Tests with second-order packing

(type 3 encoding)

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The NFPGRIB defines the level of GRIB coding in output arpege/aladin files. Level of GRIB packing: NVGRIB is one of GRIB packing options. Up to now the keys can assume one of three values for three types of encoding: 0 (no packing at all) or 1 (standart GRIB encoding) or 2 (modified GRIB encoding) (for more see [1]). Two more type (-1 and 3) of encoding data with FA[1] are introduced (ibidem). The impact of the second-order packing (encoding type 3) with the possibility to make compression on the size of data files (and data in general) was the aim of the experiment.

In the next section the experiment is described shortly, then some observations, remarks and met difficulties are pointed and in last part the results (tables and plots of chosen meteorological fields) for default NVGRIB/NFPGRIB=2 and NVGRIB/NFPGRIB=3 for type 3 encoding are shown.

1 Experiment

Within the 3-step experiment configuration e927 (arpege→aladin) as well as ee927 (aladin→aladin) then prediction and fullpos results on account of NVGRIB and NFPGRIB values were examined. Due to running scripts with "new" executable binary ALADIN (see farther) some changes in namelist (modifiying operational ones for configuration e927/ee927, prediction and fullpos) had to be done:

```
&NAMOPH
  NCADFORM=0,
/
&NAMPARO
  LMPOFF=.FALSE.,
  NPROC=$NPROC,
  NPRTRW=$NPROC,NPRTRV=1,
  NPRGPNS=$NPROC,NPRGPEW=1,
  NOUTPUT=1,
/
&NAMPAR1
  NSTRIN=$NPROC,
  NSTROUT=$NPROC,
  LSPLIT=.FALSE.,
/
```

where NPROC=$(Psize).
The default type encoding is 2 so that the namelists assume:

```
&NAMFA
   NBITCS=-1,
   NSTRON=-1,
   NBITPG=-1,
/
&NAMFPC
  CFPFMT='LELAM',
  CFPDOM(1)='FRAN',
```

[1]Fichier Arpege

```
   CFP3DF(1)='TEMPERATURE',
   .
   .
   .
 /
```

or when the default values of NVGRIB and NFPGRIB are put *explicite*:

```
 &NAMFA
    NBITCS=-1,
    NSTRON=-1,
    NBITPG=-1,
    NVGRIB=2,
 /
 &NAMFPC
   CFPFMT='LELAM',
   CFPDOM(1)='FRAN',
   CFP3DF(1)='TEMPERATURE',
   .
   .
   .
   NFPGRIB=2,
 /
```

The results of configuration e927/ee927, prediction and fullpos work with type 3 encoding vs type 2 encoding represented the area of our interests.

- configuration e927, prediction, fullpos

  To start up configuration e927 the historical arpege files fetched from cougar (delage):
  `/chaine_arpege/mxpt/mxpt001/arpege/oper/production/2005/07/28/r0/`
  as the input were used. The result of configuration e927 run represents the input given to prediction startup and next, based on prediction output data files, fullpos was launched. Finally the surface temperature, surface pressure and sea level pressure (as the example of fields obtained for one set of NVGRIB and NFPGRIB keys) were ploted and size of files with data calculated in each step with various values of NVGRIB and NFPGRIB were listed for comparison.

  In case of omitted run of configuration e927 the prediction was started up with aladin historical files from cougar (delage):
  `/chaine_arpege/mxpt/mxpt001/france/oper/production/2005/07/28/r0/`

  Other files used in tests:

  Executable binary ALADIN file (size 117986028) fetched from `tora`:
  `/u/gp/mrpm/mrpm602/pack/nfpgrib/bin/`

Clim files for July: `clim_t358_isba07` and `clim_france_isba07` from `tora`:
`/u/ch/mxpt/mxpt001/arpege/france/oper/const/clim/mens`
and
`/u/ch/mxpt/mxpt001/aladin/france/oper/const/clim/mens`
respectively

Namelists `namel_e927`, `namel_previ` from `tora` (with changes as above):
`/u/ch/mxpt/mxpt001/aladin/france/oper/namel`

- configuration ee927, prediction, fullpos

  To complete the experiment on account of `NVGRIB` and `NFPGRIB` the tests with configuration ee927, prediction and fullpos were done for the same (identity) domain i.e. France→France and try for France→Pyrenees too.

  - France (identity)

    To start up configuration ee927 the historical aladin files were fetched from cougar (delage):
    `/chaine_arpege/mxpt/mxpt001/france/oper/production/2005/07/28/r0/`

    Executable binary ALADIN file (size 117986028) fetched from `tora`:
    `/u/gp/mrpm/mrpm602/pack/nfpgrib/bin/`

    Clim file for July (used twice as `const.clim.FRAN` and `Const.Clim`):
    `clim_france_isba07` from `tora`:
    `/u/ch/mxpt/mxpt001/aladin/france/oper/const/clim/mens`

    Namelists `namel_e927`, `namel_previ` from `tora` (with changes as above):
    `/u/ch/mxpt/mxpt001/aladin/france/oper/namel`

  - Pyrenees

    To run configuration ee927 for France→Pyrenees
    `/u/gp/mrpm/mrpm602/fa/ald/his/france_19980608.h12.ISBA`
    `/u/gp/mrpm/mrpm602/fa/ald/cli/france.m06.ISBA`
    `/u/gp/mrpm/mrpm602/fa/ald/cli/pyrenees.m06`
    files (fetched from `tora`) were used (as the only ones available for mentioned above domain)

    Executable binary ALADIN file (size 117986028) fetched from `tora`:
    `/u/gp/mrpm/mrpm602/pack/nfpgrib/bin/`
    In addition some changes in namelist were made in this case:

```
NVCLIA=0
NVGSN=.F.
LO3ABC=.F.
```

The results of configuration e927/ee927, prediction and fullpos work with type 3 encoding vs type 2 encoding represented the area of our interests.

