FULL-POS

USERS' GUIDE

in ARPEGE/IFS cycle CY23T1

and

ALADIN cycle AL14 with ARPEGE/IFS cycle CY23T1

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1 INTRODUCTION

FULL-POS is a powerful and sophisticated post-processing package. It is intended to be used for operation and research as well.

FULL-POS has two main parts : the vertical interpolations, then the horizontal interpolations. In between, a spectral treatment is sometimes possible for the dynamic fields.

1.1 Organisation of this manual

This manual contains information about the installation, the use and the management of the code of FULL-POS.

It is assumed that the user has some familiarity with the configuration 001 of ARPEGE/IFS or ALADIN and understands the basic features of post-processing operations.

Much of the information presented in this document is also available inside the code via the comments lines, especially in the comdecks.

1.2 Reporting bugs

If you find any bugs or deficiencies in this software, then please write a short report and send it to Ryad.Elkhatib@meteo.fr

FULL-POS has so many features that it is difficult to validate all the possible namelists configurations.

If you have wishes for further developments inside FULL-POS, then please write a short report as well, that could be discussed.

1.3 Terminology

This section describes certain words which are used in this document.

POS : this is the subroutine which performs the vertical interpolations ; its name will be used to talk about the previous internal post-processing in ARPEGE/IFS.

Off-line : the post-processing is performed as if it was a particular configuration of ARPEGE/IFS

In-line : the post-processing is performed during the direct integration of the model

Spectral fit : after the vertical interpolations, dynamic fields can be fitted in the spectral space before the horizontal interpolations in grid-point space.

Spectral filter : this concerns only the fields which are spectrally fitted. in the spectral space, these fields can be filtered ; there are two kinds of filters : the so-called "THX" filter for derivatives (vorticity, vertical velocity, deformations etc) and the so-called "bell-shape" filter for geopotential, temperature, medium sea level pressure, etc. Concerning the derivatives, the spectral "THX" filter consists in a smooth overtruncation of the fields in the unstretched spectral space ; concerning the other fields, the spectral filter consists in a bell-shaped diffusion in the stretched spectral space.

Configuration 927 : special configuration of post-processing which enables to create historical files. Note that the name "configuration 927" is an historical error : in fact, this process is not a specific configuration, but just a particuliar post-processing namelist (inside the configuration 001).

1.4 Summary of features

FULL-POS is a post-processing package containing many features. The following is just a small list of the main available features :

- Multiple fields from the dynamics, the physics, the cumulated fluxes or the instantaneous fluxes
- post-processing available on any pressure level, height (above output orography) level, potential vorticity level, potential temperature level or model level
- Multiple latitudes X longitudes output subdomains, or one gaussian grid with any definition, or one grid of kind 'ALADIN', with any definition
- Multiple possible optimisations of the memory or the CPU time used, through specific I/O schemes, vectorisation depth, distribution and various other segmentations.
- Possible spectral treatment for all the fields of a given post-processing level type
- Customization of the names of the post-processed fields
- Support for computing a few other fields without diving deeply into the code of FULL-POS
- Ability to perform post-processing in-line or off-line
- Ability to make ARPEGE or ALADIN history files, starting from a file ARPEGE or a file ALADIN (processes "927", "E927" and "EE927")

1.5 Acknowledgements

Thanks to Alain Joly who invented first the "French POS" concept which became "FULL-POS", and to Jean-François Geleyn who has adopted my point of view about this internal new post-processing. Credit and thanks to Jean Pailleux who convinced ECMWF to let METEO-FRANCE implement this software in ARPEGE/IFS ; to Mats Hamrud for his advice on vertical scannings, his help for long distance debugging and the re-usable code he has written on I/O scheme, spectral transforms and horizontal scanning ; to Vincent Cassé for these long talks about interpolations and how the so-called "semi-lagrangian buffers" work ; to Jean-Marc Audoin and Eric Escalière who helped me to write a part of the code ; to Patrick Le Moigne and Jean-Daniel Gril who spent time to let me try to understand the geometry of ALADIN. Congratulations and tanks to Gabor Radnoti who managed in the huge task to implement FULL-POS inside ALADIN ; to Jaouad Boutahar and Mehdi Elabed for their debugging in FULL-POS. Thank you to Jean-Noel Thepaut who believed in the use of FULL-POS for the incremental variational analysis. Thank to you all who will use FULL-POS and be happy of it (and maybe find out residual bugs ?)

Special thanks to the workstation "Nout", to Edit_file and the mouse on NOS-Ve with which the code is typed, and to the user friendly Crisp editor under UNIX environment, with which this manual has been typed.

2 BASIC USAGE

2.1 Getting started

2.1.1 Installing the software

In METEO-FRANCE, FULL-POS is available in Arpege/Ifs cycle CY22, and in Aladin cycle AL13 matching with Arpege/Ifs cycle CY22T2.

You will also need the auxilary library and eclib for fft's.

2.1.2 Preparing the namelists file

Be sure that your namelists file contains the following namelists :
NAMAFN, NAMFPC, NAMFPD, NAMFPG, NAMFPF, NAMFPIOS, NAMFPSC2.
All these namelists are specific to FULL-POS, except NAMAFN which is a little bit more general.
FULL-POS is also using NAMCT0, and possibly NAMDIM.

2.1.3 Running FULL-POS

FULL-POS is executable only in configuration 001 ; so set NCONF=1 in NAMCT0. Then, to invoke FULL-POS, you have to set LFPOS = .TRUE. in NAMCT0. Note that it is not possible to run all together FULL-POS and the previous internal post-processing POS ; When LFPOS = .TRUE., POS is desactivated.

Then, to choose the post-processing time steps, you must use NFRPOS and NPOSTS as you did before with POS.
Remember :
if NPOSTS(0)=0 then
    post-processing occurs every NFRPOS time steps (including time 0)
if NPOSTS(0) >0 then
    NPOSTS(0) is the number of post-processing events,
    and the post-processing time steps will be :
    NPOSTS(1)*NFRPOS, NPOSTS(2)*NFRPOS,
    ... NPOSTS(NPOSTS(0))*NFRPOS
if NPOSTS(0) <0 then
    NPOSTS(0) is the number of post-processing events,
    and the post-processing events will occur at :
    NPOSTS(1)*NFRPOS hours, NPOSTS(2)*NFRPOS hours,
    ... NPOSTS(NPOSTS(0))*NFRPOS hours.

If you are running FULL-POS off-line, it is recommanded to use the eulerian advection scheme of the model (LSLAG=.FALSE.)

If you do not specify anything else, then FULL-POS will run, but you will not get any output file since you did not ask for any output field.

Imagine now that you add in the namelist NAMFPC the following variables :
    CFP3DF='GEOPOTENTIEL','TEMPERATURE',
    RFP3F=50000.,85000.,

then you will get a post-processing file which will contain the geopotential and the temperature at 500 hPa and 850 hPa on the model gaussian grid. The output file will be a file ARPEGE named PFAAAA000+nnnn, where 'AAAA' is the name of the experiment (CNMEXP(1:4)), and nnnn the forecast range (in time steps or in hours, according to the value of LINC in NAMOPH)

2.1.4 About set-up

The namelists variables and the set-up have been built in order to use the namelists default values as far as possible, and to respect a hierarchy. The namelists which are related to FULL-POS are read in the following order : NAMAFN, then NAMFPC, then NAMFPD, then NAMFPG, then NAMFPF, then NAMFPSC2, then NAMFPIOS. It is mostly useful to remember the order : NAMFPC, then NAMFPD, then NAMFPG, then NAMFPF.

2.2 Main features of namelists

2.2.1 NAMAFN

This namelist contains the ARPEGE field names and some field descriptors. It is used for a special customization, and it will be described later. Concerning the post-processing of dynamic fields the variables inside this namelist are derived types.

2.2.2 NAMFPC

This is the main namelist for post-processing. It contains the list of the fields to post-process, the format of the output subdomain(s) (Spherical harmonics, gaussian grid, grid of kind 'Aladin' or grid of kind 'Latitude X longitude'), and various options of post-processing.

2.2.3 NAMFPD

This namelist defines the boundaries and the horizontal dimensions of each output subdomain. Many default values are available through a clever use of the previous namelist NAMFPC.

2.2.4 NAMFPG

This namelist defines the geometry of the output subdomain(s). It is used mostly when the output geometry is a Gaussian grid or a grid of kind 'Aladin'. Default geometry is the geometry of the model.

2.2.5 NAMFPF

This namelist defines the shape of the filtering functions. It is used for a special customization, and it will be described later.

2.2.6 NAMFPSC2

This namelist is used to optimize the performance of the code in terms of vectorisation or memory used. It will be described later.

2.2.7 NAMFPIOS

This namelist is used to activate some packing parameters or parameters to tune the I/O efficiency. It will be described later.

2.3 Basic namelists variables

This section will describe the main variables of the namelists :
NAMFPC, NAMFPD and NAMFPG.

2.3.1 NAMFPC

CFPFMT :format of the output files ;

character variable which can be only 'MODEL', 'GAUSS', 'LELAM' or 'LALON', respectively for spherical harmonics, a global model grid, a grid of kind 'ALADIN' or grids of kind 'Latitudes X Longitudes'. Default is 'GAUSS' in Arpege/Ifs, and 'LELAM' in Aladin.

CFPDOM : names of the subdomains ; array of 10 characters ; if CFPFMT is 'GAUSS' or 'LELAM', then you can make only one output domain ; otherwise (CFPFMT is 'LALON'), you can make up to 10 subdomains. The name(s) of the subdomain(s) can be any string of 7 characters maximum. The default values are : CFPDOM(1)='000' and CFPDOM(i)=' ' for i greater than 1. This means by the way that by default, you ask for only one output (sub)domain.

CFP3DF : ARPEGE names of the 3D dynamics fields to be post-processed ; array of 12 characters. By default, the array is blanked, which means : no 3D dynamics fields to post-process. The ARPEGE names of these fields are listed in appendix A.1.1 and are available on the listing of any job. (locate : 'YOMAFN')

CFP2DF : same as CFP3DF for the 2D dynamics fields to be post-processed ; array of 16 characters. The ARPEGE names of these fields are listed in appendix A.1.2 and are available on the listing of any job. (locate : 'YOMAFN')

CFPPHY : same as CFP2DF for surface grid-point fields from physical parameterisations ; array of 16 characters. The ARPEGE names of these fields are listed in appendix A.1.3 and are available on the listing of any job. (locate : 'YOMAFN')

CFPCFU : same as CFPPHY for cumulated fluxes ; array of 16 characters. The ARPEGE names of these fields are listed in appendix A.1.4 and are available on the listing of any job. (locate : 'YOMAFN')

CFPXFU : same as CFPPHY for instantaneous fluxes ; array of 16 characters. The ARPEGE names of these fields are listed in appendix A.1.5 and are available on the listing of any job. (locate : 'YOMAFN')

RFP3P : post-processing pressure levels ; array of real values in Pa ; No default values.

RFP3H : post-processing height levels (above orography) ; array of real values in meters ; No default values.

RFP3TH : post-processing potential temperature levels ; array of real values in Kelvin ; No default values.

RFP3PV : post-processing potential vorticity levels ; array of real values in S.I. unit ; No default values.

NRFP3S : post-processing eta levels ; array of integer ; No default values.

Note that if you ask for post-processing on fluxes, you do not need to specify anything particuliar in the namelists NAMCFU or NAMXFU : these namelists will be automatically modified by FULL-POS in order to get the required fluxes.

Note that if you ask for spherical harmonics in output (CFPFMT='MODEL'), the upper air grid-point fields, the surface grid point fields and the fluxes will be written out on the model gaussian grid (with poles values added). In fact, this option can be used as an alternative to the previous 'POS' (set up with the namelist NAMPPC).

2.3.2 NAMFPD

NLAT : number of latitudes for each output (sub)domain (poles not included if a gaussian grid is required) ; array of integers ; corresponds to the variable NDGL of the output grid(s)

NLON : number of longitudes for each output (sub)domain ; array of integers ; corresponds to the variable NDLON of the output grid(s)

RLATN : northern latitude in degrees for each output (sub)domain ; array of reals

RLATS : southern latitude in degrees for each output (sub)domain ; array of reals

RLONW : western longitude in degrees for each output (sub)domain ; array of reals

RLONE : eastern longitudes in degrees for each output (sub)domain ; array of reals

If you ask for a grid ALADIN (CFPFMT='LELAM'), there are additionnal variables that you can specify :

NFPLUX : actual last row of longitude

NFPGUX : actual last row of latitude

NFPZONL : half the size of area I in x

NFPZONG : half the size of area I in y

These variables have many possible default values, depending on the content of the namelist NAMFPC (parameters CFPFMT and CFPDOM), and depending on the model (Arpege or Aladin) :

Case ARPEGE :

- if CFPFMT='LALON', there are many possible default values, according to the value of CFPDOM in NAMFPC :

CFPDOM	NLAT	NLON	RLATN	RLATS	RLONW	RLONE
'HENORD'	60	180	89.25	0.75	0.	358.
'HESUDC'	60	180	-0.75	-89.25	0.	358.
'HESUDA'	30	90	-1.5	-88.5	0.	356.
'ATLMED'	65	129	72.75	24.75	-84.	44.
'EURATL'	103	103	71.25	20.25	-32.	36.
'ZONCOT'	81	81	63.75	33.75	-20.	20.
'FRANCE'	61	61	53.25	38.25	-8.	12.
'GLOB15'	121	240	90.	-90.	0.	358.5
'EURAT5'	105	149	72.	20.	-32.	42.
'ATOUR10'	81	166	80.	0.	-100.	65.
'EUROC25'	105	129	61.	35.	-15.	17.
'GLOB25'	73	144	90.	-90.	0.	357.5
'EURSUD'	41	54	48.25	28.25	-34./3.	24.
'EUREST'	39	73	60.25	41.25	-56/3.	88./3.
'GRID25'	21	41	75.	25.	-50.	50.
'MAROC'	158	171	42.90	19.20	-19.80	5.85
'OCINDIEN'	67	89	33.	-66.	0.	132.
'REUNION05'	61	141	-5.	-35.	30.	100.

