

## **901 configuration with GRIB2 (GRIB\_API)**

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## Introduction :

The 901 configuration of ARPEGE/IFS code is dealing with the conversation of the ECMWF MARS GRIB file into METEO-FRANCE FA file. The technical detail of this configuration and circumstances please find in the GMAPDOC by Patrick Saez([http://www.cnrm.meteo.fr/gmapdoc/spip.php?article38&var\\_recherche=c901&var\\_lang=en](http://www.cnrm.meteo.fr/gmapdoc/spip.php?article38&var_recherche=c901&var_lang=en)) .

Until the end of 2010 the ECMWF provides their datas in GRIB1 format, which binary type was enough for the recent and old model resolutions (model levels under 100). It's planned for early 2011 to increase of the vertical resolution in the operational forecasting system and a new GRIB2 format is implemented at ECMWF, which able to store this increasing amount of model datas against the previous GRIB1 (Further details : <http://www.ecmwf.int/services/dissemination/grib2test.html>).

The GRIBEX grib coding software is also changed with the GRIB\_API software, which can handle both of the GRIB1 and the GRIB2 format in the future(GRIB\_API : [http://www.ecmwf.int/products/data/software/grib\\_api.html](http://www.ecmwf.int/products/data/software/grib_api.html)).

Therefore the ECMWF GRIB coding changes arrogate the changes of the code, which handle the ECMWF GRIB of course. The main goal of the modification of the 901 configuration is to make ready the routines in connection with GRIB\_API and GRIB2 format.

## Technical details 1 (GRIB2 format) :

The recent status of the ECMWF GRIB2 dataset is just in preliminary phase and the only way to make tests with this format is the conversation of the native GRIB1 to GRIB2 with GRIB\_API tools. The tool *grib1to2* provides the simplest way to make this conversation which reads the field from GRIB1 file and writes into a GRIB2. The following GRIB format changes will be referred only the GRIB file of the model level datas. Accordingly the GRIB file of the surface parameters is still remained in GRIB1 format, because some parameter definitions are missing in the latest GRIB\_API(1.9.5.0) version.

As the documentation of ECMWF IC and LBC for ALADIN runs mentioned, the following files have to be retrieved from MARS archive and make conversation with model level datas :

- atmospheric spectral fields (ICMSHa001INIT) GRIB1 → convert(*grib1to2*) **GRIB2**
- atmospheric grid-point fields (ICMUAa001INIT) GRIB1 → convert(*grib1to2*) **GRIB2**
- surface grid-point fields (ICMGGa001INIT) GRIB1 → stay in **GRIB1**

The conversation of the GRIB files is described with more details in the ECMWF web documantation (<http://www.ecmwf.int/services/dissemination/grib2test.html#resources>).

## Technical details 2 (GRIB\_API and modified routines) :

The modifications of the 901 configuration are touched the code in two place, the first was the setup level(*suarg.F90*) where the program set some initial arguments from the GRIB files and the another was the control level(*cprep1.F90*) where the core of the configuration is happened. The 901 configuration is a minimum configuration of the ARPEGE/IFS without any LAM and exotic geometry handling options. These efforts are dealing with the Interoperability projects and with the new 902, 903 configurations in the future.

The modifications of the *suarg.F90* are mainly based on the changes of the IOSTREAM calls to GRIB\_API calls. The setup part of the date, truncation vertical level infos etc.

Regarding the control level(*cprep1.F90*), the main part of the routine is the initialization and reading from the GRIB file has to be modified. The GRIBEX calls are changed to GRIB\_API calls followed the ECMWF recommendations ([http://www.ecmwf.int/products/data/software/grib\\_api.html](http://www.ecmwf.int/products/data/software/grib_api.html)). Some example of the changes can be seen below:

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```
> CALL PBGRIB(NINISH,IGRIB,ILENBYT,ILONS,IRET)
```

```
< CALL grib_open_file(ifile, CLFILN(JFILN),'r')
< CALL grib_new_from_file(ifile,jgrib,iret)
```

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```
> CALL GSTATS(1703,0)
> CALL GRIBEX(ISEC0,ISEC1,ISEC2,ZSEC2,ISEC3,ZSEC3,ISEC4,&
> & ZGRBDAT,ILENWOR,IGRIB,ILENWOR,IWORD,'D',IERR)
> CALL GSTATS(1703,1)
> ....
```

```
< CALL grib_get(jgrib,'paramId',ISEC1(6),ierr)
< CALL grib_get(jgrib,'level',ISEC1(8),ierr)
< CALL grib_get(jgrib,'values',ZGRBDAT,ierr)
< ....
```

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The philosophy of the GRIB\_API coding is quite different like the GRIBEX one where not necessary to decode all the GRIB infos just the most important ones. At this moment it's hard to synchronize the GRIB\_API releases and ARPEGE/IFS cycles in a suite and the recommendation is that to use the same GRIB\_API release in a cycle as in a concordant IFS cycle. The other part of the code was unchanged (write into FA, defining fields).

