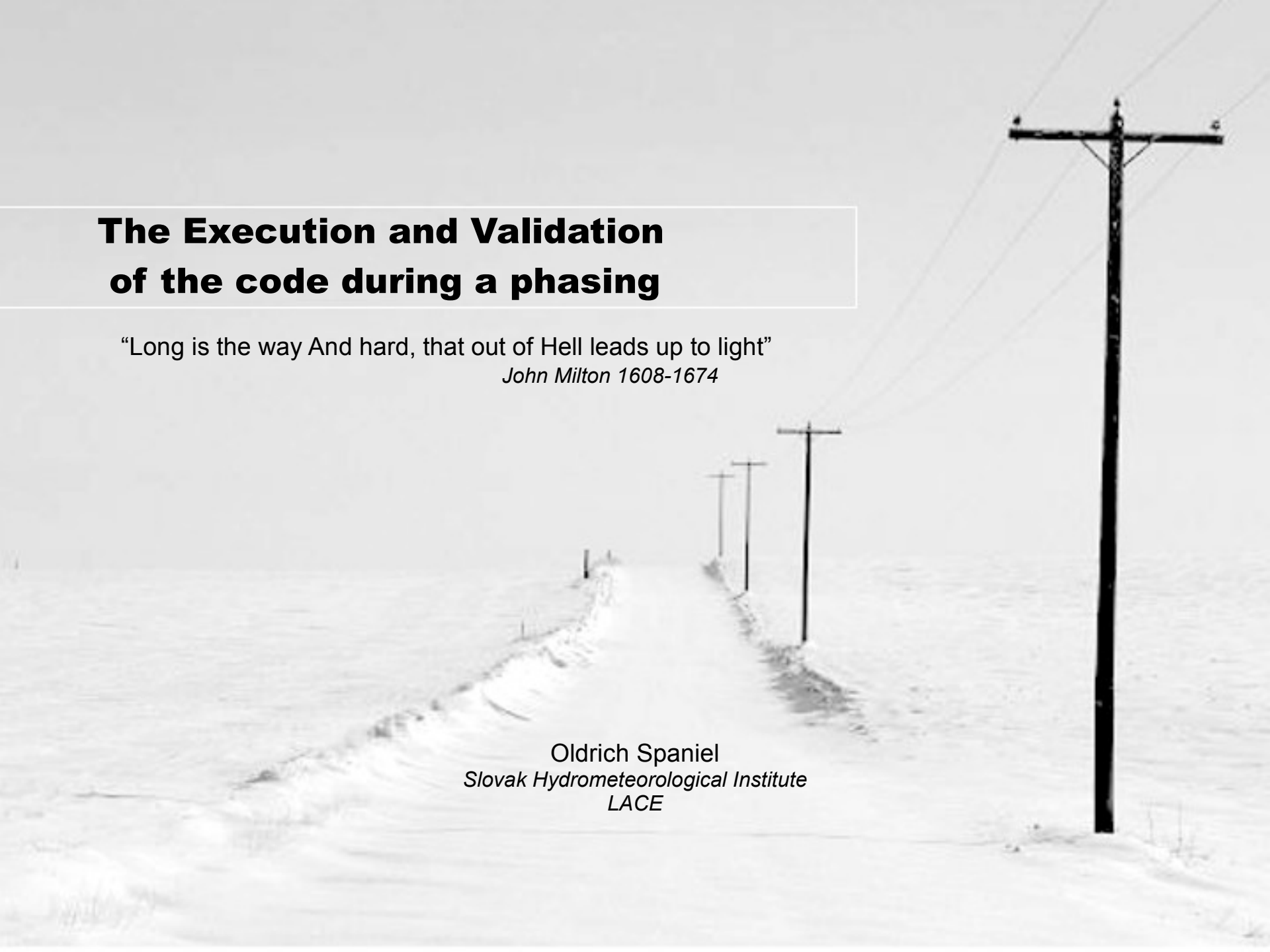
The Execution and Validation of the code during a phasing

"Long is the way And hard, that out of Hell leads up to light"
John Milton 1608-1674



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Phasing - *keywords*

- Phasing generally
- Architecture of the code, coding norms and rules
- Configurations
- ClearCase - source code repository
- Mitraillette, OLIVE - validation tool
- Gmkpack - compilation tool

Execution – *computing environment at MF*

past

current

NEC
SX8-R *tori* (research)

NEC
SX8-R *sumo* (oper)

SX8-R cluster *tori* (research)
32 nodes - 8CPU's/node
- 128 GB/node
9.0 Tflops

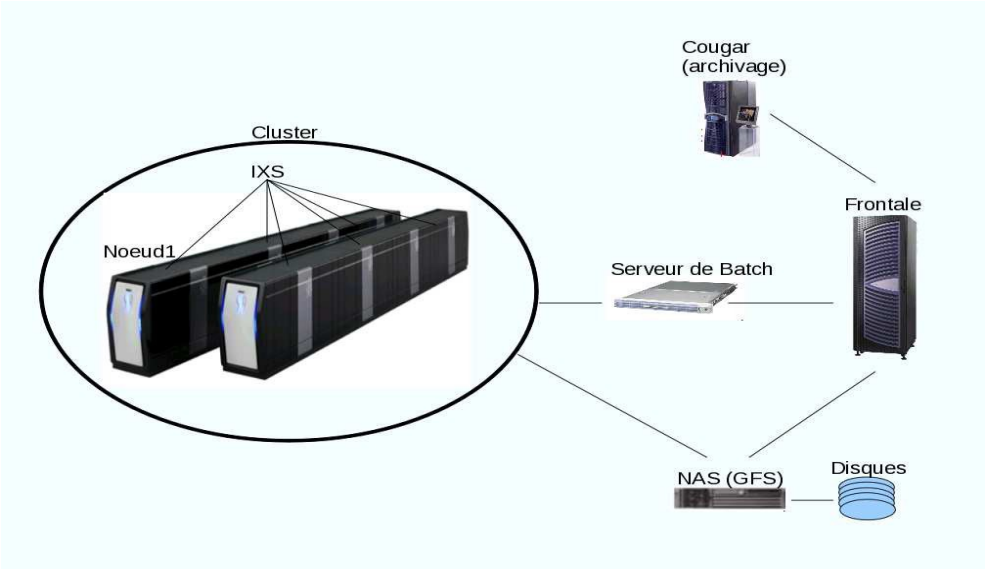
SX9 cluster *yuki* (research)
10 nodes - 16 CPU's/node
- 1TB/node
16.3 Tflops

SX9 cluster *kumo* (oper)
10 nodes - 16 CPU's/node
- 1TB/node
16.3 Tflops

merou.meteo.fr - ClearCase
cougar.meteo.fr - data storage

Execution – *computing environment at MF*

- **NEC SX9** cluster *yuki* (research)



- scalar front-end
- 10 nodes x 16 vector CPU's x

- The main standard NQS instructions
  - **job submission**
    qsub [option] myjob *(llsubmit for AIX)*
  - **job monitoring**
    qstat [reqid] *(llq for AIX)*
    qstat_all
  - **to stop/kill job**
    qdel reqid *(llcancel for AIX)*

- NQS queues – ft, nocpu, 1proc, mono, multi, multi4, vector

- The User's Gide – *Introduction to NEC "tori" machine at MeteFrance, 2007*
  - queue structure
  - disk configuration and file systems
  - the Fortran compiler

Execution – *units and steps*

Necessary units

- Binary
- Namelist
- Initial conditions&LBC (clim files e(e)927)
- NEC specific environment variables
- Optionally model specific environment variables
- NQS header

and steps

- Lunching the job(s)
- Monitoring of the execution
- Access to the outputs

Execution – *binary*

- Provided by GCO team of Météo-France (*masterpack*)

A new pack is available for pre-cycle CY36T2 .