- if CFPFMT='LELAM' then there are many possible default values, according to the value of CFPDOM in NAMFPC :

CFPDOM	RLATN	RLATS	NLAT
'BELG'	53.62576250095276	47.00552234610564	72
'SLOV'	50.31862495	41.48230800	48
'MARO'	43.03274783	18.41928424	160
'OPMA'	43.84932233	17.32436063	108
'LACE'	56.04274264	33.07606553	192
'ROUM'	52.86547894	35.28895004	72
'FRAN'	54.97543335	33.66090012	200
other name	55.02332687	36.20003128	180

CFPDOM	RLONW	RLONE	NLON
'BELG'	359.7271331650663	10.81654377459938	72
'SLOV'	8.11809117	19.87921810	48
'MARO'	-19.89127081	9.83167877	160
'OPMA'	-20.79065513	11.39205009	108
'LACE'	1.16026046	41.19323585	216
'ROUM'	14.16917554	39.71861793	72
'FRAN'	-11.17915630	19.64583206	200
other name	-9.18826294	19.26073265	180

CFPDOM	NFPGUX(C+I+E / C+I)	NFPLUX(C+I+E / C+I)
'BELG'	61 / 72	61 / 72
'SLOV'	37 / 48	37 / 48
'MARO'	149 / 160	149 / 160
'OPMA'	97 / 108	97 / 108
'LACE'	181 / 192	205 / 216
'ROUM'	61 / 72	61 / 72
'FRAN'	189 / 200	189 / 200
other name	169 / 180	169 / 180

while NFPZONL=NFPZONG=8 in any case.

- if (CFPFMT='GAUSS' or CFPFMT='MODEL') then the default values are : NLAT=NDGL and NLON=NDLON (same parameters as the model)

Case ALADIN :

- if CFPFMT='LALON', the default values are : NLAT=NDGL ; NLON=NDLON ; while the corners (RLATN, RLATS, RLONW, RLONE) are internally computed in order to remain inside the model area
- if (CFPFMT='LELAM' or CFPFMT='MODEL'), the default values are as follows :

Fullpos	NLAT	NLON	NFPZONL	NFPZONG
Aladin	NDGL	NDLON	NBZONL	NBZONG

Fullpos	NFPGUX(C+I+E/C+I)	NFPLUX(C+I+E/C+I)
Aladin	NDGUX / NDGL	NDLUX / NDLON

Fullpos	RLATN	RLATS	RLONW	RLONE
Aladin	ELAT2	ELAT1	ELON1	ELON2

- if CFPFMT='GAUSS', the default values are : NLAT=32, NLON=64

Note that if you ask for the model horizontal geometry (CFPFMT='MODEL'), all these parameters will be reset to the default values by the program.

2.3.3 NAMFPG

NFPMAX : truncation order.

If CFPFMT='GAUSS', it is the truncation corresponding to the output grid ; default is NSMAX.

If CFPFMT='LELAM', it is the truncation in the meridional direction ;

default is so that 3*NFPMAX+1=NLAT.

If CFPFMT='LALON', it is the truncation of the gaussian grid which would have been defined by NLAT latitudes and NLON longitudes ; default is so that 3*NFPMAX+1 = MIN(NLAT,NLON).

The next variables are used only if (CFPFMT='GAUSS')
or if (CFPFMT='MODEL' and LELAM=.FALSE.) :

FPMUCEN : Sine of the latitude of the pole of interest ; default is RMUCEN in Arpege/Ifs. Also used in Aladin for ; see section 5.1

FPLOCEN : Longitude of the pole of interest (in radians) ; default is RLOCEN in Arpege/Ifs. Also used in Aladin for ; see section 5.1

NFPHTYP : grid reduction :

0 = regular grid

1 = number of points proportional to sqrt(1-mu**2)

2 = number of points read on namelist NAMFPG
Default is NHTYP in Arpege/Ifs if NLAT=NDGL ; otherwise NFPHTYP=0

NFPRGRI : number of active points on a parallel ;
Default is NRGRI in Arpege/Ifs if NLAT=NDGL ; otherwise NFPRGRI(:)=NLON
Note that the reduce grids can be computed thanks to a deducated procedure named *surgery*.

FPSTRET : stretching factor ; default is RSTRET in Arpege/Ifs and 1. in Aladin

NFPTTYP : 1 = pole of interest at the northern pole of the real Earth ; 2 = pole of interest anywhere on the real Earth ; default is NSTTYP in Arpege/Ifs. Also used in Aladin for ; see section 5.1

FPNLGINC : increment to get non-linear grid ; default is 1. (quadratic grid)

NFPQUAD : Quadrature (1 : Gauss ; 2 : Lobatto) ;
Default is NQUAD in Arpege/Ifs and 1 in Aladin.

The next variables are used only if : (CFPFMT='LELAM') or if (CFPFMT='MODEL' and LELAM=.TRUE.) :

NMFPMAX : Truncation order in zonal direction ;
default is so that 3*NMFPMAX+1=NLON.

FPBETA : Angle of rotation (in degrees) ; default is 0.

NFPROTEQ : Parameter for the rotation :

0 = no rotation

1 = the reference point of rotation is rotated to the equator, the north pole is on the new Greenwich meridian

Default is 0 in ARPEGE and NROTEQ in ALADIN.

FPLONR : geographic longitude of reference point of rotation (in degrees) ; default is 0. in ARPEGE and ELONR in ALADIN.

FPLATR : geographic latitude of reference point of rotation (in degrees) ; default is 0. in ARPEGE and ELATR in ALADIN.

NFPGIV0 : choice of reference point for projection ; default is 0 in ARPEGE and NGIV0 in ALADIN.

FPLON0 : geographic longitude of reference for the projection (in degrees)

FPLAT0 : geographic latitude of reference for the projection (in degrees)

FPRPK : K projection parameter and definition

NFPSOTRP : isotropy parameter under projection ; default is 1 in ARPEGE and NSOTRP in ALADIN.

The default values of these four variables depend on the model used :
Case ARPEGE : the default values depend on CFPDOM, as follows :

CFPDOM	FPLON0	FPLAT0	FPRPK
'BELG'	2.57831001	46.46884918	0.725
'SLOV'	17.0	46.24470064	0.7223
'MARO'	-7.0	31.56059436	0.5234
'OPMA'	-7.0	31.56059436	0.5234
'LACE'	17.0	46.24470064	0.7223
'ROUM'	25.0	44.77301983	0.7043
'FRAN'	25.0	44.77301983	0.7043
other name	2.57831001	46.46884918	0.725

Case ALADIN : the default values are as follows :

Fullpos	FPLON0	FPLAT0	FPRPK
Aladin	ELON0	ELAT0	ERPK

Note that if you ask for the model horizontal geometry (CFPFMT='MODEL'), all these parameters will be reset to the default values by the program.

NFPLEV : number of levels ; default is NFLEVG

FPVALH : "A" coefficients of vertical system ; default are VALH

FPVBH : "B" coefficients of vertical system ; defaults are VBH

FPVP00 : Reference pressure ; default is VP00

Note that if NFPLEV is different from NFLEV, there will be a recomputation attempt for FPVALH and FPVBH to be try to be the values currently used together with NFPLEV.

2.4 Output file handling

2.4.1 Files structure

FULL-POS makes files of kind 'ARPEGE/ALADIN' : if you ask for a gaussian grid in output (CFPFMT='GAUSS'), you will get a file of kind ARPEGE ; If you ask for a grid of kind 'ALADIN' (CFPFMT='LELAM'), you will get a file of kind 'ALADIN' ; if you ask for a set of files of kind 'Latitudes X Longitudes' (CFPFMT='LALON'), then you will also get files of kind 'ALADIN', with the only particularity that the output geometry is without any projection.
As a consequence, procedures like 'chagal' which are used in Toulouse to plot output files from ALADIN are re-usable to plot FULL-POS files 'LELAM' or 'LALON'.
Note that if CFPFMT='MODEL', you can get spectral or gridpoint data in output.

2.4.2 Name of the output files

There is one post-processing file for each time step and each (sub)domain.

The output files are named : 'PFAAAADDDDDDD+nnnn', where :

'PF' is a fixed prefix

AAAA is the so-called "name of the experiment" (CNMEXP(1:4))

DDDDDDD is the name of the output (sub)domain (CFPDOM)

nnnn is the post-processing time step (in steps or hours according to LINC in NAMOPH)

Example : if you ask for post-processing at time 0, with CNMEXP='FULLPOS' and CFPDOM='ANYWHERE', then the output file wil be named : PFFULLANYWHER+0000

2.4.3 Content of the output files

To read a field in an output file, you have to specify through the subroutine FACILE the name of the field you wish to get.

For a "surface" field, this name is the ARPEGE field name that has been defined in the namelist NAMFPC ; it is a string of 16 characters.

For an upper air field, this name is also the ARPEGE field name that has been defined in the namelist NAMFPC (string of 12 characters), but furthermore, you must specify the kind of post-processing level ("prefix" of the field) and the value of this level. There are 5 possibilities, according to the level type :

Level type	prefix	unity	number of letters for level value
Pressure	'P'	Pascal	5
Height	'H'	Meter	5
Potential vorticity	'V'	deciPVU	3
Potential temperature	'T'	Kelvin	3
Eta	'S'	-	3

Example : temperature at 2 PVU is 'V020TEMPERATURE'

Warning : fields on pressure levels bigger than or equal to 1000 hPa are written out with truncated names ; for example, temperature at 1000 hPa is 'P00000TEMPERATURE' ; while 'P00500TEMPERATURE' could be as well the temperature at 5 hPa or the temperature at 1005 hPa !

3 ADVANCED USAGE

The purpose of this section is to describe certain variables (in namelists) which users may need, but which are either too complex, or too rarely needed to warrant complicating the previous section.

3.1 scientific or technical options for post-processing

3.1.1 Spectral fit on dynamic fields

If you wish to post-process surface dynamic fields or upper air dynamic fields on pressure levels, potential temperature levels or potential vorticity levels, it is possible to perform a spectral fit between the vertical interpolations and the horizontal interpolations. In namelist NAMFPC, you will find the following variables :

LFITP : logical ; .TRUE. to spectrally fit the post-processed fields on pressure levels ; default is .TRUE.

LFITT : same as LFITP for the post-processed fields on potential temperature levels ; default is .FALSE.

LFITV : same as LFITP for the post-processed fields on potential vorticity levels ; default is .FALSE.

LFIT2D : same as LFITP for the 2D dynamic post-processed fields ; default is .TRUE.

Note that if you ask for post-processing of dynamic fields which are not spectral in the model, then these post-processed fields will not be spectrally fitted, even if the corresponding switch LFITxx is .TRUE.

Note that if you wish to post-process upper air dynamic fields on height levels or hybrid levels, it is not possible to apply such spectral fit because the horizontal interpolations are performed BEFORE the vertical interpolation in order to respect the displacement of the planetary boundary layer.

3.1.2 Height levels or hybrid levels

Additive variables are available in namelist NAMFPC :

LFPQ : logical ; .FALSE. to interpolate relative humidity then deduct specific humidity ; .TRUE. to interpolate the specific humidity then deduct the relative humidity. It is better to use the default value (.FALSE.) : in this case, relative humidity is conserved within displacement of the planetary boundary layer and it is interpolated vertically. Relative humidity is considered to have better properties for an interpolation than mixing ratio even if it is not a conservative quantity.

FPBL : real ; critical thickness of the planetary boundary layer. Default is 17500 Pa.

LSNOWI, LSNOWO : These options are used only if LFPQ=.FALSE. LSNOWO specifies how the output file is created and should be used as LNEIGE in configuration 001 subsequently. LSNOWI requires knowlege about input file. In the case of doubt, use the same option as for LSNOWO (a situation close to LFPQ=.TRUE.). Defaults are : LSNOWI=LNEIGE and LSNOWO=LNEIGE.

RFPMXZ : real ; (non-critical) maximum difference between interpolated orography and output orography. Default is 3000. times the acceleration of the gravity.

3.1.3 Vorticity and Divergence

In the model, wind components, relative vorticity and divergence are all available in grid-point space. As a consequence, there are two possibilities to post-process relative vorticity, absolute vorticity and divergence : either you interpolate these fields starting from the vorticity and the divergence inside the model, or you interpolate these fields starting from the wind components inside the model. In the latter case, wind is vertically interpolated, then transformed into vorticity and divergence in spectral space ; then the vertically interpolated vorticity and divergence are horizontally interpolated.

By default, relative vorticity, absolute vorticity and divergence are post-processed starting from the wind inside the model. To post-process relative vorticity, absolute vorticity and divergence starting from the vorticity and the divergence inside the model, you just have to set LFPUVDZ=.FALSE. in the namelist NAMFPC.

3.1.4 Stream function and velocity potential

In the model, stream function and velocity potential are not available in grid-point space. As a consequence, there are two possibilities to post-process these fields : either you interpolate them starting from the vorticity and the divergence inside the model (set LFPUVKP=.FALSE.), or you interpolate them starting from the wind components inside the model (set LFPUVKP=.TRUE., as the default value). In both cases, the transformations to get stream function and velocity potential are done in spectral space. As a consequence, you need to set the corresponding keys LFITxx to .TRUE.

