APPLICATION OF GRIB CODE IN THE YUGOSLAV METEOROLOGICAL OPERATIONAL SYSTEM (YUMOS)

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1. Introduction

The contemporary meteorological operational system should enable the efficient handling and processing of a great number of meteorological data. The use of binary-oriented codes BUFR and GRIB are the appropriate way for realization of this application. The binary codes become more popular in comparison to the standard character - oriented reports such as SYNOP, TEMP, PILOT etc. In any case, these codes belong to the future.

The data in binary form take considerably less memory space which results in:

- much faster transfer of data from one computer to another;
- considerably less memory space in the data bases.

The Yugoslav Meteorological Service started in 1988 the development of the new generation of its own meteorological system (so-called YUMOS).

The central component of the system is the limited area UB/NMC eta model - the updated version of the previous HIBU model (Mesinger et al., 1988; Janjić 1989).

The inclusion of the UB/NMC eta model into operational system has been planned to be done by the end of 1989. The operational handling of the disseminated ECMWF products in GRIB form is being realized through the specially designed YUMOS component - the sub-system for reception, local storage and the access to the ECMWF products. The local fields data base (FDB) composed of the ECMWF products disseminated daily is used for the following purposes:

- defining the time-dependent conditions at the boundaries of limited-area model;
- as the first-guess fields in the limited-area model;
- for the graphic presentation of the ECMWF products in synoptic practice;

- for further dissemination of the ECMWF fields to the domestic regional centres following their special requirements.

Fig. 1 presents the main components of the ECMWF sub-system as a part of YUMOS.

The other YUMOS sub-system for the GTS data handling is also being developed using the binary code (BUFR in this case). Finally, the UB/NMC eta model prognostic fields will be coded also in GRIB form and stored in the separate FDB.

2. Sub-system for the ECMWF products handling

Since the beginning of August 1988, the ECMWF has been disseminating prognostic products in GRIB form to the Yugoslav Meteorological Service. This dissemination has been started after establishing the link between the ECMWF VAX cluster and Yugoslav telecommunication system based on MICRO VAX computers and DECNET Protocol. The speed of communicating is 9 200 bps.

2.1. Acquisition and decoding

The Yugoslav Meteorological Service accepts daily 974 ECMWF prognostic fields. The dissemination request is formulated in the following way as suggested by ECMWF:

```
DIS,TYPE=AN,  LEVT=SFC,  LEVE=OFF,  REPR=LL,  GRID=3.0/3.0,
    COUN=YUG,  OPTI=NORM,
    AREA=81.0/-90.0/ 9.0/ 60.0,
    PARA=MSL/ST/10U/10V/2T/2D
DIS,LEVT=PL,
    LEVE=1000/850/700/500/400/300/250/200/150/100,
    PARA=GH/T/U/V
DIS,PARA=Q,
    LEVE=1000/850/700/500
DIS,TYPE=FC,  LEVT=SFC,  LEVE=OFF,
    STEP=6/12/18/24/30/36/42/48/54/60/66/72/78/84/90/96,
    PARA=MSL/ST/10U/10V/2T/2D
DIS,PARA=TP,
    STEP=24/48/72/96/120
DIS,LEVT=PL,
    PARA=GH/T,
    LEVE=1000/850/700/500/400/300/250/200/150/100,
    STEP=6/12/18/24/30/36/42/48/54/60/66/72/78/84/90/96/120,
         144/168/192/216/240
DIS,PARA=U/V,
    LEVE=1000/850/700/500/400/300/250/200/150/100,
    STEP=6/12/18/24/30/36/42/48/54/60/66/72/78/84/90/96
DIS,PARA=Q,
   LEVE=1000/850/700/500
END
```