2 Remarks

In general, scripts to enable configuration e927/ee927 with `NVGRIB`=2 are called cou3 while those enabling configuration e927/ee927 with `NVGRIB`=3 are marked cou3v3. *Per analogiam* the names of scripts starting up prediction with `NVGRIB`=2 are pre3 and pre3v3 are the names of ones launched prediction with `NVGRIB`=3. As for fullpos scripts fpos3 and fpos3v3 (with `NFPGRIB`=2 both) used output data from pre3 and pre3v3 respectively as input. Output data files from configuration e927/ee927 run are put in `COUPL` subdirectories, the ones from prediction are in `RESULT`, and results of fullpos can be found in `RESULT_fpos` subdirectories. Plots (with the names after tests markers and *T* for surface temperature, *P* for surface pressure and *MSL* for sea level pressure) are in
`/cnrm2_a/mrpe/mrpe690/lato05/RESULTS_pic`
directory. Encoding types used in tests and markers of the tests as well as directories on cougar where are stored example data, output files with annotation and remarks and scripts are listed bellow:

vNOe22p33
`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/vNOe22p33`

conf. e927:	no run	
prediction:	`NVGRIB`=2	3 processors
fullpos:	`NFPGRIB`=2	3 processors

vNOe32p33
`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/vNOe32p33`

conf. e927:	no run	
prediction:	`NVGRIB`=2	3 processors
fullpos:	`NFPGRIB`=2	3 processors

vd32p233
`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/vd32p233`

conf. e927:	`NVGRIB`=2	2 processors
prediction:	`NVGRIB`=2	3 processors
fullpos:	`NFPGRIB`=2	3 processors

v332p222
`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v332p222`

conf. e927:	`NVGRIB`=3	2 processors
prediction:	`NVGRIB`=3	2 processors
fullpos:	`NFPGRIB`=2	2 processors

v332p333

`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v332p333`

conf. e927:	`NVGRIB=3`	3 processors
prediction:	`NVGRIB=3`	3 processors
fullpos:	`NFPGRIB=2`	3 processors

v3332p222

`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v3332p222`

conf. e927:	`NVGRIB=3`, `NFPGRIB=3`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	2 processors

v3333p222

`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v3332p222`

conf. e927:	`NVGRIB=3`, `NFPGRIB=3`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=3`	2 processors

NOTE: the same as for v3332p222 test directory; fullpose output: fpos3v3.o93315_3333p222, fullpose output data file (example): PFFPOS000v3nfpgrib3+0006, no plot by CHAGAL

vd32p222i (identity)

`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/vd32p222i`
or `/cnrm2_a/mrpe/mrpe690/lato05/EE927/FR_FRi`

conf. ee927:	`NVGRIB=2`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	2 processors

v332p222i (identity)

`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v332p222i`
or `/cnrm2_a/mrpe/mrpe690/lato05/EE927/FR_FRi`

conf. ee927:	`NVGRIB=3`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	2 processors

v332p223

`/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v332p223`

conf. e927:	`NVGRIB=3`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	3 processors

v2p2 (Pyrenees)

`/cnrm2_a/mrpe/mrpe690/lato05/EE927/FR_PIR`

conf. ee927:	NVGRIB=2	2 processors
prediction:	no run	
fullpos:	no run	

v3p2 (Pyrenees)

`/cnrm2_a/mrpe/mrpe690/lato05/EE927/FR_PIR`

conf. ee927:	NVGRIB=3	2 processors
prediction:	no run	
fullpos:	no run	

NOTE: with NVGRIB=3 doesn't work (nonhydrostatic fields removal did not help); script: cou3v3_pir, comment: cou3_pi.o3026 or cou3_pi.o3076 (cou3_pi.o3090)

In order to satisfy the correct scripts' work (and succeed) it is necessary to remember about some "details".

- to conduct configuration e927 with 2 processors `VPP_MBX_SIZE=64000000` can be set while configuration e927 with 3 processors `VPP_MBX_SIZE=128000000`[2] requires (for more see: cou3_2p3, cou3_3p3, c3v3_06.o97348_2p3 or c3v3_06.o97358_3p3 in `/cnrm2_a/mrpe/mrpe690/lato05/DO_analizy` on cougar)
- if NVGRIB=3 is switched on the every next step the same number of processors is needed consistently e.g:

conf. e927:	no run	
prediction:	NVGRIB=3	3 processors
fullpos:	NFPGRIB=2	3 processors

  or

conf. e927:	NVGRIB=2	2 processors
prediction:	NVGRIB=3	3 processors
fullpos:	NFPGRIB=2	3 processors

  Otherwise (e.g.

conf. e927:	NVGRIB=3	2 processors
prediction:	NVGRIB=3	2 processors
fullpos:	NFPGRIB=2	3 processors)

  "rubbish" appears as a result of computation. Compare Fig.2, Fig.3 and Fig.9 that exemplify above examples. (For more see: `/cnrm2_a/mrpe/mrpe690/lato05/WORK_NVGRIB3/v332p223` with subdirectories or output pre3v3_.o93831_3333p23 and script pre3v3_3 "after" e927 with 2 processors or another output fpos3v3.o93806_3333p223 and script fpos3v3_3 "after" e927 and prediction with 2

[2] i.e more than 64000000

processors (`/cnrm2_a/mrpe/mrpe690/lato05/DO_analizy` both) on cougar and compare with v3333p222 or with v3332p222)

- When the ee927 configuration is run for the same domain (identity) the keys from `&NAMFPD` must be removed i.e.:

```
&NAMFPD
/
```

  for more see: cou3 and c3v3_00.o416, c3v3_00.o417, c3v3_00.o418 (`NFPGRIB`=2) or cou3_3, c3v3_00.o444, c3v3_03.o445, c3v3_06.o446 (`NFPGRIB`=3) with no key in
  `/cnrm2_a/mrpe/mrpe690/lato05/EE927/FR_FRi`
  then compare with cou3v3 and c3v3_00.o171, c3v3_03.o172 or c3v3_06.o173 (ibid.) with values for the keys set explicitly (despite identity the `LLSAME`=.F. and `LLESAME`=.F. in this case)

- configuration ee927 France→Pyrenees with type 3 encoding does not work (works with default type 2). Results and annotation can be found in
  `/cnrm2_a/mrpe/mrpe690/lato05/EE927/FR_PIR`

- Plotting program for visualizing results of aladin model CHAGAL doesn't work with data from fullpos running with `NFPGRIB`=3 for that reason for all (but one) fullpos process `NFPGRIB`=2 was used.

Bellow the influence of the type encoding on the size of output data file in each of step of experiment is shown in the tables.