3.1.5 Potential vorticity surfaces

It is possible to tune the minimum pressure of model level to provide an equatorial cap in the computation of variables on constant PV surfaces ; the variable to set in namelist NAMFPC is RFPVCAP, with the following default values : LECMWF : 8900. Pa ; else : 15000. Pa

3.1.6 Usage of an external climatology

It is possible to use auxilary climatological files to improve the accuracy of the horizontal interpolations. The variable which controls the usage of an external climatology is NFPCLI in the namelist NAMFPC. There are three possible options for the time being :

NFPCLI = 0 : climatology is not used.

NFPCLI = 1 : use of auxilary land-sea mask and orography.

In your script, the local name of this external climatology file should be :

'const.clim.DDDDDDD', where DDDDDDD is the variable CFPDOM of the namelist NAMFPC. This file should be of the same geometry as the post-processing file you want to make.

NFPCLI = 2 : use of auxilary land-sea mask, orography, surface temperature, relative surface wetness, deep soil temperature, relative deep soil wetness, albedo, emissivity, standard deviation of orography, percentage of vegetation, roughness lenth, anisotropy coefficient of topography, direction of the main axis of topography and snow depth.

For that you need to make 2 climatology files : the first one, named 'Const.Clim', should be in the input model geometry, the second one, named

'const.clim.DDDDDDD', where DDDDDDD is the variable CFPDOM of the namelist NAMFPC, should in the output (post-processing) geometry.

NFPCLI = 3 : same as NFPCLI = 2, but with more auxilary fields for "ISBA files" purpose : type of vegetation, minimum stomatic resistance, percentage of clay, percentage of sand, root depth, leaf area density and thermal surface roughness length.

Additive variables are at disposal to control the climatology usage :

RFPCORR : critical height difference between source and model orography, for correcting surface temperature through standart profile. Default is 300. times the acceleration of the gravity.

RFPCSAB : Critical sand percentage difference between source and model climatology for computing relative soil moisture in ISBA ; default is 0.01

RFPCD2 : Critical soil depth difference between source and model climatology for computing relative soil moisture in ISBA ; default is 0.001

LFPMOIS : Month allowed for climatology usage :

.FALSE. => month of the model (forecast)

.TRUE. => month of the initial file

Default is .FALSE. ; it is recomanded to set LFPMOIS=.TRUE. to enable in-line post-processing

How to make the external climatology files ? Just run the configuration 923 (Arpege/Ifs) for a gaussian grid, or the configuration E923 (Aladin) for a grid 'ALADIN', Latitudes X longitudes. Do not forget to specify in the namelists of the configuration 923/E923 the definition(s) of your output (sub)domain(s). Remember that in the case of outputs of the kind 'Latitudes X longitudes', there is no extension zone (so : NDGL=NDGUX and NDLON=NDLUX) and the geometry is not a plane (so : LRPLANE=.FALSE.). Note also that in the case of any limited area output, the orography should not be fitted (set LKEYF=.FALSE. in NAMCLA) when you are doing ordinary post-processing.

3.1.7 NAMFPF : Tuning of the spectral filters

In the spectral space, absolute vorticity, relative vorticity, divergence, vertical velocity, stretching and shearing deformations, and potential vorticity are filtered. If you wish to keep these fields unfiltered, then just set LFPFIL=.FALSE. in Arpege/Ifs, or LFPBED=.FALSE. in Aladin.
On the other hand, you can keep the filter active but you can tune the filtering function.

In Arpege/Ifs, this function looks like a smoothed step function ; for a given wavenumber n in the unstretched spectral space, the formula is :

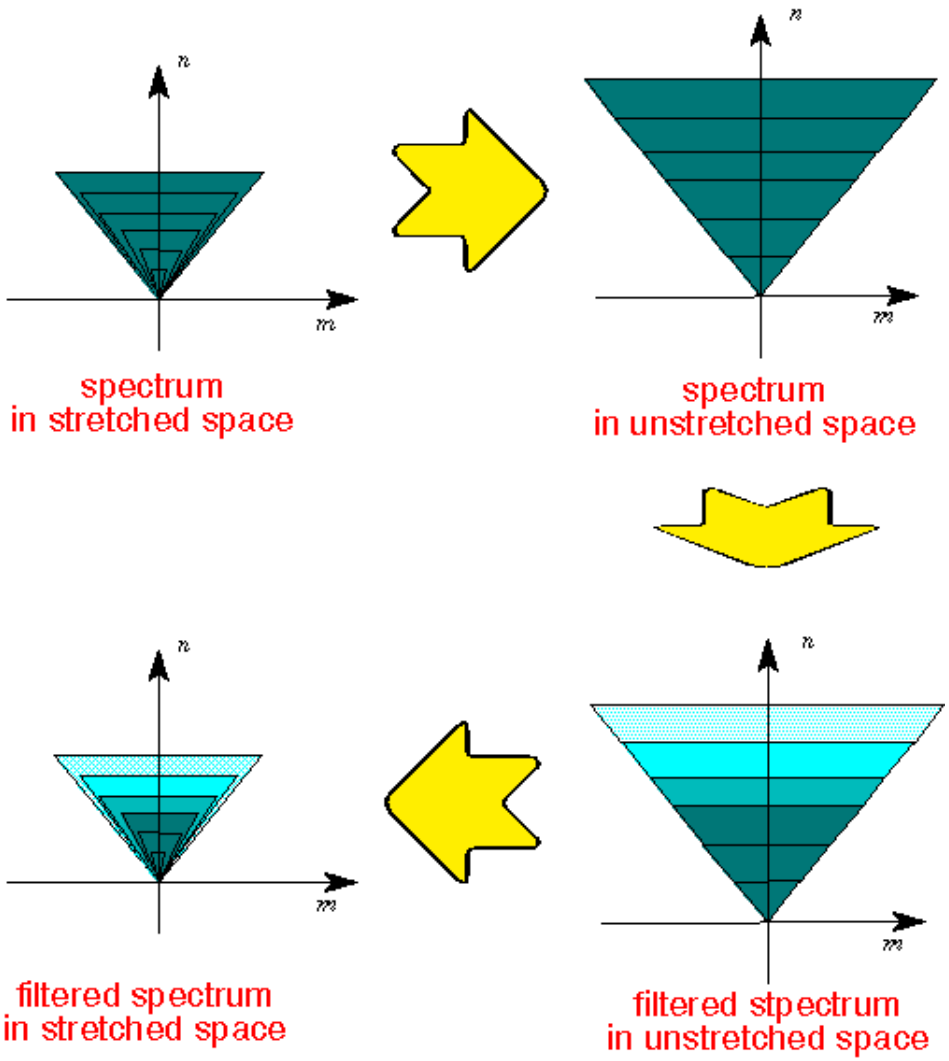
$$f(n) = \frac{1-\tanh(k(n-n_0))}{2}$$

(The use of the function hyperbolic tangent is the reason of the nickname "THX" for this filter).

It means that this function equals roughly 1 if n is less than n_0, and 0 if it is bigger than n_0.
k and n_0 are tunable :
n_0 is the variable NFMAX. If CFPFMT='GAUSS' or 'MODEL', the default value is NFPMAX*FPSTRET ; else, it is the truncation of the gaussian grid which would have been defined by NLAT latitudes and NLON longitudes with default so that :

Full-pos

Filter for derivatives
in ARPEGE



3*NFMAX+1=MIN(NLAT,NLON).
k is defined as follows :

$k = \frac{\ln(1-\varepsilon)/\varepsilon}{L}$ where ε and L are percentages.

This means that : on L times the width of the spectrum, the function will decrease quickly, and that at the boundaries of this "window", the values of the fuction will be respectively $1-\varepsilon$ and ε.

L and ε are respectively RFPWID and RFPEPS. The default values are both 0.1

In Aladin, this filter is a "Bell-shaped" function. For a given pair of wavenumbers (n, m), the formula is :

$f(n,m) = e^{\frac{-k}{2}((n/N)^2+(m/M)^2)}$

where N is the model truncation (NSMAX) and k a tunable variable. k is RFPBED in namelist.

It is also possible to filter the non-derivative post-processed fields through "Bell-shaped" filters. Separate "Bell-shaped" filters are available for geopotential, temperature, medium sea level pressure, relative humidity and all other non-derivatives. By default, these filters are active for geopotential, temperature, medium sea level pressure and relative humidity.
In Aladin, the formula is the same as above.
In Arpege/Ifs, for a given wavenumber n in the stretched spectral space, the formula is :

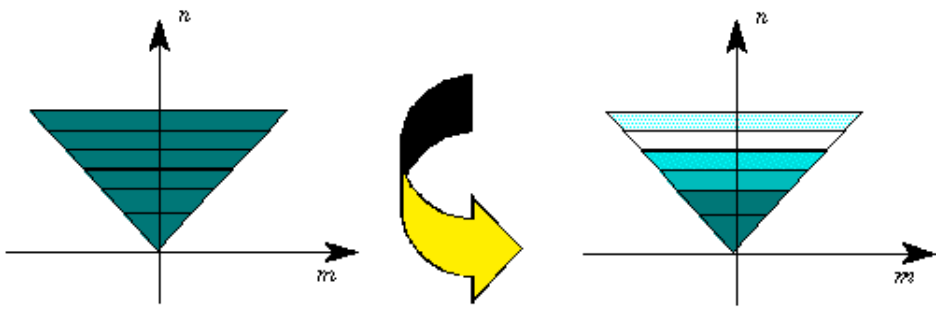
$f(n) = e^{\frac{-k}{2}(n/N)^2}$

where N is the model truncation (NSMAX) and k a tunable variable.
The array below summerizes the existing "Bell-shaped" filters (default values are parenthesis) :

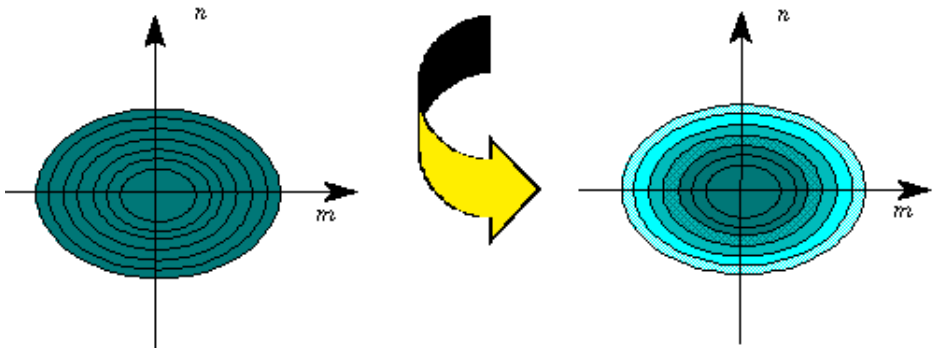
Full-pos

Gaussian filter

in ARPEGE



in ALADIN



Field	Available in Model	Switch (.TRUE. if active)	k
Derivatives		LFPBED	RFPBED
	Aladin only	(.TRUE.)	(6.)
Geopotential		LFPBEG	RFPBEG
	Arpege/Ifs	(.TRUE.)	(4.)
	Aladin	(.TRUE.)	(6.)
Temperature		LFPBET	RFPBET
	Arpege/Ifs	(.TRUE.)	(4.)
	Aladin	(.TRUE.)	(6.)
Mean sea level pressure		LFPBEP	RFPBEP
	Arpege/Ifs	(.TRUE.)	(4.)
	Aladin	(.TRUE.)	(6.)
Relative humidity		LFPBEH	RFPBEH
	Arpege/Ifs	(.TRUE.)	(4.)
	Aladin	(.TRUE.)	(6.)
All other non-derivatives		LFPBEL	RFPBEL
	Arpege/Ifs	(.FALSE.)	(4.)
	Aladin	(.FALSE.)	(6.)

Furthermore, in Arpege/Ifs, it is also possible to perform *at the end* an overtruncation of each post-processed field.
This overtruncation is equivalent to the so-called "THX" filter, but it is applied in the stretched spectral space and then n_0 is equal to the variable NPMAX in the namelist NAMDIM.
Note that this overtruncation is active only if NPMAX is less than NSMAX.
The feature NPMAX is currently not used.

3.1.8 Water contents

Specific variables are available in namelist NAMFPC : since water contents are interpolated as relative values, it is necessary to know the maximum values in output files. If the corresponding variable in namelist is set to -999., then the maximum value in output will be set as the same than in input.

WSXO : real ; maximum surface moisture in output. Default is -999.

WDXO : real ; maximum deep soil moisture in output. Default is -999.

WCXO : real ; maximum "climatological" moisture in output. Default is -999.

Notice : these parameters are useful only when NFPCLI=0, 1 or 2.

3.1.9 Changing the horizontal representation of dynamic variables

For any post-processing field out of dynamics, it is possible to choose the horizontal representation (spectral or gridpoint), providing that the field can be computed in both representation. This is

independant of the representation of the field in the model (so it is a way to convert these fields from spectral to gridpoint or vice-versa).
The variable to set is : TFP_[*]
The default value may depend of the key LECMWF.

3.1.10 Adiabatic post-processing

To run the post-processing in the adiabatic model, you should (not ask for physical fields and) carefully remove the physical fields from the model, by setting the following variables in namelists :

```
/NAMPHY
   LSOLV=.FALSE.,
   LFGEL=.FALSE.,
   LFGELS=.FALSE.,
   LMPHYS=.FALSE.,
   LNEBN=.FALSE.,
   LREASUR=.TRUE.,
/END
/NAMDPHY
   NVSO=0,
   NVCLIV=0,
   NVRS=0,
   NVSF=0,
   NVSG=0,
   NCSV=0,
   NVCLIN=0,
   NVCLIP=0,
/END
```

Notice : for technical reasons, it is important to keep LREASUR=.TRUE.