ClearCase :

cc_getpack -r 36t1 -b t2 [-v 01] -u mybranch - public
view: arp_public_CY36T1_t2.01

gmkpack (SX9) :

gmkpack -r cy36t1 -b t2 -v 00 -u cy36t2gco -l SX20r400 -o ft -p masterodb

- Own pack by gmkpack based on master pack (*userpack*)
- Mitraillette script

MYOWNBIN=/cnrm/gp/mrpe/mrpe693/pack/cy36t2gcoYF/bin/MASTERODB
GOUROUBIN='cy36t1_masterodb-t2.00.SX20r400.x.exe'

Execution – *binary*

- Provided by GCO (*masterpack*)

```
Wed May 19 07:25:51 2010 1714887 od36t1_addbias1c-t2.00.SX20r400.x.exe
Wed May 19 07:25:57 2010 9543345 ut36t1_addozoaer-t2.00.SX20r400.x.exe
Wed May 19 07:26:00 2010 9655793 ut36t1_addsurf-t2.00.SX20r400.x.exe
Wed May 19 07:25:54 2010 9380855 ut36t1_cloud-t2.00.SX20r400.x.exe
Wed May 19 07:26:02 2010 1710887 od36t1_addscan1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:05 2010 9883850 tf36t1_atstprog-t2.00.SX20r400.x.exe
Wed May 19 07:26:10 2010 127133777 od36t1_bator-t2.00.SX20r400.x.exe
Wed May 19 07:26:15 2010 1851797 od36t1_biasconv1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:18 2010 10291681 al36t1_surfmix-t2.00.SX20r400.x.exe
Wed May 19 07:26:21 2010 10256533 al36t1_blendsur-t2.00.SX20r400.x.exe
Wed May 19 07:26:24 2010 2588489 od36t1_calcbias1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:27 2010 1801071 od36t1_calcscan1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:30 2010 10257733 al36t1_chklimits-t2.00.SX20r400.x.exe
Wed May 19 07:26:33 2010 9884860 ut36t1_combi-t2.00.SX20r400.x.exe
Wed May 19 07:26:36 2010 2295790 od36t1_cyclebias1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:40 2010 123486596 od36t1_biasprep1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:47 2010 1847134 od36t1_cyclescan1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:49 2010 1776120 od36t1_biassele1c-t2.00.SX20r400.x.exe
Wed May 19 07:26:53 2010 3286484 ut36t1_dategrib-t2.00.SX20r400.x.exe
Wed May 19 07:26:56 2010 7146741 xr36t1_ddhc-t2.00.SX20r400.x.exe
Wed May 19 07:26:58 2010 6559905 xr36t1_ddhr-t2.00.SX20r400.x.exe
Wed May 19 07:27:01 2010 6637225 xr36t1_ddht-t2.00.SX20r400.x.exe
Wed May 19 07:27:04 2010 10930495 ta36t1_eatstpro-t2.00.SX20r400.x.exe
Wed May 19 07:27:08 2010 8209911 ta36t1_etestadj-t2.00.SX20r400.x.exe
Wed May 19 07:27:11 2010 123193293 od36t1_fcqodb-t2.00.SX20r400.x.exe
Wed May 19 07:27:17 2010 9457814 ut36t1_gobptout-t2.00.SX20r400.x.exe
Wed May 19 07:27:20 2010 12491666 ut36t1_inversion-t2.00.SX20r400.x.exe
Wed May 19 07:27:22 2010 1098248 od36t1_ioassign-t2.00.SX20r400.x.exe
Wed May 19 07:27:26 2010 123297192 al36t1_lamflag-t2.00.SX20r400.x.exe
Wed May 19 07:27:32 2010 8227995 ut36t1_lectbdap-t2.00.SX20r400.x.exe
Wed May 19 07:27:40 2010 122996121 od36t1_mandalay-t2.00.SX20r400.x.exe
Wed May 19 07:27:57 2010 227242996 cy36t1_master-t2.00.SX20r400.x.exe
Wed May 19 07:28:06 2010 7143560 ut36t1_9t1-t2.00.SX20r400.x.exe
Wed May 19 07:28:11 2010 354417522 cy36t1_masterodb-t2.00.SX20r400.x.exe
Wed May 19 07:28:21 2010 7076858 cy36t1_mrgvarbc-t2.00.SX20r400.x.exe
Wed May 19 07:28:35 2010 151732467 od36t1_tools-t2.00.SX20r400.x.exe
Wed May 19 07:28:26 2010 148458204 od36t1_compress-t2.00.SX20r400.x.exe
Wed May 19 07:28:41 2010 23762804 ms36t1_oimain-t2.00.SX20r400.x.exe
```

progpack – gmkpack command for list of executables

Execution – *namelist*

- NAMELIST
  - standard F90 statement
  - to add annotated input during execution
  - without re-compiling of the program
- Namelist *nam001_lacealaro (700 lines and 150 namelists) ->* **fort.4**

Technical settings
Global settings
Host specific settings
MPP options
File settings

Dynamics setting
Main dynamics switches
Non-hydrostatic settings
Vertical finite elements
DFI

Main physics options
ALADIN
AROME
Alaro
Hirald physics
Old surface
SURFEX
Vertical finite element
DDH

E927 Interpolation settings
Main fullpos settings
E927 nh
SURFEX initial file generation
Aladin e927
Arome e927

General postprocessing switches
Default fullpos settings
NH postprocessing
Switches for postprocessing with surfex
Special cases for arome

Assimilation
Canari
Aladin canari
Screening
Aladin screening
Arome screening
Alaro screening
Minimization
Aladin minimization
Alaro minimization

4DVAR namelists
4DVAR minimization
4DVAR screening
4DVAR trajectory

Climate generation
Climate generations (e923)

Execution – *namelist*

- Namelist

Technical settings
Global settings
Host specific settings
MPP options
File settings
Dynamics setting
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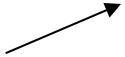
Vertical finite elements
DFI
Main physics options
ALADIN
AROME
Alaro
Hirald physics
Old surface
SURFEX
Vertical finite element
DDH



Technical settings
Host specific settings

```
NAMCT0
 LOPT_SCALAR      ! to run code optimised for scalar machines.
NAMDIM
 NPROMA           ! working dimension for grid-point computations
NAMFPSC2
 NFPROMA          ! size of working arrays for horizontal post-processing
NAMJFH
 N_VMASS          ! MASS library vector routines
NAMPAR0
 MP_TYPE          ! the technique used for message passing
 MBX_SIZE         ! mailbox size for MPI
 LMPOFF           ! switch on/off message passing
NAMPAR1
 NCOMBFLEN        !size of communication buffer
```

Execution – *namelist*

- Namelist

Technical settings
- *Global settings*
- *Host specific settings*
- *MPP options*
- *File settings*

Dynamics setting
- *Main dynamics switches*
- *Non-hydrostatic settings*
- *Vertical finite elements*
- *DFI*

Main physics options
- *ALADIN*
- *AROME*
- *Alaro*
- *Hirald physics*
- *Old surface*
- *SURFEX*
- *Vertical finite element*
- *DDH*