France

	`NVGRIB`=2 and/or `NFPGRIB`=2 file size [MB]	`NVGRIB`=3 and/or `NFPGRIB`=3 file size [MB]
configuration e927	36.13	17.40 ÷ 17.79
prediction	42.69 (39.44 for hh=00)	19.27 ÷ 19.96 (17.33 for hh=00)
fullpos	1.87	1.62

Table 1 The impact of the second-order packing (encoding type 3) with the possibility to make compression on the size of data files in case arpege→aladin.

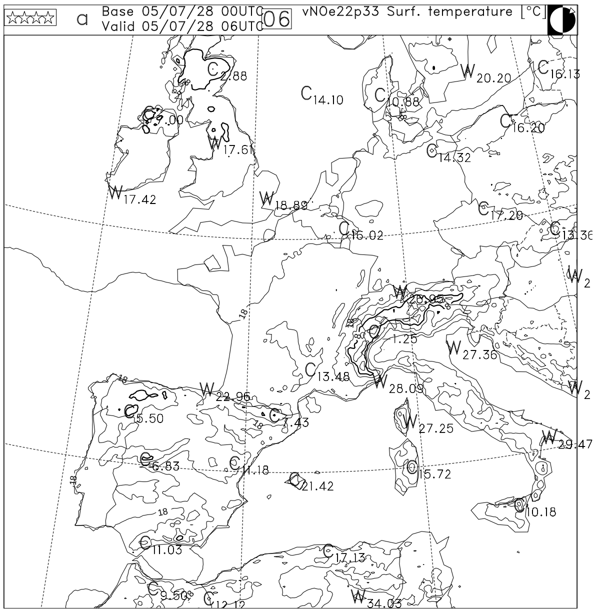
France (identity)

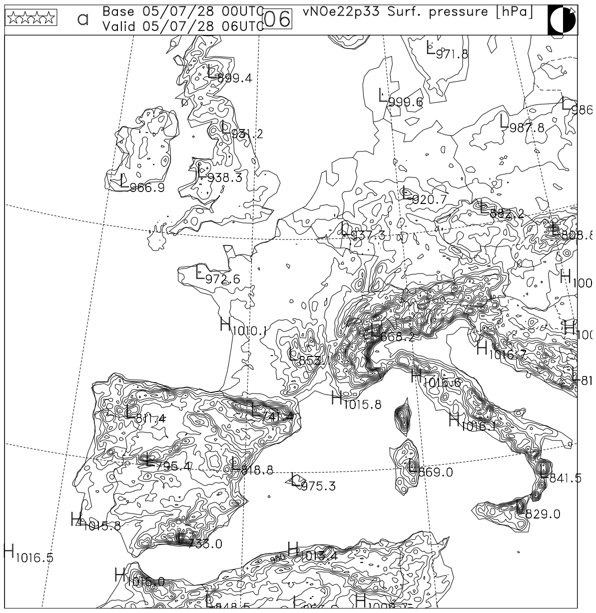
	`NVGRIB`=2 and/or `NFPGRIB`=2 file size [MB]	`NVGRIB`=3 and/or `NFPGRIB`=3 file size [MB]
configuration ee927	36.13	16.37 (15.58for hh=00)
prediction	42.69 (39.44 for hh=00)	19.24 ÷ 19.63 (17.35 for hh=00)
fullpos	1.87	

Table 2 The impact of the second-order packing (encoding type 3) with the possibility to make compression on the size of data files in case aladin→aladin.

Note: the size of the files in case of `NVGRIB/NFPGRIB`=2 (e.g vd22p222i or vNOe22p33) is the same for given step (for example configuration e927 output data files size are 36126720) while (having a bearing on sizes) second-order packing reduses sizes of files but the files vary in size on the other hand.
Note: there is no plots for R_3333p222 (CHAGAL doesn't work). No 'stop', 'jwe', nor 'abort' (but 'WARNING') appeared in output (see: fpos3v3.o93315_3333p222)

Last, the plots of meteorological fields (surface temperature, surface pressure, and sea level pressure) show how the type 3 encoding affects the results. The prediction and fullpos (no configuration e927) with default values of `NVGRIB` and `NFPGRIB` were run to obtain the result to compare with (vNOe22p33). Then the plots according the changes brought on are inserted.





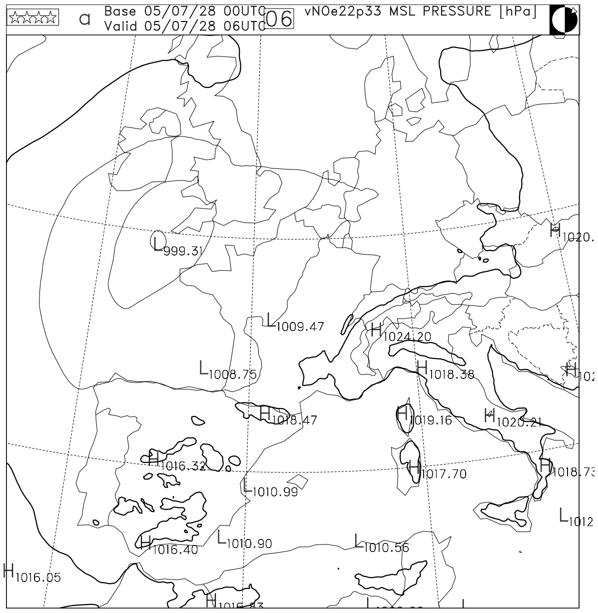
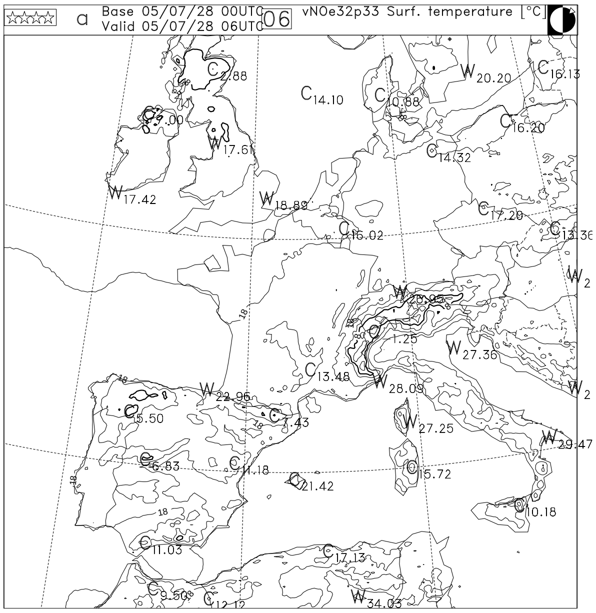
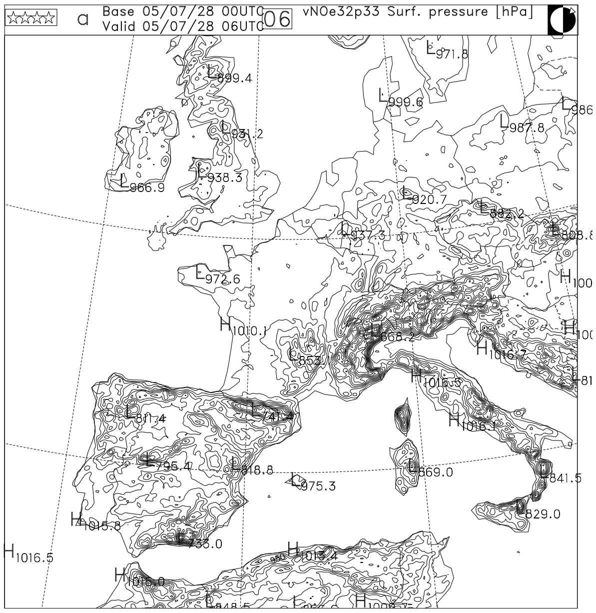


