Regional Cooperation for Limited Area Modeling in Central Europe

LACE
nwp central europe

SHMU – NWP models, nowcasting RC LACE - radar assimilation

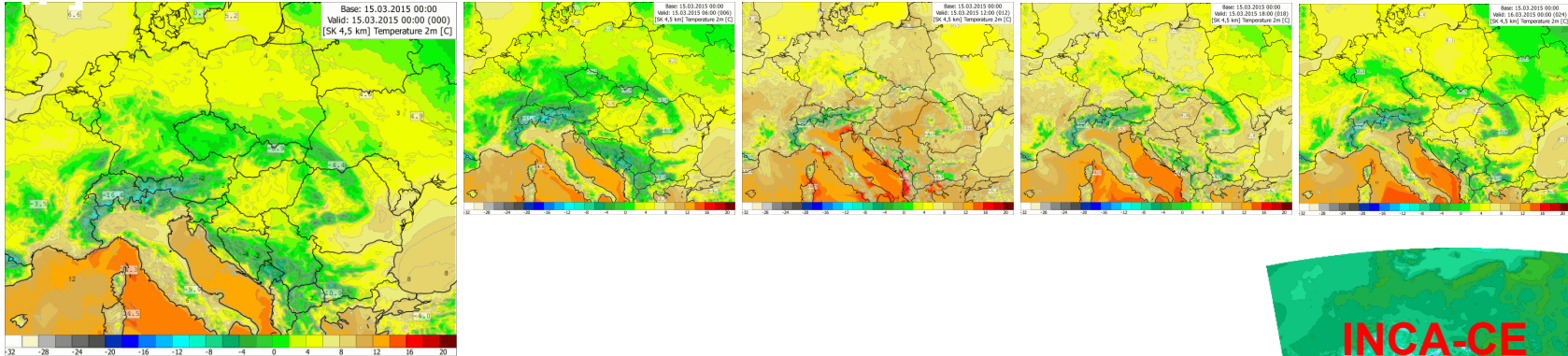NWP SHMU Michal Nestiak, J.Vivoda, M.Bellus, M. Derkova, R. Bujnak, O. Spaniel, R. Zehnal

DHMZ SHMU OMSZ ZAMG ROMANIA ANM

*R*egional *C*ooperation for
*L*imited *A*rea Modeling in *C*entral
*E*urope

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NWP models in operative on SHMU

- ALADIN 9km, 37lev   (00,06,12,18 UTC)

- ALADIN 4.5km,63 lev (00, 12 UTC /assimilation cycling 00,06,12,18/)

- Already product for forecasters, hydrology

- All new products for key customers is based on „p012"

  - /solar power plant, road maintenance, .../

- waiting for switch to new HPC maybe start porting May/June 2015

- INCA2 SK 1km (each 10min analyse, each 1h 24h forecast)

- http://www.shmu.sk/sk/?page=1755

- INCA2 CE 1km (each 1h, 24h forecast)

- http://inca-ce.eu/CE-Portal/index.html

NWP models runs on SHMU

ALADIN-SK [4.5x4.5 km = 1671x 1766 each / 6h => Forecast 72 h]

+
ACTUAL
OBS

+
ACTUAL
OBS

+
ACTUAL
OBS

INCA-CE 1x1 km 1671x 1766 T2m

INCA-CE 1x1 km 1671x 1766
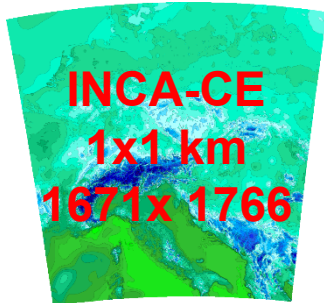
Each 1h -> 24h Forecast / 1h step 7 minutes after all data available

INCA-CE 1x1 km 1671x 1766 dd, ff, wg

ALADIN SK 9.0 km /72h/ - 10min
ALADIN SK 4.5 km /72h/ - 50min

3

ZAMG   ROMANIA ANM

Operative run 24/7/365

Space comsumptions

Only 3D analyze

1x1km ,200m vertical step 0 -4600m

100 MB /data/nwp/products/inca2_tq.ce/yyyy-mm-dd_HH/T_Z.grb
 60 MB /data/nwp/products/inca2.2_uv.ce/ yyyy-mm-dd_HH /VV_FC_INCA.grb
 60 MB /data/nwp/products/inca2.2_uv.ce/ yyyy-mm-dd_HH /UU_FC_INCA.grb

