Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Configuration 903 for LBC files

Martina Tudor, Ryad El Khatib and Martin Belluš

ZAMG DHMZ OMSZ METEO ROMANIA SHMU ARSO METEO Slovenia

Introduction

Limited area models (LAMs) need lateral boundary conditions (LBCs)
Operational NWP LAM needs prognostic LBCs, taken from a global NWP model
Available options are several, but here we focus on LBCs from ARPEGE and IFS.

ARPEGE: 8 km resolution, 105 levels
IFS: 15.4 km resolution, 60 levels
LBCs are on a quadratic grid

Overview of operational LBCs used in LACE
Options for LBCs from IFS
Issues, problems, questions …

Input data

We get LBC files from IFS dissemination

We can experiment using IFS data from MARS archive

These are not identical (but should not be very different)
There is no IFS output file, get the data from MARS!
Options that work with some meaningful grid values for HRES (and for EPS too):
current oper octa grid O1280 (O640)
Reduced GG for GP fields N640
Reduced GG for SP fields T1279
Latlon 0.07/0.07 (0.15/0.15)
Full GG F1280 …
901 works with N grids
903 workswith O grids
Use MIR (**mars -m**) for SST (Ulf Andrae), now it **is a default**!

Current (operational) procedures

From ARPEGE

ARPEGE grid

↓ e927

Lambert grid

From IFS HRES and ENS

IFS octahedral grid

↓ MARS

IFS reduced Gaussian grid

↓ e901

ARPEGE grid

↓ e927

Lambert grid

IFS octahedral grid

↓ MARS

Lat lon grid

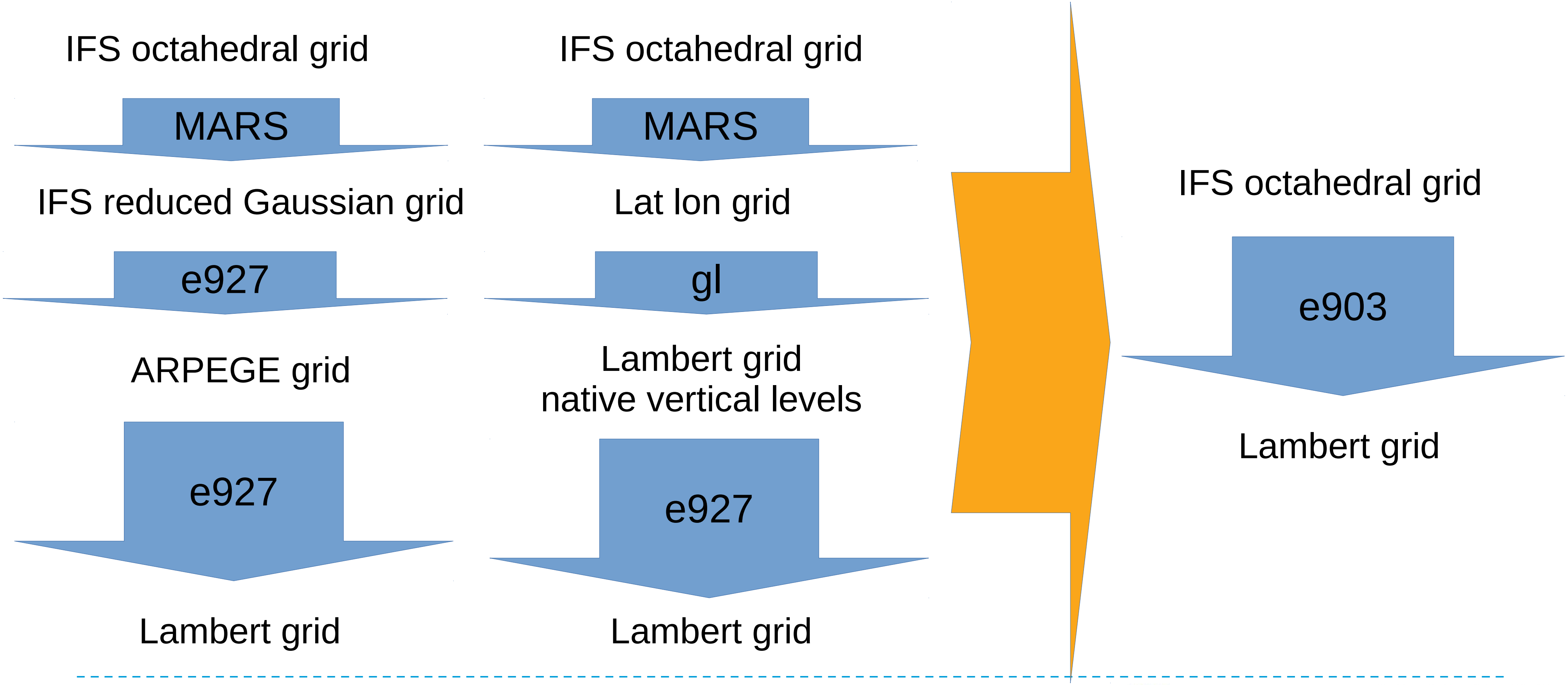
↓ gl

Lambert grid
native vertical levels

↓ e927

Lambert grid

New procedure for IFS HRES and ENS



Mars request HRES

Get all needed data on O1280 cubic grid

```
RET,
   DATE      = $DATE,
   TIME      = $TIME,
   STEP      = $STEP,
   LEVTYPE   = SFC,
   PARAM     =
198.128/235.128/10.228/11.228/12.228/13.228/14.228/238.128/34.128/35.128/36.128/37.128/38.128/148.128/8.228/9.228/129.128/31.128/7.228/26.128/139.128/170.128/183.128/236.128/39.128/40.128/41.128/42.128/141.128/32.128/33.128/172.128/66.128/67.128,
   CLASS     = OD,
