



A Consortium for CONvection-scale modelling
Research and Development



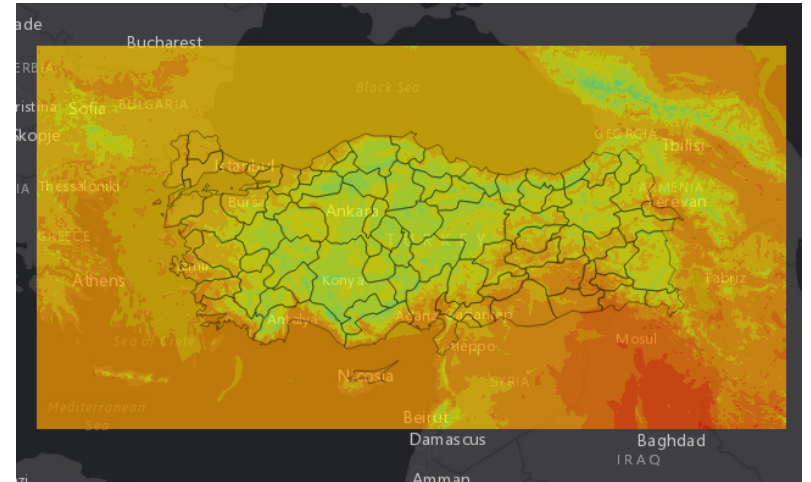
Calculation of B-Matrix at ECMWF with Support of ZAMG and SHMU

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AROME-Turkey



- 1.7 km horizontal resolution, 72 vertical levels, 50 seconds time step, model version cy43t2_bf10.
- Observations processed by SAPP are assimilated in surface data assimilation (CANARI-OIMAIN).
- Running on ecflow every 3 hours (from 00 to 21 UTC), coupling with ECMWF-IFS.
- Producing forecasts up to 24 hours.



Arome-Tr Ruc fullpos domain

Background Error Statistics



- Cycle 43t2_bf11 was installed on cca by using Maria Monteiro's user_profile and .gmkfile info.
- MASTERODB, FEDIACOV and FESTAT binaries were created.
- For 903 configuration, model version cy46_bf01 from ZAMG was used.
- The scripts provided by ZAMG (run_903.ksh, diffarome_bmatrix.ksh, festat_bmatrix.ksh) and SHMU (marsens.pl) were firstly tested on ECMWF cca.
- The B-Matrix of AROME-Tr was calculated by ensemble approach for 30 days (20210811-20210909).
- 00 and 12 UTC runs and 4 ensemble members were used. In total 120 forecast differences were calculated.
- Number of forecast differences > Number of model vertical level

B-Matrix Calculation



- The steps of calculation:
- Extract data from MARS to run 903 (marsens.pl)
- Run 903 to create LBC (run_903.ksh)
- Run prepsurf and a short 001
- Calculate forecast differences (diffarome_bmatrix.ksh)
- Calculate B-matrix (festat_bmatrix.ksh)

B-Matrix Calculation



Extraction of necessary data for 903

- Retrieving ensemble and operational forecast surface and model level data from MARS archive.
- In the script, the parameters such as date, time, member can be defined.

MARS Request =>STREAM=ENFO, TYPE=PF or CF

STREAM=OPER, TYPE=AN (ICMGGMARS)

- OUTPUT:

ICMGG+0000RR.mem – surface gridpoint data

ICMUA+0000RR.mem - upper air gridpoint data

ICMSH+0000RR.mem – spectral data

```
ICMGGMARS+000000.1
shortName
asn
rsn
swvl1
swvl2
swvl3
swvl4
stl1
sd
stl2
lsm
stl3
src
skt
stl4
istl1
istl2
istl3
istl4
tsn
sr
al
cvl
cvh
tvh
stl
ci
sst
sdfor
slor
sdor
isor
anor
aluvp
aluvd
alnlp
alnid
lai_lv
lai_hv
lsrh
```

```
ICMSHMARS+000000.1
shortName
lnsp
vo
d
t
2
413 of 413 grib messages in ICMHMARS+000000.1
```

```
ICMUAMARS+000000.1
shortName
q
o3
crwc
cswc
clwc
ciwc
cc
```