----

Forecast 24h

60 MB /data/nwp/products/inca2_tq.ce/yyyy-mm-dd_HH/TT_FC_INCA.grb
One T2m field whole day   1440 MB per day

500 MB RH_FC_INCA.grb | TD_FC_INCA.grb | TT_FC_INCA.grb | Z0_FC_INCA.grb | ZS_FC_INCA.grb
5 fields whole day   12000 MB = 12GB per day

For 10 years reanalyze 45 TB

dsmc retr -asnode=hpc /data/nwp/oper/grib/shmu/2013-01-01_00/SURFPREC_TOTAL.tar

▸ IBM Tivoli Storage Manager

▸ Command Line Backup-Archive Client Interface

▸ Client Version 6, Release 2, Level 5.0

▸ Client date/time: dd.mm.yyyy HH:MM:SS

▸ (c) Copyright by IBM Corporation and other(s) 1990, 2013. All Rights Reserved.

▸ Retrieve function invoked.

▸ Node Name: HPCDEV01

▸ Session established with server TSM: AIX-RS/6000

▸ Server Version 5, Release 5, Level 5.0

▸ Server date/time: dd.mm.yyyy HH:MM:SS Last access: dd.mm.yyyy HH:MM:SS

▸ Accessing as node: HPC

▸ Retrieving   9,123,840 /data/nwp/oper/grib/shmu/2013-01-01_00/SURFPREC_TOTAL.tar --> /data/users/nwp202/wrk/aladin/SURFPREC_TOTAL_20130101_00.tar [Done]

▸ Retrieve processing finished.

▸ Total number of objects retrieved: 1

▸ Total number of objects failed: 0

▸ **Total number of bytes transferred: 8.70 MB**

▸ **Data transfer time: 0.15 sec**

▸ **Network data transfer rate: 57,682.46 KB/sec**

▸ **Aggregate data transfer rate: 111.81 KB/sec**

▸ **Elapsed processing time: 00:01:19**

INCA2 SK precipitations reanalyze

▸ Imagine that for one precipitation analyze need

- ▸ HDF5 from radars : 2 SK | 2 CZ | 3 PL

- ▸ HDF5 from NowcastingSAF

- ▸ (02-CT,03-CTTH, 04-PC size 15min: 30 MB 5min: 90MB)

- ▸ ALADIN forecast

Only analyze with 5 min time step

"Best retrieveve time" = 10 min /only luck you don't need the ALADIN data each 5 minutes/

