

MARS – Advanced use



Read action: filtering

Not available with the MARS Web API

- Read requests can be used to filter/manipulate already retrieved data.
- Read UNIX file specified by **source**.
- Data written to a file specified by **target**.
- Read doesn't need all directives.

```
read,  
  source    = "myfile",  
  levelist  = 1000,  
  grid      = 1/1,  
  target    = "only_1000"
```

Multi-target

Not available with the MARS Web API

- Can organise GRIB target files depending on values of MARS language keywords or of ecCodes keys
- MARS keyword (as echoed by MARS) enclosed in **square** brackets:

Request

```
retrieve,  
  type      = an,  
  expver    = 1,  
  levtype   = sfc,  
  date      = 20010101,  
  time      = 00/06/12/18,  
  target    = "analysis.[time]"  
...
```

MARS output

```
mars - INFO - 20020515.1237 - Creating target name: analysis.0000  
mars - INFO - 20020515.1237 - Creating target name: analysis.0600  
mars - INFO - 20020515.1237 - Creating target name: analysis.1200  
mars - INFO - 20020515.1237 - Creating target name: analysis.1800
```

Set env. variable **MARS_MULTITARGET_STRICT_FORMAT=1** to use directive values as reported by MARS.

Multi-target

Not available with the MARS Web API

- ecCodes key name enclosed in **curly** brackets:

Request

```
retrieve,  
  type      = an,  
  param     = t/u/v,  
  expver    = 1,  
  levtype   = sfc,  
  date      = 20010101,  
  time      = 00/06/12/18,  
  target    = "analysis.{shortName}"  
...
```

MARS output

```
mars - INFO - 20140222.164526 - Creating target name: analysis.t  
mars - INFO - 20140222.164527 - Creating target name: analysis.u  
mars - INFO - 20140222.164527 - Creating target name: analysis.v
```

Multiple requests

Available with the MARS Web API and client

- More than one request in a single call to MARS.
- Append to target:

```
retrieve,  
  date    = 20010101,  
  time    = 12,  
  type    = an,  
  target  = "analysis_fc"
```

```
retrieve,  
  date    = 20000101,  
  time    = 12,  
  type    = fc,  
  step    = 0/12,  
  target  = "analysis_fc"
```

Multiple requests

Parameter inheritance

Parameters not set in the second request (and subsequent ones) are inherited from the previous one:

Inherited parameters

```
retrieve,  
  class = od,  
  expver = 1,  
  stream = oper,  
  date = -10,  
  time = 12,  
  type = an,  
  target = "analysis"  
retrieve,  
  type = fc,  
  step = 24/to/72/by/24,  
  target = "forecast"
```

Removing a parameter

```
retrieve,  
  class = od,  
  expver = 1,  
  stream = oper,  
  date = -10,  
  time = 12,  
  type = fc,  
  step = 24/to/72/by/24,  
  target = "forecast"  
retrieve,  
  type = an,  
  step = off,  
  target = "analysis"
```

Unwanted inherited parameters are removed by specifying “off”

Fieldset

Not available with the MARS Web API

- Temporary storage in memory for further processing:

```
retrieve,  
  class      = od,  
  expver     = 1,  
  stream     = oper,  
  date       = -10,  
  levtype    = ml,  
  levelist   = 1/to/60,  
  param      = t,  
  time       = 12,  
  type       = an,  
  fieldset   = analysis
```

Fieldset

Not available with the MARS Web API

- 'analysis' above can be seen as a variable to be referenced in a further request.
- At the end of the call to MARS, all fieldsets are released.
- Write requests save fieldsets into UNIX files:

```
write,  
  fieldset = analysis,  
  target   = "data.grb"
```

Compute

Not available with the MARS Web API

- Computations on GRIB fields with same shape:
 - **fieldset**
 - **formula**
 - Scalar values allowed
 - Predefined functions in formula, e.g.

```
compute,  
  formula  = "x/2+log(y)*x",  
  fieldset = z
```

where **x** and **y** are two fieldsets which have been initialised beforehand.

Compute

Not available with the MARS Web API

Mixing fields and scalars:

Compute on
2 fields
is a **field**

Compute on
a field and a scalar
is a **field**

Compute on
2 scalars
is a **scalar**

Bitmaps and missing values:

Not considered in computations but copied

GRIB headers on result of **compute** are incorrect. They are copied from the first fieldset!

Compute: example

Not available with the MARS Web API

```
retrieve,  
  class      = od,  
  expver     = 1,  
  stream     = oper,  
  type       = analysis,  
  date       = -10,  
  time       = 12,  
  levtype    = sfc,  
  param      = 165.128,  # u  
  grid       = 1/1,  
  fieldset   = u  
retrieve,  
  param      = 166.128,  # v  
  fieldset   = v  
compute,  
  formula    = "sqrt(u*u + v*v)",  
  fieldset   = speed  
write,  
  fieldset   = speed,  
  target     = "windspeed.grib"
```

- 1 Retrieve the u component into fieldset u
- 2 Retrieve v into fieldset v – the other keywords are inherited from the previous request
- 3 Compute the wind speed from u and v into fieldset speed
- 4 Write fieldset speed to the file windspeed

Time-Critical Option 1 (TC1)

ECaccess allows to start your MARS request when the latest forecast is made available

- 1 Select your event. `ecaccess-event-list` command prints all available events

```
$ ecaccess-event-list
177      fc00h144      At this stage, the deterministic forecast at 00UTC for step 144 (6 days) is complete.
```

- 2 Submit your ecaccess job which will be started every time the selected event is released

```
$ ecaccess-job-submit -eventIds 177 -jobName mars_request.sh -retryCount 3
```

- 3 Use `ecaccess-job-list` to list your jobs

```
$ ecaccess-job-list
24400189  ecs  WAIT   1/1  Oct 13 06:32  [fc00h144 (177);fc12h144 (181)] mars_request.sh
24402398  ecs  STDBY  0/1  Oct 13 06:32  [fc00h144 (177);fc12h144 (181)] mars_request.sh
24399131  ecs  DONE   1/1  Oct 11 18:28  [fc00h144 (177);fc12h144 (181)] mars_request.sh
```

All ECaccess / TC1 are monitored by operators at ECMWF who can re-run the failed requests
<https://confluence.ecmwf.int/spaces/ECAC/pages/41651958/ecaccess>

Practicals: Advanced MARS usage

MS computing training courses – Advanced MARS usage

Take away message

- Which way of accessing ECMWF data is most appropriate for you
 - Dissemination
 - Open data (ftp server)
 - *CDS
 - MARS
- Which tool is most appropriate for retrieving data from MARS
 - webAPI
 - MARS client on ECMWF's HPC
 - Polytope
- **Earthkit-data as a wrapper**