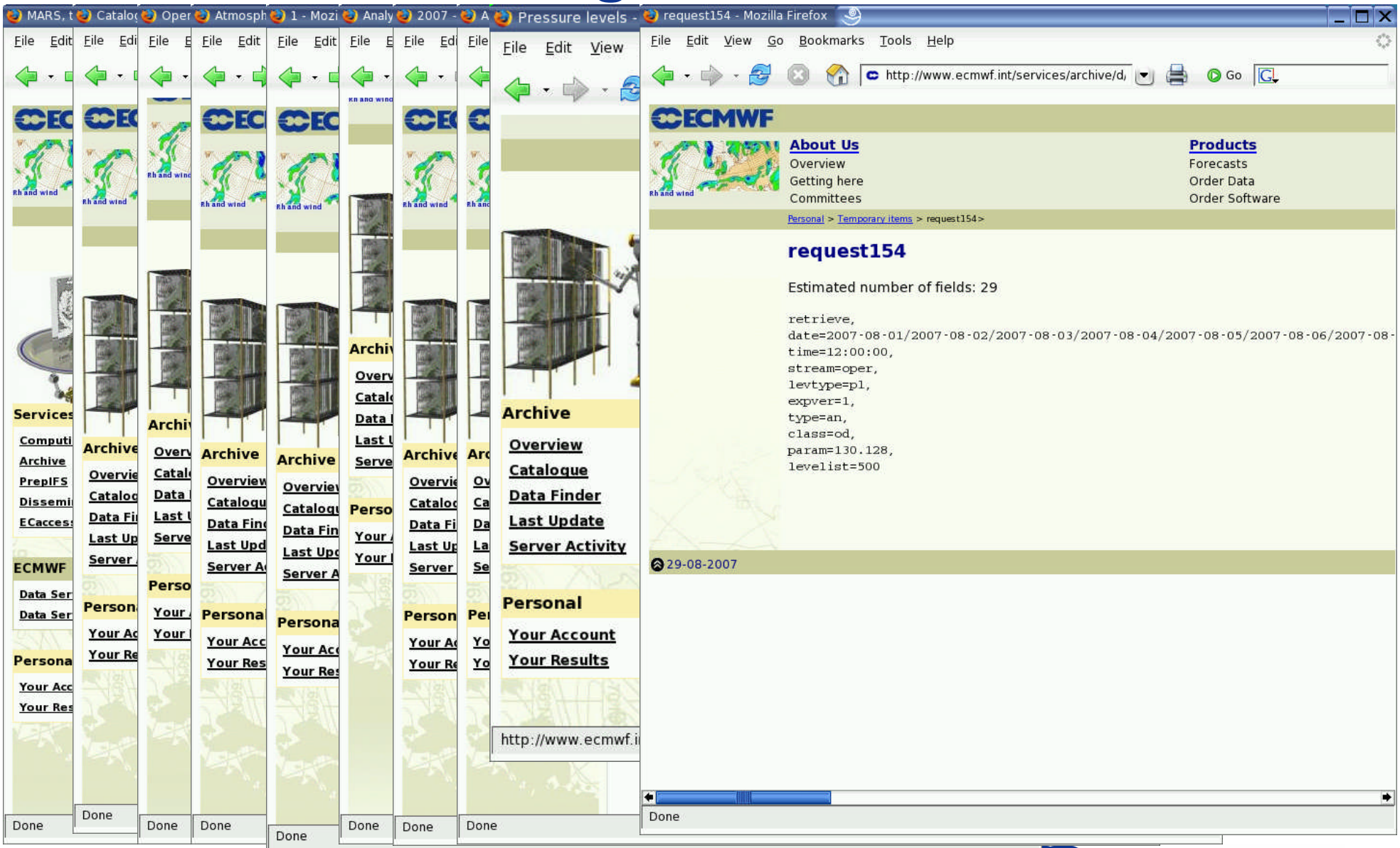
- **Requires command of MARS language**
- **Allows more options/functionality**
  - **Manipulation of already retrieved fields**
  - **Computation**
- **Suitable for substantial retrievals (e.g. ERA-40)**
- **Retrievals can be automated (ecaccess event triggers)**
- **On Member State server “ecgate”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

Requires full computer user registration!