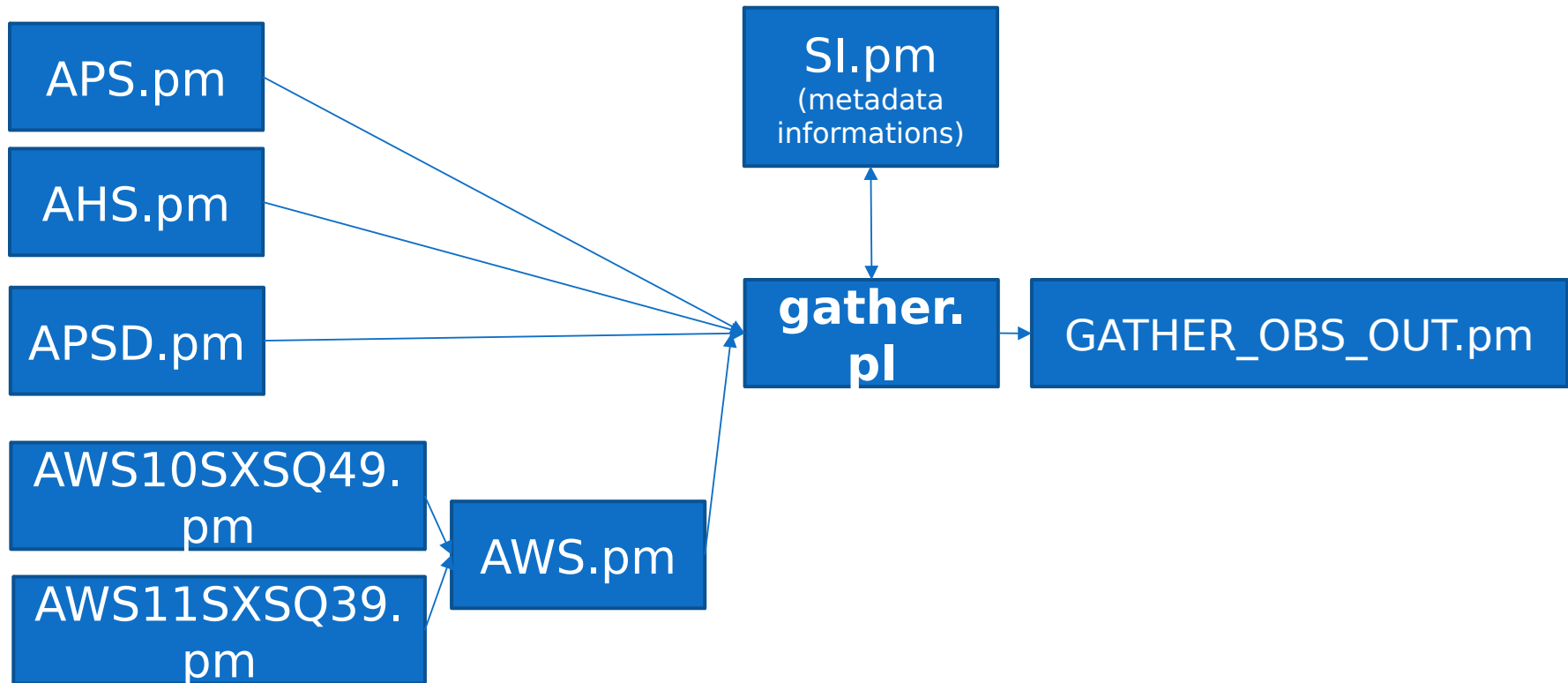**ALADIN SK 9.0km 281x220 (whole Europe, one field)**   **0.09 MB**

ALADIN SK 4.5km 561x439 (whole EUROPE | one field)   **0.36 MB**

ALADIN SK 2.5km 289x189 (only Slovakia)   **0.11 MB**

New automatic stations on SHMU (POVAPSYS2)

- HOLIC
- SENICA
- MYJAVA
- BRATISLAVA - LETISKO
- JASLOVSKE BOHUNICE
- PIESTANY
- MORAVSKY SVATY JAN
- ZILINA - DOLNY HRICOV
- MOCHOVCE
- DUDINCE
- BANSKA BYSTRICA
- BANSKA STIAVNICA
- BZOVIK
- VIGLAS - PSTRUSA
- DOLNE PLACHTINCE
- LOM NAD RIMAVICOU
- BREZNO
- LIESEK
- MALINEC
- BOLKOVCE
- POPRAD - TATRY
- TELGART
- RATKOVA
- RIMAVSKA SOBOTA
- GANOVCE
- REVUCA
- KOSICE - LETISKO
- TISINEC
- SOMOTOR
- VYSOKA NAD UHOM

- And still revive new …

New gather observations based on MySQL

```
APS.pm
AHS.pm
APSD.pm

AWS10SXSQ49.pm
AWS11SXSQ39.pm
```

```
AWS.pm
```

```
SI.pm
(metadata informations)
```

```
gather.pl
```

```
GATHER_OBS_OUT.pm
```

tual station list for analyse term is more important than before
p://inca.kol.shmu.sk/tools/si.php?ci=73&cc=AT&out=lat,lon,ii,name&date_E=yyyymmdd_HHMM&int=1440&

GATHER_OBS_OUT

- "{si,RR[mm/h],flag}"

- "{lon,lat,RR[mm/h]}"

- "{lon,lat,RR[mm],size}"

- "{lon,lat,RR,size}"

- "{si,lon,lat,RR}"

- "{lon,lat,pstext,RR}"

- "{lon,lat,RR}"

- "{date,ii,RR}"