   TYPE      = FC,
   STREAM    = $STREAM,
   EXPVER    = 0001,
   TARGET    = "ICMGG${CNMEXP}+0000[STEP]"

RET,
   DATE      = $DATE,
   TIME      = $TIME,
   STEP      = 00,
   LEVTYPE   = SFC,
   PARAM     = 74/163/43/234/173/174/160/161/162/27/28/16/17/18/30/15/29,
   CLASS     = OD,
   TYPE      = AN,
   STREAM    = $STREAM,
   EXPVER    = 0001,
   TARGET    = "ICMGG${CNMEXP}"
```

MARS request – surface forecast fields HRES

ID	Short name	Name	Units	Type	Step	Levtype
7	Scfr	Soil clay fraction	0-1	FC	0-78	SFC
8	Sro	Surface runoff	m	FC	0-78	SFC
9	Ssro	Sub-surface runoff	m	FC	0-78	SFC
10	Ws	Wind speed	m/s	FC	0-78	SFC
11	Udvw	U component of divergent wind	m/s	Type	Steps	Lev
12	vdvw	V component of divergent wind	m/s	FC	0-78	SFC
13	urtw	U component of rotational wind	m/s	FC	0-78	SFC
14	vrtw	V component of rotational wind	m/s	FC	0-78	SFC
26	Cl	Lake cover	0-1	FC	0-78	SFC
31	Ci	Sea ice fraction	0-1	FC	0-78	SFC
129	Z	Geopotential	m2/s2	FC	0-78	SFC
172	Lsm	Land sea mask	0-1	FC	0-78	SFC
141	Sd	Snow depth	m(water)	FC	0-78	SFC
32	Asn	Snow albedo	0-1	FC	0-78	SFC
33	Rsn	Snow density	kg/m3	FC	0-78	SFC
35	Istl1	Ice temperature layer 1	K	FC	0-78	SFC
36	Istl2	Ice temperature layer 2	K	FC	0-78	SFC
37	Istl3	Ice temperature layer 3	K	FC	0-78	SFC
38	Istl4	Ice temperature layer 4	K	FC	0-78	SFC
39	Swvl1	Volumetric soil water layer 1	m3/m3	FC	0-78	SFC
40	Swvl2	Volumetric soil water layer 2	m3/m3	FC	0-78	SFC
41	Swvl3	Volumetric soil water layer 3	m3/m3	FC	0-78	SFC
42	Swvl4	Volumetric soil water layer 4	m3/m3	FC	0-78	SFC
66	lai_lv	Leaf area index for low vegetation	m2/m2	FC	0-78	SFC
67	lai_hv	Leaf area index for high vegetation	m2/m2	FC	0-78	SFC
139	Stl1	Soil temperature level 1	K	FC	0-78	SFC
170	Stl2	Soil temperature level 2	K	FC	0-78	SFC
183	Stl3	Soil temperature level 3	K	FC	0-78	SFC
236	Stl4	Soil temperature level 4	K	FC	0-78	SFC
238	Tsn	Temperature of snow layer	K	FC	0-78	SFC
198	Src	Skin reservoir content	m	FC	0-78	SFC
235	Skt	Skin temperature	K	FC	0-78	SFC
148	Chnk	Charnock	~	FC	0-78	SFC