Fig.1 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	no run	
prediction:	`NVGRIB=2`	3 processors
fullpos:	`NFPGRIB=2`	3 processors





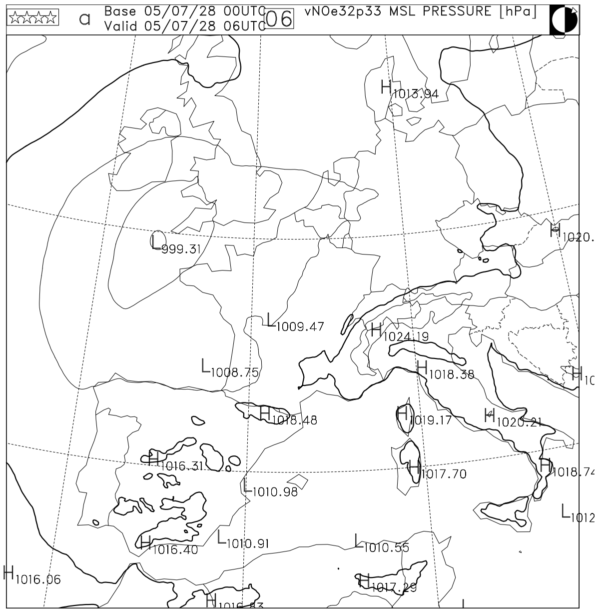
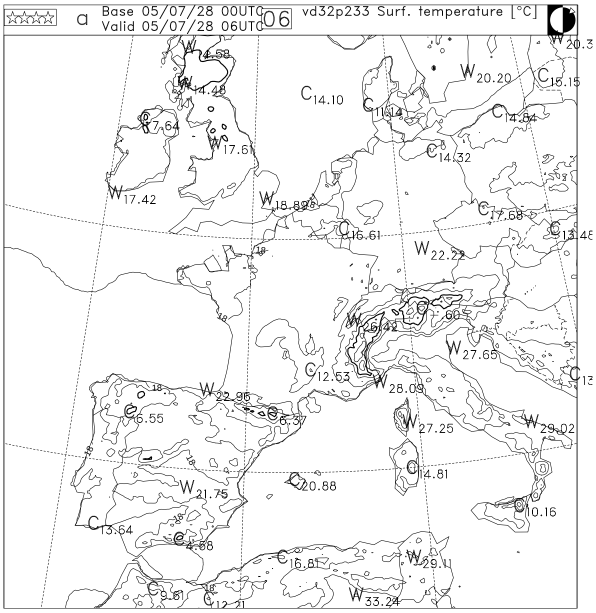
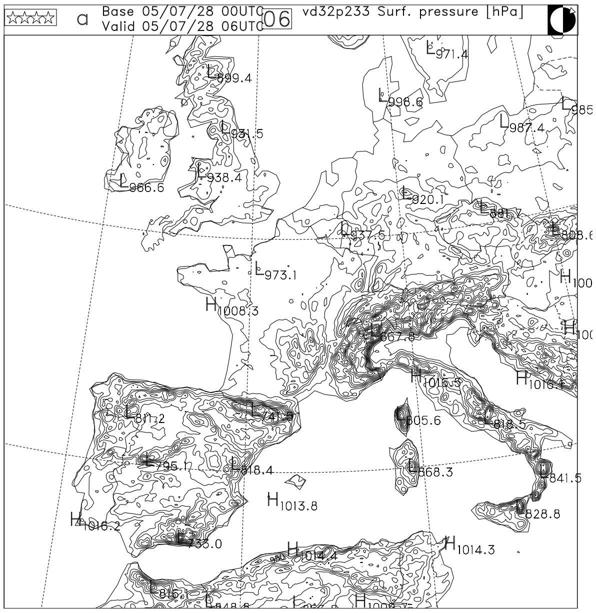


Fig.2 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	no run	
prediction:	NVGRIB=3	3 processors
fullpos:	NFPGRIB=2	3 processors