- "{ii,RR}", "{lon,lat,RR,black}", "{si,ii,RR,black}" , "{hips_www}"
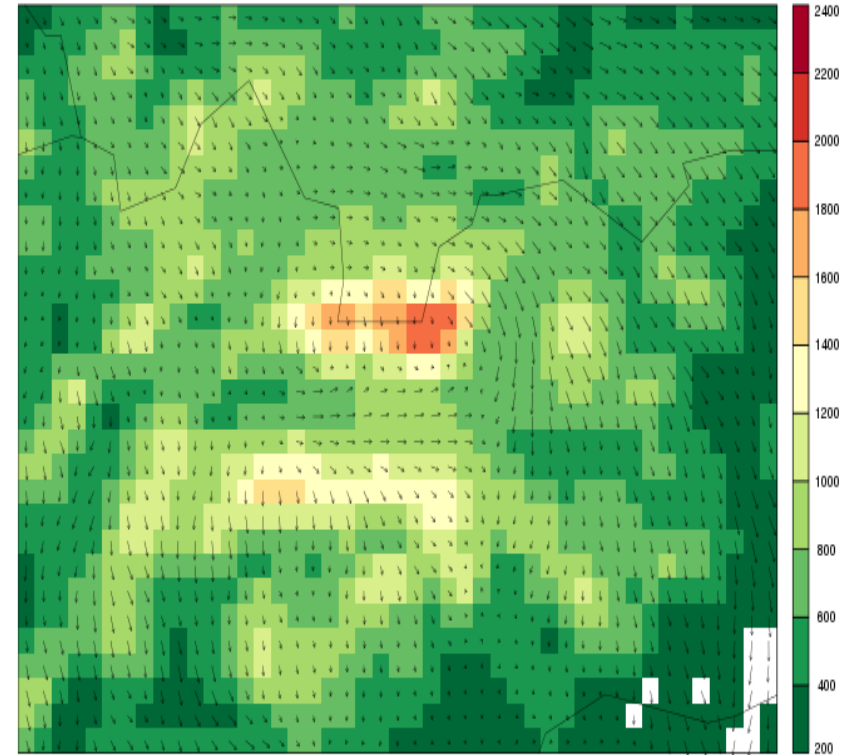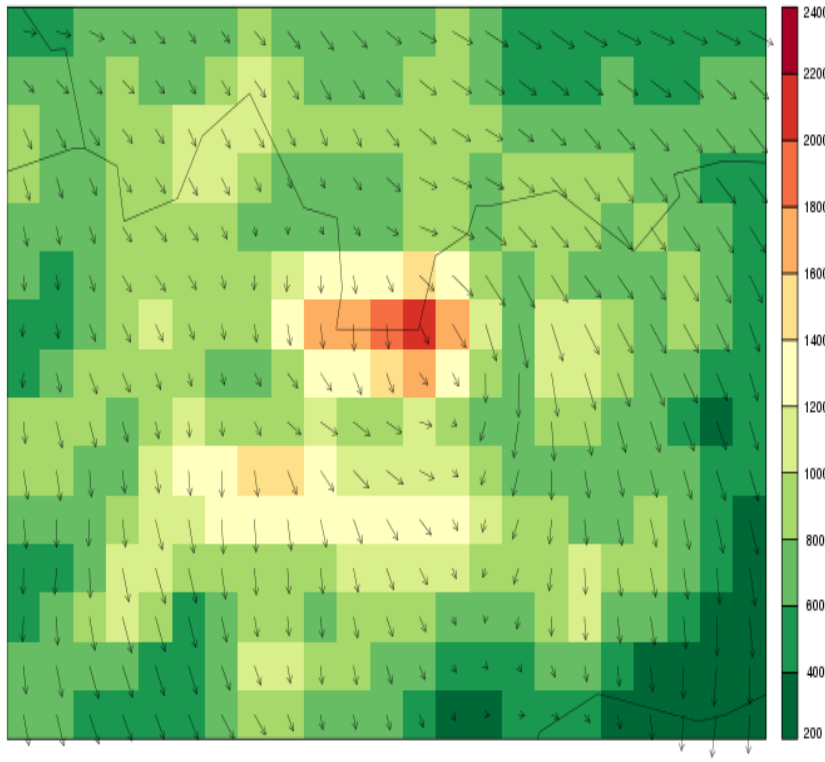
  - . ... and many others for each application

Radar assimilation

- Already collected data

- RC-LACE radar data was already collected

- INCA2-CE chain for QC

- outputs is single radars files with QC fields for reflectivity

- New INCA2 precipitation module was implemented in OMSZ

- Problem with implementation of QC for wind

  - In orginal INCA only analyse was 3D field

  - On SHMU works on INCA2 wind module which have 3D analyse and forecast but still is too slow

  - Main problem is that winds from radars was not implemented yet

  - We would like direct implementation of radar HDF5 and satellite winds

- Prepared CONRAD

- 36T1 experiment is already prepared on AROME 2.5km

Compare oper (9km) vs p012 (4.5km)

oper

test

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What our plans with winds from radar?