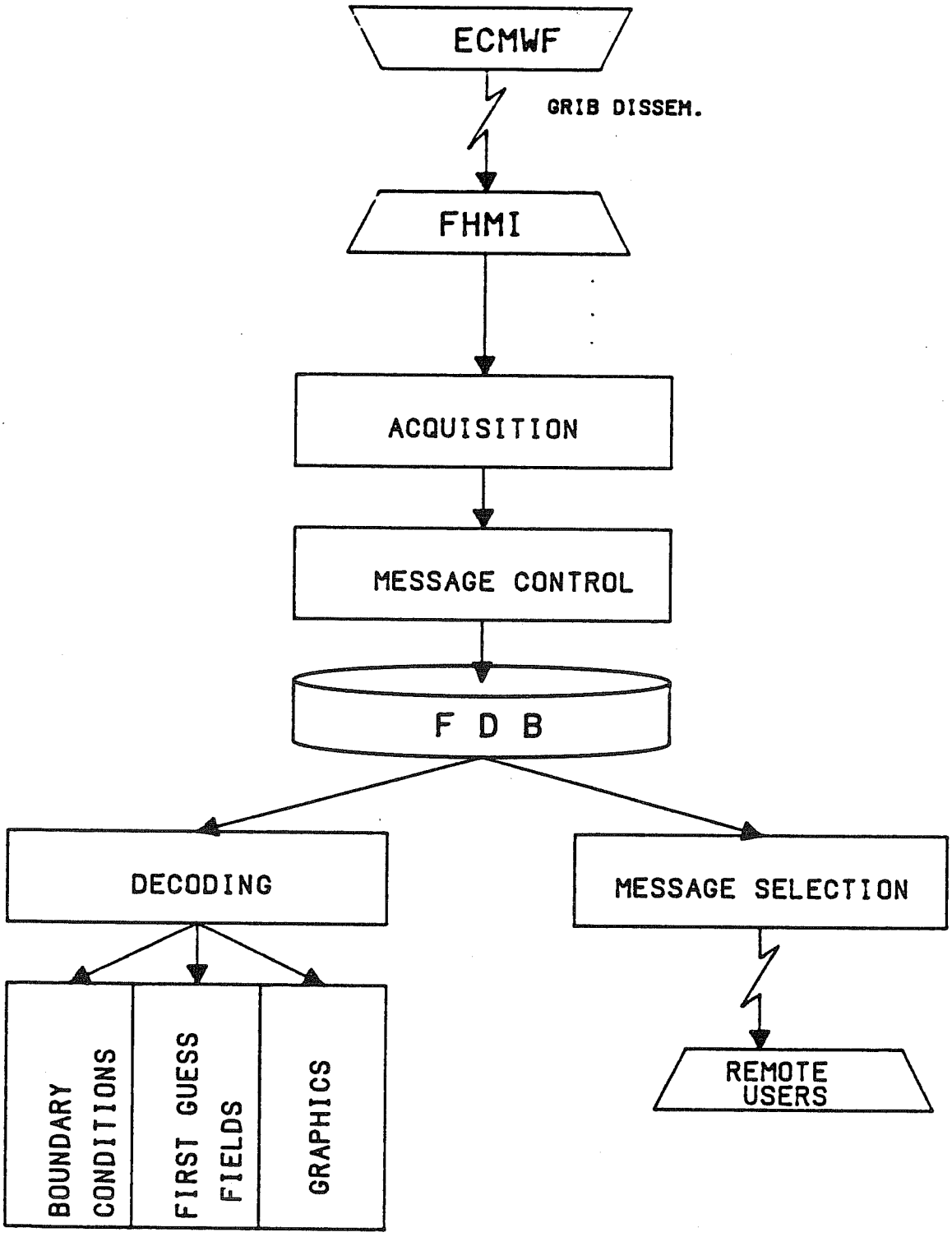


Fig.1: YUMOS sub-system for handling the ECMWF products

Dissemination is realized by the transfer of $i_{max} = 23$ files. One time check point corresponds to one file. Further on, one particular file consists of j_m GRIB messages, where one message denotes one prognostic field for the selected vertical level and selected time check point. Number j_m within one file depends on the dissemination request. The structure of the dissemination set is presented in Fig.2.

