

# STATUS OF USE OF CLCONF IN CY40, AND PROPOSALS FOR FUTURE PLANS.

Karim YESSAD

June 10, 2013

Version 5.

## 1 Introduction.

Calls to STEPO require a character variable CLCONF with 9 characters.

- CLCONF(1:1) for file writing.
- CLCONF(2:3) for direct spectral transforms.
- CLCONF(4:4) for grid-point part of the model.
- CLCONF(5:5) for diagnostics.
- CLCONF(6:6) for observation.
- CLCONF(7:8) for inverse spectral transforms.
- CLCONF(9:9) for spectral calculations.

This paper tries to do an inventory of existing values for CLCONF; for each item we try to do an inventory of routines using CLCONF or CDCONF.

Additionally to that, we try to list intermediate steps leading to a significant simplification of the use of CLCONF.

FULL-POS has now its own STEPO\_FPOS and its own definition of CDCONF. This technical document will not deal with FULL-POS features.

## 2 List of existing values for CLCONF in CY40 and meaning.

### 2.1 CLCONF(1:1) for file writing.

- 0: no file writing.
- write of historical or model level files:
  - A: model “standard” historical file writing (sp, gp, cfu, xfu).
  - D: cf. A. but spectral fields only.
  - F: cf. A, but CLCONF(1:1)='F' only occurs when LLWRRE=T in CNT4.
  - L: model level file writing (cf. 'A' but for GRIB files only).
  - Q: model “standard” historical file writing (cf. 'A') + SURFEX writing.
  - S: writing SURFEX output files.
  - References to 'G', 'J', 'P', 'X' in WRMLPPA are not correct and must be removed.
- IO on trajectory:
  - B: calls (E)COPTRA or RD801 under IOPACK.
  - T: calls (E)COPTRA under IOPACK.
- Miscellaneous:
  - I: write increments (call to WRINC).
  - J: read increments (call to RDINC).
  - R: writing restart files.
  - W: writing transmission coefficients for simplified radiation scheme.
- The following letters are used in FULL-POS but not under STEPO: E,K,M,U,Y,Z.
- The following letters are not used: G,H,N,O,P,V,X.

## 2.2 CLCONF(2:5) for inverse spectral transforms.

- 00: no inverse spectral transforms.
- AA: model “standard” inverse spectral transforms, with calculation of derivatives.
- E0: for trajectory, with calculation of derivatives (used via CNT4TL and CNT4AD).
- GB: cf. AA but without calculation of derivatives (used via CNT4TL).
- K0, KD: cf. E0 but without calculation of derivatives: for trajectory (used via CNT4TL and CNT4AD).
- M1: cf. GB (used in routine CANARI only).

## 2.3 CLCONF(4:4) for grid-point part of the model.

- 0: no grid-point calculation.
- 1: appears in routine CANARI only.
- A: model “standard” grid-point calculation.
- B: cf. 'A' but some calculations are done with a timestep replaced by 0 (seems to interact with some FULL-POS diagnostics).
- X: cf. 'A' but when grid-point calculations are used for diagnostics (for CFU, XFU).

## 2.4 CLCONF(5:5) for diagnostics in grid-point space.

- 0: no diagnostic.
- L: appears in SCAN2MAD and SCAN2MTL; controls calls to LCNORGGAD, LCNORGGTL, LCNORAVAR.

Remark: replacement of CLCONF(5:5) can be done as follows:

- new key LR\_LCNORGG instead of CLCONF(5:5)='L' to control calls to LCNORGGAD, LCNORGGTL, LCNORAVAR.

## 2.5 CLCONF(6:6) for observation.

- 0: no observation treatment.
- A: appears in SCAN2MTL: call to VEC2GP.
- B: appears in SCAN2MTL: call to VEC2GP (cf. 'A').
- G: appears in SCAN2MAD: call to GET\_TRAJ\_GRID.
- H: appears in SCAN2M: call to SUJBVCOORD.
- N: appears in SUJBWAVGEN.
- X: appears in SCAN2MAD: call to GET\_TRAJ\_GRID (cf. 'G').
- 1: appears in SCAN2M: grid-point calculations for CANARI, call to CAPOTX.
- C, F and V: COBSALL is called.