3.1.11 Horizontal interpolations

It is possible to choose the way how dynamical fields on one side, or physical fields and fluxes on the other side, will be interpolated, thanks to the following variables in namelist NAMFPC :

NFPINPHY : controls the horizontal interpolations of physical fields and fluxes ; = 12 (default value) for quadratic interpolations ; = 4 for bilinear interpolations ; = 0 to adopt the nearest point rather than interpolating.

NFPINDYN : controls the horizontal interpolations of dynamical fields ; = 12 (default value) for quadratic interpolations ; = 4 for bilinear interpolations ; = 0 to adopt the nearest point rather than interpolating.

Note that setting NFPINPHY = NFPINDYN = 0 enables to run the post-processing without any climatology, even when any ISBA field is requested.

3.1.12 The problem of lakes and islands

When the output resolution is so that a single gridpoint lake or island is created, the horizontal interpolations taking into account the land/sea nature will not work properly since no neighbouring points will be of the same nature as the target point ; hence all the neighbouring points will be used in the interpolation process. This can lead to irrealistic temperatures or water contents. To avoid this, an alternative option has been developped : set LFPLAKE=.TRUE. in namelist NAMFPC and then surface temperature, deep soil temperature, surface and deep soil water contents will be modified as follows :

- created single gridpoint lakes will be overwritten by the climatology data
- created single gridpoint island will be overwritten by the climatology data
- lakes gridpoints, *as identified by the climatology*, will be overwritten by the climatology data

(the last item intends to improve the existing quality of the climatology data over lakes, when it is possible)

Remark : the positive impact of the feature still need be proved.

3.2 Optimization of the performance

3.2.1 Writing out post-processing files

To write post-processed fields on an output file, you first extract them from an array (or a workfile). Rather than extracting the fields one after the other, the fields are grouped in packets, and these packets of fields are extracted one after the other. You can specify the maximum number of fields in a packet by modifying the variable NFPXFLD in the namelist NAMFPIOS. The default value is the maximum possible depending on the number of fields to produce). Raising the value of NFPXFLD should save CPU time to the detriment of the memory cost, and vice versa.

This is still valid in the distributed memory code ; the specificity is just that the "extraction" process consists in inter-processors communications.

3.2.2 NAMDIM : Vectorization depth in vertical post-processing

During the vertical interpolations, the memory used and the CPU time used can be tuned thanks to the variable NPROMA in the namelist NAMDIM. The bigger NPROMA is, the quicker the post-processing should run, but then the memory cost should increase as well, and vice-versa. In the case of the configurations 927/e927, ee927, there is another variable playing the same role : IPROM2 (in NAMDIM as well). In such configurations, while IPROM2 deals with the actual vertical interpolations, NPROMA deals with the filling of arrays prior to the actual horizontal interpolations.

Anyway, one should not forget that the values to adopt for NPROMA/IPROM2 are highly related to the architecture of the machine used.

3.2.3 NAMFPSC2 : horizontal segmentation and vectorization

The purpose of this subsection is to describe the variable NFPROMAG in the namelist NAMFPSC2 ; this variable is very useful to find a compromise between the vectorization and the

memory cost in the horizontal post-processing, and it is also very useful to make efficient I/O schemes on horizontal post-processing.

The variable NFPROMAG represents the horizontal depth of work in the horizontal post-processing ; it is obvious that this variable has some similarity with the famous variable NPROMA (in namelist NAMDIM) (its use is just more flexiblein the shared memory code). First of all, it is important to explain how the post-processing data flow is managed in the post-processing arrays/workfiles :
the model data is split in packets of points of fixed size NPROMA ; each model packet is treated by one task, and is independant from the other packets.
Each output point (ie where post-processing is performed) is related to one model packet : the one which contains the model point which is the nearest from it. That way, the output points are sorted out, so that each post-processing packet (ie the group of all the output points which are related to the same model packet) has a specific size.
In order to use the I/O subroutines already available in ARPEGE/IFS, each
post-processing packet has been split in sub-rows of fixed size NFPROMAG. Each post-processing packet is treated by one task which performs a loop on the number of sub-rows in the current post-processing packet.
Note that an empty post-processing packet is characterized by a number of sub-rows equal to zero ; as a consequence, empty post-processing packets do not lead to memory spill. On the opposite, each non-empty post-processing packet contains a specific number of unused words.
Searching for a compromise between vectorization and memory cost, the value of NFPROMAG can be any integer from 1 to the size of the biggest post-processing packet. The bigger NFPROMAG will be, the more the vectorization will be efficient, and the more memory will be needed. The default value of NFPROMAG is the mean size of the post-processing packets, as this value appeared to be the best compromise. However, if the I/O schemes are activated, the size of the biggest post-processing packet may be a more efficient value. In the listing, the user will find more information to find out the value to adopt : just before "COMMON YOMFPSC2" is printed out, the following information is written :

- size of the smallest post-processing packet
- size of the biggest post-processing packet
- mean size of the post-processing packets
- standart deviation of the size of the post-processing packets

You can also know the memory you have lost in the post-processing arrays : just locate "TOTAL MEMORY LOST IN WORDS ="

3.2.4 packing/unpacking

In the Distributed Memory code, the packing/unpacking of the global fields can be distributed : in namelist NAMPAR1 :

NSTRIN : number of processors used for unpacking

NSTROUT : number of processors used for packing

Concerning NSTRIN, the best performances are obtained when this variable is set like the total number of processors used in the model (NPROC). But concerning NSTROUT, the best performances are obtained for an intermediate value (roughly NPROC/2).

3.3 Customization

3.3.1 Fields names and other post-processing controls

It is possible to change the name of each output field. The names used by default are printed on the listing (locate "YOMAFN"). The modified variables should be written in the namelist NAMAFN. Concerning the dynamic fields, there are more degrees of freedom for each field, since

3.3.2 Output files name

It is possible to change the prefix 'PF' of the output files : the variable to be changed is CFPDIR in the namelist NAMFPC ; it is a character variable of maximum 180 characters. For instance, if you specify : CFPDIR='$HOME/fullpos/', then your output files will be automatically written on your $HOME/fullpos directory, with the name : AAAADDDDDDD+nnnn

3.3.3 Free-use fields

It is possible to create additive post-processing without making many modifications in the code of FULL-POS.

Dynamic fields :
There are 30 free upper air dynamic fields and 15 free surface dynamic fields. There are represented in namelist NAMAFN respectively by the derived types arrays : TFP_FUA and TFP_FSU
Then in the subroutines POS or ENPOS, you will have to compute the fields you wish and to perform the vertical interpolations respectively under the logics LL_FUA(.) and LL_FSU(.)

You are supposed to control the initialization of the other elements of the derived types. Your own 3D fields will be treated as fitable non-derivatives : it means that these fields will be fitted or not, according to the switches LFITP, LFITH, LFITV, LFITT, LFITS, LFIT2D, and also the variables TFP_FUA(.)The "Bell-shaped" filter may be performed if LFPBEL=.TRUE., but that the "THX" filter will never be performed on these fields.

Physical fields :
There are 2 ways to compute them :

- Either you read the fields from the historical file and the you interpolate them via FULL-POS. In this case you should read the fields from the descriptors NVXTR2/CVEXTR2 (see the namelist NAMDPHY) ; there are 30 free fields that can be computed that way (generic name : CNPVX2 in the namelist YOMAFN)
- Or you can compute as you wish your own fields in the subroutine HPOS. For that purpose there are 15 free fields (generic name : CNPFSU in the namelist YOMAFN)

3.3.4 Making an accurate list of post-processed fields

In ordinary case, at each post-processing time step, all the fields that are written in the namelist NAMFPC are post-processed at all the levels and for all the output domains written in the namelist NAMFPC.
However, it is possible to get, at each post-processing time step, exactly the fields you wish, and nothing more : in that case, you have to make another namelists file which will contains the selection of the fields you wish to get.

First, you have to set in NAMCT0 the variable CNPPATH as the directory where the selection files will be. Under this directory, the name of a selection file must be xxtDDDDHHMM, where DDDDHHMM specifies the date/time of the post-processing time step.
Then a selection file must contain 7 new namelists : NAMFPPHY, NAMFPDY2, NAMFPDYP, NAMFPDYH, NAMFPDYV, NAMFPDYT and NAMFPDYS.
Namelist NAMFPPHY is for physical fields and fluxes ; it contains the following parameters :

CLPHY : names of selected physical fields ; array of 16 characters

CLDPHY : names of selected subdomains, separated by ":", for each selected physical field ; characters array (example : 'DOM1:DOM2:DOM3')

CLCFU : names of selected cumulated fluxes fields ; array of 16 characters

CLDCFU : names of selected subdomains, separated by ":", for each selected cumulated flux ; characters array (example : 'DOM1:DOM2:DOM3')

CLXFU : names of selected instantaneous fluxes fields ; array of 16 characters

CLDXFU : names of selected subdomains, separated by ":", for each selected instantaneous flux ; characters array (example : 'DOM1:DOM2:DOM3')

Namelist NAMFPDY2 is for 2D dynamics fields ; it contains the following parameters :

CL2DF : names of selected fields ; array of 16 characters

CLD2DF : names of selected subdomains, separated by ":", for each selected field ; characters array (example : 'DOM1:DOM2:DOM3')

The following namelists :
NAMFPDY2, NAMFPDYP, NAMFPDYH, NAMFPDYV, NAMFPDYT and NAMFPDYS
are for fields postprocessed respectively on pressure levels, height levels, potential vorticity levels, isentropic levels and hybrid levels ; they contain the same following parameters :

CL3DF : names of selected fields ; array of 16 characters

IL3DF : list of selected indexes of post-processing levels, for each selected field ; integer array of 2 dimensions ; first subscript is for selected post-processing level ; second one is the local field index.

CLD3DF : names of selected subdomains, separated by ":", for each selected level and each selected field ; characters array of 2 dimensions ; first subscript is the local index of the selected level ; second one is the local field index (example : 'DOM1:DOM2:DOM3')

Note that all the fields or levels or domains written in a selection file should be included in the main namelist NAMFPC, otherwise the job will abort.

AppendixA.3is an example of use of selection files.

3.4 Miscellaneous

3.4.1 Packing of output data

The number of bits to be used for GRIB packing inside an output file is tunable, through variables in namelist NAMAFN, for each output field. The default value is 24 for all fields except orography which should not be packed in the model in order to keep consistency between spectral and gridpoint orography (default value is 64). If you wish to modify the default values, refer to the appendixA.1 or to the prints out of the common YOMAFN in the listing to find out the names of the variables to be changed.

3.4.2 Prints out

By locating 'FULL-POS NORMS' (or 'FULL-POS SPNORMS' in you ask for spectral coefficients) on the listing, you will see that at each post-processing time step the mean value of each subdomain of each field is printed out. This is useful to validate the code of FULL-POS from one cycle to another. If you wish to get rid of these prints, then set LFPNORM=.FALSE. in the namelist NAMFPC. Note that you can also check the content of the output files by using the variable LRFILAF in NAMCT1.
If you have to cope with a severe bug in the post-processing, the you may set LTRACEFP=.TRUE. in the namelist NAMFPC : this option is used to print out more information during the post-processing set-up and the post-processing time steps. Be careful with this option : you might get an enormous listing if the number of output points is quite big !
Furthermore, in Aladin, setting LTRACEFP=.TRUE. is a way to find out what is the biggest domain LATxLON that is included in the model : search for the prints after the prints out of YOMFPG.

3.4.3 post-processing on model grid and levels

If you ask for fields on the model grid (CFPFMT='MODEL')
and on model levels (NRFP3S=...),
there will be no vertical interpolations nor horizontal interpolations ; the dynamic spectral fields will be written out on post-processing files as spectral data. To get them gridpoint, set LFITS=.FALSE. and/or LFIT2D=.FALSE. in NAMFPC (default values are : .TRUE.)

3.4.4 GRIB encoding

By default, post-processed fields are encoded in Arpege/Aladin files according to a modified version of GRIB. This is changeable through NFPGRIB in NAMFPC :

NFPGRIB=0 : no packing of fields
NFPGRIB=1 : standard GRIB encoding on fields
NFPGRIB=2 : modified GRIB encoding (default value) on fields

3.4.5 Post-processing of extension zone in ALADIN

setting NDOMFP in NAMFPC, you can choose the domain definition of fields in files (for ALADIN);

=-1 : physical fields and dynamic fields are gridpoints, stored on (C+I)+E
= 0 : physical fields and dynamic fields are gridpoints, stored on (C+I)
Default is 0 ; you can set NDOMFP=-1 to get the extension zone, providing you are defining it.

Once you have requested the extension zone, you may set the variable of the namelist NAMFPEZO :

NSTREFP : number of processors used to compute the extension zone ; default is 1 (increasing this parameter seems not to bring benefits).

NFPROMEL : Vector length in the computation of the extension zone ; default is odd and is the maximum possible value.

Notice : the computation of the extension zone is possible only with Aladin library.

3.4.6 Customized complexion of certain fields

LFPRH100 : .TRUE. to convert relative humidity in percent ; default = LECMWF

LFPLOSP : is a variable to handle surface pression (Ps) or its logarithm, taking also into account the value of NLOSP :

LFPLOSP =.TRUE. $\Leftrightarrow$

Fill Ps array with Ps or Ln(Ps), according to NLOSP ;

Fill Ln(Ps) array always with Ln(Ps)

LFPLOSP =FALSE. $\Leftrightarrow$

Fill Ps array always with Ps ;

Fill Ln(Ps) array with Ps or Ln(Ps), according to NLOSP

If (LECMWF) then the default value is .FALSE. Else, the default value is .TRUE. except for the configuration 927 where it is set internally.

These variables are in the namelist NAMFPC.

