MARS – Advanced use

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User Support

Content

- Other verbs: list, read, write, compute

- List archive contents (list)

- Manipulate already retrieved data (read)

- Multiple targets

- Multiple requests

- Compute

- Examples

- Practical session

List

- Alternative to the archive catalogue on the web:
  - Amount of data
  - Number of fields
  - Number of tapes. (directive 'output=cost' required)
  - Suitable for batch mode

- Default is all, except for class, expver, stream, type and date.
- It does list only the archive, not the Fields Database.
- Can keep a report specifying target.

List

- Example

```
list,
      class                        = od,
      stream                       = oper,
      expver                       = 1,
      date                         = 20020501,
      time                         = 00/12,
      type                         = an,
      levtype                      = pl,
      levelist                     = 1000/850/500,
      param                        = z/t
```

List

- Output

```
class   = od
cost    = 12 fields, 6.0236 Mbytes online
expver  = 1
file[0] = marsa:/marsodoper:/1/an/20020501/pl/126649:/20020512.125422
id      = 126649
levtype = pl
stream  = oper
type    = an
date          file   length  levelist   offset        param     time
2002-05-01 0     526350  1000        84740812   129.128  00:00:00
2002-05-01 0     526350  1000        85267162   130.128  00:00:00
…
2002-05-01 0     526350  850         315858028  129.128  12:00:00
2002-05-01 0     526350  850         316384378  130.128  12:00:00
2002-05-01 0     526350  500         326363356  129.128  12:00:00
2002-05-01 0     526350  500         326889706  130.128  12:00:00

Grand Total:
============

Entries    : 12
Total      : 6,316,200 (6.0236 Mbytes)
```

List: incomplete datasets

- example

```
list,
    class               = od,
    stream              = kwbc,
    expver              = 1,
    date                = 20020501,
    time                = 00/12,
    type                = an,
    levtype             = pl,
    levelist            = 1000/850/500,
    param               = z/t
```

List: incomplete datasets

- output

```
class   = od
cost    = 6 fields, 32.3047 Kbytes online, 54.3438 Kbytes on 1 tape
expver  = 1
file[0] = marsa:/marsodkwbc:/1/an/20020501/pl/126932:/20020512.124906
file[1] = -
id      = 126932
levtype = pl
stream  = kwbc
type    = an
date          file length levelist  offset   param   time
2002-05-01 0   16540  1000      0        129.128 00:00:00
2002-05-01 0   11284  850       16540  130.128 00:00:00
2002-05-01 0   16540  500       27824  129.128 00:00:00
2002-05-01 0   16540  1000      44364  129.128 12:00:00
2002-05-01 0   11284  850       60904  130.128 12:00:00
2002-05-01 0   16540  500       72188  129.128 12:00:00

Grand Total:
============

Entries      : 6
Total        : 88,728 (86.6484 Kbytes)
```

Retrieve incomplete datasets

- expect

> The MARS WebAPI sets 'expect=any'.

```
retrieve,
    class           = od,
    stream          = kwbc,
    expver          = 1,
    date            = 20020501,
    time            = 00/12,
    type            = an,
    levtype         = pl,
    levelist        = 1000/850/500,
    expect          = 6,
    param           = z/t
```

Read: filtering

- 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                = 2.5/2.5,
    target              = "only_1000"
```

Not available with the MARS WebAPI.

Filtering

- Retrieve fails if desired data is not present in source