## 2.6 CLCONF(7:8) for direct spectral transforms.

- 00: no direct spectral transforms.
- AA: model “standard” direct spectral transforms.
- GG: differs from 'AA' only by the fact that we start from grid-point (DIV,VOR) instead of (U,V) to compute spectral (DIV,VOR).
- UU (LAM models only): standard direct spectral transforms called under SPECFITA (case LELAM=T only, because 'AA' is used if LELAM=F). Differs from 'AA' only by the fact that we start from grid-point (DIV,VOR) instead of (U,V) to compute spectral (DIV,VOR).

## 2.7 CLCONF(9:9) for spectral calculations.

- 0: no spectral calculation.
- A: model “standard” spectral calculations (at least semi-implicit scheme and horizontal diffusion).
- I: cf. 'A' but without horizontal diffusion (used in the DFI).
- The following letter is used in FULL-POS but not under STEPO: P.

We recall what “standard” spectral calculations contains:

- spectral mass corrector (if LMASCOR=T).
- semi-implicit scheme.
- horizontal diffusion schemes (including sponge).
- nudging in spectral space for climate models (if LNUDG=T).
- spectral nudging for LAM models (if LDESPCL=T).

## 2.8 Examples.

- CLCONF='0AAA00AAA': standard model timestep without writing historical files.
- CLCONF='A00000000': simply writes historical files.

## 3 Routines using CDCONF or CLCONF, and routines calling STEPO in CY39.

CLCONF in ARP:

```
canari/cadavr.F90
canari/canari.F90
control/cnt0.F90
control/cnt3.F90
control/cnt4ad.F90
control/cnt4.F90
control/cnt4t1.F90
dfi/dfi3.F90
dfi/pc_ini.F90
oops/error_covariance_3d_mod.F90
oops/fields_io_mod.F90
sinvect/lcnorad.F90
sinvect/lcnort1.F90
var/cosjl.F90
phys_ec/callparad.F90 (CL_CDCONF)
```

CLCONF in ALD:

```
coupling/elswa3.F90
```

CDCONF in ARP:

```
adiab/cpg25.F90 (CDCONF(4:4) only)
adiab/cpg2ad.F90 (CDCONF(4:4) only)
adiab/cpg2.F90 (CDCONF(4:4) only)
adiab/cpg2t1.F90 (CDCONF(4:4) only)
adiab/cpg_drv_ad.F90 (CDCONF(4:4) only)
adiab/cpg_drv.F90 (CDCONF(4:4) only)
adiab/cpg_drv_t1.F90 (CDCONF(4:4) only)
adiab/lacdynshwad.F90 (CDCONF(4:4) only)
adiab/lacdynshw.F90 (CDCONF(4:4) only)
adiab/lacdynshwt1.F90 (CDCONF(4:4) only)
adiab/spc2ad.F90 (CDCONF(9:9) only)
adiab/spc2.F90 (CDCONF(9:9) only)
c9xx/coptra.F90 (CDCONF(1:1) only)
control/gp_model_ad.F90
control/gp_model.F90
control/gp_model_t1.F90
control/scan2mad.F90
control/scan2m.F90
control/scan2mt1.F90
control/spc2mad.F90 (CDCONF(9:9) only)
control/spc2m.F90 (CDCONF(9:9) only)
control/spcmad.F90 (CDCONF(9:9) only)
control/spcm.F90 (CDCONF(9:9) only)
control/stepoad.F90
control/stepo.F90
control/stepot1.F90
dia/inifaout.F90 (CDCONF(1:1) only)
dia/wrmlppa.F90 (CDCONF(1:1) only)
dia/wrmlpp.F90 (CDCONF(1:1) only)
obs_preproc/obsprep.F90 (CDCONF='V' only)
op_obs/bgobs.F90 (CDCONF(6:6) only)
phys_ec/ec_phys_drv.F90 (CDCONF(4:4) only)
phys_ec/ec_phys.F90 (CDCONF(4:4) only)
phys_ec/vdfmain.F90 (CDCONF(4:4) only)
phys_ec/vdfouter.F90 (CDCONF(4:4) only)
transform/transdirhad.F90 (CLCONF(8:8) only)
transform/transdirh.F90 (CLCONF(8:8) only)
transform/transdir_mdlad.F90 (CLCONF(8:8) only)
transform/transdir_mdl.F90 (CLCONF(8:8) only)
transform/transinvhad.F90
transform/transinvh.F90
utility/iopack.F90 (CLCONF(1:1) only)
utility/opdis.F90
var/jbvcoord_interpolate_ad.F90 (CDCONF='N' only)
var/jbvcoord_interpolate.F90 (CDCONF='N' only)
var/jbvcoorg.F90 (CDCONF='P' or 'Q' only)
var/vec2gp.F90 (CDCONF(6:6) only)
```