- Now AROME/ALARO wind analyse on resolution 2.5km/1km is comparable quality like INCA wind analyse
  (2014-10/11/12 make Jozef Vivoda tests with 100m INCA analyses for Slovak Airports)

- Maybe is better code quality control routine for wind directly inside model

- RUC (1h) we also running analyse each hour like in INCA (t2m,wind, relative humidity,…)

- Why don't use last 1h forecast as background control field?

- Why don't use directly OROGRAPHY of model?

  - ZMODOR = ROBHDR(JOBS,MDBMOR)

  - ZDATA(15) = ZMODOR

RC LACE Asimilation stage 2014 in OMSZ

(F) arp/module/yomcoctp.F90
CMA OBS./CODE TYPES

!ODB SET $RADAR = 13
INTEGER(KIND=JPIM) :: NRADAR   I   RADAR
INTEGER(KIND=JPIM) :: NRADARSQ   I   RADAR SQ. NO
INTEGER(KIND=JPIM) :: NRADA1   I   RADAR CODE TYPE 1
INTEGER(KIND=JPIM) :: NRADA1SQ   I   RADAR CODE TYPE 1 SQ. NO.

CHARACTER(LEN=32) :: CCMOOTP(JPNOTP) ! Names of observation types
INTEGER(KIND=JPIM) :: MNOCTP(JPNOTP)   ! Number of codetypes, per obs type
CHARACTER(LEN=32) :: CCMOCTP(511)   ! Names of code types
INTEGER(KIND=JPIM) :: MSQBYCTP(511)   ! Coverts from codetype to sequence No.

(F) arp/module/yomvnmb.F90
YOMVNMB - CMA VARIABLE NUMBERING

MODULE YOMVNMB
!   NVNUMB(74) I   RADAR REFLECTIVITY
….
!   NVNUMB(93) I   RADAR RADIAL WIND

(F) arp/obs_preproc/new_thinn.F90
SUBROUTINE NEW_THINN(KTSLOT)
LMFSCREEN
12 THINNING OF ACTIVE RADAR DATA

RC LACE Asimilation stage 2014 in OMSZ

```
(F) arp/var/ecset.F90
SUBROUTINE ECSET(KTSLOTNO,KOBTOT,KOFFTOT)

1.2   Define the order of processing
ITYPLIST( 1)=NSCATT   ; INGRP( 1)=1
ITYPLIST( 2)=NAIREP   ; INGRP( 2)=1
ITYPLIST( 3)=NDRIBU   ; INGRP( 3)=1
ITYPLIST( 4)=NPAOB    ; INGRP( 4)=1
ITYPLIST( 5)=NSYNOP   ; INGRP( 5)=1
ITYPLIST( 6)=NSATOB   ; INGRP( 6)=NSATOBGRP
ITYPLIST( 7)=NPILOT   ; INGRP( 7)=1+1 ! Increase for Aeolus
ITYPLIST( 8)=NTEMP    ; INGRP( 8)=1
ITYPLIST( 9)=NLIMB    ; INGRP( 9)=NLIMBGRP
ITYPLIST(10)=NRADAR   ; INGRP(10)=1
ITYPLIST(11)=NSATEM   ; INGRP(11)=NSATGRP
ILISTLEN=11

CLTYPNAME(NSCATT)='   SCATT'
CLTYPNAME(NAIREP)='   AIREP'
CLTYPNAME(NDRIBU)='   DRIBU'
CLTYPNAME(NPAOB )='    PAOB'
CLTYPNAME(NSYNOP)='   SYNOP'
CLTYPNAME(NSATOB)='   SATOB'
CLTYPNAME(NPILOT)='   PILOT'
CLTYPNAME(NTEMP) ='    TEMP'
CLTYPNAME(NLIMB) ='    LIMB'
CLTYPNAME(NRADAR)='   RADAR'
```