4 THE CONFIGURATIONS 927, E927 and EE927

4.1 What does that mean ?

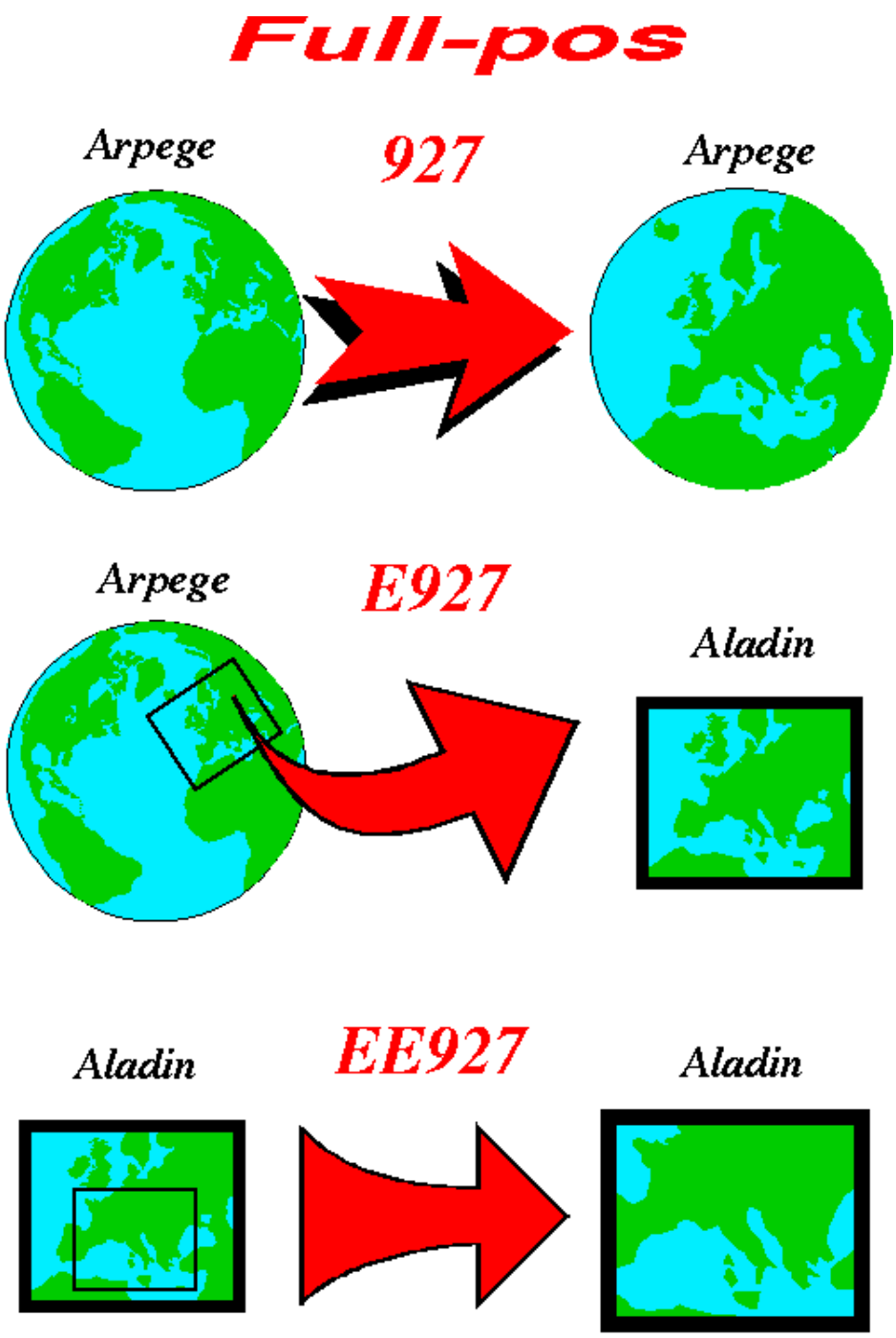
The configuration 927 is the way to use Fullpos in order to change the geometry and/or the resolution of an historical spectral file. Actually, it is not a specific configuration. Let us rather call it a configuration of post-processing : in that case, the horizontal interpolations are done before the vertical interpolations, and the upper air dynamic variables are (usually) produced as spectral coefficients.
Such a process is switched on by setting LFPSPEC=.TRUE. in the namelist NAMFPC.
"927" is to make a file Arpege, starting from a file Arpege
"E927" is to make a file Aladin, starting from a file Arpege
"EE927" is to make a file Aladin, starting from a file Aladin.

4.2 Getting started

4.2.1 Configuration 927

First, you will have to load the only libraries that are necessary to run Arpege/Ifs
Then, starting from an ordinary namelists file to do off-line post-processing within Arpege/Ifs, change or add the following parameters :

```
/NAMAFN (Let this namelist empty)
/END
/NAMFPC
   CFPFMT='GAUSS',
   CFP3DF(1)='TEMPERATURE',
   CFP3DF(2)='FONC.COURANT',
   CFP3DF(3)='POT.VITESSE',
   CFP3DF(4)='HUMI.SPECIFIQUE',
   CFP2DF(1)='SURFPRESSION',
   CFP2DF(2)='SPECSURFGEOPOTENTIEL',
   CFPPHY(1)='SURFTEMPERATURE',
```


Full-pos
Arpege
927
Arpege
Arpege
E927
Aladin
Aladin
EE927
Aladin

CFPPHY(2)='PROFTEMPERATURE ',
CFPPHY(3)='PROFRESERV.EAU ',
CFPPHY(4)='SURFRESERV.NEIGE',
CFPPHY(5)='SURFRESERV.EAU ',
CFPPHY(6)='SURFZ0.FOIS.G ',
CFPPHY(7)='SURFALBEDO ',
CFPPHY(8)='SURFEMISSIVITE ',
CFPPHY(9)='SURFET.GEOPOTENT',
CFPPHY(10)='SURFIND.TERREMER',
CFPPHY(11)='SURFPROP.VEGETAT',
CFPPHY(12)='SURFVAR.GEOP.ANI',
CFPPHY(13)='SURFVAR.GEOP.DIR',
CFPPHY(14)='SURFIND.VEG.DOMI',
CFPPHY(15)='SURFRESI.STO.MIN',
CFPPHY(16)='SURFPROP.ARGILE',
CFPPHY(17)='SURFPROP.SABLE',
CFPPHY(18)='SURFEPAIS.SOL',
CFPPHY(19)='SURFIND.FOLIAIRE',
CFPPHY(20)='SURFRES.EVAPOTRA',
CFPPHY(21)='SURFGZ0.THERM',
CFPPHY(22)='SURFRESERV.INTER',
CFPPHY(23)='PROFRESERV.GLACE',
CFPPHY(24)='SURFRESERV.GLACE',
LFPSPEC=.T., *(switch on the process 927)*
NRFP3S=1,2,3,4,5,6,7,8,9,10,11,12, ... *up to NFPLEV (see below)*
NFPCLI=3,
/END
/NAMFPD
NLAT= *(choose it yourself)*
NLON= *(choose it yourself)*
/END
/NAMFPG
FPMUCEN=*(choose it yourself)*
FPLOCEN=*(choose it yourself)*
NFPHTYP=*(choose it yourself)*
NFPRGRI=*(fill it yourself if NFPHTYP=2)*
FPSTRET=*(choose it yourself)*
NFPTTYP=*(choose it yourself)*
NFPMAX=*(choose it yourself)*
NFPLEV= *(the number of levels you wish)*
FPVALH=*(fill it yourself if NFPLEV is an uncommon value)*
FPVBH=*(fill it yourself if NFPLEV is an uncommon value)*
/END
/NAMCT0
NFRHIS=1,
NHISTS(0)=1,
NHISTS(1)=1,
NFRPOS=1,
NPOSTS(0)=1,

NPOSTS(1)=0,
/END
/NAMDYN
NLOSP=0, *(For better interpolation of surface pressure)*
/END
/NAMINI
NEINI=0,
/END

Note that you should have two climatological files in your working directory : the first one, named 'Const.Clim', should be a climatological file Arpege of input geometry ; the second one, named 'const.clim.*CFPDOM* should be a climatological file Arpege of output geometry.

4.2.2 Configuration E927

First, you will have to load all the libraries that are necessary to run Aladin.
Then, the model should be Arpege/Ifs : if you are using the command line system, set -marpifs ; otherwise, set LELAM=.FALSE. in NAMCT0.
Finally, starting from an ordinary namelists file to do off-line post-processing within Arpege/Ifs, change or add the following parameters :

```
/NAMAFN
   TFP_U
   TFP_V
/END
/NAMFPC
   CFPFMT='LELAM',
   CFP3DF(1)='TEMPERATURE',
   CFP3DF(2)='WIND.U.PHYS',
   CFP3DF(3)='WIND.V.PHYS',
   CFP3DF(4)='HUMI.SPECIFIQUE',
   CFP2DF(1)='SURFPRESSION',
   CFP2DF(2)='SPECSURFGEOPOTENTIEL',
   CFPPHY(1)='SURFTEMPERATURE',
   CFPPHY(2)='PROFTEMPERATURE ',
   CFPPHY(3)='PROFRESERV.EAU ',
   CFPPHY(4)='SURFRESERV.NEIGE',
   CFPPHY(5)='SURFRESERV.EAU ',
   CFPPHY(6)='SURFZ0.FOIS.G ',
   CFPPHY(7)='SURFALBEDO ',
   CFPPHY(8)='SURFEMISSIVITE ',
   CFPPHY(9)='SURFET.GEOPOTENT',
   CFPPHY(10)='SURFIND.TERREMER',
   CFPPHY(11)='SURFPROP.VEGETAT',
   CFPPHY(12)='SURFVAR.GEOP.ANI',
   CFPPHY(13)='SURFVAR.GEOP.DIR',
   CFPPHY(14)='SURFIND.VEG.DOMI',
   CFPPHY(15)='SURFRESI.STO.MIN',
   CFPPHY(16)='SURFPROP.ARGILE',
   CFPPHY(17)='SURFPROP.SABLE',
   CFPPHY(18)='SURFEPAIS.SOL',
```

```
   CFPPHY(19)='SURFIND.FOLIAIRE',
   CFPPHY(20)='SURFRES.EVAPOTRA',
   CFPPHY(21)='SURFGZ0.THERM',
   CFPPHY(22)='SURFRESERV.INTER',
   CFPPHY(23)='PROFRESERV.GLACE',
   CFPPHY(24)='SURFRESERV.GLACE',
   LFPSPEC=.T., (switch on the process 927)
   NRFP3S=1,2,3,4,5,6,7,8,9,10,11,12, .... up to NFPLEV (see below)
   NFPCLI=3,
/END
/NAMFPD
   NLAT= (choose it yourself)
   NLON= (choose it yourself)
   RLATN=(choose it yourself)
   RLATS=(choose it yourself)
   RLONW=(choose it yourself)
   RLONE=(choose it yourself)
   NFPGUX=(choose it yourself)
   NFPZONL=(choose it yourself)
   NFPZONG=(choose it yourself)
/END
/NAMFPG
   NFPMAX=(choose it yourself)
   NMFPMAX=(choose it yourself)
   NFPLEV= the number of levels you wish
   FPVALH=(fill it yourself if NFPLEV is an uncommon value)
   FPVBH=(fill it yourself if NFPLEV is an uncommon value)
   FPRPK=(choose it yourself)
   NFPSOTRP=(choose it yourself)
   NFPGIV0=(choose it yourself)
   FPLONR=(choose it yourself)
   FPLATR=(choose it yourself)
   NFPROTEQ=(choose it yourself)
   FPLON0=(choose it yourself)
   FPLAT0=(choose it yourself)
/END
/NAMCT0
   NFRHIS=1,
   NHISTS(0)=1,
   NHISTS(1)=1,
   NFRPOS=1,
   NPOSTS(0)=1,
   NPOSTS(1)=0,
/END
/NAMDYN
   NLOSP=0, (For better interpolation of surface pressure)
/END
/NAMINI
   NEINI=0,
```

/END

Note that you should have two climatological files in your working directory : the first one, named 'Const.Clim', should be a climatological file Arpege (input geometry) ; the second one, named 'const.clim.*CFPDOM* should be a climatological file Aladin (output geometry).

4.2.3 Configuration EE927

First, you will have to load all the libraries that are necessary to run Aladin.
Then, starting from an ordinary namelists file to do off-line post-processing within Aladin, change the namelists as suggested above for E927.

Note that you should have two climatological files in your working directory : the first one, named 'Const.Clim', should be a climatological file Aladin of input geometry ; the second one, named 'const.clim.*CFPDOM* should be a climatological file Aladin of output geometry.

4.2.4 Non-hydrostatic historical files

To make non-hydrostatic historical files, you just have to run the configuration e927 or ee927 with the following additive parametres :
/NAMDYN
NDLNPR=1, *(special discretisation of delta(Log(P)))*
/NAMFPC
CFP3DF(5)='PRESS.DEPART', *(pressure departure)*
CFP3DF(6)='VERTIC.DIVER', *(vertical divergence)*
/NAMCT0
LNHDYN=.FALSE./.TRUE., *(depending whether your input file is hydrostatic or not)*

4.3 Advanced usage

4.3.1 Let your imagination do it !

Once you have a good knowledge of FULL-POS, you can tune various parameters of namelists as you wish !
Furthermore, doing the horizontal interpolations before the vertical interpolations can help you get fields that are uncomputable with the normal configuration of post-processing. For example, starting from a file Arpege, try to postprocess the potential vorticity on the model levels, onto a grid Aladin : with the normal post-processing configuration, the request will abort, because some derivatives will be missing. But this should work using the configuration E927 and asking for gridpoint fields (LFITS=.FALSE.).

