Fullpos Algorithms

A Report on the scalability issues of F*ull*pos/927 in the Arpege / Aladin

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07. 09.2012

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1. INTRODUCTION

F*ull*Pos is a Post-Processing package embedded inside the Arpege/IFS/Aladin software. It is fully compatible with the model itself. Mainly, it is composed of two pieces, vertical interpolations and horizontal interpolations.

When making historical files in F*ull*Pos, it needs to invoke two parts which are required to start the control cascade from almost the beginning. By removing the code below the condition LFPART2 and making more straightforward mechanism instead is planed in this study. Scalability of F*ull*POS can be increased avoiding from these limitations.

This study has started September 2010, during this period; spectral package debugged if it has ability to setup two different type of geometry. Some of the routines in the package are modified to have a convenient way of keeping different type of geometries. Grid point transposition from FPOS distribution to the spectral distribution is computed. Modular spectral norms wrapper for FPOS is coded and validated.

New configuration is validated, however in the beginning; spectral norms were slightly different from each other when we get closer to the lower levels. These differences captured near the surface and identical at the top. The reason for this kind of behaviour was grid point surface pressure field was converting to spectral field after the horizontal interpolations completed. New 928 configuration is omitted this part.

2. AN OVERVIEW

In the new (e)(e)927 the STEPO sequence;

```
0AA0M0000
0000I0000
0000E0FF0
Z00000000
```

There are some work-flows revisions by Ryad El Khatib such as, LFPOS and LFPSPEC has replaced by a single new one named NFPOS(we were using NFPSPEC), working as follows:

```
Fullpos switched off          : NFPOS=0    <=>  LFPOS=.F.
Fullpos “configuration 1”     : NFPOS=1    <=>  LFPOS=.T. + LFPSPEC=.F.
Fullpos “configuration 927”   : NFPOS=927 <=>  LFPOS=.T. + LFPSPEC=.T.
Fullpos “configuration 2”     : NFPOS=2    <=>  LFPOS=.T. + new code
```

and one more new configuration added named NFPOS=928 : like NFPOS=927 but the spectral transforms formerly needed to restart the model are by passed. This configuration will help to validate NFPOS=2 and may be used as an optimisation of NFPOS=927.

STEPO was using in the old framework of Fullpos, and it is replaced by a new routine which is specific to FullPOS named as STEPO_FPOS. This give us opportunity to have less

complex code and OOPS considerations.

Combination of these studies is now referred to as FullPOS-2.

3. MAP FACTOR

The LAM models has the particularity that the map factor should be used to reduce the wind fields when written out to files. This map factor is computed in gridpoint space then, for the sake of dynamic stability, it is smoothed by a truncation in spectral space (see the subroutine suebig.F90).

So far in Fullpos the computation of the map factor didn't take into account the smoothing, either because the fields where produced for back-end post-processing, or because the mechanism of the configuration 927 enabled to use the map factor computed by the model itself.

With Fullpos-2 it will be necessary to compute and smooth the map factor for a spectral resolution which is different from the model one. Therefore we shall need to modularize the computation of the map factor in the model, then to externalize it in the scope of the externalization of Fullpos.(quoted passage from FULLPOS-2 Design & Specifications study – Revision #4 by R. El Khatib)

For these purposes, truncation part of the SUGEM2 is externalized and modularized in a new routine called as SUEGM. This routine is controlled by SUEFPGM and calling from SUBFPOS.

3.1 List of Modifications and New Routines

Name of the Routine	Modifications
SUEGM	new routine which is externalized from "suegem2"
SUEFPGM	new routine that updates values of GM
SUBFPOS	call suefpgm
SUEGEM2	Externalization of Truncation part
ETRANS_INQ	KCPL4M added
SUFPRFPDS	New map factor pointer (MFPMOF)
ESPFP	Read map factor and use it both for SP&GP fields
SUFPG	Control variables
SUFPRFPBUF	copy map factor

Table 3.1: *List of modified source codes*

4. TARGET DISTRIBUTION

The case LFPDISTRIB will have to be enriched with various options of distribution patterns. It can be the current pattern (if no spectral fits are concerned, like in sub-cases of NFPOS=1 or 927), or any pattern made possible by the spectral transforms package. Indeed, a strict North-South distribution in grid-point space together with a strict “level” distribution in spectral space may be optimal on the post-processing side, while the model could use a mixed distribution in both spaces. Unfortunately the spectral transforms package is not yet flexible enough to handle other distribution patterns than the model one ; however we should investigate on the possibility to enable this flexibility.

Ultimately, the original LFPDISTRIB distribution pattern should disappear and be replaced by a simple pattern from the spectral transforms.(quoted passage from FULLPOS-2 Design & Specifications study – Revision #4 by R. El Khatib)

Grid point transposition from FPOS distribution to the spectral distribution was computed in SUFPMERGE. This routine is externalized, also arguments & dimensioning are computed by using inquired variables from spectral package.

4.1 List of Modifications and New Routines

Name of the Routine	Modifications
SUFPMERGE_DEP	New routine, departure distribution to target one.
SUFPTRICK	Temporary routine to call SUFPMERGE_DEP.

Table 4.1: *List of modified source codes*

5. CONCLUSION

F*ull*POS is a post-processing package containing many features such as making ARPEGE or ALADIN history files, whether starting from a file ARPEGE or a file ALADIN. However, these sequence subdivided into two parts (internal and external part) which are required I/O operations and starting control cascade from the beginning in order to change the setup of the spectral transform . Scalability of F*ull*POS can be increased avoiding from these limitations.

In this study, map factor is smoothed by a truncation in spectral space and modularized the computation of the map factor in the model, then it is externalized it in the scope of the externalization of Fullpos.

Also, global addresses which are computed by using the local address of the starting geometry matched with the global address of the target geometry and local addresses in the target geometry were saved and coded in SUFPMERGE which is a sub-routine in TRFP2TRANS. This routine is externalized and used to compute target distrubution. Computation of gridpoint norms for a chunk of field is based on avarege, max and min values. Maxloc&minloc will use for the validation of the gridpoint transposition instead of using maxval&minval.