&NAMCT0
LOPT_SCALAR=.FALSE., ! to run code optimised for scalar machines.
LSPRT=.TRUE.,
NCONF=1,
LELAM=.TRUE.,
LRPLANE=.TRUE.,
LECMWF=.FALSE.,
LSLAG=.TRUE.,
LTWOTL=.TRUE.,
LREGETA=.TRUE.,
LVFE_REGETA=.TRUE.,
NSTOP=1,
NFRHIS=1,
NHISTS(0)=-55,
NHISTS(1:55)=-0,-1,-2,-3,-4,-5,-6,-7,-8,-9,-10,-11,-12,-13,-14,-15,-16,-17,-18,-19,-20,-21,-22,-23,-24,-25,-26,-27,-28,-29,-30,-31,-32,-33,-34,-35,-36,-37,-38,-39,-40,-41,-42,-43,-44,-45,-46,-47,-48,-49, -50,-51,-52,-53,-54, ! array containing history write-up steps
LFPOS=.FALSE.,
NFRPOS=1,
NPOSTS(0)=-55, NPOSTS(1:55)=-0,-1,-2,-3,-4,-5,-6,-7,-8,-9,-10,-11,-12,-13,-14,-15,-16,-17,-18,-19,-20,-21,-22,-23,-24,-25,-26,-27,-28,-29,-30,-31,-32,-33,-34,-35,-36,-37,-38,-39,-40,-41,-42,-43,-44,-45,-46,-47,-48,-49,-50,-51,-52,-53,-54, ! array containing postprocessing steps
NFRSDI=5,
NFRGDI=5,
NFRISP=3,
NPISPS(0)=0,
CNMEXP='ALAD',
LFBDAP=.TRUE.,
NPRINTLEV=1,
NSPPR=1,
/

Execution – *namelist&mitraillette*

- *Namelist – template modified by script*

```
$CP ${NAM_PATH}/nam001_lacealaro_4 nam001_lacealaro

sed \
    -e "s/XLOPT_SCALAR/$LOPT_SCALAR/" \
    -e "s/substr6/$MBX_SIZE/" -e 's/substrA/2/' -e 's/substrB/2/' \
    -e 's/substr2/FALSE/' -e 's/substrC/4/' \
    -e 's/substr4/2/' -e 's/substr5/FALSE/' \
nam001_lacealaro > namprovi

\cat < namprovi
$CP namprovi fort.4
```

```
&NAMINI
  NEINI=substr4,
 /
 &NAMPAR0
  MBX_SIZE=16000000,
  NOUTPUT=1,
  NPROC=substrC,
  NPRGPNS=substrA,
  NPRGPEW=substrB,
  NPRTRW=substrA,
  NPRTRV=substrB,
  LMPOFF=.substr2.,
  MP_TYPE=2,
 /
 &NAMPAR1
  LEQ_REGIONS=.FALSE.,
  LSPLIT=.FALSE.,
  NSTRIN=substrC,
  NSTROUT=substrC,
  NCOMBFLEN=1800000,
 /
```

Execution – *practical hints*

Substitution

/bin/ksh

```
sed \
    -e "s/XLOPT_SCALAR/$LOPT_SCALAR/" \
    -e "s/substr6/$MBX_SIZE/" \
    -e 's/substrA/2/' -e 's/substrB/2/' -e 's/substrC/4/' \
    -e 's/substr2/FALSE/' \
    -e 's/substr4/2/' -e 's/substr5/FALSE/' \
nam001_lacealaro > namprovi
```

/usr/bin/perl

```
# prepare namelist
&subst_file($nam, "fort.4",
  __LMPOFF__   => $lmpoff,
  __MBX_SIZE__ => $ENV{MBX_SIZE},
  __NHISTS__   => $nhists,
  __NPROC__    => $nproc,
  __TEFRCL__   => $tefrcl,
) or
  &abort("Cannot prepare namelist fort.4!");
```

ksh & perl

```
for i in 00 03 06 09 12 15 18 21 24
 do
  perl -i -p -e "s/_rr_/$i/" run_ee927.$i
 done
```

Find

check status of compilation

```
cd src/local
find . –name “*.F*” –o –name “*.f*” –o –name “*.c”  | wc –l
find . –name “*.o”  | wc –l
```

to find some string in file

```
cd src/local
find . –name “*.F*” –exec grep –l -i “NPROC” {} \;
```

Output comparison

mostly on local PC

```
gvim -d <file1> <file2> ...
vi
```

Fortran&compiler

Execution – *input files*

- Initial conditions&Lateral Boundary Conditions (e001)

LACE_20070125r0_analyse+0000 -> **ICMSHLACEINIT** (70MB, 320x288, 9km)
LACE_20070125r0_COUPL0000 -> **ELSCFLACEALBC000** (120MB)
LACE_20070125r0_COUPL0003 -> **ELSCFLACEALBC001**
LACE_20070125r0_COUPL0006 -> **ELSCFLACEALBC002**
LACE_20070125r0_COUPL0009 -> **ELSCFLACEALBC003**
LACE_20070125r0_COUPL0012 -> **ELSCFLACEALBC004**

- Climatological files (e927 - transform input file from Arpege to ALADIN)

T358_20070131h12_ICMSHARPE-> **ICMSHFPOSINIT**
clim_t358_isba01 -> **Const.Clim** (ARPEGE climatology file input geometry)
clim_france_isba01 -> **const.clim**.<EXP> (ALADIN climatology file output geometry)

Execution – *environment variables on SX9*

- NEC specific environment variables

```
export F_UFMTENDIAN=31
export F_SYSLEN=1000
export F_FMTBUF=131072
export F_PROGINF=DETAIL
export F_FTRACE=FMT2
export F_RECLUNIT=BYTE
export MPIPROGINF=ALL_DETAIL
export MPISEPSELECT=0
export MPISUSPEND=ON
export  MPIEXPORT="MPISUSPEND, F_FTRACE, F_FMTBUF, F_RECLUNIT, MPIPROGINF,
PATH, DR_HOOK, DR_HOOK_IGNORE_SIGNALS"
```

Execution – *model variables*

- Optionally model specific environment variables

```
export DR_HOOK=0
export DR_HOOK_IGNORE_SIGNALS=-1
```

Execution – *lunching the job on SX9*

- Lunching the job(s)

$MPILAUNCH ./MASTER -c${NCONF} -v${VERS} -m${MODEL} -e${CNMEXP} -t${TSTEP} -f${NSTOP} -a${ADVEC} $ZOPT >lola 2>&1

```
MPILAUNCH="mpirun -nn 1 -nnp 4"
NCONF = 001
VERS = meteo
MODEL = aladin
CNMEXP = AA1T
TSTEP = 360.
NSTOP =  h48            but NSTOP=1 in NAMELIST !
ADVEC = sli
```

- QNS header

```
#PBS -S /bin/ksh
#PBS -N AA1T000
#PBS -j o
#PBS -T mpisx
#PBS -l elapstim_req="6000,5980"
#PBS -l cputim_job="6000,5980"
#PBS -l cpunum_job=4
#PBS -b 1
#PBS -l memsz_job=16000Mb
#PBS -q vector
#PBS -v NPROC=4
```

Execution – *output&mitraillette*

- output files

lola - stdout
NODE.001_01 – model output
ifs.stat – timing statistic
history witness file $CFNHWF – ECHIS
mitraillette output file - <code><nr>.o<requestID> - > #PBS -N **AA1T000**
(fort.91 - pseudosatellite image)