4.3.2 Process 927 inside a loop

You may need to write a script in order to run FULL-POS process 927 inside a loop : for instance, to prepare boundary conditions for Aladin, starting from Arpege forecasts. In that case, between two requests, you must remove a control file which is created by FULL-POS. Its name is defined by the variable CFPNCF in the namelist NAMCT0 ; the default value is 'ncf927'.

4.3.3 In-line process 927

You may wish to use FULL-POS process 927 inside a forecast run. This is possible, but for that, you must set LFPBACK=.TRUE. in the namelist NAMFPC. This key enables you to come back to the initial geometry of the model. This feature is usually not used.

5 BOGUSSING

5.1 Cyclone translation in Aladin

It is possible to translate a cyclone inside an Aladin file. This procedure will translate the cyclone to a geographical point given in namelist. The following variables should be set in the namelist NAMFPG :

NFPTTYP : set NFPTTYP=2 to activate the translation if the output grid is not global

FPMUCEN : In Aladin : sine of the latitude of the observed cyclone ;

default value is sin(ELAT0)

FPLOCEN : In Aladin : longitude of the observed cyclone (in degrees) ;

default value is ELON0

Notice : to define the translation vector, the cyclone seen by the model is located through the minimum of surface pressure in the whole model area (C+I).

Usually, this procedure is used to re-build the upper-air fields of an historical file Aladin (using the configuration EE927 in adiabatic mode). In order not to translate the orography, one should first lower the orography to zero, then translate, and finally re-set the original orography.

5.2 Aladin injection in Arpege

It is possible to "inject" data out of Aladin post-processing inside a file Arpege : this is called "the bogussing configuration", or "the configuration 927E" because it works like the configuration E927 but in a "reverse" way.

To use this configuration, you should use a namelist of configuration 927, but invoking "aladin" instead "arpifs", and set in namelist NAMFPC the new variable NFPINCR=1 (default value is 0). Furthermore, you have to provide 3 input files instead of one :

ICMSH${CNMEXP(1:4)}INIT : Aladin bogussed coupling file

ELSCF${CNMEXP(1:4)}ALBC : Aladin coupling file (before bogussing)

BGPX${CNMEXP(1:4)}${CFPDOM} : Arpege background file

Notice : the Arpege background file should contain all the fields of a normal historical file in gridpoint. Furthermore : in this file surface pressure should be the true surface pressure and not its logarithm.

Important notice : for the time being, this configuration "927E" works only in adiabatic mode (i.e. : it is not yet possible to inject physical surface fields except orography).

A APPENDIXES

A.1 NAMAFN : Post-processable fields descriptors

This namelist contains the ARPEGE field names and some field descriptors.

A.1.1 3D dynamic fields (CFP3DF)

Field	TYPE NAME	%CLNAME	%IBITS	%LLGP
Absolute Vorticity.....	TFP_ABS	ABS_VORTICIT	24	F
Atmospheric liquid water..	TFP_W	LIQUID_WATER	24	T
Atmospheric solid water...	TFP_S	SOLID_WATER	24	T
Cloud fraction.....	TFP_CLF	CLOUD_FRACTI	24	T
Divergence.....	TFP_DIV	DIVERGENCE	24	F
Equiv. pot. temperature...	TFP_ETH	THETA_EQUIVA	24	F
Free upper air field n 01.	TFP_FUA(01)	UPPER_AIR.01	24	F
Free upper air field n 02.	TFP_FUA(02)	UPPER_AIR.02	24	F
Free upper air field n 03.	TFP_FUA(03)	UPPER_AIR.03	24	F
(truncated list - 30 variables)				
Geopotential.....	TFP_Z	GEOPOTENTIEL	24	F
Montgomery potential.....	TFP_MG	MONTGOMERY G	24	F
Ozone.....	TFP_O3MX	OZONE	24	F
Passive scalar nr 01.....	TFP_SCVA(01)	#001.SCALAR	24	F
Passive scalar nr 02.....	TFP_SCVA(02)	#002.SCALAR	24	F
Passive scalar nr 03.....	TFP_SCVA(03)	#003.SCALAR	24	F
(truncated list - 5 variables)				
Potential temperature.....	TFP_TH	TEMPE_POTENT	24	F
Potential Vorticity.....	TFP_PV	POT_VORTICIT	24	F
Pressure Departure.....	TFP_PD	PRESS.DEPART	24	F
Pressure.....	TFP_P	PRESSURE	24	F
Pseudo Vertic. Divergence.	TFP_VD	VERTIC.DIVER	24	F
Relative humidity.....	TFP_HU	HUMI_RELATIV	24	F
Shearing Deformation.....	TFP_SHD	SHEAR_DEFORM	24	F
Specific humidity.....	TFP_Q	HUMI.SPECIFI	24	F
Stream function.....	TFP_KHI	FONC.COURANT	24	F
Stretching Deformation....	TFP_STD	STRET_DEFORM	24	F
Temperature.....	TFP_T	TEMPERATURE	24	F
True Vertical NH Velocity.	TFP_VW	VERT.VELOCIT	24	F
U-momentum of wind.....	TFP_U	VENT_ZONAL	24	F
Velocity potential.....	TFP_PSI	POT.VITESSE	24	F
Vertical velocity.....	TFP_VV	VITESSE_VERT	24	F
Vorticity.....	TFP_VOR	VORTICITY	24	F
V-momentum of wind.....	TFP_V	VENT_MERIDIE	24	F
Wet bulb pot. temperature.	TFP_THPW	THETA_PRIM_W	24	F
Wind velocity.....	TFP_WND	WIND_VELOCIT	24	F

Notice :

- vertical velocity "omega" is expressed in Pa/s
- true vertical velocity "w" is expressed in m/s.

A.1.2 2D dynamic fields (CFP2DF)

```
   Field                    :    TYPE NAME    %CLNAME      %IBITS %LLGP
Free surface field nr 01..  :  TFP_FSU(01) SURF2D.01          24     F
Free surface field nr 02..  :  TFP_FSU(02) SURF2D.02          24     F
Free surface field nr 03..  :  TFP_FSU(03) SURF2D.03          24     F
                             (truncated list - 15 variables)
HU cls..................... :     TFP_RCLS CLSHU.RELATI.POS   24     T
ICAO jet pressure.......... :     TFP_PJET JETPRESSURE        24     T
ICAO Tropopause pressure.. :     TFP_PCAO ICAOTROP.PRESSUR   24     T
ICAO Tropo. temperature... :     TFP_TCAP ICAOTROP.TEMPERA   24     T
Log. of Surface pressure.. :     TFP_LNSP LOG.SURF.PRESS     24     F
Map factor................. :     TFP_GM   MAP_FACTOR         24     T
Maxi. temperature in cls.. :     TFP_TX   CLSTEMPE.MAX.POS   24     T
Mean sea level pressure... :     TFP_MSL  MSLPRESSURE        24     F
Mini. temperature in cls.. :     TFP_TN   CLSTEMPE.MIN.POS   24     T
module of wind cls........ :     TFP_FCLS CLSWIND_VELO.POS   24     T
Q cls...................... :     TFP_QCLS CLSHU.SPECIF.POS   24     T
Surface geopotential...... :     TFP_FIS  SPECSURFGEOPOTEN   64     F
Surface pressure.......... :     TFP_SP   SURFPRESSION       24     F
Surface Vertical Velocity. :     TFP_WWS  SURFVERT.VELOCIT   24     F
T cls...................... :     TFP_TCLS CLSTEMPERATU.POS   24     T
Total water vapour........ :     TFP_TWV  SURFTOT.WAT.VAPO   24     T
Tropo. Folding Indicator.. :     TFP_FOL  TROPO_FOLD_INDIC   24     T
U cls...................... :     TFP_UCLS CLSVENT_ZONA.POS   24     T
U-momentum of ICAO jet.... :     TFP_UJET JETVENT_ZONAL      24     T
V cls...................... :     TFP_VCLS CLSVENT_MERI.POS   24     T
V-momentum of ICAO jet.... :     TFP_VJET JETVENT_MERIDIEN   24     T
```

A.1.3 Surface fields (CFPPHY)

```
Albedo ................................ CNAL   = SURFALBEDO          NBAL   = 24
Analysed RMS of geopotential ........  CNPCAAG= SURFETA.GEOPOTEN    NBPCAAG= 24
Anisotropy coeff. of topography ...... CNACOT = SURFVAR.GEOP.ANI    NBACOT = 24
Clim. relative deep soil wetness ..... CNCDSW = PROFPROP.RMAX.EA    NBCDSW = 24
Clim. relative surface soil wetness .. CNCSSW = SURFPROP.RMAX.EA    NBCSSW = 24
Deep soil temperature ................. CNDST  = PROFTEMPERATURE     NBDST  = 24
Deep soil wetness ..................... CNDSW  = PROFRESERV.EAU      NBDSW  = 24
Direction of main axis of topography . CNDPAT = SURFVAR.GEOP.DIR    NBDPAT = 24
Emissivity ............................ CNEMIS = SURFEMISSIVITE      NBEMIS = 24
Forecasted RMS of geopotential ....... CNPCAPG= SURFETP.GEOPOTEN    NBPCAPG= 24
Frozen deep soil wetness .............. CNFDSW = PROFRESERV.GLACE    NBFDSW = 24
Frozen superficial soil wetness ...... CNFSSW = SURFRESERV.GLACE    NBFSSW = 24
Index of vegetation ................... CNIVEG = SURFIND.VEG.DOMI    NBIVEG = 24
Interception content .................. CNIC   = SURFRESERV.INTER    NBIC   = 24
INTERPOLATED surface temperature ..... CNRDST = INTSURFTEMPERATU    NBRDST = 24
```

```
Land/sea mask ..................... CNLSM  = SURFIND.TERREMER   NBLSM  = 24
Leaf area index ................... CNLAI  = SURFIND.FOLIAIRE   NBLAI  = 24
OUTPUT Grid-point geopotential ..... CNGFIS = SURFGEOPOTENTIEL   NBGFIS = 64
Percentage of clay within soil ..... CNARG  = SURFPROP.ARGILE    NBARG  = 24
Percentage of land ................. CNLAN  = SURFPROP.TERRE     NBLAN  = 24
Percentage of sand within soil ..... CNSAB  = SURFPROP.SABLE     NBSAB  = 24
Percentage of vegetation ........... CNVEG  = SURFPROP.VEGETAT   NBVEG  = 24
Relaxation deep soil wetness ....... CNRDSW = RELAPROP.RMAX.EA   NBRDSW = 24
Resistance to evapotranspiration ... CNHV   = SURFRES.EVAPOTRA   NBHV   = 24
Roughness length of bare surface
(times g)........................... CNBSR  = SURFZOREL.FOIS.G   NBBSR  = 24
Snow albedo ........................ CNALSN = SURFALBEDO NEIGE   NBALSN = 24
Snow density ....................... CNSNDE = SURFDENSIT.NEIGE   NBSNDE = 24
Snow depth ......................... CNSD   = SURFRESERV.NEIGE   NBSD   = 24
Soil depth ......................... CND2   = SURFEPAIS.SOL      NBD2   = 24
Standart deviation of orography
(times g) .......................... CNSDOG = SURFET.GEOPOTENT   NBSDOG = 24
Stomatal minimum resistance ........ CNRSMIN= SURFRESI.STO.MIN   NBRSMIN= 24
Surface albedo for non snowed areas .. CNBAAL = SURFALBEDO.COMPL   NBBAAL = 24
Surface relative moisture ......... CNPSRHU= SURFHUMI.RELATIV   NBPSRHU= 24
Surface roughness (times g) ........ CNSR   = SURFZ0.FOIS.G      NBSR   = 24
Surface soil wetness ............... CNSSW  = SURFRESERV.EAU     NBSSW  = 24
Surface temperature ................ CNST   = SURFTEMPERATURE    NBST   = 24
Thermal roughness length (times g) ... CNZ0H  = SURFGZ0.THERM      NBZ0H  = 24
U-momentum of vector anisotropy ..... CNPADOU= SURF.U.ANISO.DIR   NBPADOU= 24
V-momentum of vector anisotropy ..... CNPADOV= SURF.V.ANISO.DIR   NBPADOV= 24

Extra field #01 .................... CNPVX2 = SURFEXTRAFIELD01   NBVX2  = 24
Extra field #02 .................... CNPVX2 = SURFEXTRAFIELD02   NBVX2 = 24
.
.
.
Extra field #30 .................... CNPVX2 = SURFEXTRAFIELD30   NBVX2 = 24

Free field #01 ..................... CNPFSU = SURFFREE.FIELD01   NBFSU = 24
Free field #02 ..................... CNPFSU = SURFFREE.FIELD02   NBFSU = 24
.
.
.
Free field #15 ..................... CNPFSU = SURFFREE.FIELD15   NBFSU = 24
```