MARS request – surface forecast fields HRES

ID	Short name	Name	Units	Type	Step	Levtype
74	Sdfor	Standard deviation of filtered subgrid orography	m	AN	0	SFC
160	sdor	Standard deviation of orography	m	AN	0	SFC
161	isor	Anisotropy of subgrid scale orography		AN	0	SFC
162	anor	Angle of subgrid scale orography		AN	0	SFC
163	slor	Slope of subgrid scale orography		AN	0	SFC
42	slt	Soil type		AN	0	SFC
234	lsrh	Logarythm of surface roughness length for heat		AN	0	SFC
173	sr	Surface roughness	m	AN	0	SFC
174	al	Albedo	0-1	AN	0	SFC
15	aluvp	UV visible albedo for direct rad.	0-1	AN	0	SFC
16	aluvd	UV visible albedo for diff. rad.	0-1	AN	0	SFC
17	alnip	Near IR albedo for direct rad.	0-1	AN	0	SFC
18	alnid	Near IR albedo for diff. rad	0-1	AN	0	SFC

ID	Short name	Name	Units	Type	Step	Levtype
133	q	Specific humidity		FC	0-78	ML (137)
203	o3	Ozone mixing ratio		FC	0-78	ML
75	crwc	Specific rain water content		FC	0-78	ML
76	cswc	Specific snow water content		FC	0-78	ML
246	clwc	Specific cloud liquid water content		FC	0-78	ML
247	ciwc	Specific cloud ice water content		FC	0-78	ML
248	cc	Fraction cloud cover		FC	0-78	ML
152	lnsp	Logarythm of surface pressure		FC	0-78	ML
138	vo	vorticity	1/s	FC	0-78	ML
155	d	divergence	1/s	FC	0-78	ML
130	t	temperature	K	FC	0-78	ML
129	z	geopotential	m2/s2	AN	0	ML

Input files for 903

ICMGGLACE+00[STEP] contains the surface gridpoint fields (prognostic or not)

ICMUALACE+00[STEP] contains the upper air gridpoint fields on the model levels

ICMSHLACE+00[STEP] contains the spectral fields (upper air and surface, including geopotential)

E903 namelist

Print out all the fields needed

```
&NAMFPC
  CFPFMT='LELAM',
  CFPDOM(1)='${DOMAIN}',
  CFPDIR='${CFPDIR}',
  CFP2DF(1)='SURFPRESSION',
  CFP2DF(2)='SPECSURFGEOPOTENTIEL',
  CFP3DF(1)='TEMPERATURE',
  CFP3DF(2)='WIND.U.PHYS',
  CFP3DF(3)='WIND.V.PHYS',
  CFP3DF(4)='HUMI.SPECIFIQUE',
  CFPPHY(1)='SURFTEMPERATURE',
  CFPPHY(2)='SURFIND.TERREMER',
  CFPPHY(3)='SURFA.OF.OZONE',
  CFPPHY(4)='SURFB.OF.OZONE',
  CFPPHY(5)='SURFC.OF.OZONE',
  CFPPHY(6)='SURFAEROS.SEA',
  CFPPHY(7)='SURFAEROS.LAND',
  CFPPHY(8)='SURFAEROS.SOOT',
  CFPPHY(9)='SURFAEROS.DESERT',
  CFPPHY(10)='SURFRESERV.NEIGE',
  CFPPHY(11)='PROFTEMPERATURE',
  CFPPHY(12)='PROFRESERV.EAU',
  CFPPHY(13)='SURFRESERV.EAU',
  CFPPHY(14)='SURFZ0.FOIS.G',
  CFPPHY(15)='SURFALBEDO',
  CFPPHY(16)='SURFEMISSIVITE',
  CFPPHY(17)='SURFET.GEOPOTENT',
  CFPPHY(18)='SURFIND.TERREMER',
  CFPPHY(19)='SURFPROP.VEGETAT',
  CFPPHY(20)='SURFVAR.GEOP.ANI',
  CFPPHY(21)='SURFVAR.GEOP.DIR',
  CFPPHY(22)='SURFIND.VEG.DOMI',
  CFPPHY(23)='SURFRESI.STO.MIN',
  CFPPHY(24)='SURFPROP.ARGILE',
  CFPPHY(25)='SURFPROP.SABLE',
  CFPPHY(26)='SURFEPAIS.SOL',
  CFPPHY(27)='SURFIND.FOLIAIRE',
  CFPPHY(28)='SURFRES.EVAPOTRA',
  CFPPHY(29)='SURFGZ0.THERM',
  CFPPHY(30)='SURFRESERV.INTER',
  CFPPHY(31)='PROFRESERV.GLACE',
  CFPPHY(32)='SURFRESERV.GLACE',
  CFPPHY(33)='SURFDENSIT.NEIGE',
  CFPPHY(34)='SURFALBEDO NEIGE',
  CFPPHY(35)='SURFALBEDO.SOLNU',
  CFPPHY(36)='SURFALBEDO.VEG',
  NFPCLI=2,
 NRFP3S=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,
53,54,55,56,57,58,59,60,….. 137, (up to the number of levels)
```