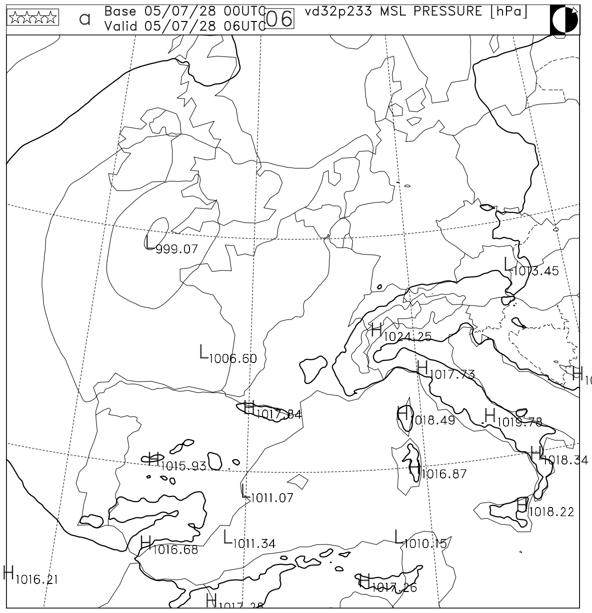
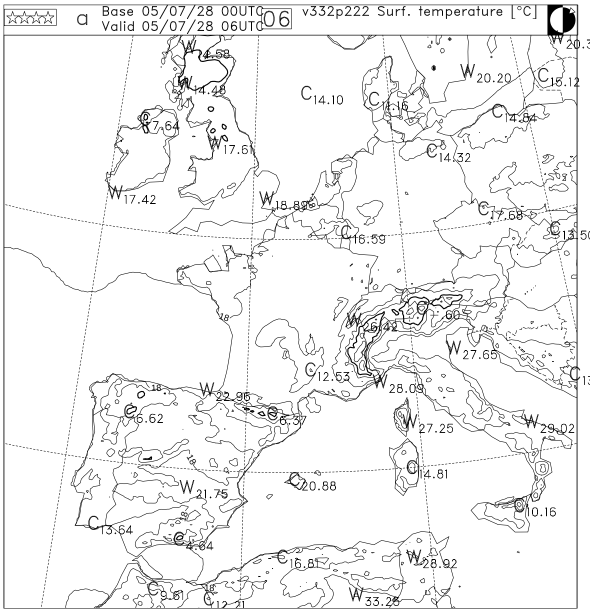
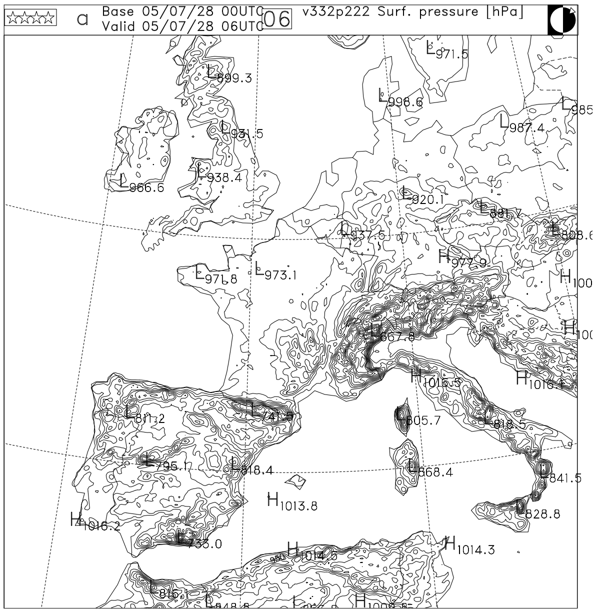


Fig.3 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	`NVGRIB` default (=2)	2 processors
prediction:	`NVGRIB=3`	3 processors
fullpos:	`NFPGRIB=2`	3 processors





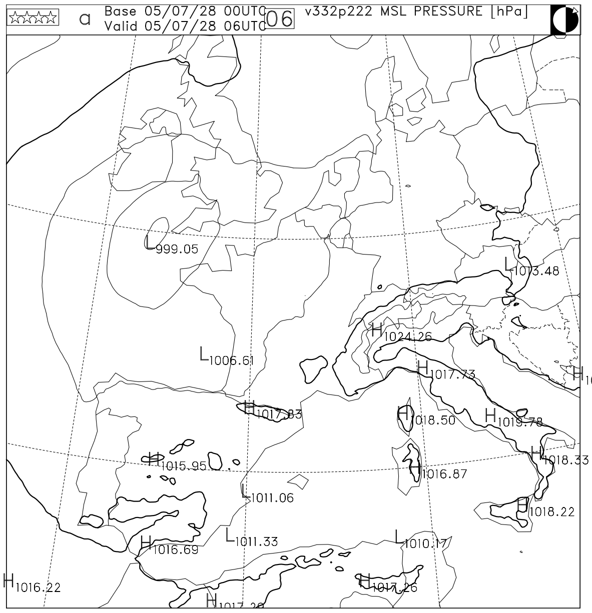
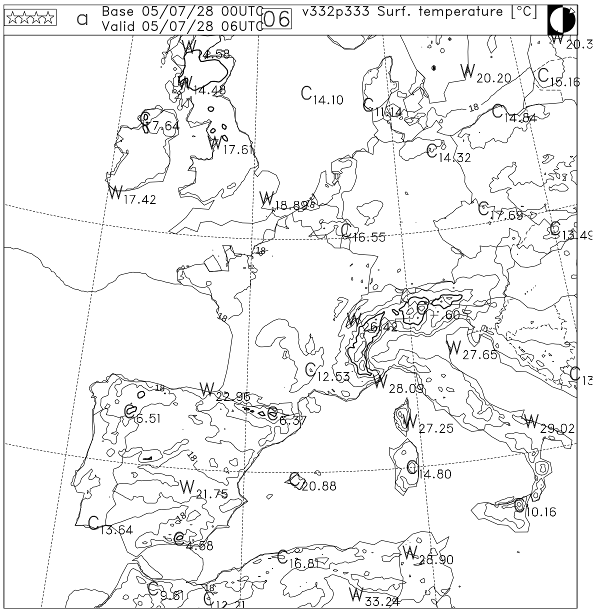
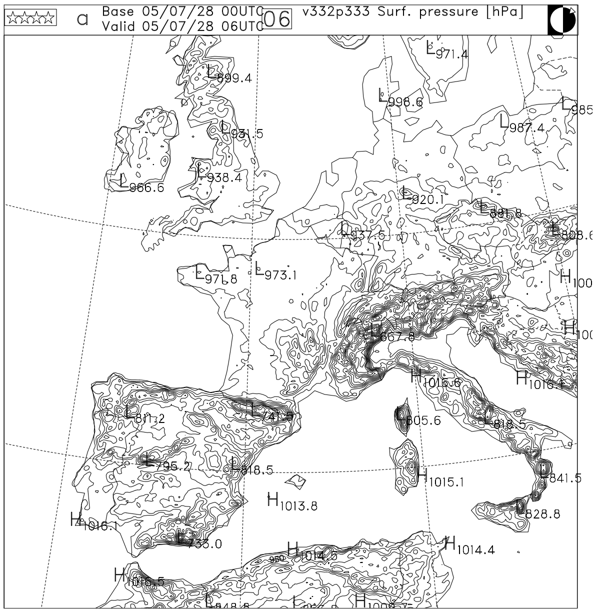