Execution – *practical hints*

- output

$MPILAUNCH ./MASTER -c${NCONF} -v${VERS} -m${MODEL} -e${CNMEXP} -t${TSTEP} -f${NSTOP} -a${ADVEC} $ZOPT ***>lola 2>&1***

0 STDIN - standard input
1 STDOUT - standard output
2 STDERR - standard error

- “aladin > lola 2>1″ — stdout is redirected to file “lola” and stderr is redirected to a file named “1″
- “aladin > lola 2>&1″ — stdout is redirected to file “lola” and stderr is redirected to where stdout is redirected (bit bucket)
- “aladin > lola &2>1″ — stdout is redirected to file “lola”, then character “&” comes, which means that this process will run in background. Then comes 2>1 which will create an empty file with the name 1.
- “aladin > /dev/null 2>&1″ — stdout is redirected to /dev/null and stderr is redirected to where stdout is redirected (bit bucket)

Execution - *output&mitraillette*

- *output files*

\cat lola

$MPILAUNCH ./MASTER -c${NCONF} -v${VERS} -m${MODEL} -e${CNMEXP} -t${TSTEP} -f${NSTOP} -a${ADVEC} $ZOPT ***>lola 2>&1***

\cat NODE.xxx_xx

```
if [ -a NODE.001_01 ]
then
  for file in NODE*
  do
    set +x
    echo ''
    echo ' Listing d execution pour partie parallelisee: fichier ' $file
    echo ' Listing for the parallelised part: file ' $file
    echo ''
    set -x
    \cat $file
  done
fi
```

Execution - *output*

- *output files* - Labeling of NODE file

NODE.MYSETA_MYSETB
MYSETA own processor set a (is in the range 1 to NPRGPNS)
MYSETB own processor set b (is in the range 1 to NPRGEW)

```
&NAMPAR0
  NOUTPUT=2,
  NPROC=30,
  NPRGPNS=6,
  NPRGPEW=5,
  NPRTRW=6,
  NPRTRV=5,
  MBX_SIZE=128000000,
  LMPOFF=.FALSE.,
  MP_TYPE=2,
 /
 &NAMPAR1
  LSPLIT=.FALSE.,
  NSTRIN=30,
  NSTROUT=15,
  NCOMBFLEN=8000000,
&NAMCT0
  NPRINTLEV=1,
/
```

NOUTPUT determines which PEs are going produce diagnostic output.
The others do not output (LOUTPUT=.F.) or sends data to /dev/null.
NOUTPUT : 0 = No diagnostic output
1 = Only diagnostic output from PE1 (default)
2 = Diagnostic output from all PEs into separate files

NPRGPNS : Number of processors used during grid-point phase in North-South
NPRGPEW : Number of processors used during grid-point phase in East-West
NSTRIN: Number of processors requerd to perform input processing
NSTROUT: Number of processors requered to perform output processing

```
NODE.001_01  NODE.002_01  NODE.003_01  NODE.004_01  NODE.005_01  NODE.006_01
NODE.001_02  NODE.002_02  NODE.003_02  NODE.004_02  NODE.005_02  NODE.006_02
NODE.001_03  NODE.002_03  NODE.003_03  NODE.004_03  NODE.005_03  NODE.006_03
NODE.001_04  NODE.002_04  NODE.003_04  NODE.004_04  NODE.005_04  NODE.006_04
NODE.001_05  NODE.002_05  NODE.003_05  NODE.004_05  NODE.005_05  NODE.006_05
```

NPRINTLEV : 0 = "basic prints'; 1 = "more prints"; 2 = "debug prints"

Execution - *output*

- *Statistical output files*

\cat ifs.stat

```
06:42:17 000000000 CNT3        -999    0.54     0.54     1.28       0:00       0:00 0.00000000000000E+00
06:42:28 0AAX00000 STEPO          0     4.02     4.02    12.63       0:04       0:12 0.00000000000000E+00
06:42:33 AAAA00AAA STEPO          0     4.65     4.65     4.88       0:08       0:17 0.41748924452934E-04
06:42:42 0AAA00AAA STEPO          1     5.60     5.60     8.80       0:14       0:26 0.41405736619102E-04
06:42:46 0AAA00AAA STEPO          2     4.38     4.38     4.40       0:18       0:30 0.41350140867601E-04
06:42:50 0AAA00AAA STEPO          3     4.35     4.35     4.37       0:23       0:35 0.41195844449934E-04
06:42:55 0AAA00AAA STEPO          4     4.35     4.35     4.35       0:27       0:39 0.41085843990520E-04
06:42:59 0AAA00AAA STEPO          5     4.35     4.35     4.36       0:31       0:44 0.40992754495281E-04
06:43:04 0AAA00AAA STEPO          6     4.45     4.45     4.45       0:36       0:48 0.40902412766805E-04
06:43:08 0AAA00AAA STEPO          7     4.41     4.41     4.43       0:40       0:52 0.40815682307460E-04
06:43:12 0AAA00AAA STEPO          8     4.39     4.39     4.40       0:45       0:57 0.40744880785425E-04
06:43:17 0AAA00AAA STEPO          9     4.40     4.40     4.42       0:49       1:01 0.40684876326724E-04
06:43:21 AAAA00AAA STEPO         10     4.42     4.42     4.44       0:53       1:06 0.40632016734597E-04
06:43:28 0AAA00AAA STEPO         11     5.87     5.87     6.21       0:59       1:12 0.40583415980155E-04
06:43:32 0AAA00AAA STEPO         12     4.48     4.48     4.49       1:04       1:16 0.40541612714287E-04
```

vector cp time of last step

cp time of last step

real time of last step

accumulated real time

Execution - *status*

Successful execution (e001) NUSTOP = 648 (integration time/TSTEP) 72hod/400s

- **NODE.001_01**

```
--- Start of IFS output from processor   30 ----------------------------------
--- Logical units setup ------------------------------------
--- Set up machine-specific constants----------------------------------
--- Set up command line arguments
….
------ END OF SETUPS at level 0 ---------------------------------------

INTEGRATION JOB
…..
NSTEP =     0 STEPO    0AAX00000    8.620    8.620   31.413       428549152
….
END CNT3
NSTEP =   648 CNT0     000000000    0.750    0.750    0.811    0.925        683222592
 *** END CNT0 ***
```

- **ifs.stat**

```
 03:10:00 000000000 CNT3      -999     0.45     0.45     1.29      0:00      0:00 0.00000000000000E+00
 03:10:30 0AAX00000 STEPO        0     8.62     8.62    31.41      0:08      0:31 0.00000000000000E+00
 03:10:36 AAAA00AAA STEPO        0     5.63     5.63     6.22      0:14      0:37 0.24877262464701E-04
 03:10:43 0AAA00AAA STEPO        1     6.90     6.90     7.04      0:21      0:44 0.25235471717805E-04
 03:10:48 0AAA00AAA STEPO        2     5.31     5.31     5.31      0:26      0:50 0.25232337859691E-04
 03:10:54 0AAA00AAA STEPO        3     5.31     5.31     5.33      0:31      0:55 0.24620476055484E-04
 ……
 04:15:59 0AAA00AAA STEPO      647     5.23     5.23     5.25     63:42     66:00 0.27808116592837E-04
 04:16:04 A00000000 STEPO      648     5.26     5.26     5.27     63:47     66:06 0.27853630571633E-04
 04:16:05 000000000 CNT0       648     0.75     0.75     0.81     63:48     66:06 0.27853630571633E-04
```

- **Historical file(s)**

```
ICMSH////+0000, …, ICMSH////+0072
```

- **no any core file(s)**

Execution - *status*

Unsuccessful execution

Take a cup of tea or coffee

You will very probably need it ….

