

ecCodes

GRIB Fortran 90 - Python APIs Practicals 2

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Practical 2: ecCodes indexing

```
ecgate$ cd $SCRATCH/eccodes_api_practicals/exercise2
ecgate$ cd F90 # or 'cd Python'
ecgate$ ls
Makefile eccodes_index.f90 eps grib_api_index.f90
```

- The file 'eps' contains ENS fields for all (50) (perturbed) ensemble members for some (4) parameters, e.g. see output of 'grib_ls eps'.
- The objective of this exercise is to write a Fortran or a Python program using ecCodes and the indexed access method to compute the ensemble mean for one parameter.
- The files eccodes_index.f90 and grib_api_index.f90 (or .py) contain a skeleton of the code or script. Please complete one of them. If you are confident, you can start from 'scratch'.

Practical 2: Main program

```
program index
use eccodes
implicit none
```

```
integer      :: iret
integer,dimension(:),allocatable :: paramId,number
integer      :: paramIdSize,numberSize
integer      :: i,j
integer      :: idx,igrib,count,numberOfValues
real (KIND=8),dimension(:), allocatable  :: values, result
```

2 index tables will be needed



two tables are defined for the data values.



Compile/link with:

Fortran: `gfortran -o eccodes_index eccodes_index.f90 $ECCODES_INCLUDE $ECCODES_LIB`

or use **make**.

Practical 2: ecCodes indexing

- Run the resulting code with:

```
$ eccodes_index # (or grib_api_index) for Fortran
```

```
$ python eccodes_index.py # (or grib_api_index.py) for Python
```

- Now change the link for the input file 'eps' to the grib2 file (also available from ~trx/ecCodes/data) and run the program again.

```
$ make grib2
```

Practical 3: ecCodes timings

```
$ cd $SCRATCH
```

```
$ cd eccodes_api_practicals/exercise3
```

```
$ ls
```

```
Makefile  ensmean_indexed.f90  ensmean_indexed_read.f90  run  dirs  
ensmean_reduced.f90  ensmean.f90  input  run.out
```

```
$ make
```

```
$ run
```

- The 4 Fortran codes do the same thing. They all compute ensemble means and standard deviations with ecCodes for 12 fields (4 parameters – 3 levels).

Practical 3: ecCodes timings

- The code in `ensmean.f90` reads the complete grib file for each computation of a mean and std. It also decodes the data values even if a field is not used.
- The code in `ensmean_reduced.f90` is like the first code, but the data values for a field are decoded only when they are needed.
- The code in `ensmean_indexed.f90` builds an index based on the keys parameter, ensemble number and level. The grib messages are then accessed through this index. The index is then saved into a file.
- The code in `ensmean_indexed_read.f90` is exactly the same as the previous except that the index is read from a file, not built.
- Note the different run times! Beware of best access method for different access pattern:
 - Sequential i/o (`codes_grib_new_from_file`) suitable for sequential access.
 - Indexed i/o (`codes_new_from_index`) suitable for random access.

Practical 4: ecCodes encoding

```
$ cd $SCRATCH
$ cd eccodes_api_practicals/exercise4
$ cd F90 # or Python
$ ls
Makefile eccodes_create.f90 eps grib_api_create.f90
```

- The objective of this exercise is to extend the code used in practical 2 to create a new grib message containing the ensemble mean, using ecCodes.
- Different options are available to create a grib message:
 - Clone the new field to be produced from one of the input grib fields.
 - Use a sample (or template) from the default samples directory. See 'codes_info'.
 - Use a sample from a private samples directory.

Practical 4: ecCodes encoding

- The first option is the easiest to implement. For simplicity, we suggest you to use this option.
- The file `codes_create.f90` (or `grib_api_create.py`) contain a skeleton of the code to create a grib message. Please can you try to add the code needed to create a grib message. Follow the instructions in the code. Use 'make' to compile the codes, then run the program or run the Python script.
- To change the GRIB headers, see local definitions under <http://apps.ecmwf.int/codes/grib/format/grib1/local/> and <http://apps.ecmwf.int/codes/grib/format/mars/type/> for the datatype.
- Now change the link for the input file 'eps' to the grib2 file (also available from `~trx/ecCodes/data`) and run the program again.

`$ make grib2`

Practical 5: ecCodes grid packing

```
$ cd $SCRATCH
$ cd eccodes_api_practicals/exercise5
$ ls
eps.grib1  eps.grib2  ls.out  pack_data.cmd  pack_data.out
$ ./pack_data.cmd
```

- The objective of this exercise is to see the impact of different types of packing.
- For simplicity, we only look at some packing types for grid point data.
- Note that the timings may vary.
- Note that ecCodes may not do the packing requested. Check the `packingType` of output files with `grib_ls`.

Practical 5: ecCodes API grid packing

- Which packing is the fastest, the slowest?
- Which packing does achieve the best compression'?
- Which packing types are not available for GRIB1?