A.1.4 Cumulated fluxes (CFPCFU)

```
Boundary Layer Dissipation ......... CNCBLD = SURFDISSIP SURF    NBCBLD = 24
CAPE out of the model .............. CNCCAPE= SURFCAPE.MOD.CFU   NBCCAPE= 24
Clear sky longwave radiative flux .... CNCTHC = SURFRAYT THER CL   NBCTHC = 24
Clear sky shortwave radiative flux ... CNCSOC = SURFRAYT SOL CL    NBCSOC = 24
Cloudiness ......................... CNCC   = SURFCUMUL NEBUL    NBCC   = 24
Contribution of Convection to Cp.T ... CNCCVS = SURFFL.CT CONVEC   NBCCVS = 24
Contribution of Convection to Q ..... CNCCVQ = SURFFL.Q  CONVEC   NBCCVQ = 24
```

```
Contribution of Convection to U ..... CNCCVU = SURFFL.U  CONVEC   NBCCVU = 24
Contribution of Convection to V ..... CNCCVV = SURFFL.V  CONVEC   NBCCVV = 24
Contribution of Turbulence to Cp.T ... CNCTUS = SURFFL.CT TURBUL   NBCTUS = 24
Contribution of Turbulence to Q ..... CNCTUQ = SURFFL.Q  TURBUL   NBCTUQ = 24
Convective Cloud Cover ............... CNCCCC = ATMONEBUL.CONVEC   NBCCCC = 24
Convective precipitation ............. CNCCP  = SURFPREC.EAU.CON   NBCCP  = 24
Convective Snow Fall ................. CNCCSF = SURFPREC.NEI.CON   NBCCSF = 24
Deep soil water content run-off ...... CNCDRU = PROFRUISSELLEMEN   NBCDRU = 24
Evapotranspiration ................... CNCETP = SURFEVAPOTRANSPI   NBCETP = 24
Flux d eau dans le sol ............... CNCEAS = SURFEAU DANS SOL   NBCEAS = 24
Flux de chaleur dans le sol .......... CNCCHS = SURFCHAL. DS SOL   NBCCHS = 24
High Cloud Cover ..................... CNCHCC = ATMONEBUL.HAUTE    NBCHCC = 24
Interception water content run-off.... CNCIRU = SURFRUISS. INTER   NBCIRU = 24
Large Scale Precipitation ............ CNCLSP = SURFPREC.EAU.GEC   NBCLSP = 24
Large Scale Snow fall ................ CNCLSS = SURFPREC.NEI.GEC   NBCLSS = 24
Latent Heat Evaporation .............. CNCLHE = SURFFLU.LAT.MEVA   NBCLHE = 24
Latent Heat Sublimation .............. CNCLHS = SURFFLU.LAT.MSUB   NBCLHS = 24
Liquid specific moisture ............. CNCLI  = ATMOHUMI LIQUIDE   NBCLI  = 24
Low Cloud Cover ...................... CNCLCC = ATMONEBUL.BASSE    NBCLCC = 24
Medium Cloud Cover ................... CNCMCC = ATMONEBUL.MOYENN   NBCMCC = 24
Melt snow ............................ CNCFON = SURFFONTE NEIGE    NBCFON = 24
MOCON out of the model ............... CNCMOCO= CLPMOCON.MOD.CFU   NBCMOCO= 24
Snow mass ............................ CNCSNS = SURFRESERV NEIGE   NBCSNS = 24
Snow Sublimation ..................... CNCS   = SURFFLU.MSUBL.NE   NBCS   = 24
Soil Moisture ........................ CNCWS  = SURFCONTENU EAU    NBCWS  = 24
Solid specific moisture .............. CNCICE = ATMOHUMI SOLIDE    NBCICE = 24
Surface down solar flux .............. CNCSOD = SURFRAYT DIFF DE   NBCSOD = 24
Surface down thermic flux ............ CNCTHD = SURFRAYT THER DE   NBCTHD = 24
Surface downward moon radiation ...... CNCSMR = SURFRAYT.LUNE.DE   NBCSMR = 24
Surface Latent Heat Flux ............. CNCSLH = SURFCHAL LATENTE   NBCSLH = 24
Surface parallel solar flux .......... CNCSOP = SURFRAYT DIR SUR   NBCSOP = 24
Surface Sensible Heat Flux ........... CNCSSH = SURFFLU.CHA.SENS   NBCSSH = 24
Surface solar radiation .............. CNCSSR = SURFFLU.RAY.SOLA   NBCSSR = 24
Surface Thermal radiation ............ CNCSTR = SURFFLU.RAY.THER   NBCSTR = 24
Surface water content run-off......... CNCSRU = SURFRUISSELLEMEN   NBCSRU = 24
Tendency of Surface pressure ......... CNCTSP = SURFPRESSION SOL   NBCTSP = 24
Top clear sky longwave radiative flux  CNCTTHC= SOMMRAYT THER CL   NBCTTHC= 24
Top clear sky shortwave radiative flux CNCTSOC= SOMMRAYT SOL CL    NBCTSOC= 24
Top mesospheric enthalpy ............. CNCTME = TOPMESO ENTH       NBCTME = 24
Top parallel solar flux .............. CNCTOP = TOPRAYT DIR SOM    NBCTOP = 24
Top Solar radiation .................. CNCTSR = SOMMFLU.RAY.SOLA   NBCTSR = 24
Top Thermal radiation ................ CNCTTR = SOMMFLU.RAY.THER   NBCTTR = 24
Total Cloud cover .................... CNCTCC = ATMONEBUL.TOTALE   NBCTCC = 24
Total Ozone .......................... CNCTO3 = ATMOOZONE TOTALE   NBCTO3 = 24
Total precipitable water ............. CNCQTO = ATMOHUMI TOTALE    NBCQTO = 24
Transpiration ........................ CNCTP  = SURFTRANSPIRATIO   NBCTP  = 24
U-momentum of Gravity-Wave Drag stress CNCUGW = SURFTENS.DMOG.ZO   NBCUGW = 24
U-momentum of Turbulence stress ...... CNCUSS = SURFTENS.TURB.ZO   NBCUSS = 24
V-momentum of Gravity-Wave Drag stress CNCVGW = SURFTENS.DMOG.ME   NBCVGW = 24
```

```
V-momentum of Turbulence stress ..... CNCVSS = SURFTENS.TURB.ME   NBCVSS = 24
Water Evaporation ..................... CNCE   = SURFFLU.MEVAP.EA   NBCE   = 24
```

Notice : precipitations are expressed in kg/m^2 (equivalent to mm)

A.1.5 Instantaneous fluxes (CFPXFU)

```
CAPE out of the model ................ CNXCAPE= SURFCAPE.MOD.XFU   NBXCAPE= 24
Cloudiness out of the subroutine
ARANEB and at the model level the
closest to 550 hPa .................... CNXC   = SURFCUMUL NEBUL    NBXC   = 24
Contribution of Convection to Cp.T ... CNXCVS = S000FL.CT CONVEC   NBXCVS = 24
Contribution of Convection to Q ...... CNXCVQ = S000FL.Q  CONVEC   NBXCVQ = 24
Contribution of Convection to U ...... CNXCVU = S000FL.U  CONVEC   NBXCVU = 24
Contribution of Convection to V ...... CNXCVV = S000FL.V  CONVEC   NBXCVV = 24
Contribution of Gravity Wave Drag to U CNXGDU = S000FL.U ONDG.OR   NBXGDU = 24
Contribution of Gravity Wave Drag to V CNXGDV = S000FL.V ONDG.OR   NBXGDV = 24
Contribution of Turbulence to Cp.T ... CNXTUS = S000FL.CT TURBUL   NBXTUS = 24
Contribution of Turbulence to Q ...... CNXTUQ = S000FL.Q  TURBUL   NBXTUQ = 24
Contribution of Turbulence to U ...... CNXTUU = S000FL.U  TURBUL   NBXTUU = 24
Contribution of Turbulence to V ...... CNXTUV = S000FL.V  TURBUL   NBXTUV = 24
Convective Cloud Cover ............... CNXCCC = SURFNEBUL.CONVEC   NBXCCC = 24
Convective precipitation .............. CNXCP  = S000PLUIE CONVEC   NBXCP  = 24
Convective Snow Fall .................. CNXCSF = S000NEIGE CONVEC   NBXCSF = 24
Gusts out of the model ................ CNXGUST= CLSRAFAL.MOD.XFU   NBXGUST= 24
Height of the PBL out of the model
(times g) ............................. CNXPBLG= CLPGEOPO.MOD.XFU   NBXPBLG= 24
High Cloud Cover ...................... CNXHCC = SURFNEBUL.HAUTE    NBXHCC = 24
Large Scale Precipitation ............. CNXLSP = S000PLUIE STRATI   NBXLSP = 24
Large Scale Snow fall ................. CNXLSS = S000NEIGE STRATI   NBXLSS = 24
Low Cloud Cover ....................... CNXLCC = SURFNEBUL.BASSE    NBXLCC = 24
Maximum temperature at 2 meters ...... CNXX2T = CLSMAXI.TEMPERAT   NBXX2T = 24
Medium Cloud Cover .................... CNXMCC = SURFNEBUL.MOYENN   NBXMCC = 24
Minimum temperature at 2 meters ...... CNXN2T = CLSMINI.TEMPERAT   NBXN2T = 24
MOCON out of the model ................ CNXMOCO= CLPMOCON.MOD.XFU   NBXMOCO= 24
Relative Humidity at 2 meters ........ CNX2RH = CLSHUMI.RELATIVE   NBX2RH = 24
Specific Humidity at 2 meters ........ CNX2SH = CLSHUMI.SPECIFIQ   NBX2SH = 24
Surface solar radiation ............... CNXSSR = S000RAYT.SOLAIRE   NBXSSR = 24
Surface Thermal radiation ............. CNXSTR = S000RAYT.TERREST   NBXSTR = 24
Temperature at 2 meters ............... CNX2T  = CLSTEMPERATURE     NBX2T  = 24
Top Solar radiation ................... CNXTSR = SOMMRAYT.SOLAIRE   NBXTSR = 24
Top Thermal radiation ................. CNXTTR = SOMMRAYT.TERREST   NBXTTR = 24
Total Cloud cover ..................... CNXTCC = SURFNEBUL.TOTALE   NBXTCC = 24
U-momentum of gusts out of the model . CNXUGST= CLSU.RAF.MOD.XFU   NBXUGST= 24
U-momentum of wind at 10 meters ...... CNX10U = CLSVENT.ZONAL      NBX10U = 24
V-momentum of gusts out of the model . CNXVGST= CLSV.RAF.MOD.XFU   NBXVGST= 24
V-momentum of wind at 10 meters ...... CNX10V = CLSVENT.MERIDIEN   NBX10V = 24
Wind velocity at 10 meters ............ CNX10FF= CLSWIND.VELOCITY   NBX10FF= 24
```

A.2 Dictionnary of usefull namelists variables

CFP2DF : *(NAMFPC)* ; 2D dynamics fields to post-process ; see section 2.3.1

CFP3DF : *(NAMFPC)* ; 3D dynamics fields to post-process ; see section 2.3.1

CFPCFU : *(NAMFPC)* ; Cumulated fluxes to post-process ; see section 2.3.1

CFPDIR : *(NAMFPC)* ; prefix for the output files ; see section 3.3.2

CFPDOM : *(NAMFPC)* ; names of the subdomains ; see section 2.3.1

CFPFMT : *(NAMFPC)* ; format of the output files ; see section 2.3.1

CFPNCF : *(NAMCT0)* ; file name for FULL-POS control file ; see section 4.3.2

CFPPHY : *(NAMFPC)* ; Physical fields to post-process ; see section 2.3.1

CFPXFU : *(NAMFPC)* ; Instantaneous fluxes to post-process ; see section 2.3.1

CNPPATH : *(NAMCT0)* ; path name for selection files ; see section 3.3.4

FPBETA : *(NAMFPG)* ; Angle of rotation for LAM output ; see section 2.3.3

FPBL : *(NAMFPC)* ; Critical thickness of the planetary boundary layer ; see section 3.1.2

FPLAT0 : *(NAMFPG)* ; geographic latitude of projection reference point for LAM output ; see section 2.3.3

FPLATR : *(NAMFPG)* ; geographic latitude of rotation reference point for LAM output ; see section 2.3.3

FPLOCEN : *(NAMFPG)* ; Longitude of the pole of interest for Gaussian grid, or longitude of the observed cyclone ; see section 2.3.3

FPLON0 : *(NAMFPG)* ; geographic longitude of projection reference point for LAM output ; see section 2.3.3

FPLONR : *(NAMFPG)* ; geographic longitude of rotation reference point for LAM output ; see section 2.3.3

FPMUCEN : *(NAMFPG)* ; Sine of the latitude of the pole of interest for Gaussian grid, or sine of the latitude of the observed cyclone for limited area grids ; see section 2.3.3

FPRPK : *(NAMFPG)* ; K projection parameter and definition for LAM output ; see section 2.3.3

FPSTRET : *(NAMFPG)* ; stretching factor for Gaussian grid ; see section 2.3.3

FPVALH : *(NAMFPG)* ; "A" coefficients of output vertical system ; see section 2.3.3

FPVBH : *(NAMFPG)* ; "B" coefficients of output vertical system ; see section 2.3.3

FPVP00 : *(NAMFPG)* ; Reference pressure for output vertical system ; see section 2.3.3

IPROM2 : *(NAMDIM)* ; Vector length for the second part of the configurations 927, e927, ee927 ; see section 3.2.2

LFIT2D : *(NAMFPC)* ; Spectral fit of 2D dynamic post-processed fields ; see section 3.1.1

LFITP : *(NAMFPC)* ; Spectral fit of pressure levels post-processed fields ; see section 3.1.1

LFITS : *(NAMFPC)* ; Spectral fit of eta levels post-processed fields ; see section 3.4.3

LFITT : *(NAMFPC)* ; Spectral fit of isentropic levels post-processed fields ; see section 3.1.1

LFITV : *(NAMFPC)* ; Spectral fit of potential vorticity levels post-processed fields ; see section 3.1.1

LFPBACK : *(NAMFPC)* ; switch for going back to the initial geometry ; see section 4.3.3

LFPBED : *(NAMFPF)* ; switch for bell-shaped filter on derivatives in Aladin ; see section 3.1.7

LFPBEG : *(NAMFPF)* ; switch for bell-shaped filter on geopotential ; see section 3.1.7

LFPBEH : *(NAMFPF)* ; switch for bell-shaped filter on relative humidity ; see section 3.1.7