- **check the script output**
  cp: ERROR: Cannot access ELSCFAA1TALBC000: No such file or directory
  cp namelist: No such file or directory

- **check the NQS output**
  %NQSII(INFO): Batch job received signal SIGKILL. (Exceeded per-req elapse time limit)

  #PBS -l elapstim_req="6000,5980"
  #PBS -l cputim_job="6000,5980"

Execution - *status*

Unsuccessful execution

- **Abort call**

```
=> consistency check of the geometry in the cadre will be more forgiving
  SURFTEMPERATURE  READ FROM ARPEGE FILE INTO RESVR 01 000
  SURFIND.TERREMER READ FROM ARPEGE FILE INTO VARSF 01 000
  SURFA.OF.OZONE   MISSING FROM ARPEGE FILE
 ABOR1 CALLED
 RDGPFA : ABOR1 CALLED
```

Execution - *status*

Unsuccessful execution

- **Fatal error**

STDERR

```
>>>ignore_signals(): DR_HOOK will ignore signal#54 altogether
  19:22:54 STEP    0 H=   0:00 +CPU= 49.959
  19:23:19 STEP    1 H=   0:01 +CPU= 18.326
  19:23:44 STEP    2 H=   0:02 +CPU= 18.304
  19:24:09 STEP    3 H=   0:03 +CPU= 18.572
  19:24:35 STEP    4 H=   0:04 +CPU= 18.733
  19:25:00 STEP    5 H=   0:05 +CPU= 19.180
 SMILAG TRAJECTORY UNDERGROUND     84 TIMES.
 SMILAG TRAJECTORY UNDERGROUND    178 TIMES.
  19:25:26 STEP    6 H=   0:06 +CPU= 19.357
    * 252 Floating-point zero divide PROG=apl_arome ELN=7859(41102c994)
    * 252 Floating-point zero divide PROG=apl_arome ELN=1815(4116f07ec)
    * 252 Floating-point zero divide PROG=apl_arome ELN=7859(41102c988)
    * 252 Floating-point zero divide PROG=apl_arome ELN=1815(4116f07ec)
    * 252 Floating-point zero divide PROG=apl_arome ELN=7859(4000f025c)
……..
 Called from cnt0 ELN=292(400003ee0)
    * 253 Invalid operation PROG=aro_adjust ELN=227(4116f07d4)
    * 250 Floating-point data overflow PROG=gpxyb ELN=225(4000f0218)
    * 252 Floating-point zero divide PROG=apl_arome ELN=1988(4116eb400)
 ****  99 Execution suspended PROG=gpxyb ELN=225(4000f0218)
                Called from master ELN=56(400000c7c)
 ****  99 Execution suspended PROG=aro_adjust ELN=227(4116f07d4)
                Called from cpg_gp ELN=2044(4063c801c)
                Called from apl_arome ELN=2105(4116dd3f0)
                Called from cpg ELN=1847(40499cfb4)
                Called from mf_phys ELN=4320(4111c28dc)
```

Execution - *status*

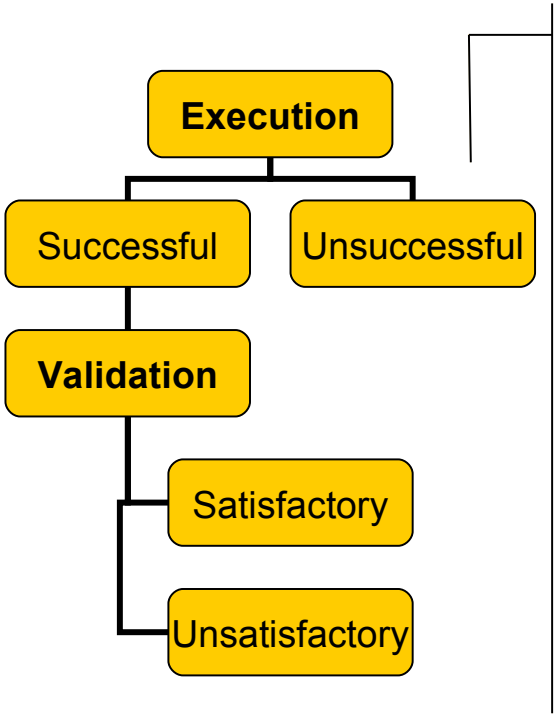
Unsuccessful execution

- **Fatal error**

STDOUT

```
GPNORM CLOUD_FRACTI          AVERAGE                MINIMUM                MAXIMUM
         AVE    0.616160484552944E-01 0.000000000000000E+00 0.100000000000000E+01
 GPNORM SRC                    AVERAGE                MINIMUM                MAXIMUM
         AVE    0.148083675186829E-03 0.000000000000000E+00 0.356028525154773E+00
 GPNORM EZDIAG01               AVERAGE                MINIMUM                MAXIMUM
         AVE    0.375012087628870E-06 0.000000000000000E+00 0.315611359879882E-02
 GPNORM EZDIAG02               AVERAGE                MINIMUM                MAXIMUM
         AVE    0.547644416117916E-03 0.000000000000000E+00 0.907500000000000E+00
 NSTEP =      7 STEPO    0AAA00AAA
```

Execution – *practical hints*



- Identification of crash (abort, fatal error, stupid mistake in script, …)
- Read the output, if no idea read the output more carefully again.
- Read output from compilation (warning).
- Don’t use directly debugger, prefer a the print/write statement.
- Use signal trapping (Dr Hook) for first approach.
- The most problems should be quite trivial and easy to fix, don't panic.
- Talk with the others about issues, try to find relevant/responsible people.
- Source navigator.
- Check namelist.
- Compiling with aiding options.
- Switch off MPI, to run on 1 CPU.
- Recompile (suspected part) without optimization.
- Recompile code on the another platform - scalar/vector.
- Reproducibility of the failure, to run binary again.
- Find any hint in doc, web forum, google.
- Debugging with a debugger (dbx, TotalView).

Execution - *Dr.Hook* (by Sami Saarinen)

- A Fortran & C library creating simple instrumentation tool.
- Trap run-time problems.
  - Designed for complex MPI tasks and OpenMP threads.
  - In case of error captured via Unix-signals, prints the current active calling tree
  - Traceback should be printed
- Low overhead (1 to 10%)
- Displays calling tree in standard output.
- Gathering profile info per subroutine (as by-product).
  - Wall-clock or CPU times
  - Mflops/s & MIPS performance
- Insert automatically calls in IFS since cy28.

