ecCodes GRIB: Advanced Topics

Part II

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Overview

- **Parameter database**
- **GRIB1 to GRIB2 conversion**
- **Local configuration**

GRIB 1 parameter (WMO coding)

“10 metre U wind component”

indicatorOfParameter = 33 [u-component of wind (m/s)]
table2Version = 3
indicatorOfTypeOfLevel = 105 [Specified height level above ground (m)]
level = 10

GRIB 2 parameter (WMO coding)

“10 metre U wind component”

discipline = 0 [Meteorological products]

parameterCategory = 2 [Momentum]

parameterNumber = 2 [u-component of wind (m s-1)]

typeOfFirstFixedSurface = 103 [Specified height level above ground (m)]

scaleFactorOfFirstFixedSurface = 0

scaledValueOfFirstFixedSurface = 10

GRIB 1 parameter (ECMWF local coding)

“10 metre U wind component”

indicatorOfParameter = 165 [10 metre u-component of wind (m/s)]
table2Version = 128

ecCodes solution

- **There are different ways of coding a parameter!**
- **Use a VIRTUAL (computed) key to decouple user level from coding level**
- **User code gets/sets a virtual key and ecCodes gets/sets the appropriate coded keys**
- **Local configuration is available to deal with local codes**

ecCodes parameter

- **ecCodes provides some edition independent keys to identify a parameter:**
  - **paramId**
  - **shortName**
  - **name**
  - **units**
  - **centre**

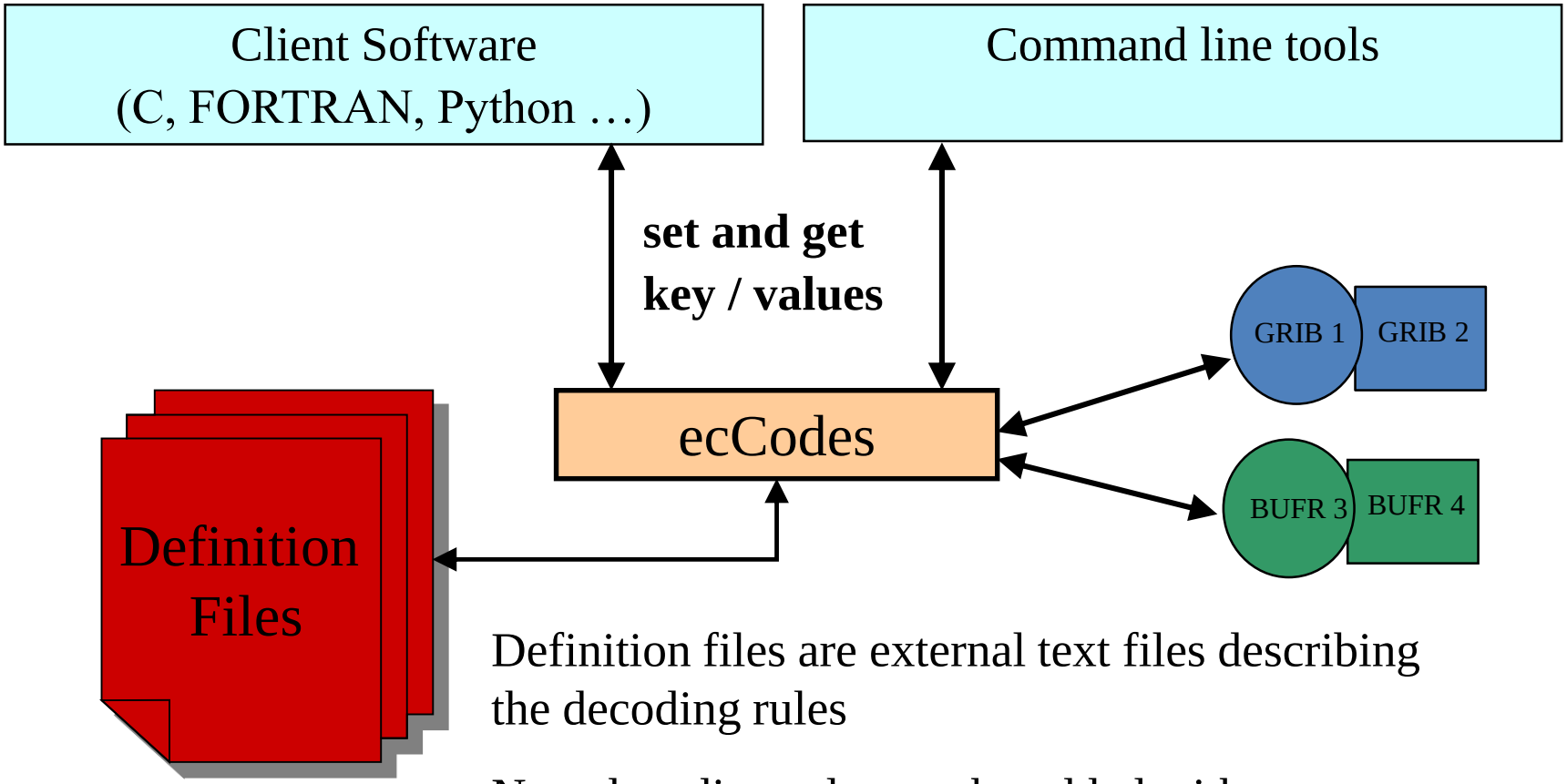
ecCodes parameters (GRIB 1)