Fig.4 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	NVGRIB=3	2 processors
prediction:	NVGRIB=3	2 processors
fullpos:	NFPGRIB=2	2 processors





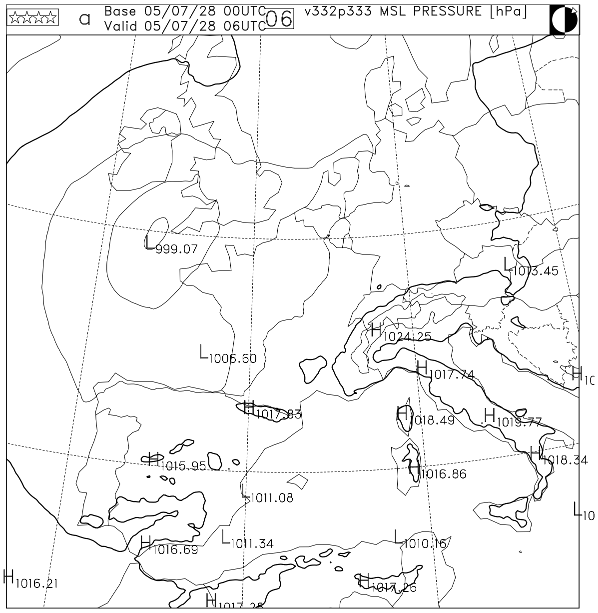
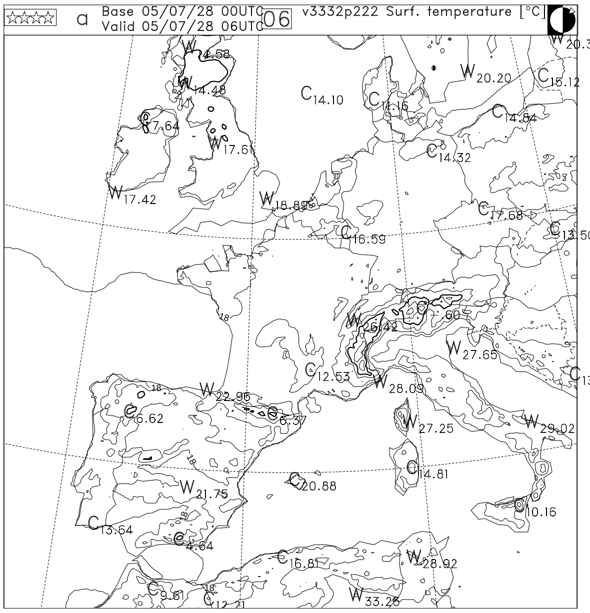
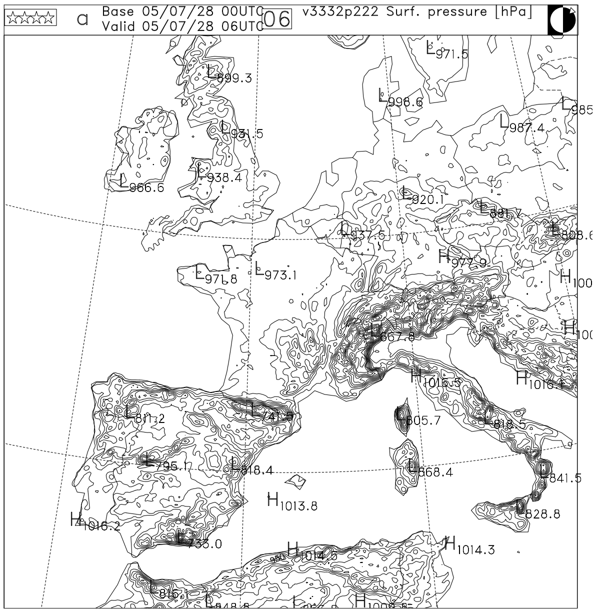


Fig.5 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	`NVGRIB=3`	3 processors
prediction:	`NVGRIB=3`	3 processors
fullpos:	`NFPGRIB=2`	3 processors





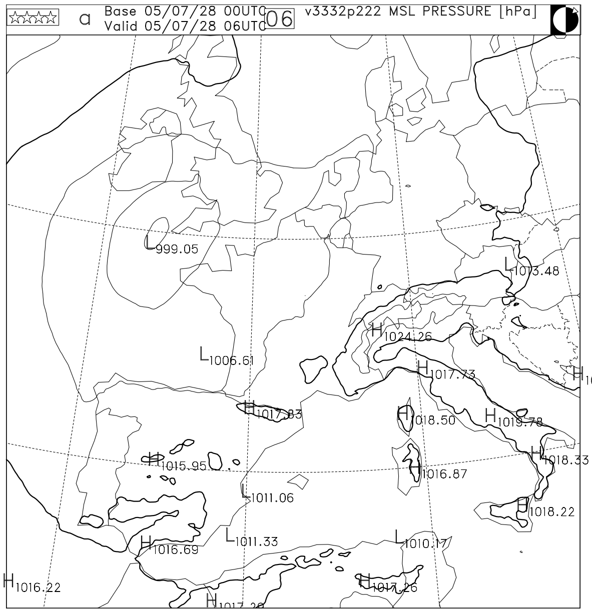
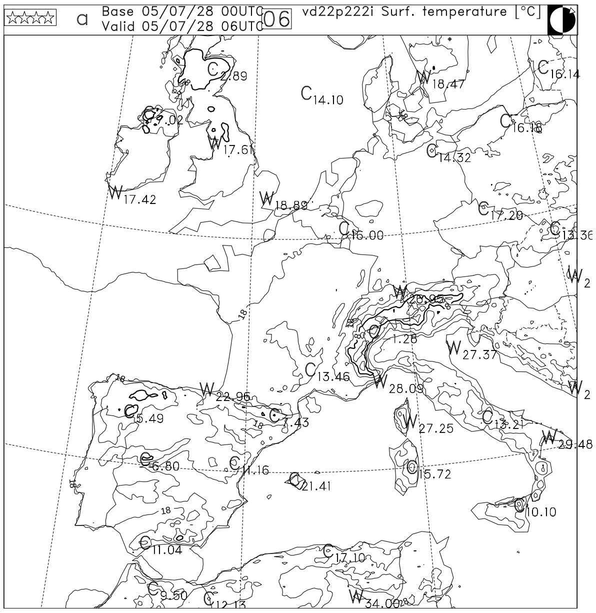
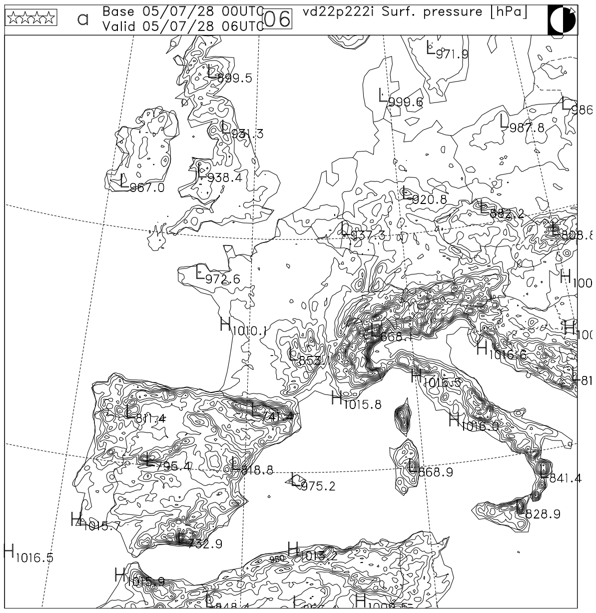