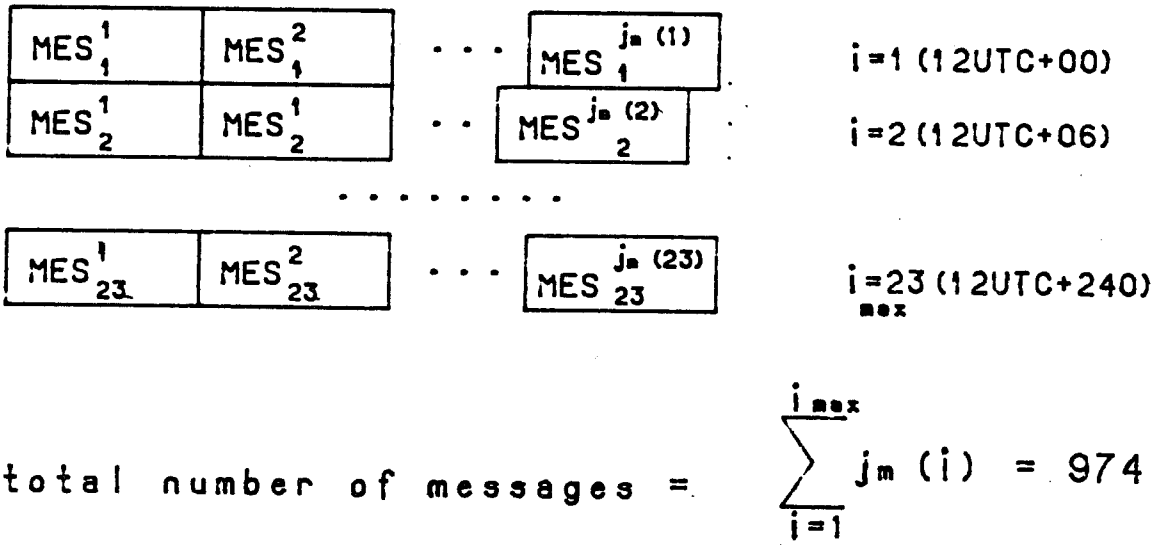


Fig.2 Dissemination ECMWF set structure

The VAX system DD_SWEEPER, developed by the ECMWF, has been installed on the telecommunication computer of the Federal Hydrometeorological Institute. This procedure is activated every 15 minutes and the transfer of files checked at the same time. If yes, the decoding of the available GRIB messages is started. In this phase only the first two GRIB sections are decoded.

The contents of GRIB message (Section IV) is left in the original binary form.

2.2. Formation of the local ECMWF fields data base

In accordance with the stated dissemination request, the request logical table has been defined. The table is three-dimensional array with the dimensions:

- N_{cp} (number of time check points)
- N_p (number of meteorological parameters)
- N_l (number of vertical levels)

The value of the logical variable .TRUE. in the table denotes the field of the particular parameter at the determined level and at the fixed check-point time. By decoding the first two sections of GRIB message, together with consulting the request logical table, its actuality and validity is also checked. After this control, the GRIB message is recorded in FDB. The record is realized by direct access, on the basis of the calculated pointer. The message retains its original GRIB form in FDB. The retention period of the base is two days for the back-up reasons.

The following information illustrate the efficiency of transferring and storing of fields in GRIB code:

- 974 fields of the dimensions 51x25 grid points occupy 3905 VAX blocks (approx. 2 Mbytes),
- the transfer of these messages requires about 45 minutes at the speed of 9200 bps.

2.3. Approach to the local FDB and some applications

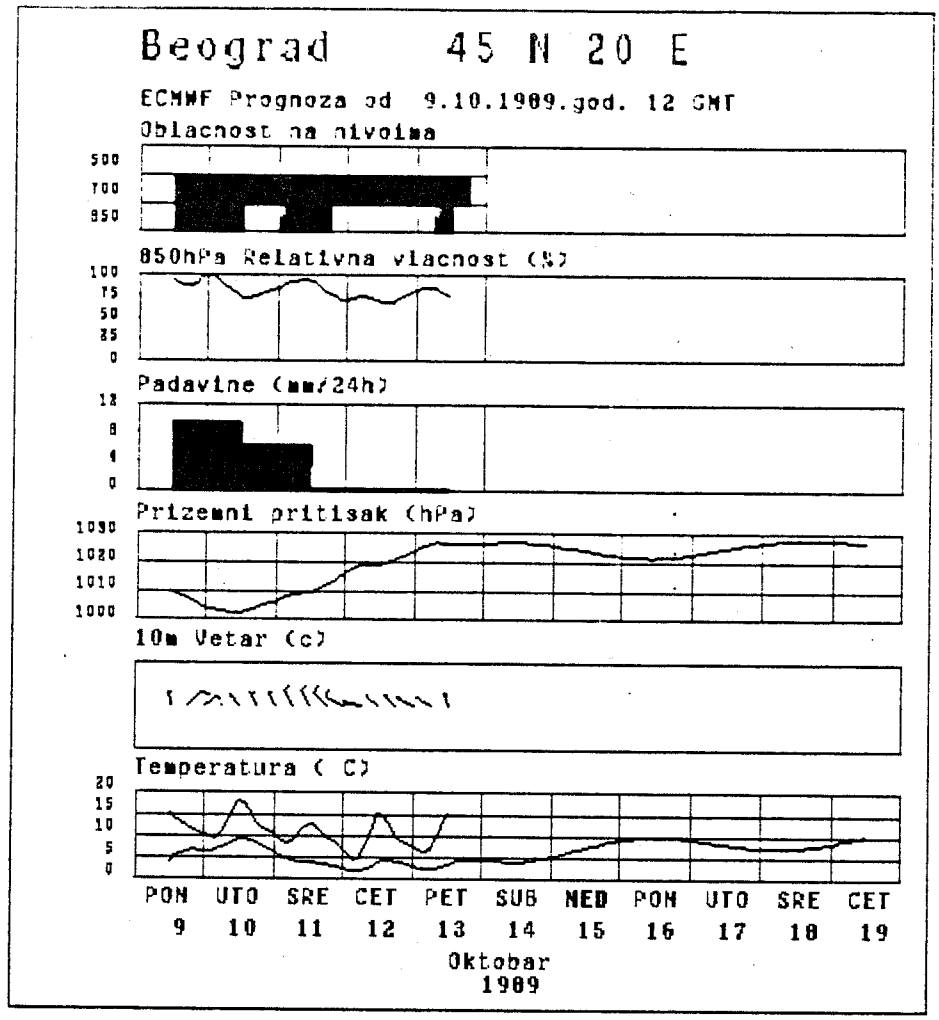
The order of fields in FDB is determined internally and does not coincide with the dissemination order. In order to establish the more efficient access to the fields in different operational applications (boundary conditions, graphic presentation and so on) this redefinition is done. As an example, the index of the pointer denoting the number of the vertical level is the inner index of the logical table pointer array. In this way, the unnecessary skipping over the FDB during the approach to the base is avoided in the great number of the operational programmes.