```
retrieve,
    class                   = od,
    stream                  = oper,
    expver                  = 1,
    date                    = 20010101,
    time                    = 12,
    type                    = an,
    levtype                 = pl,
    levelist                = 1000,
    param                   = z/t,
    source                  = "myfile",
    target                  = "only_1000"
```

Not available with the MARS WebAPI.

Multi-target

- Can organise GRIB target files depending on values of MARS language keywords or of GRI_API key.
- MARS Keyword (as echoed by MARS) enclosed in square brackets:
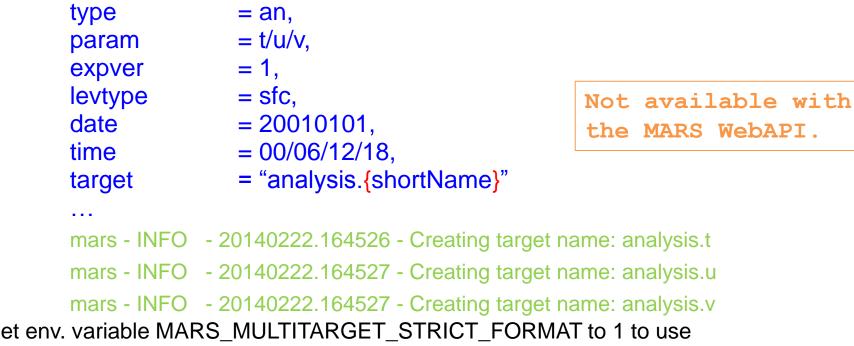
retrieve,

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

Not available with the MARS WebAPI.

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

Multi-target

- GRIB_API key name enclosed in curly brackets:

retrieve,

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

Not available with the MARS WebAPI.

mars - INFO - 20140222.164526 - Creating target name: analysis.t

mars - INFO - 20140222.164527 - Creating target name: analysis.u

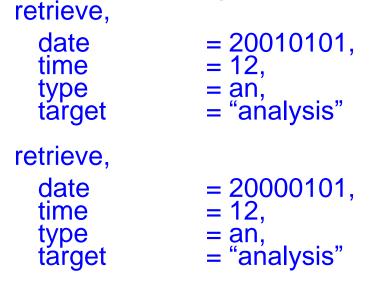mars - INFO - 20140222.164527 - Creating target name: analysis.v

- Set env. variable MARS_MULTITARGET_STRICT_FORMAT to 1 to use directive values as reported by MARS. This variable also expands GRIB1 and GRIB2 parameter numbers in a different way.

Multiple requests

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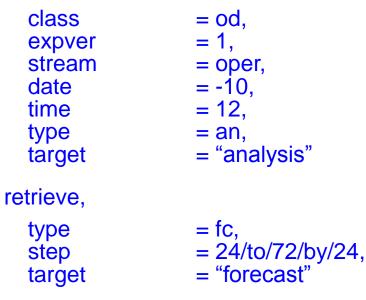
- Append to target:

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

retrieve,
    date            = 20000101,
    time            = 12,
    type            = an,
    target          = "analysis"
```

Available with the MARS WebAPI and client.

Multiple requests

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

```
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"
```

Multiple requests: inheritance

- Unwanted inherited parameters are removed by specifying "off", e.g.:

```
retrieve,
    class           = od,
    expver          = 1,
    stream          = enfo,
    type            = pf,
    date            = -10,
    levtype         = pl,
    levelist        = 1000/500,
    step            = 12,
    number          = 1/to/50,
    target          = "ensemble.data"

retrieve,
    type            = fc,
    stream          = oper,
    number          = off,
    target          = "deterministic.data"
```

Fieldset

- Temporary storage for further processing:

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

Not available with the MARS WebAPI.

Fieldset

- '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"

Not available with the MARS WebAPI.

Compute

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

  Not available with the MARS WebAPI.

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

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

Compute

- 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 on computations but copied
- GRIB headers on result of compute are incorrect. They are copied from the first fieldset.

Not available with the MARS WebAPI.

Compute: example

```
retrieve,
    class = od, expver = 1, stream = oper,
    type = analysis, date = -10,
    param = u, grid = 2.5/2.5,
    fieldset         = u
retrieve, param = v,
    fieldset = v
compute,
    formula = "sqrt(u*u + v*v)",
    fieldset = speed
write,
    fieldset = speed,
    target = "windspeed"
```

Not available with the MARS WebAPI.

Compute: applications.

- Compute Surface pressure from LNSP.
- Apply the land/sea mask to some fields.

  read, source="temperature.grib", param=T, fieldset=temp

  read, source="lsm.grib", fieldset=lsm, param=lsm

  compute, fieldset=lsm_temp, formula="(lsm>0.5)*temp"

  write, fieldset=lsm_temp, target="temperature_lsm.grib"

- Statistical calculations … min, max, mean, rms …
- De-accumulate fields (see practical).
- Build "new meteorological" fields from existing fields. See for example:

  http://www.ecmwf.int/en/forecasts/documentation-and-support/evolution-ifs/cycles/change-soil-hydrology-scheme-ifs-cycle

Reference

- Mars user guide:

  https://software.ecmwf.int/wiki/display/UDOC/MARS+user+documentation