Fig.6 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	NVGRIB=3 NFPGRIB=3	2 processors
prediction:	NVGRIB=3	2 processors
fullpos:	NFPGRIB=2	2 processors





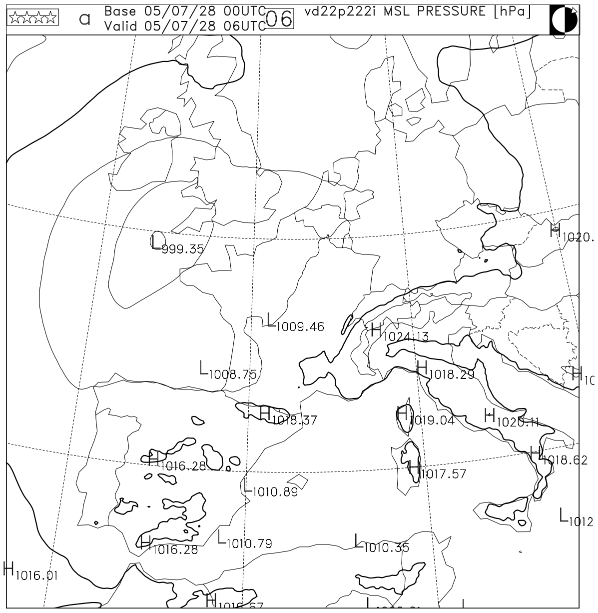
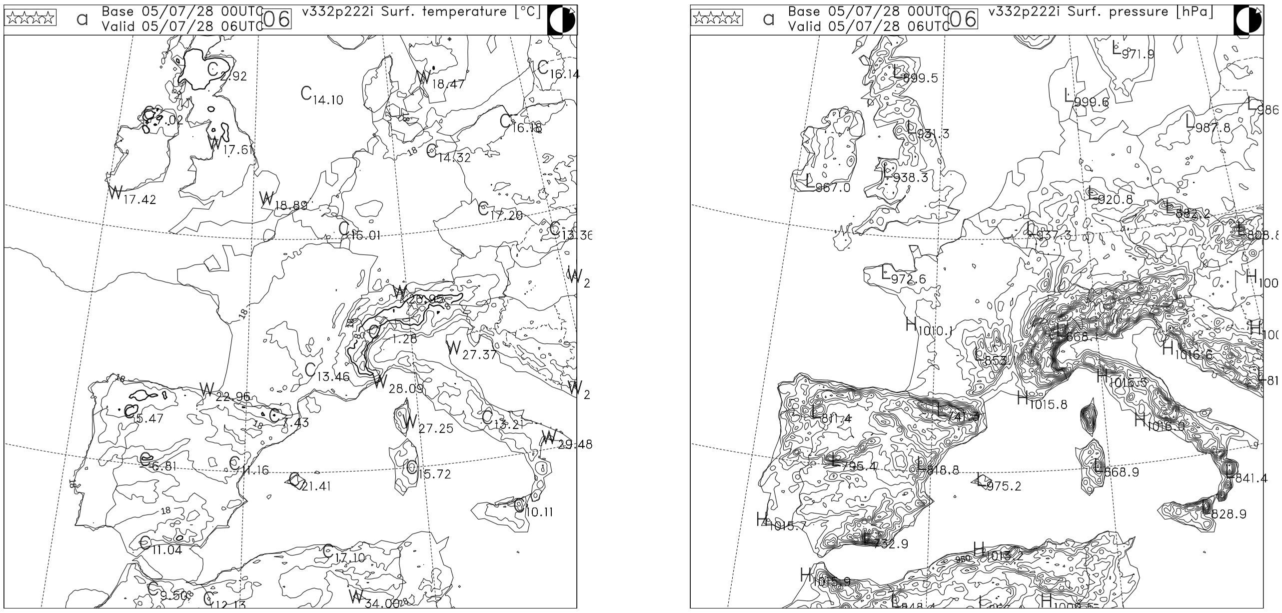


Fig.7 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. ee927 (identity):	no run	
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	2 processors