CDCONF in ALD:

```
c9xx/ecoptra.F90 (CDCONF(1:1) only)
control/espomad.F90 (CDCONF(9:9) only)
control/espcom.F90 (CDCONF(9:9) only)
transform/etransdirhad.F90 (CDCONF(8:8) only)
transform/etransdirh.F90 (CDCONF(8:8) only)
transform/etransdir_mdlad.F90 (CDCONF(8:8) only)
transform/etransdir_mdl.F90 (CDCONF(8:8) only)
transform/etransinvhad.F90
transform/etransinvh.F90
```

STEPO in ARP:

```
canari/cadavr.F90
canari/canari.F90
control/cnt4ad.F90
control/cnt4.F90
control/cnt4t1.F90
control/sim4d.F90
dfi/dfi3.F90
dfi/pc_ini.F90
sinvect/lcnorad.F90
sinvect/lcnortl.F90
sinvect/suforce.F90
sinvect/wrtsv.F90
var/bgevecs.F90
var/bgvecs.F90
var/cosens.F90
var/cosjc.F90
var/cosjl.F90
var/cosjr.F90
var/suecges.F90
var/sujbwavgen.F90
var/upspec.F90
var/xformev.F90
```

STEPO in ALD:

```
sinvect/ewrtsv.F90
var/ecosjr.F90
var/ewreini.F90
```

obsolete occurrences of CDCONF(4:4) also appears in some routines of project “SUR”.

## 4 A proposal about intermediate steps to limit the use of CLCONF.

### 4.1 Introduction.

Completely removing CLCONF will be a difficult task (is it really desirable to do it?), and it seems better to progress slowly and carefully, step by step, in order to simplify the current use of CLCONF. Reorganisation of STEPO in order to start by grid-point calculations instead of spectral ones could lead to a re-definition of CLCONF with some simplifications. The new CLCONF could be a 6-letter one with the following definition:

- new CLCONF(1:1): grid-point calculations (current CLCONF(4:4)).
- new CLCONF(2:2): observation (current CLCONF(6:6)).
- new CLCONF(3:3): direct spectral transforms (current CLCONF(7:8)).
- new CLCONF(4:4): spectral calculations (current CLCONF(9:9)).
- new CLCONF(5:5): file writing (current CLCONF(1:1)).
- new CLCONF(6:6): inverse spectral transforms (current CLCONF(2:3)).

To simplify CLCONF we can work according to the following steps:

- Step 1: easy cleanings and removal of obsolete configurations which appear in a very limited amount of pieces of code.
- Step 2: simplify use of CLCONF in direct spectral transforms.
- Step 3: simplify use of CLCONF in inverse spectral transforms.
- Step 4: simplify use of CLCONF(1:1).
- Step 5: simplify use of CLCONF(6:6).
- Step 6: replace scories of CLCONF(5:5) by something else.
- Step 7: go towards a 6-letter CLCONF replacing elements 1, 2:3, 4, 6, 7:8, 9.