LFPBEL : *(NAMFPF)* ; switch for Bell-shaped filter on all other non-derivatives ; see section 3.1.7

LFPBEP : *(NAMFPF)* ; switch for bell-shaped filter on mean sea level pressure ; see section 3.1.7

LFPBET : *(NAMFPF)* ; switch for bell-shaped filter on temperature ; see section 3.1.7

LFPFIL : *(NAMFPF)* ; switch to filter derivatives in Arpege/Ifs ; see section 3.1.7

LFPLAKE : *(NAMFPC)* ; special treatment for lakes and islands ; see section 3.1.12

LFPLOSP : *(NAMFPC)* ; to handle surface pression or its logarithm, taking into account the value of NLOSP ; see section 3.4.6

LFPMOIS : *(NAMFPC)* ; Month allowed for climatology usage ; see section 3.1.6

LFPNORM : *(NAMFPC)* ; prints out mean values of post-processed fields ; see section 3.4.2

LFPOS : *(NAMCT0)* ; FULL-POS main switch ; see section 2.1.3

LFPQ : *(NAMFPC)* ; .F. to interpolate specific humidity from relative humidity ; see section 3.1.2

LFPRH100 : *(NAMFPC)* ; to convert relative humidity in percent ; see section 3.4.6

LFPSPEC : *(NAMFPC)* ; switch for "process 927" ; see section 4.1

LFPUVDZ : *(NAMFPC)* ; divergence/vorticities computed from wind ; see section 3.1.3

LFPUVKP : *(NAMFPC)* ; velocity potential/stream function computed from wind ; see section 3.1.4

LINC : *(NAMCT1)* ; .TRUE. to get time stamp in hours rather than in time steps

LMLTSK : *(NAMCT0)* ; switch for multitasking

LSNOWI : *(NAMFPC)* ; Snow in input file ; see section 3.1.2

LSNOWO : *(NAMFPC)* ; Snow in output file ; see section 3.1.2

LTRACEFP : *(NAMFPC)* ; verboose option ; see section 3.4.2

N1POS : *(NAMCT1)* ; Switch on (=1) or switch off (=0) the post-processing after the setup

NCONF : *(NAMCT0)* ; configuration ; see section 2.1.3

NDLNPR : *(NAMDYN)* ; special discretisation of delta(Log(P)) for non-hydrostatism ; see section 4.2.4

NDOMFP : *(NAMFPC)* ; domain definition of fields in files for LAM output ; see section 3.4.5

NEXPBFPA : *(NAMFPIOS)* ; Number of bits for exp. when packing on pre-processed dynamic data

NEXPBFPD : *(NAMFPIOS)* ; Number of bits for exp. when packing on post-processed dynamic data

NEXPBFPP : *(NAMFPIOS)* ; Number of bits for exp. when packing on post-processed physic/fluxes

NEXPBFPR : *(NAMFPIOS)* ; Number of bits for exp. when packing on output geometry/climatology

NEXPBFPW : *(NAMFPIOS)* ; Number of bits for exp. when packing on weights

NEXPBGP : *(NAMIOS)* ; Number of bits for exp. when packing surface fields

NEXPBGU : *(NAMIOS)* ; Number of bits for exp. when packing upper air gridpoint fields

NEXPBGX : *(NAMIOS)* ; Number of bits for exp. when packing on vertically post-processed fields

NEXPBT9 : *(NAMIOS)* ; Number of bits for exp. when packing gridpoint fields at t-dt

NEXPBXF : *(NAMIOS)* ; Number of bits for exp. when packing instantaneous fluxes

NFMAX : *(NAMFPF)* ; truncation order in unstretched space to filter derivatives in Arpege/Ifs

NFPCLI : *(NAMFPC)* ; Level usage of climatology ; see section 3.1.6

NFPGIV0 : *(NAMFPG)* ; Choice of reference point for projection for LAM output ; see section 2.3.3

NFPGRIB : *(NAMFPC)* ; level of GRIB coding in output file for fields ; see section 3.4.4

NFPGUX : *(NAMFPD)* ; actual last row of latitude for LAM output ; see section 2.3.2

NFPHTYP : *(NAMFPG)* ; grid reduction for Gaussian grid for limited area grids ; see section 2.3.3

NFPINCR : *(NAMFPC)* ; bogussing parameter ; see section 5.2

NFPINDYN : *(NAMFPC)* ; kind of horizontal interpolations for dynamical fields ; see section 3.1.11

NFPINPHY : *(NAMFPC)* ; kind of horizontal interpolations for physical fields and fluxes ; see section 3.1.11

NFPLEV : *(NAMFPG)* ; number of output eta levels ; see section 2.3.3

NFPMAX : *(NAMFPG)* ; truncation order (in meridional direction for LAM output) ; see section 2.3.3

NFPQUAD : *(NAMFPG)* ; Quadrature for Gaussian grid ; see section 2.3.3

NFPRGRI : *(NAMFPG)* ; number of active points on each for Gaussian grid ; see section 2.3.3

NFPROMAG : *(NAMFPSC2)* ; Working dimension of horizontal post-processing subrows ; see section 3.2.3

NFPROMEL : *(NAMFPEZO)* ; Vector length in the computation of the extension zone ; see section 3.4.5

NFPROTEQ : *(NAMFPG)* ; Parameter of rotation for LAM output ; see section 2.3.3

NFPSOTRP : *(NAMFPG)* ; isotropy parameter under projection for LAM output ; see section 2.3.3

NFPTTYP : *(NAMFPG)* ; Rotation parameter for Gaussian grid, or translation parameter for limited area grids ; see section 5.1

NFPXFLD : *(NAMFPIOS)* ; Number of fields extracted from a post-processing buffer/workfile ; see section 3.2.1

NFPZONG : *(NAMFPD)* ; half the size of area I in y for LAM output ; see section 2.3.2

NFPZONL : *(NAMFPD)* ; half the size of area I in x for LAM output ; see section 2.3.2

NFRPOS : *(NAMCT0)* ; post-processing frequency ; see section 2.1.3

NLAT : *(NAMFPD)* ; number of latitudes for each output (sub)domain ; see section 2.3.2

NLON : *(NAMFPD)* ; number of longitudes for each output (sub)domain ; see section 2.3.2

NLOSP : *(NAMDYN)* ; To use surface pressure or its logarithm as the primitive variable

NMFPMAX : *(NAMFPG)* ; Truncation order in zonal direction for LAM output ; see section 2.3.3

NPCKFCF : *(NAMIOS)* ; packing factor for I/O on cumulated fluxes

NPCKFFPA : *(NAMFPIOS)* ; packing factor for pre-processed dynamic data

NPCKFFPD : *(NAMFPIOS)* ; packing factor for post-processed dynamic data

NPCKFFPP : *(NAMFPIOS)* ; packing factor for post-processed physic/fluxes

NPCKFFPR : *(NAMFPIOS)* ; packing factor for output geometry/climatology

NPCKFFPW : *(NAMFPIOS)* ; packing factor for weights

NPCKFGP : *(NAMIOS)* ; packing factor for I/O on surface fields

NPCKFGU : *(NAMIOS)* ; packing factor for I/O on upper air gridpoint fields

NPCKFGX : *(NAMIOS)* ; packing factor for I/O on vertically post-processed fields

NPCKFT9 : *(NAMIOS)* ; packing factor for I/O on gridpoint fields at t-dt

NPCKFXF : *(NAMIOS)* ; packing factor for I/O on instantaneous fluxes

NPMAX : *(NAMDIM)* ; Post-processing over-truncation ; see section 3.1.7

NPOSTS : *(NAMCT0)* ; post-processing control array ; see section 2.1.3

NPROC : *(NAMPAR1)* ; number of processor elements

NPROMA : *(NAMDIM)* ; Vector length for the first part of the configurations 927, e927, ee927, and for standard post-processing ; see section 3.2.2

NRFP3S : *(NAMFPC)* ; post-processing eta levels ; see section 2.3.1

NSTREFP : *(NAMFPEZO)* ; number of processors used to compute the extension zone ; see section 3.4.5

NSTRIN : *(NAMPAR1)* ; number of processors used for reading then unpacking ; see section 3.2.4

NSTROUT : *(NAMPAR1)* ; number of processors used for packing before writing out to file ; see section 3.2.4

NTASKS : *(NAMCT0)* ; number of shared memory tasks.

RFP3H : *(NAMFPC)* ; post-processing height levels (above orography) ; see section 2.3.1

RFP3PV : *(NAMFPC)* ; post-processing potential vorticity levels ; see section 2.3.1

RFP3P : *(NAMFPC)* ; post-processing pressure levels ; see section 2.3.1

RFP3TH : *(NAMFPC)* ; post-processing potential temperature levels ; see section 2.3.1

RFPBED : *(NAMFPF)* ; Intensity of bell-shaped filter on derivatives in Aladin ; see section 3.1.7

RFPBEG : *(NAMFPF)* ; bell-shaped filter on geopotential ; see section 3.1.7

RFPBEH : *(NAMFPF)* ; bell-shaped filter on relative humidity ; see section 3.1.7

RFPBEL : *(NAMFPF)* ; bell-shaped filter on all other non-derivatives ; see section 3.1.7

RFPBEP : *(NAMFPF)* ; bell-shaped filter on mean sea level pressure ; see section 3.1.7

RFPBET : *(NAMFPF)* ; bell-shaped filter on temperature ; see section 3.1.7

RFPCD2 : *(NAMFPC)* ; Critical soil depth difference between source and model climatology ; see section 3.1.6

RFPCORR : *(NAMFPC)* ; critical height difference between source and model orography ; see section 3.1.6

RFPCSAB : *(NAMFPC)* ; Critical sand percentage difference between source and model climatology ; see section 3.1.6

RFPEPS : *(NAMFPF)* ; value at the window right side of the filter for derivatives in Arpege/Ifs ; see section 3.1.7

RFPMXZ : *(NAMFPC)* ; Non-critical maximum difference between interpolated orography and output orography ; see section 3.1.2

RFPVCAP : *(NAMFPC)* ; Minimum pressure of model level to provide an equatorial cap in the computation of variables on constant PV surfaces ; see section 3.1.5

RFPWID : *(NAMFPF)* ; "window" of the filter for derivatives in Arpege/Ifs ; see section 3.1.7

RLATN : *(NAMFPD)* ; northern latitude for each output (sub)domain ; see section 2.3.2

RLATS : *(NAMFPD)* ; southern latitude for each output (sub)domain ; see section 2.3.2

RLONE : *(NAMFPD)* ; eastern longitude for each output (sub)domain ; see section 2.3.2

RLONW : *(NAMFPD)* ; western longitude for each output (sub)domain ; see section 2.3.2

WCXO : *(NAMFPC)* ; maximum "climatological" moisture in output ; see section 3.1.8

WDXO : *(NAMFPC)* ; maximum deep soil moisture in output ; see section 3.1.8

WSXO : *(NAMFPC)* ; maximum surface moisture in output ; see section 3.1.8

A.3 An example of a selection file

Imagine you want to get the following fields :

- Model orography on domains FRANCE and EUROC25 at time h00
- Surface pressure on domain EUROC25 at times h00 and h03
- Geopotential at 500 hPa on domains FRANCE and EUROC25 at time h00
- Geopotential at 850 hPa on domains FRANCE and EUROC25 at time h03
- Temperature at 850 hPa on domain FRANCE at time h00
- Temperature at 500 hPa on domain EUROC25 at time h00 and h03
- Potential vorticity at 300 K on domain FRANCE at time h00

The solution can be :

```
/NAMCT0
   CNPPATH='.',
/END
/NAMFPC
   CFP2DF(1)='SPECSURFGEOPOTEN',
   CFP2DF(2)='SURFPRESSION',
   CFP3DF(1)='GEOPOTENTIEL',
   CFP3DF(2)='TEMPERATURE',
   CFP3DF(3)='POT_VORTICIT',
   RFP3P(1)=500.,
   RFP3P(2)=850.,
   RFP3T(1)=300.,
   CFPDOM(1)='FRANCE',
   CFPDOM(2)='EUROC25',
/END
```

And then under the current directory :

```
cat < EOF >> xxt00000000
/NAMFPPHY
/END
/NAMFPDY2
   CL2DF(1)='SPECSURFGEOPOTEN',
   CLD2DF(1)='FRANCE:EUROC25',
   CL2DF(2)='SURFPRESSION',
   CLD2DF(2)='EUROC25',
/END
/NAMFPDYP
   CL3DF(1)='GEOPOTENTIEL',
   ILD3DF(1,1)=1,
   CLD3DF(1,1)='FRANCE:EUROC25',
   CL3DF(2)='TEMPERATURE',
   ILD3DF(1,2)=1,2,
   CLD3DF(1,2)='EUROC25',
   CLD3DF(2,2)='FRANCE',
```

```
/END
/NAMFPDYH
/END
/NAMFPDYV
   CL3DF(1)='POT_VORTICIT',
   ILD3DF(1,1)=1,
   CLD3DF(1,1)='FRANCE',
/END
/NAMFPDYT
/END
/NAMFPDYS
/END
EOF
cat < EOF >> xxt00000300
/NAMFPPHY
/END
/NAMFPDY2
   CL2DF(1)='SURFPRESSION',
   CLD2DF(1)='EUROC25',
/END
/NAMFPDYP
   CL3DF(1)='GEOPOTENTIEL',
   ILD3DF(1,1)=2,
   CLD3DF(1,1)='FRANCE:EUROC25',
   CL3DF(2)='TEMPERATURE',
   ILD3DF(1,2)=1,
   CLD3DF(1,2)='EUROC25',
/END
/NAMFPDYH
/END
/NAMFPDYV
/END
/NAMFPDYT
/END
/NAMFPDYS
/END
EOF
```