- **centre**
- **table2Version**
- **indicatorOfParameter**
- **levelType**
- **level**
- **…**

ecCodes parameters (GRIB 2)

- **discipline**
- **parameterCategory**
- **parameterNumber**
- **typeOfFirstFixedSurface**
- **scaleFactorOfFirstFixedSurface**
- **scaledValueOfFirstFixedSurface**
- **typeOfSecondFixedSurface**
- **scaleFactorOfSecondFixedSurface**
- **scaledValueOfSecondFixedSurface**
- **…**

ecCodes - Design



Definition files are external text files describing the decoding rules

New decoding rules can be added without rebuilding ecCodes

Concept: shortName

GRIB 2

‘2t’ = { discipline=0; parameterCategory=0; parameterNumber=0 ;
typeOfFirstFixedSurface=103; scaleFactorOfFirstFixedSurface=0;
scaledValueOfFirstFixedSurface=2; }

GRIB1

‘2t’ = { indicatorOfParameter=11; table2Version=3;
levelType=105; level=2;}

GRIB1 ECMWF local coding

‘2t’ = { indicatorOfParameter=167; table2Version=128;}

Concept: paramId

GRIB 2

167 = { discipline=0; parameterCategory=0; parameterNumber=0 ;
typeOfFirstFixedSurface=103; scaleFactorOfFirstFixedSurface=0;
scaledValueOfFirstFixedSurface=2; }

GRIB1

167 = { indicatorOfParameter=11; table2Version=3;
levelType=105; level=2;}

GRIB1 ECMWF local coding

167 = { indicatorOfParameter=167; table2Version=128;}

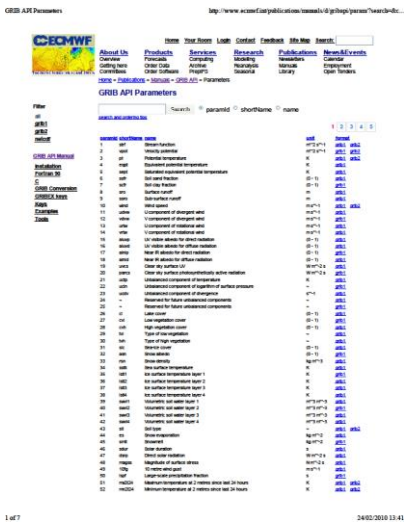
GRIB Parameters in ecCodes

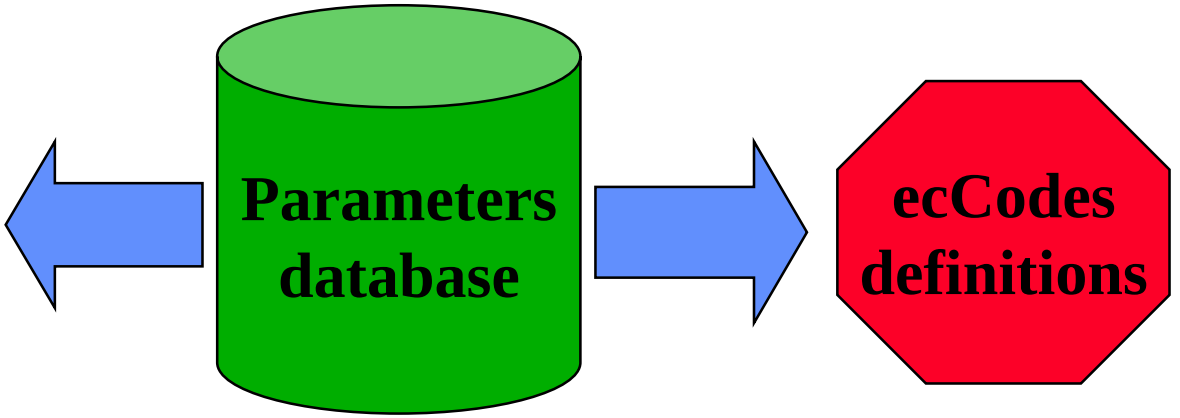
- **The Parameters database is accessible here:**

  http://apps.ecmwf.int/codes/grib/param-db/

Parameters database

WEB





Parameters: Practicals

```
cd $SCRATCH
tar xf  ~trx/ecCodes/eccodes_grib_parameters.tar
cd grib_parameters
```

