ECMWF training course - 2016
Advanced MARS usage
Practical examples - solutions.

EXERCISE 1 (multiple target)

```
retrieve,
        type      = an,
        expver    = 1,
        levtype   = pl,
        levelist  = 1000/850/700/500/400/300,
        param     = 129,
        date      = 20110302,
        time      = 0000/0600/1200/1800,
        target    = "analysis.[time].[levelist]"
```

A sample request is available in ~trx/mars_adv/multi_target.req

EXERCISE 2 (List)

Based on the above request and **WITHOUT EXTRACTING THE DATA,** can you estimate what volume is occupied by all the operational analysis for one recent week on pressure levels? Check the number of fields, the number of tapes

```
list,
    class   = od,
    type    = an,
    expver  = 1,
    stream  = da,
    levtype = pl,
    date    = 20150201/to/20150207,
    target  = "ops_1week_pl.lst"
```

You could similarly check what has been archived for one week in, say 1991, for ERA-15, ERA-40 or ERA-interim, e.g. for era-15:

```
list,
    class   = er,
    type    = an,
    expver  = 1,
    stream  = da,
    levtype = pl,
    repress = sh,
    date    = 19910201/to/19910207,
    target  = "e15_1week_pl.lst",
    output  = cost
```

For info, the **whole daily analysis** contains **51MB** for ERA-15 (T106), **228MB** for ERA-40 (T159), **704MB** for ERA-interim (T255) and **30GB** for the current operations (T1279).

EXERCISE 3 (MARS Computations)

Using the MARS browser, can you isolate the operational forecast precipitation fields available in MARS. Either you can use parameter 228 (Total Precipitation) or you can use the two components, Large Scale precipitation (param 142) and Convective Precipitation (param 143). ('142+143=228')

Could you create one field with the Total Precipitation forecast for today, between 00:00 and 24:00, based on yesterday's forecast.

```
retrieve,
        param=228,
        type=fc,
        class=od,
        levtype=sfc,
        expver=1,
        stream=oper,
        step=12/36,
        date=-1,
        time=12,
        target="precipitation"

read,
        source="precipitation",
        step=36,
        param=228,
        field=step36_228

read,
        source="precipitation",
        step=12,
        param=228,
        field=step12_228

compute,
        field=daily_precip,
        formula="step36_228-step12_228"

write,
        field= daily_precip,
        target="total_daily_precip.grib"
```

A sample request is available in ~trx/mars_adv/compute_total_daily_precip

EXERCISE 4 (Concluding quiz on reasonable size of MARS requests)

You have to extract all ERA-40 analysis data on all pressure levels for one year. Considering the volumes seen in exercise 2, knowing the restrictions on disk space, keeping in mind the architecture of MARS, the "restartability" of your task, which option would you use:

A. One request with the content of "xv ~trx/mars_adv/year.gif": **too big …**

```
ret,
   class=ei,
   type=an,
   expver=1,
   stream=da,
   levtype=pl,
   levelist=10/30/50/70/100/150/200/250/300/400/500/600/700/775/850/925/1000,
   date=19910101/to/19911231,
   time=0000/0600/1200/1800,
   param=129/130/135/138/155/157,
   target="analysis_pl_y.grib"
```

B. 12 requests with the content of "xv ~trx/mars_adv/month.gif": **ok (?)**

```
ret,
   class=ei,
   type=an,
   expver=1,
   stream=da,
   levtype=pl,
   levelist=10/30/50/70/100/150/200/250/300/400/500/600/700/775/850/925/1000,
   date=19910101/to/19910131,
   time=0000/0600/1200/1800,
   param=129/130/135/138/155/157,
   target="analysis_pl_m.grib"
```
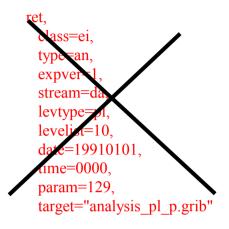
C. Number of levels * Number of times * Number of days * Number of params

requests (148920) requests with the content of "xv ~trx/mars_adv/day.gif": **too small, inefficient!!**

ret,
class=ei,
type=an,
expver=1,
stream=da,
levtype=pl,
levelist=10,
date=19910101,
time=0000,
param=129,
target="analysis_pl_p.grib"

D. Other? Maybe one week/two weeks to a couple of months at a time …

What other factors should you take into account?

- Interpolation – increased volume and increased CPU time.
- Subarea - decreased volume.
- Data set (number of levels, resolution)
- Disk capacity to handle your final files, here and at your end
- Transfer rates between ECMWF and your site. Reliability of connections.
- Number of fields.
- …