Execution - *Dr.Hook* (by Deborah Salmond presentation)

Dr.Hook environment variables

- **Enable Dr.Hook** (call-tree/tracebackonly => cheap)
  DR_HOOK=1
- **Enable** wall-clock time **profiling** information at exit
  DR_HOOK_OPT=prof
  The profile will be written to files drhook.prof.<1..nproc>
- **Redirect profile-file** to /path/file.<1..nproc>
  DR_HOOK_PROFILE=/path/file
- **Restrict output to MPL-task** MYPROC=1
  DR_HOOK_PROFILE_PROC=1
- **Collect HPM** (Mflop/s & MIPS) information
  DR_HOOK_OPT=hpmprof or mflops

Execution - *Dr.Hook*

- **In each routine add Dr.Hook**

```
USE PARKIND1 ,ONLY : JPRB
USE YOMHOOK ,ONLY : LHOOK, DR_HOOK

….. before first executable statement
IF (LHOOK) CALL DR_HOOK('SUBROUTINE',0,ZHOOK_HANDLE)
…..
IF (LHOOK) CALL DR_HOOK('SUBROUTINE',1,ZHOOK_HANDLE)
      after last executable statement
END
```

Execution - *Dr.Hook* (by Deborah Salmond presentation)

- **traceback**

```
0: 15:57:40 STEP 936 H= 234:00 +CPU= 41.379
13:[myproc#14,tid#4,pid#55924]: Received signal#24 (SIGXCPU) ;Memory: 2019178K (heap), 0K (stack)
13:[myproc#14,tid#1,pid#55924]:  MASTER ,#1,st=1,wall=0.000s/0.000s
13:[myproc#14,tid#1,pid#55924]:   CNT0 ,#1,st=1,wall=0.000s/0.000s
13:[myproc#14,tid#1,pid#55924]:    CNT1 ,#1,st=1,wall=0.000s/0.000s
13:[myproc#14,tid#1,pid#55924]:     CNT2 ,#1,st=1,wall=0.000s/0.000s
13:[myproc#14,tid#1,pid#55924]:      CNT3 ,#1,st=1,wall=0.000s/0.000s
13:[myproc#14,tid#1,pid#55924]:       CNT4 ,#1,st=1,wall=0.000s/0.000s
13:[myproc#14,tid#1,pid#55924]:        STEPO ,#978,st=1,wall=10531.259s/0.000s
13:[myproc#14,tid#1,pid#55924]:         SCAN2H ,#1018,st=1,wall=8913.967s/0.043s
13:[myproc#14,tid#1,pid#55924]:          SCAN2MDM ,#1018,st=1,wall=8913.896s/32.036s
13:[myproc#14,tid#1,pid#55924]:           GP_MODEL ,#938,st=1,wall=8845.641s/4.830s
13:[myproc#14,tid#1,pid#55924]:            EC_PHYS ,#213893,st=1,wall=6144.597s/22.378s
13:[myproc#14,tid#1,pid#55924]:            CALLPAR ,#213893,st=1,wall=5856.788s/88.130s
13:[myproc#14,tid#1,pid#55924]:             SLTEND ,#213893,st=1,wall=662.390s/179.559s
13:[myproc#14,tid#1,pid#55924]:              CUADJTQ ,#117188599,st=1,wall=1992.364s/1477.382s
13:[myproc#14,tid#4,pid#55924]:               EC_PHYS ,#213356,st=1,wall=6145.442s/22.418s
13:[myproc#14,tid#4,pid#55924]:               CALLPAR ,#213356,st=1,wall=5860.376s/88.000s
13:[myproc#14,tid#4,pid#55924]:                CUCALLN ,#213810,st=1,wall=2731.710s/27.983s
13:[myproc#14,tid#4,pid#55924]:                 CUMASTRN ,#213810,st=1,wall=2679.495s/36.678s
13:[myproc#14,tid#4,pid#55924]:                  CUDDRAFN ,#213810,st=1,wall=66.548s/23.442s
13:
13: Signal received: SIGXCPU -CPU time limit exceeded
13:
13: Traceback:
13: Location 0x0000377c
13: Offset 0x0000009c in procedure _event_sleep
13: Offset 0x00000318 in procedure sigwait
13: Offset 0x000006c8 in procedure pm_async_thread
13: Offset 0x000000a4 in procedure _pthread_body
13: ---End of call chain ---
```

Execution - *Dr.Hook*

- **Profiling**

```
Profiling information for program='/users/nwp102/newpack/bin/al36t1/bin/MASTERODB', proc#1:
        No. of instrumented routines called : 887
        Instrumentation started : 20100804 075431
        Instrumentation   ended : 20100804 075620
        Instrumentation overhead: 0.25%
        Memory usage : 1527 MBytes (heap), 449 MBytes (rss), 100 MBytes (stack), 1806 (paging)
        Wall-time is 108.56 sec on proc#1 (30 procs, 1 threads)
        Thread#1:      108.56 sec (100.00%)
```

#	% Time (self)	Cumul (sec)	Self (sec)	Total (sec)	# of calls	Self ms/call (Size; Size/sec; Size/call; MinSize; MaxSize)	Total ms/call	Routine@<thread-id>
1	15.47	16.797	16.797	19.915	1323	12.70	15.05	ACRANEB@1
2	5.62	22.894	6.097	6.107	19845	0.31	0.31	LAITRI@1
3	5.55	28.918	6.023	6.490	3	2007.69	2163.31	SUSPECA@1
4	4.73	34.050	5.133	5.134	1323	3.88	3.88	ACCOEFK@1
5	4.52	38.953	4.902	6.043	1323	3.71	4.57	ACCVUD@1
6	4.06	43.361	4.409	4.411	3969	1.11	1.11	ACTQSATS@1
7	3.43	47.087	3.726	6.903	1323	2.82	5.22	APLMPHYS@1
8	2.83	50.159	3.072	3.073	1323	2.32	2.32	ACNEBN@1
9	2.65	53.034	2.874	2.876	1323	2.17	2.17	ACMODO@1
10	2.51	55.760	2.726	3.116	1323	2.06	2.36	AC_CLOUD_MODEL@1
11	2.24	58.189	2.429	60.835	1323	1.84	45.98	APLPAR@1
12	2.20	60.576	2.387	2.388	294	8.12	8.12	TRGOTL@1
13	2.04	62.790	2.214	2.214	34	65.11	65.12	TRLTOM@1
14	1.96	64.917	2.127	2.595	2646	0.80	0.98	ELASCAW@1
15	1.53	66.578	1.661	1.662	2646	0.63	0.63	ELARCHE@1
16	1.49	68.199	1.621	1.622	2646	0.61	0.61	GPMPFC@1
17	1.38	69.697	1.498	1.498	40	37.44	37.44	TRLTOG@1
18	1.36	71.175	1.478	1.479	1323	1.12	1.12	ACTQSAT@1
19	1.30	72.585	1.411	1.439	97902	0.01	0.01	ACCOLL@1
20	1.27	73.968	1.383	1.383	21	65.87	65.88	SLCOMM2A@1

Validation - *norms*

- Spectral NORMS

```
SPECTRAL NORMS -    LOG(PREHYDS)    0.114938835182227E+02     OROGRAPHY      0.300349554410728E+04
LEV     VORTICITY              DIVERGENCE            TEMPERATURE            HUMIDITY              KINETIC ENERGY
AVE 0.716293034596198E-04 0.506715046916652E-04 0.244446030748210E+03 0.131532297789441E-02 0.285392636678923E+03
  1 0.973100352831129E-04 0.559091931070525E-04 0.235103047890534E+03 0.544555534226397E-06 0.242105022337195E+04
  2 0.922334184768253E-04 0.595647966022288E-04 0.205931568605008E+03 0.236904250749531E-06 0.119367431375501E+04
  3 0.790301550494398E-04 0.497200011195356E-04 0.200886824059941E+03 0.280390784690367E-06 0.703089869875611E+03
  4 0.731143924513154E-04 0.486040189936846E-04 0.201603134676071E+03 0.324802670048053E-06 0.567263339632288E+03
     .....
 40 0.509846963639055E-04 0.539321183757805E-04 0.275730474116406E+03 0.414333643086734E-02 0.171211892223949E+02
 41 0.487517885812882E-04 0.535417919252534E-04 0.276110362403759E+03 0.424879931726579E-02 0.138644753324207E+02
 42 0.464409767604179E-04 0.519460419937983E-04 0.276350551777098E+03 0.433529571122673E-02 0.107263007833496E+02
 43 0.446267243544812E-04 0.481202903596144E-04 0.276450909467029E+03 0.442053305384443E-02 0.754707330362136E+01
```