### **First tests, preliminary validation :**

First tests around the modifications was examined on the *yuki* where the modified userpack was based on the 36t2 ARPEGE model cycle and the GRIB\_API release was the 1.9.5.0. Further validations and test runs were run on ECMWF HPCF(c1a) as well.

The first test was the comparison of the different binaries with the same GRIB 1 files. As it was mentioned earlier the GRIB\_API can handle both of the GRIB format. The way of the comparison was to make a 901-923-901-927(for TELECOM domain) run with the old and the modified binary. The minimum, maximum values of the spectral fields(inverse gp transform) were checked after the first 901 and the differences after 927 for the LAM results visually. In this tests there were no differences in the spectral extremes and the LAM results as well.

The second test of the modifications was the comparison of the different GRIB format with the same modified binary. The method was the same as in the first test. There were a differences after the first 901 in spectral extremes, a sample can be seen below for Temperature for 20<sup>th</sup> Jan 2010 on several model levels:

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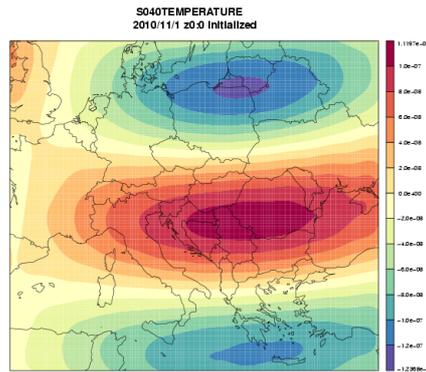
Min= 167.7443315433806      Max= 222.5577511142847 GRIB2 LEV1  
Min= 167.7443315340036      Max= 222.5577511192029 GRIB1 LEV1  
**Dif= 9.3770040621166117e-09      Dif= -4.9181778649654007e-09**

Min= 233.7772263897305      Max= 309.3774421725030 GRIB2 LEV10  
Min= 233.7772264001113      Max= 309.3774421778182 GRIB1 LEV10  
**Dif= -1.038080199577962e-08      Dif= -5.3152007239987142e-09**

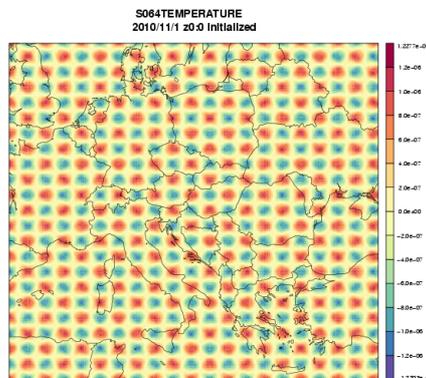
Min= 222.4556346976041      Max= 286.2742695982012 GRIB2 LEV70  
Min= 222.4556324877145      Max= 286.2742694125668 GRIB1 LEV70  
**Dif= 2.2098896010902536e-06      Dif= 1.8563440562502365e-07**

Min= 219.4126494683250      Max= 308.2687002449981 GRIB2 LEV90  
Min= 219.4126494855162      Max= 308.2687002517373 GRIB1 LEV90  
**Dif= -1.7191212009493029e-08      Dif= -6.7391852098808158e-09**

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The biggest differences are around  $10e-06$  and it's caused by the different GRIB structure of the formats. These behavior can be seen after 927 as well:

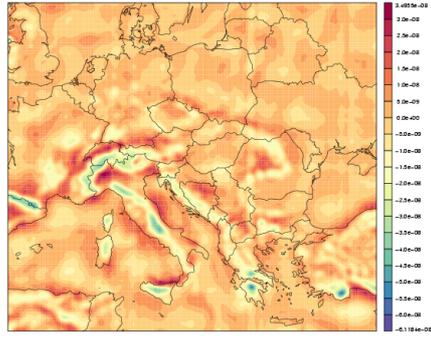


Differences in Temperature on model level 40



Differences in Temperature on model level 64

S077TEMPERATURE  
2010/11/1 z0.0 Initialized



Differences in Temperature on model level 77