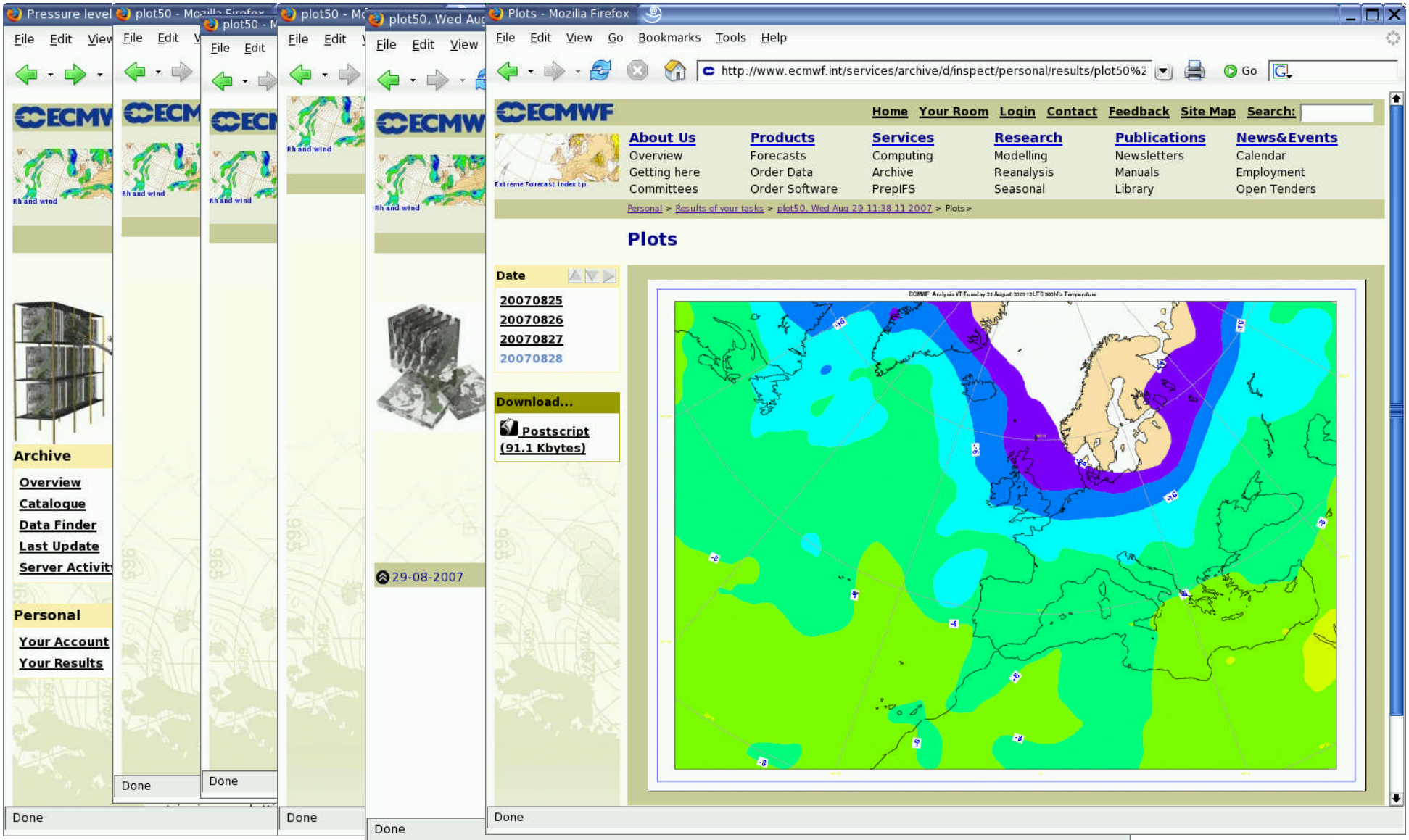
Web-MARS: Archive views



Web-MARS: Catalogue

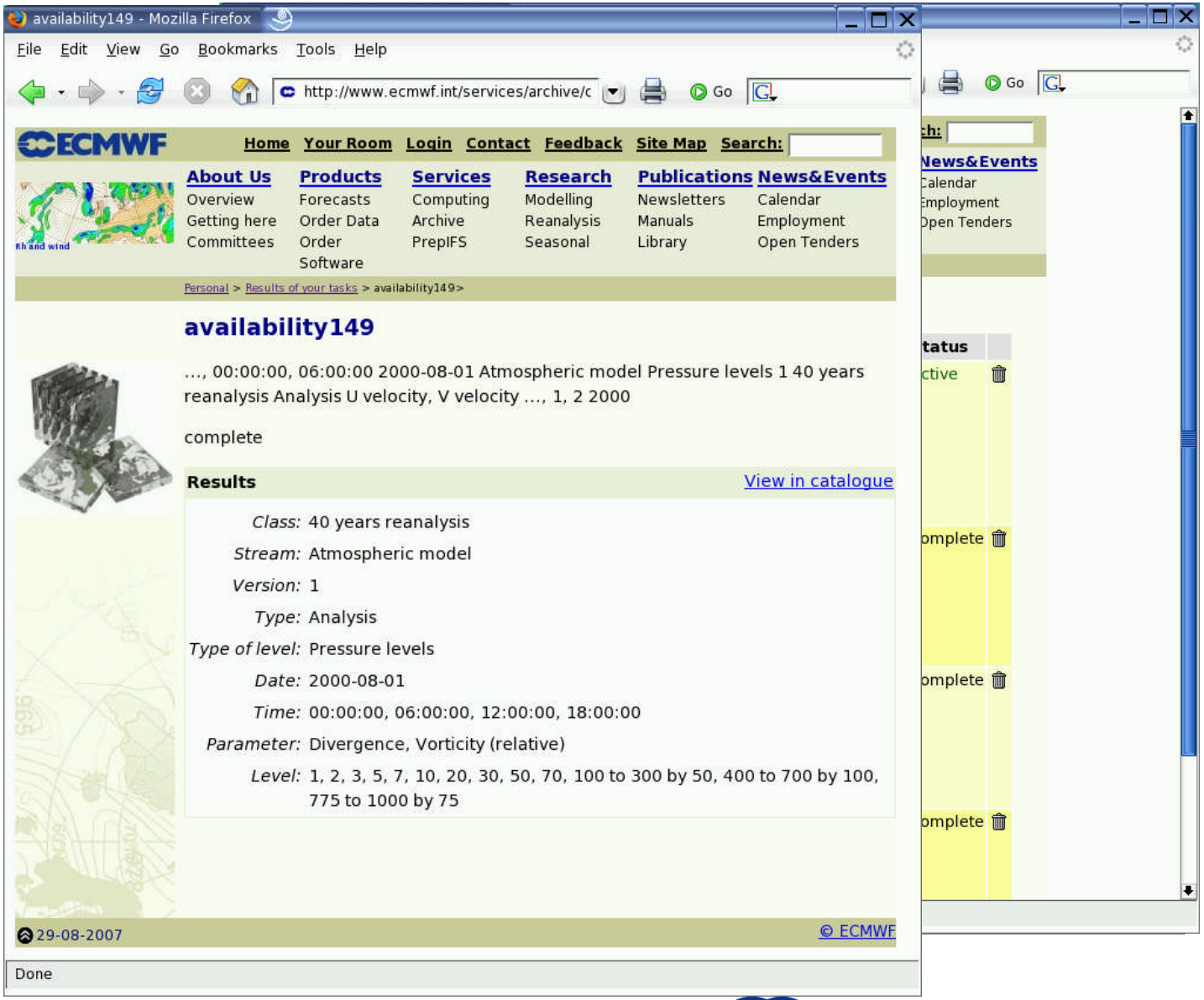


Web-MARS: Plot



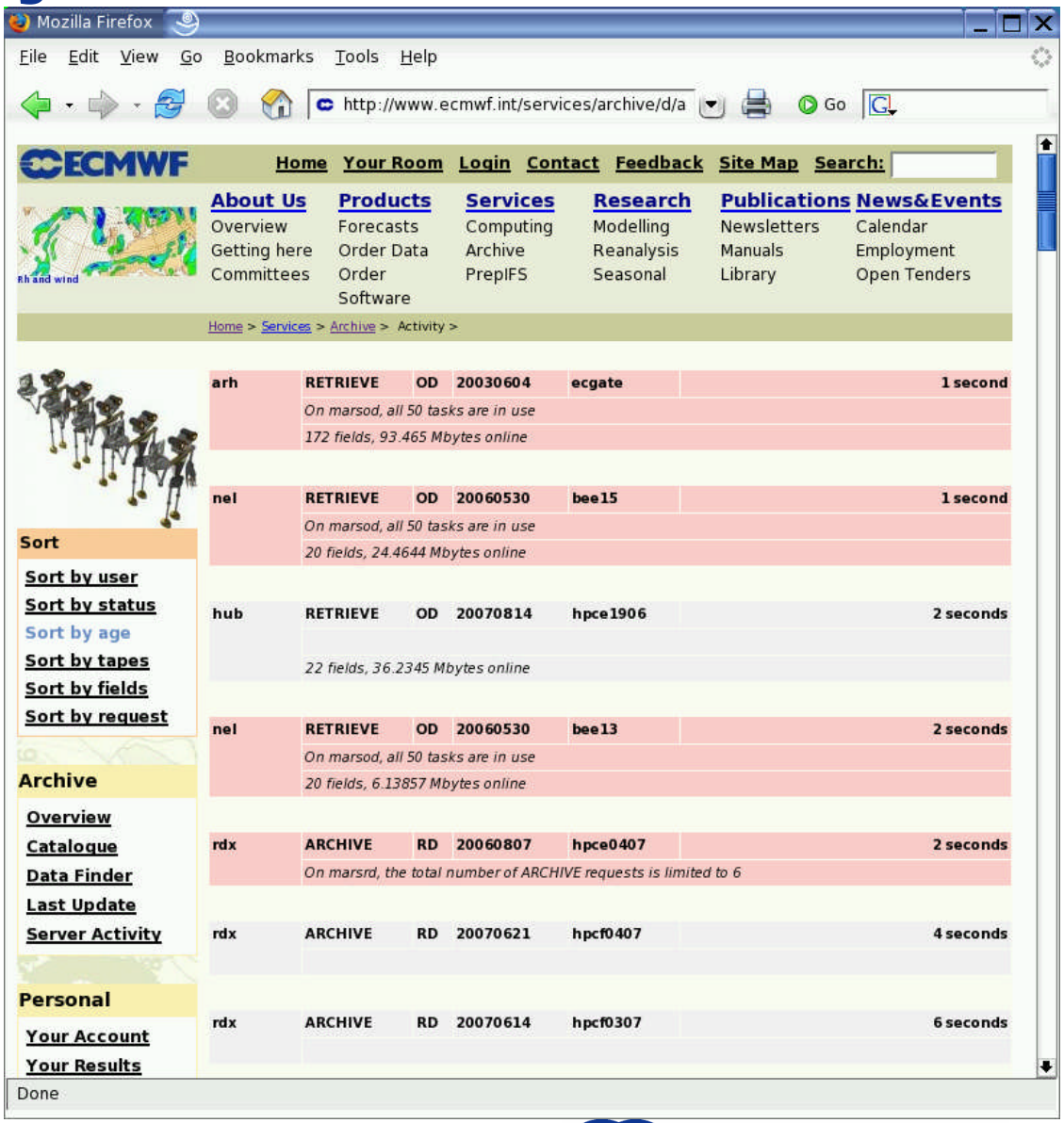
Web-MARS: Tasks

- Supervised
- Asynchronous
- Persistence



Web-MARS: Activity

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



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

```
retrieve,                                          action
    class    = od,                                 identification
    stream   = oper,
    expver   = 1,

    date     = -1,                                 date & time related
    time     = 12,

    type     = analysis,                           data related
    levtype  = model levels,
    levelist = 1/to/91,
    param    = temperature/z,

    grid     = 2.5/2.5,                            post-processing

    target   = "/scratch/…/analysis"               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 • 10^9 fields
- Growing daily by ~ 5 TB:
  - ~ 1 TB Operational data
  - ~ 4 TB Research + Projects
- More than 200 000 requests (60 • 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/