## 4.2 Examples of easy cleanings which can be done in 'step 1' and not yet done in CY40.

- CLCONF(1:1): remove references to CLCONF(1:1)='G', 'J', 'P', 'X' in WRMLPPA.
- CLCONF(4:4): remove references to obsolete CLCONF(4:4)='T' in ECMWF physics and surface (this pruning has been forgotten during the pruning of option LFULLIMP done in 2004).
- CDCONF used in OBSPREP:
  - OBSPREP: remove obsolete code under CDCONF='C'; remove tests on CDCONF (only CDCONF='V' code remains); remove dummy argument CDCONF.
  - CNT4AD and CHKOBTIM: adapt to dummy interface of OBSPREP.

## 4.3 What could include the following steps (cf. steps 2 to 5 defined above)?

The aim is to keep a simplified use of CLCONF with the following requirements:

- For each character of CLCONF, the maximum possible non-zero values is 5.
- CLCONF or CDCONF can appear in the callers of STEPO (+TL, AD), CNT4, CNT4TL, CNT4AD, DFI3, and in some routines called immediately under STEPO (+TL, AD), but not in routines called deeply under STEPO (+TL, AD).
- Inverse transforms: CLCONF(3:3) must be equal to CLCONF(2:2).
- Direct transforms: CLCONF(8:8) must remain equal to CLCONF(7:7).
- Under STEPO (+TL, AD):
  - CDCONF(1:1) may appear in IOPACK but not elsewhere.
  - CDCONF(2:2) and CDCONF(3:3) may appear in (E)TRANSINVH(AD) but not below, nor in any other routine called under STEPO (+TL, AD). In particular CDCONF(3:3) must not appear in SCAN2M.
  - CDCONF(4:4) may appear in SCAN2M (+TL, AD) and GP\_MODEL (+TL, AD) but not below GP\_MODEL (+TL, AD).
  - CDCONF(5:5) may appear in SCAN2M but not below. CDCONF(5:5) must not appear in (E)TRANSINVH.
  - CDCONF(6:6) may appear in SCAN2M but not below.
  - CDCONF(7:7) and CDCONF(8:8) may appear in (E)TRANSDIRH(AD) but not below, nor in any other routine called under STEPO (+TL, AD).
  - CDCONF(9:9) may appear in (E)SPCM(AD) and SPC2M(AD) but not below, nor in any other routine called under STEPO (+TL, AD).

The following list provides possible non-zero letters for each character of CLCONF:

- CLCONF(1:1):
  - 'A': writing historical files (replaces current 'A', 'D', 'F', 'L', 'Q', 'S').
  - 'T': IO on trajectory (replaces current 'B', 'T', 'V').
  - 'M': other actions (replaces current 'I', 'J', 'R', 'W').
- CLCONF(2:3):
  - 'AA': standard inverse transforms with derivatives (call to (E)TRANSINV\_MDL).
  - 'BB': standard inverse transforms without derivatives (call to (E)TRANSINV\_MDL). Replaces former 'M1' (CANARI) or 'GB'.
  - 'TT': standard inverse transforms for trajectory with derivatives (call to (E)TRANSINV\_MDL). Replaces former 'E0'.
  - 'UU': standard inverse transforms for trajectory without derivatives (call to (E)TRANSINV\_MDL). Replaces former 'K0' or 'KD'.
- CLCONF(4:4):
  - 'A': standard grid-point calculations.
  - 'B': cf. 'A' but with some zeroed terms (linear terms, for example).
  - 'Q': CANARI (replaces current 'I').
- CLCONF(5:5):
  - 'L': LCNORGG... routines.
- CLCONF(6:6):
  - 'A': calls to VEC2GP (replaces current 'A', 'B').