E903 namelist

Define the configuration

```
 &NAMARG
   NCONF=903,                     ! Configuration for 3D integration.
   NFPSERVER=1,                   ! configuration of post-processing server
   CNMEXP=${CNMEXP},              ! Name of the experiment
   LECMWF=.TRUE.,                 ! .T.: ECMWF configuration
   NSUPERSEDE=1,                  ! date and geometry are read in intial file
/
 &NAMCT0
   NFPOS=2,                       ! Fullpos active, configuration for model geometry changes
   NFRPOS=${NFRPOS},              ! frequency of post-processing events (time-steps)
   NPOSTS(0)=0,                   ! array containing postprocessing steps
   LSPRT=.FALSE.,                 ! .T.: if R*T/Rd "virtual temperature" as spectral variable
   LARPEGEF=.TRUE.,               ! .T. = use ARPEGE files
   LREFOUT=.FALSE.,               ! .T. compare to reference run
   NSPPR=0,                       ! 0: no spectrum printed in spnorm; only global norms averaged in
the vertical
   CFPNCF='ECHFP',                ! name of Full-POS control file (pseudo-configuration 927)
   CSCRIPT_PPSERVER=' ',          ! absolute script name for post-processing server
 /
 &NAMTRANS
   LFFTW=.TRUE.,                  ! Use FFTW if true (see TRANS package)
 /
```

E903 namelist

```
&NAMFPD
   NFPGUX=349, ! actual last row of latitude
   NFPLUX=373,  ! actual last row of longitude
   NLAT=360,       ! number of longitudes
   NLON=384,       ! number of latitudes
   RDELX(1)=8000.,   ! resolution in x and y
   RDELY(1)=8000.,   ! in meters for LELAM
   RLATC(1)=46.244700000000002,  ! domain centre latitude
   RLONC(1)=17.000000000000000, ! domain centre longitude
/
 &NAMFPG
   FPVALH(0)=0.,
   FPVALH(1)=19.800000,  ! "A" coefficients of vertical system
…
  FPVALH(137)=0.000000,
  FPVBH(0)=0.,                        ! "B" coefficients of vertical system
   FPVBH(1)=0.0000000000,
…
   FPVBH(137)=1.0000000000,
   NFPLEV=137,                              ! number of levels
   FPLAT0=46.2447000000000,   ! geographic latitude of ref. for the projection
   FPLON0=17.0000,                     ! geographic longitude of ref. for the projection
   NFPMAX=89,                            ! truncation
   NMFPMAX=95,                         ! truncation
 /
```