- Gridpoint NORMS

```
 GPNORMS OF FIELDS TO BE WRITTEN OUT ON FILE :
                              AVERAGE                MINIMUM                MAXIMUM
  SURFTENS.DMOG.ZO : 0.199560556683701E+03 -.864501981729672E+04 0.285076390497982E+05
  SURFTENS.DMOG.ME : 0.246339275490582E+03 -.148756057449814E+05 0.353031111347203E+05
  SURFTENS.TURB.ZO : 0.298224169770975E+03 -.102655000429149E+05 0.205064555398539E+05
  SURFTENS.TURB.ME : 0.443751956434103E+03 -.108964993385651E+05 0.187987562754263E+05
  SURFCFU.Q.TURBUL : -.423465779992440E-01 -.451795314855308E+00 0.136356755997045E+00
  SURFCFU.CT.TURBU : 0.799858760102411E+05 -.757697392505676E+06 0.110093352759635E+07
  SURFPREC.EAU.CON : 0.343111239372562E-01 -.217760461886465E-07 0.746564690336457E+01
  SURFFL.COND.L.CO : 0.464288201303113E-01 0.000000000000000E+00 0.815104494220350E+01
  SURFPREC.NEI.CON : 0.344080884508131E-02 -.479420876296380E-09 0.237265510791762E+01
  SURFFL.COND.N.CO : 0.234079059498538E-01 0.000000000000000E+00 0.247352499276518E+01
  SURFPREC.EAU.GEC : 0.323170986810382E-01 -.647404450275717E-07 0.674718841018485E+01
```

Validation - *norms*

- check the time evolution

```
07:55:23 STEP     7 H=    0:42 +CPU=   4.470
 SPECTRAL NORMS -   LOG(PREHYDS)     0.114864319528169E+02
LEV     VORTICITY              DIVERGENCE             TEMPERATURE            HUMIDITY              KINETIC ENERGY
AVE 0.483954307960636E-04 0.407448807854250E-04 0.249785839517264E+03 0.179902848000897E-02 0.142726355761168E+03
  1 0.566544624838712E-04 0.189495587938970E-04 0.241357390545048E+03 0.442664842711824E-06 0.964301488546453E+03
  2 0.252022116545696E-04 0.144048595544645E-04 0.217667877315775E+03 0.702205838791741E-06 0.260251654954266E+03
  ……..
 37 0.491290829488732E-04 0.618793021693314E-04 0.282150083110162E+03 0.585938728063189E-02 0.103387339354275E+02

07:55:27 STEP     8 H=    0:48 +CPU=   4.570
 SPECTRAL NORMS -   LOG(PREHYDS)     0.114864364933938E+02
LEV     VORTICITY              DIVERGENCE             TEMPERATURE            HUMIDITY              KINETIC ENERGY
AVE 0.484493523371617E-04 0.406848763267237E-04 0.249777037278105E+03 0.179780761179928E-02 0.142835010228202E+03
  1 0.566020159618153E-04 0.189234849280765E-04 0.241333093281080E+03 0.444475258350807E-06 0.963926287071157E+03
  2 0.253154348989557E-04 0.143729418091919E-04 0.217668879542835E+03 0.703367382242880E-06 0.259763929171511E+03
  ….
 37 0.492339042345611E-04 0.616647331015778E-04 0.282129140608767E+03 0.585026925403049E-02 0.102616526937346E+02

07:55:32 STEP     9 H=    0:54 +CPU=   4.500
 SPECTRAL NORMS -   LOG(PREHYDS)     0.114864402622263E+02
LEV     VORTICITY              DIVERGENCE             TEMPERATURE            HUMIDITY              KINETIC ENERGY
AVE 0.485045514208623E-04 0.406320167345970E-04 0.249768290473604E+03 0.179661111377045E-02 0.142944504741689E+03
  1 0.565504771007151E-04 0.189041360070448E-04 0.241309342820881E+03 0.446259086291882E-06 0.963507894072800E+03
  2 0.254295146694598E-04 0.143454096975756E-04 0.217671036183106E+03 0.704519993393961E-06 0.259299073663440E+03
  ….
 37 0.493235326295148E-04 0.614867915657792E-04 0.282107603020944E+03 0.584160250729108E-02 0.101888268273990E+02
```

Validation - *norms*

check the 1 CPU and more

NPROC=1

```
 NORMS AT NSTEP CNT4  480

 SPECTRAL NORMS -   LOG(PREHYDS)    0.114992771180480E+02
 LEV     VORTICITY             DIVERGENCE            TEMPERATURE             HUMIDITY              KINETIC ENERGY
 AVE 0.584046494072942E-04 0.561767981135972E-04 0.244976435086584E+03 0.124245732062369E-02 0.257892271453445E+03
   1 0.963662798710809E-04 0.554936574868131E-04 0.226602144515705E+03 0.784477827551559E-06 0.208082991747867E+04
   2 0.445474479674727E-04 0.597634692618306E-04 0.207053186177468E+03 0.406527299280804E-06 0.798525793640204E+03
   3 0.307407802772520E-04 0.511573399249311E-04 0.204874874191120E+03 0.508419966238211E-06 0.510698053967358E+03
   4 0.269087242644517E-04 0.503545000314600E-04 0.206694004168441E+03 0.578666189657784E-06 0.411290200438680E+03
```

NPROC=2

```
 NORMS AT NSTEP CNT4  480

 SPECTRAL NORMS -   LOG(PREHYDS)    0.114992771180480E+02
 LEV     VORTICITY             DIVERGENCE            TEMPERATURE             HUMIDITY              KINETIC ENERGY
 AVE 0.584046494072942E-04 0.561767981135972E-04 0.244976435086584E+03 0.124245732062369E-02 0.257892271453445E+03
   1 0.963662798710809E-04 0.554936574868131E-04 0.226602144515705E+03 0.784477827551559E-06 0.208082991747867E+04
   2 0.445474479674727E-04 0.597634692618306E-04 0.207053186177468E+03 0.406527299280804E-06 0.798525793640204E+03
   3 0.307407802772520E-04 0.511573399249311E-04 0.204874874191120E+03 0.508419966238211E-06 0.510698053967358E+03
   4 0.269087242644517E-04 0.503545000314600E-04 0.206694004168441E+03 0.578666189657784E-06 0.411290200438680E+03
```

NPROC=4

```
 NORMS AT NSTEP CNT4  480

 SPECTRAL NORMS -   LOG(PREHYDS)    0.114992771180480E+02
 LEV     VORTICITY             DIVERGENCE            TEMPERATURE             HUMIDITY              KINETIC ENERGY
 AVE 0.584046494072942E-04 0.561767981135972E-04 0.244976435086584E+03 0.124245732062369E-02 0.257892271453445E+03
   1 0.963662798710809E-04 0.554936574868131E-04 0.226602144515705E+03 0.784477827551559E-06 0.208082991747867E+04
   2 0.445474479674727E-04 0.597634692618306E-04 0.207053186177468E+03 0.406527299280804E-06 0.798525793640204E+03
   3 0.307407802772520E-04 0.511573399249311E-04 0.204874874191120E+03 0.508419966238211E-06 0.510698053967358E+03
   4 0.269087242644517E-04 0.503545000314600E-04 0.206694004168441E+03 0.578666189657784E-06 0.411290200438680E+03
```