The interface for the approach to FDB has been made for every operational application using the ECMWF fields as the input parameters. After reading the selected GRIB message, it is decoded and then the grid points values processed in accordance with the concrete application. The graphic presentation of the ECMWF products is one of the applications based on the GRIB organization of the base.

Two examples of the graphical output, operationally used in FHMI are presented in Fig.3.

3. Future plans

The establishment of the FDB has been planned after the introduction of the UB/NMC eta model in routine procedure following the same principles as with the ECMWF FDB. In this way, all existing user's programmes (meteograph, prognostic TEMP, and so on).



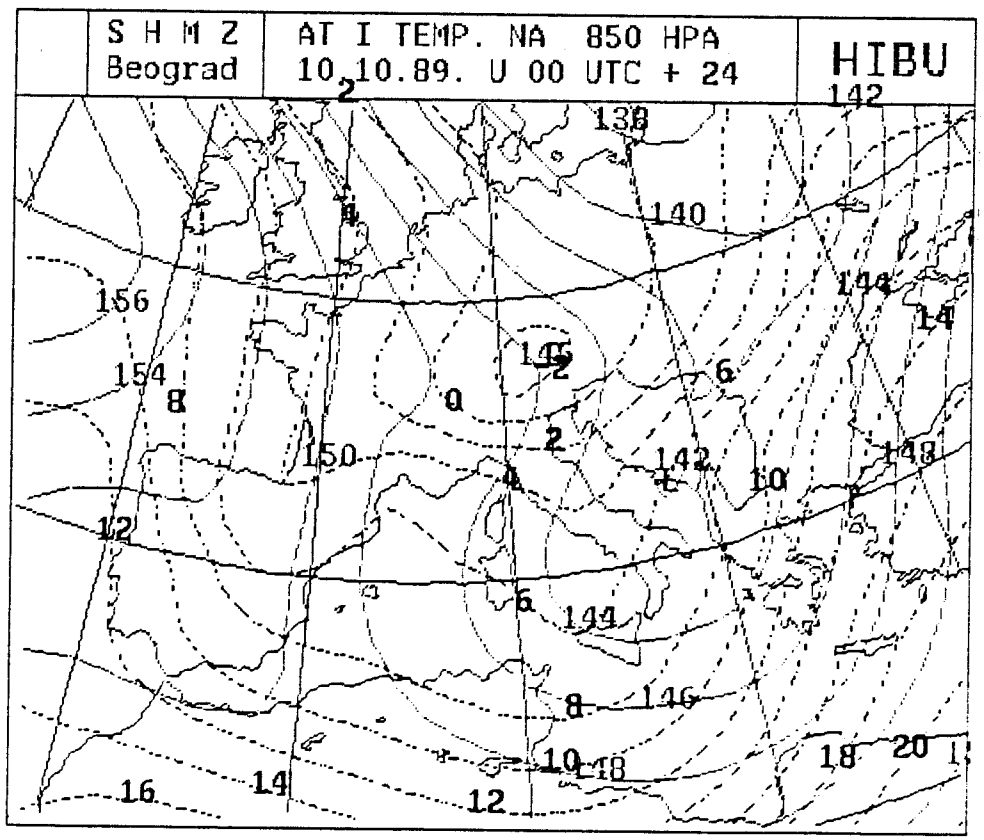


Fig.3 Examples of graphic applications

The Yugoslav meteorological operational system will be based completely on the binary representation of the data after the GTS report data base is transformed into BUFR form as it has been noticed earlier.

Finally, the gradual substitution of the character-oriented telecommunication data transfer between the FHMI and domestic local meteorological centres by the binary code exchange has also been planned.

The first successful steps have already been carried out with the local centres which have the adequate computer equipment.

REFERENCES

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Mesinger, F., Z.I.Janjić, S. Ničković, D. Gavrilov, D.G. Deaven, 1988: The step-mountain coordinate: Model description and performance for cases of Alpine lee cyclogenesis and for case of an Appalachian redevelopment. Mon. Wea. Rew., 116, 1493-1517.