Define the output domain

MARS – surface forecast fields ENS

LACE
nwp central europe

ID	Short name	Name	Units	Type	Step	Levtype
7	Scfr	Soil clay fraction	0-1	FC	0-78	SFC
8	Sro	Surface runoff	m	FC	0-78	SFC
9	Ssro	Sub-surface runoff	m	FC	0-78	SFC
10	Ws	Wind speed	m/s	FC	0-78	SFC
11	Udvw	U component of divergent wind	m/s	FC	0-78	SFC
12	vdvw	V component of divergent wind	m/s	FC	0-78	SFC
13	urtw	U component of rotational wind	m/s	FC	0-78	SFC
14	vrtw	V component of rotational wind	m/s	FC	0-78	SFC
26	Cl	Lake cover	0-1	FC	0-78	SFC
31	Ci	Sea ice fraction	0-1	FC	0-78	SFC
129	Z	Geopotential	m2/s2	FC	0-78	SFC
172	Lsm	Land sea mask	0-1	FC	0-78	SFC
141	Sd	Snow depth	m(water)	FC	0-78	SFC
32	Asn	Snow albedo	0-1	FC	0-78	SFC
33	Rsn	Snow density	kg/m3	FC	0-78	SFC
34	Sst	Sea surface temperature	K	FC	0-78	SFC
35	Istl1	Ice temperature layer 1	K	FC	0-78	SFC
36	Istl2	Ice temperature layer 2	K	FC	0-78	SFC
37	Istl3	Ice temperature layer 3	K	FC	0-78	SFC
38	Istl4	Ice temperature layer 4	K	FC	0-78	SFC
39	Swvl1	Volumetric soil water layer 1	m3/m3	FC	0-78	SFC
40	Swvl2	Volumetric soil water layer 2	m3/m3	FC	0-78	SFC
41	Swvl3	Volumetric soil water layer 3	m3/m3	FC	0-78	SFC
42	Swvl4	Volumetric soil water layer 4	m3/m3	FC	0-78	SFC
66	lai_lv	Leaf area index for low vegetation	m2/m2	FC	HRES	SFC
67	lai_hv	Leaf area index for high vegetation	m2/m2	FC	HRES	SFC
139	Stl1	Soil temperature level 1	K	FC	0-78	SFC
170	Stl2	Soil temperature level 2	K	FC	0-78	SFC
183	Stl3	Soil temperature level 3	K	FC	0-78	SFC
236	Stl4	Soil temperature level 4	K	FC	0-78	SFC
238	Tsn	Temperature of snow layer	K	FC	0-78	SFC
198	Src	Skin reservoir content	m	FC	0-78	SFC
235	Skt	Skin temperature	K	FC	0-78	SFC
148	Chnk	Charnock	~	FC	0-78	SFC

MARS request – surface forecast fields ENS

ID	Short name	Name	Units	Type	Step	Levtype
74	Sdfor	Standard deviation of filtered subgrid orography	m	HRES	0	SFC
160	sdor	Standard deviation of orography	m	HRES	0	SFC
161	isor	Anisotropy of subgrid scale orography		HRES	0	SFC
162	anor	Angle of subgrid scale orography		HRES	0	SFC
163	slor	Slope of subgrid scale orography		HRES	0	SFC
42	slt	Soil type		AN	0	SFC
234	lsrh	Logarythm of surface roughness length for heat		AN	0	SFC
173	sr	Surface roughness	m	AN	0	SFC
174	al	Albedo	0-1	AN	0	SFC
15	aluvp	UV visible albedo for direct rad.	0-1	AN	0	SFC
16	aluvd	UV visible albedo for diff. rad.	0-1	HRES	0	SFC
17	alnip	Near IR albedo for direct rad.	0-1	HRES	0	SFC
18	alnid	Near IR albedo for diff. rad	0-1	HRES	0	SFC

ID	Short name	Name	Units	Type	Step	Levtype
133	q	Specific humidity		FC	0-78	ML (137)
203	o3	Ozone mixing ratio		FC	0-78	ML
75	crwc	Specific rain water content		FC	0-78	ML
76	cswc	Specific snow water content		FC	0-78	ML
246	clwc	Specific cloud liquid water content		FC	0-78	ML
247	ciwc	Specific cloud ice water content		FC	0-78	ML
248	cc	Fraction cloud cover		FC	0-78	ML
152	lnsp	Logarythm of surface pressure		FC	0-78	ML
138	vo	vorticity	1/s	FC	0-78	ML
155	d	divergence	1/s	FC	0-78	ML
130	t	temperature	K	FC	0-78	ML
129	z	Geopotential (??????)	m2/s2	AN	0	ML

Conclusion

IFS octahedral grid

LAM (Lambert) grid

903 works!

Operational implementation

TC3