- 'T': calls to GET\_TRAJ\_GRID (replaces current 'G', 'X').
- 'J': calls to SUJB... (replaces current 'H', 'N').
- 'C': calls to COBSALL (replaces current 'C', 'F', 'V').
- 'Q': CANARI (replaces current 'I').
- CLCONF(7:8):
  - 'AA': standard direct transforms U-V to DIR-VOR (call to (E)TRANSDIR\_MDL).
  - 'GG': standard direct transforms DIR-VOR to DIR-VOR (call to (E)TRANSDIR\_MDL).
  - 'UU': alternate version of 'GG' for LAM models only (call to (E)TRANSDIR\_MDL).
- CLCONF(9:9):
  - 'A': standard spectral calculations.
  - 'I': standard spectral calculations, without horizontal diffusion.

Additionally:

- JBVCOORD\_INTERPOLATE and JBVCOORD\_INTERPOLATE\_AD: dummy argument CDCONF must be replaced by variable KDIR (current IDIRECTION). Callers CVARGPTL and CVARGPAD must be updated.
- JBVCOORG: dummy argument CDCONF must be replaced by variable LDIR (LDIR=T replacing CDCONF='P', LDIR=F replacing CDCONF='Q'). Callers JBVCOR\_WAVELET(IN)(AD) must be updated.

## 5 Work done before CY40.

### 5.1 Work done between CY38 and CY39.

- CLCONF(1:1):
  - Obsolete case 'C' has been removed.
- CLCONF(4:4):
  - Scories of CLCONF(4:4)='S' have been removed.
  - Scories of CLCONF(4:4)='T' have been removed, excepted under EC\_PHYS\_DRV where some occurrences still exist (in particular in project "SUR"). CLCONF(4:4)='T' is linked with a very old version of predictor-corrector scheme pruned in 2004 (LFULLIMP=T).
  - NMI have been removed; as a consequence CLCONF(4:4)='E' or 'F' have been removed.
  - Only the following possibilities remain: 'A', 'B', 'X'.
  - Use of CLCONF under CPG\_DRV, CPG\_DRV\_TL and CPG\_DRV\_AD has been significantly simplified. No use of CLCONF must appear any longer in routines called under CPG\_DRV, CPG\_DRV\_TL and CPG\_DRV\_AD.
- CLCONF(5:5):
  - References to obsolete cases CLCONF(5:5)='C', 'X' have been removed.
- CLCONF(6:6):
  - References to obsolete cases CLCONF(6:6)='M', 'S', 'W', 'Y', 'Z' have been removed.
- CLCONF(9:9):
  - Scories of CLCONF(9:9)='F' have been removed.
  - CLCONF(9:9)='S' or 'T' have been replaced by CLCONF(9:9)='I' (no horizontal diffusion).
  - Use of CLCONF under (E)SPCM(AD) has been significantly simplified, with the removal of redundant tests. CLCONF does not appear any longer in routines called under (E)SPCM(AD).
- FULL-POS applications of CLCONF have been completely redefined (new STEPO\_FPOS).

### 5.2 Work done between CY39 and CY39T1.

- CLCONF(1:1):
  - Obsolete case 'V' has been removed.
  - ABOR1 is called to prevent use of obsolescent configurations.
- CLCONF(2:3): only cases 'AA', 'E0', 'GB', 'K0', 'KD', 'M1' have been kept.
- CLCONF(7:8): CLCONF(8:8) is now equal to CLCONF(7:7), CLCONF(7:8) can be 'AA', 'GG' or 'UU'.

## 6 Conclusion.

Examination of CLCONF shows obsolete features, and also dirty features which are potential sources of bugs. Some inconsistencies between the use of possible values of CLCONF/CDCONF may occur throughout the call tree (this is the case for example under IOPACK). There are also mis-placed uses of some characters of CLCONF (for example CLCONF(3:3) under SCAN2M which is a scorie of an old 90's architecture where inverse Fourier transforms were done under SCAN2M).

No extensive work plan has been given to replace the use of CLCONF by something easier to deal with, but some intermediate steps have been proposed, because the progressive simplification of CLCONF will need some care. What is listed in "step 1" could be quickly removed.

The future reorganisation expected for STEPO, in order to start by grid-point calculations, could be a good occasion to redefine a 6-letter simplified CLCONF.