Validation - *norms*

- compare/validate reference with current run

Reference

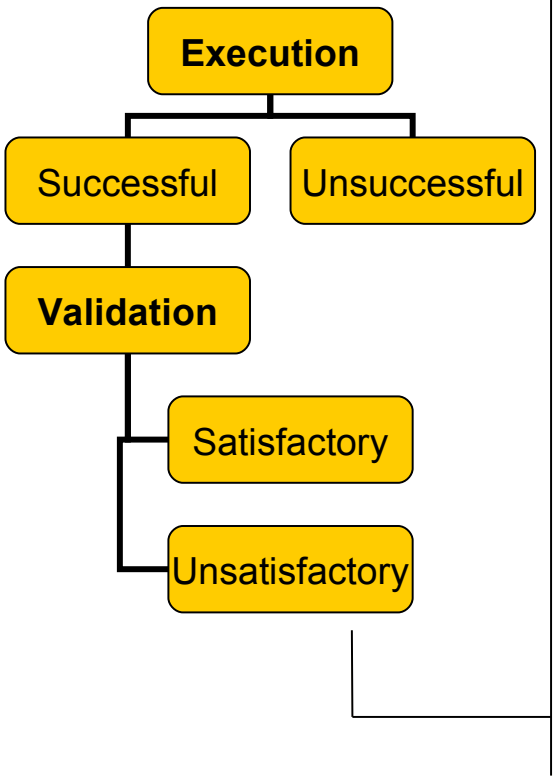
```
 NORMS AT NSTEP CNT4    0
SPECTRAL NORMS -    LOG(PREHYDS)    0.114939045211556E+02     OROGRAPHY      0.300349554410728E+04
LEV     VORTICITY             DIVERGENCE           TEMPERATURE            HUMIDITY             KINETIC ENERGY
AVE 0.706212457835994E-04 0.499429291390832E-04 0.244857318361759E+03 0.131593388860414E-02 0.285207055940075E+03
…

NORMS AT NSTEP CNT4  480
SPECTRAL NORMS -   LOG(PREHYDS)    0.114994715211561E+02
LEV     VORTICITY             DIVERGENCE           TEMPERATURE            HUMIDITY             KINETIC ENERGY
AVE 0.5547432418763 52E-04 0.5429158803562 03E-04 0.24513612741228 9E+03 0.1249395367003 81E-02 0.2575827077954 90E+03
```

Phasing cycle

```
NORMS AT NSTEP CNT4    0
SPECTRAL NORMS -    LOG(PREHYDS)    0.114939045211556E+02     OROGRAPHY      0.300349554410728E+04
LEV     VORTICITY             DIVERGENCE           TEMPERATURE            HUMIDITY             KINETIC ENERGY
AVE 0.706212457835994E-04 0.499429291390832E-04 0.244857318361759E+03 0.131593388860414E-02 0.285207055940075E+03
…
NORMS AT NSTEP CNT4  480
SPECTRAL NORMS -   LOG(PREHYDS)    0.114994708683207E+02
LEV     VORTICITY             DIVERGENCE           TEMPERATURE            HUMIDITY             KINETIC ENERGY
AVE 0.554705275213097E-04 0.542927292611885E-04 0.245136263471627E+03 0.124938045550359E-02 0.257579706810017E+03
```

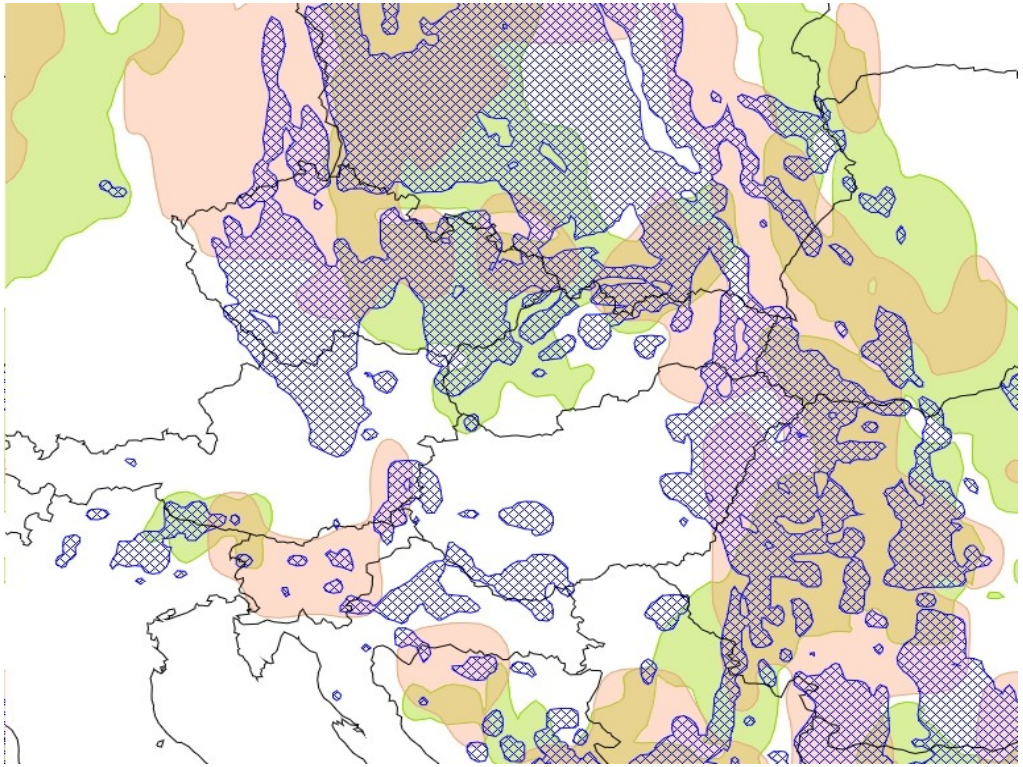
Validation – *practical hints*



- Read the output, if no idea read the output carefully again.
- Read output from compilation (warning).
- Control of the listing differences between current run and references (setup, norms).
- Set up NPRINTLEV=1 and control listing again.
- Adiabatic run.
- Switch off MPI, to run on 1 CPU.
- Printing values into output file, the print/write statement.
- Forget for total validation, prefer a series of clever tests.
- Compiling with aiding tools, options.
- Talk with the others about issues, to find relevant/responsible people.
- Check memory and CPU, to compare with reference.
- Source navigator.
- Check namelist and all condition of the references. Are they same as current cycle? Defaults should be changed.
- Does it work properly in cycle before?
- Recompile (suspected part) without optimization.
- Recompile code on the another platform - scalar/vector.
- Stop an investigation, go to bed or mountain, take relax.

Validation - *charts*

- Plots of charts



- Parallel suite / objective verification scores

Validation - *performance*

CPU/Memory

job	16 proc - al36 (exp_0017)	16 proc - 36t1 (exp_0015)	Taux
AH1T017_run1	Max memory=31444.156 Mb	Max memory=32404.156 Mb	
AH1T017_run2	Max memory=31444.156 Mb	Max memory=32404.156 Mb	*1.03*
AH1T017_run3	Max memory=31444.156 Mb	Max memory=32404.156 Mb	
AH1T017_run1	total CPU = 356.93 s	total CPU = 370.84 s	
AH1T017_run2	total CPU = 345.66 s	total CPU = 367.65 s	*1.05*
AH1T017_run3	total CPU = 353.94 s	total CPU = 371.98 s	

Now you are well prepared for next phasing event.

You are welcome ...