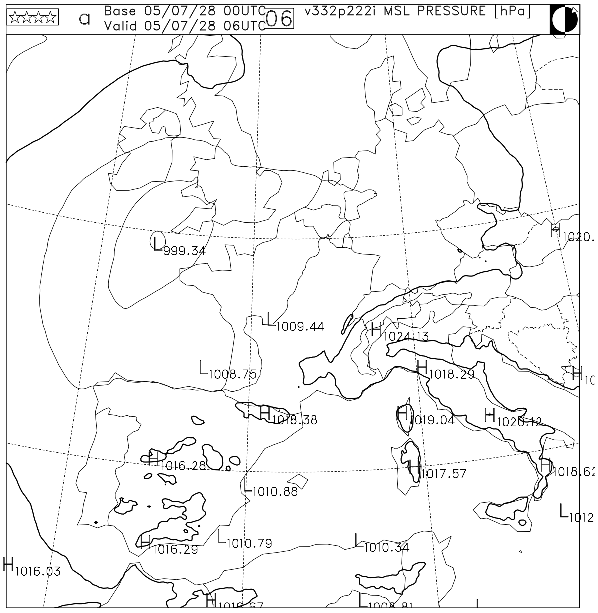
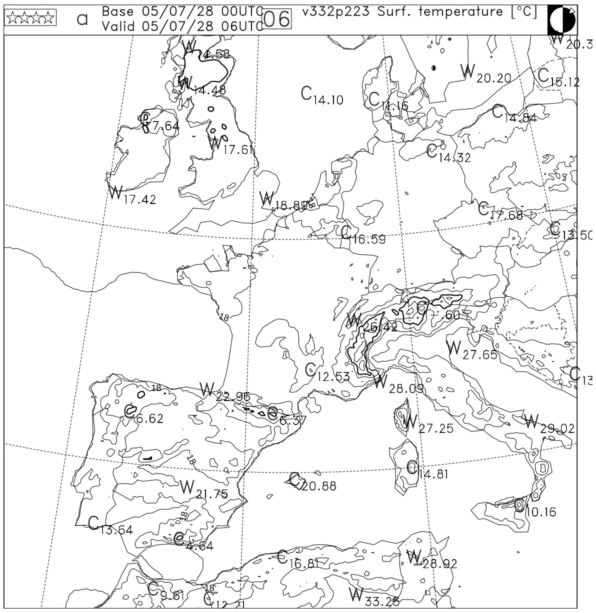


Fig.8 Surface temperature (upper left), surface pressure (upper right) and sea level pressure (bottom left) in case of:

conf. ee927 (identity):	`NVGRIB=3`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	2 processors



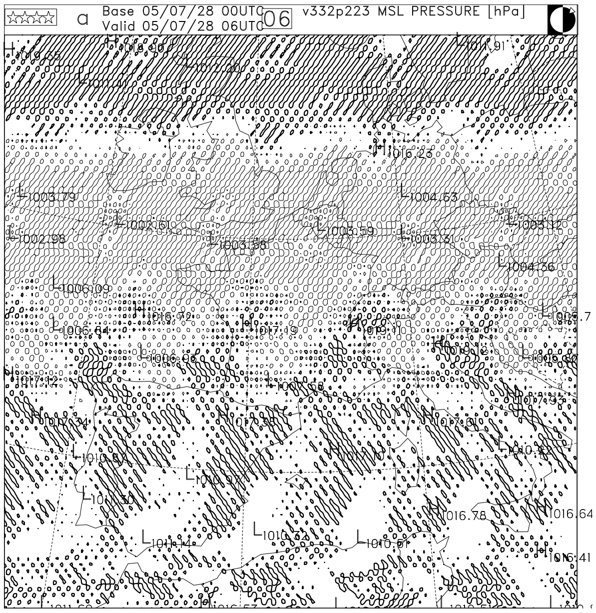
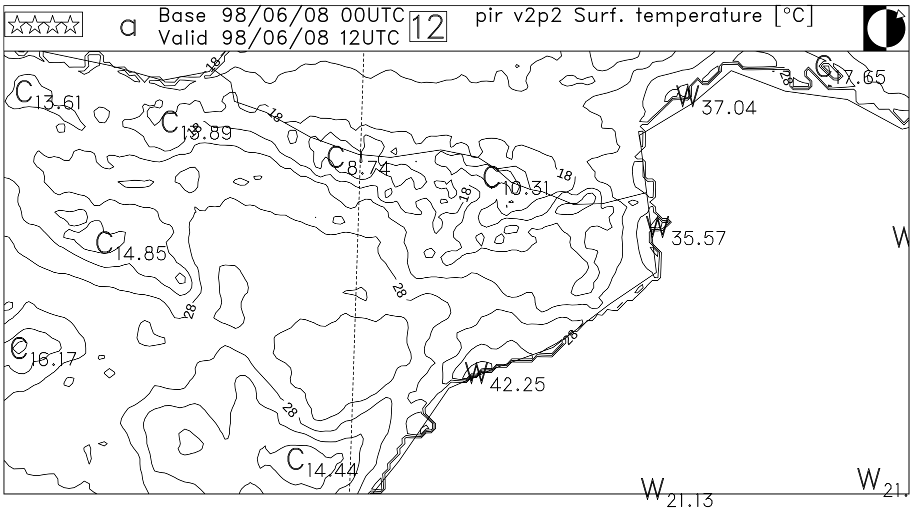


Fig.9 Surface temperature (upper left),
surface pressure (upper right)
and sea level pressure (bottom left) in case of:

conf. e927:	`NVGRIB=3`	2 processors
prediction:	`NVGRIB=3`	2 processors
fullpos:	`NFPGRIB=2`	3 processors



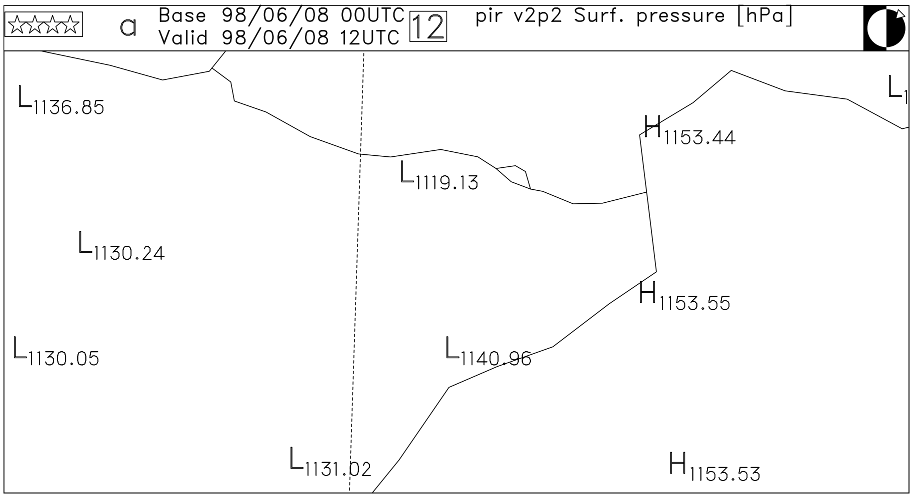


Fig.10 Surface temperature (upper), surface pressure (bottom); Pyrenees mountain in case of:

conf. e927: `NVGRIB=2` 2 processors
prediction: no run
fullpos: no run

REFERENCES

[1] Paradis, D.,Clochard, J., *GRIBEX introduction in FA files*, ALADIN Newsletter 27, July- December 2004