1. **You have two grib messages start.grib1 and start.grib2**
2. **Create the file 10u.grib1 setting shortName=10u in start.grib1**
3. **Create the file 10u.grib2 setting shortName=10u in start.grib2**
4. **Do `grib_ls -n parameter 10u.grib1 10u.grib2`. Do you see any difference**
5. **Compare the grib_dump –O of the two files and of the two messages in each file**

GRIB1 to GRIB2 conversion

```
grib_set -s edition=2 in.grib1 out.grib2
```

conversion of

- **time**
- **geography**
- **vertical**
- **parameter**
- **local**
- **data**

GRIB1 to GRIB2 conversion

- **Parameter conversion is particularly complex due to the difference between the two coding standards and the local tables used by some meteorological centres**
- **The conversion is based on the parameter's unique identifier "paramId"**

paramId based conversion

- **How to produce a GRIB for a “2 metre temperature”**

```
grib_set -s paramId=165 in.grib1 out.grib1
grib_set -s paramId=165 in.grib2 out.grib2
```

- **How to convert a GRIB1 to GRIB2**

```
grib_set -s edition=2 in.grib1 out.grib2
```

- **During the conversion to edition 2 ecCodes copies the paramId value from the GRIB1 to the GRIB2:**
  1. **get paramId(=165) from GRIB1**
  2. **change edition to 2 producing a GRIB2**
  3. **set paramId(=165) in GRIB2**

paramId based conversion

- **The conversion is possible only if a paramId is defined for both editions**

- **Check on the parameters database website if a conversion is possible**

Parameters: Practicals

We refer to the same files produced in the previous practical

1. **Convert 10u.grib1 to its GRIB2 version 10u_converted.grib2.**
2. **Do `grib_ls -n parameter 10u.grib2`**
3. **Do `grib_ls -n parameter 10u_converted.grib2`**
4. **Take the first message from start.grib1 and save it to ecmf.grib1**
5. **Set the paramId of ecmf.grib1 to 162089. Save it as ecmf.162089.grib1**
6. **Convert ecmf.162089.grib1 to GRIB edition 2. Why does it fail?**

Local configuration

- **According to WMO:**
  "…*the use of Local tables in messages intended for non-local or international exchange is strongly discouraged*"
- **The external text files defining the decoding rules used by the decoding engine are called definition files**
- **For each installation there is a default set of definition files**
- **The ECCODES_DEFINITION_PATH environment variable can be set to use local definition files instead of the definition files provided within the distribution**

Local configuration

- **The parameter descriptions for a given "centre" are contained in the files shortName.def, paramId.def, units.def, name.def in the directories**

  BASE_DIR/definitions/grib1/localConcepts/[centre:s]

  BASE_DIR/definitions/grib2/localConcepts/[centre:s]

Note: 'centre:s' means the centre as a *string* e.g. ecmf, kwbc, cnmc etc

- **The general parameter descriptions are contained in the files shortName.def, paramId.def, units.def, name.def in the directories**

  BASE_DIR/definitions/grib1

  BASE_DIR/definitions/grib2

Local configuration

ECCODES_DEFINITION_PATH=/my/definitions:/eccodes/definitions

- **The library searches for each required definition file first in /my/definitions and then in /eccodes/definitions**
- **If the file is found in /my/definitions then it used by the decoding engine**
- **The user can override all the definition files with his/her own definition files**
- **We suggest you only override the definition files containing the parameter information**

Local configuration: define a parameter locally

- **Get the directory of the definition files with the utility codes_info**
- **set the environment variable**
  ECCODES_DEFINITION_PATH=local_dir:default_definition_dir
- **Create the directories:**

  local_dir/grib1/localConcepts/[centre:s]

  local_dir/grib2/localConcepts/[centre:s]

And add files shortName.def, paramId.def, name.def & units.def.

Local configuration: define a parameter locally

- **Example from paramId.def (for GRIB1)**

```
# Direction of wind waves
500072 = {
        table2Version = 112;
        indicatorOfParameter = 101;
}
```

- **Example from shortName.def (for GRIB1)**

```
# Total precipitation of at least 10 mm
'tpg10' = {
        table2Version = 131;
        indicatorOfParameter = 62;
}
```

Local configuration: Practical

cd $SCRATCH

tar xf ~trx/ecCodes/eccodes_grib_localConfig.tar

1. **What parameter is contained in the x.grib1 and x.grib2?**
2. **Run codes_info to find the location of the default definitions**
3. **Now set ECCODES_DEFINITION_PATH to include the "mydefs" directory e.g.**

```
export
ECCODES_DEFINITION_PATH=`pwd`/mydefs:/path/to/defaults
```

4. **Now see if ecCodes recognizes the name, units etc**
5. **Test the GRIB1 to GRIB2 conversion. Compare the output with the provided x.grib2 file**
6. **Study the files/directories of "mydefs"**