(F) arp/obs_preproc/defrun.F90
***** SUBROUTINE DEFRUN - DEFINE RUN CONTROL PARAMETERS

SUBROUTINE DEFRUN

.BGQC (NVAR_RFL,JOTP,1:3) = (/9.0_JPRB,16.0_JPRB,25.0_JPRB/)
.BGQC (NVAR_DOW,JOTP,1:3) = (/9.0_JPRB,16.0_JPRB,25.0_JPRB/)

*   1.8.13 RADAR

* reflectivity bg check switch off
.RBGQC (NVAR_RFL,NRADAR,1:3)= (/9.0_JPRB,16.0_JPRB,25.0_JPRB/)*1000._JPRB
.BGQC (NVAR_RFL,NRADAR,1:3)= (/9.0_JPRB,16.0_JPRB,25.0_JPRB/)
.AQC (NVAR_RFL,NRADAR)=0.001_JPRB
.LQC (NVAR_RFL,NRADAR)=10.0_JPRB
* relative humidity of retrieved profiles
.BGQC (NVAR_H, NRADAR, 1:3)= (/10.0_JPRB,10.0_JPRB,10.0_JPRB/)
.AQC (NVAR_H, NRADAR)=0.001_JPRB
.LQC (NVAR_H,NRADAR)=10.0_JPRB
* Doppler wind
.BGQC (NVAR_DOW,NRADAR,1:3)= (/2.60_JPRB,2.60_JPRB,2.60_JPRB/)
.AQC (NVAR_DOW,NRADAR)=0.001_JPRB
.LQC (NVAR_DOW,NRADAR)=10.0_JPRB

(F) arp/obs_preproc/fgchk.F90
FIRST GUESS CHECK FOR Z/T/Q/RH/TD/T2M/TD2M/RH2M/APD/ZRL/DOW

SUBROUTINE FGCHK(KOBS,KBODY,KGRP)

!   3.2.26 REFLECTIVITY RADAR
  ELSEIF(ICMVNM == NVNUMB(74)) THEN
    IVAR=NVAR_RFL

!   3.2.27 DOPPLER WIND
  ELSEIF(ICMVNM == NVNUMB(93)) THEN
    IVAR=NVAR_DOW
    ZFAC = 400.0_JPRB/(ZRIGHT*RBGQC(IVAR,IOBTYP,JFLAG)) ! 20 m/s

Some unofficial information's

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Thanks

RC LACE Asimilation stage 2014 in OMSZ

```
!      3.15  MODEL OROGRAPHY


ZMODOR = ROBHDR(JOBS,MDBMOR)
ZDATA(15) = ZMODOR


!      3.16  LAND/SEA MASK (INTEGER)


IHORIZ = NOBSPROFS(IOBTYP)
IF (IHORIZ > 1) THEN
  ILSMSK = NINT(YGOMEC_2D(IMAPOMM)%ECLSMA(1))
ELSE
  ILSMSK = NINT(YGOMEC(IMAPOMM)%ECLSMA)
ENDIF
ZDATA(16) = ILSMSK


!      3.17  LAND/SEA MASK (REAL)


IF (IHORIZ > 1) THEN
  ZDATA(17) = YGOMEC_2D(IMAPOMM)%ECLSMA(1)
ELSE
  ZDATA(17) = YGOMEC(IMAPOMM)%ECLSMA
ENDIF


!      3.18  MODEL SURFACE PRESSURE (IN HECTOPASCALS)


IHORIZ = NOBSPROFS(IOBTYP)
IF (IHORIZ > 1) THEN
  ZMODPS = EXP(YGOMS_2D(IMAPOMM)%SP(1))
ELSE
  ZMODPS = EXP(YGOMS(IMAPOMM)%SP)
ENDIF
ZDATA(18) = ZMODPS*0.01_JPRB


!      3.19  MODEL SURFACE TEMPERATURE


IF (IHORIZ > 1) THEN
  ZMODTS = YGOMS_2D(IMAPOMM)%TS(1)
ELSE
  ZMODTS = YGOMS(IMAPOMM)%TS
ENDIF
ZDATA(19) = ZMODTS


!      3.20  MODEL 2 METRE TEMPERATURE


ZDATA(20) = RMDI
```