B-Matrix Calculation



Creation of LBCs with 903 configuration

- INPUT:

ICMUAMARS+\${astep}.\${mem}

ICMSHMARS+\${astep}.\${mem}

ICMGGMARS+\${astep}.\${mem}

- OUTPUT:

ELSCFE903+\${DOMAIN}+\${count}

```
&NAMFPC
CFPFMT='LELAM',
CFPDO(1)='{DOMAIN}',
CFPDOIR='{CFPDOIR}',
CFP3DF(1)='TEMPERATURE',
CFP3DF(2)='WIND.U.PHYS',
CFP3DF(3)='WIND.V.PHYS',
CFP3DF(4)='HUMI.SPECIFIQUE',
CFP3DF(5)='PRESS.DEPART',
CFP3DF(6)='VERTIC.DIVER',
CFP3DF(7)='RAIN', !sts 11.3.
CFP3DF(8)='ICE.CRYSTAL', !sts 11.3.
CFP3DF(9)='SNOW', !sts 11.3.
CFP3DF(10)='GRAUPEL', !sts 11.3.
CFP3DF(11)='CLOUD.WATER', !sts 11.3.
CFP3DF(12)='TKE', !sts 11.3.
CFP2DF(1)='SURFPRESSION',
CFP2DF(2)='SPECURFGEOPOTENTIEL',
CFPPHY(1)='SURFTEMPERATURE',
CFPPHY(2)='PROFTEMPERATURE',
CFPPHY(3)='PROFRESERV.EAU',
CFPPHY(4)='SURFRESERV.NEIGE',
CFPPHY(5)='SURFRESERV.EAU',
CFPPHY(6)='SURFZ0.FOIS.G',
CFPPHY(7)='SURFALBEDO',
CFPPHY(8)='SURFEMISSIVITE',
CFPPHY(9)='SURFET.GEOPOTENT',
CFPPHY(10)='SURFIND.TERREMER',
CFPPHY(11)='SURFPROP.VEGEAT',
CFPPHY(12)='SURFVAR.GEOP.ANI',
CFPPHY(13)='SURFVAR.GEOP.DIR',
CFPPHY(14)='SURFIND.VEG.DOMI',
CFPPHY(15)='SURFRESI.STO.MIN',
CFPPHY(16)='SURFPROP.ARGILE',
CFPPHY(17)='SURFPROP.SABLE',
CFPPHY(18)='SURFEPATS.SOL',
CFPPHY(19)='SURFIND.FOLIAIRE',
CFPPHY(20)='SURFRES.EVAPOTRA',
CFPPHY(21)='SURFGZ0.THERM',
CFPPHY(22)='SURFRESERV.INTER',
CFPPHY(23)='PROFRESERV.GLACE',
CFPPHY(24)='SURFRESERV.GLACE',
CFPPHY(25)='SURFDENSIT.NEIGE',
CFPPHY(26)='SURFALBEDO.NEIGE',
CFPPHY(27)='SURFALBEDO.SOLNU',
CFPPHY(28)='SURFALBEDO.VEG',
CFPPHY(29)='SURFA.OF.OZONE',
CFPPHY(30)='SURFB.OF.OZONE',
CFPPHY(31)='SURFC.OF.OZONE',
CFPPHY(32)='SURFAEROS.SEA',
CFPPHY(33)='SURFAEROS.LAND',
CFPPHY(34)='SURFAEROS.SOOT',
CFPPHY(35)='SURFAEROS.DESERT',
```

```
/
&NAMARG
NCONF=903,
NFPSEVER=1,
CNMEXP={CNMEXP},
LECMWF=.TRUE.,
NSUPERSEDE=1,
/
```

```
&NAMFPD
NFPGUX=789,
NFPLUX=1489,
NLAT=800,
NLON=1500,
RLONC=35.0,
RLATC=39.0,
RDELX=1700.000000000000,
RDELY=1700.000000000000,
```

B-Matrix Calculation



Running prepsurf to create ICMSHTURKINIT.sfx and running 001 and producing 3 hour forecast (Forecast length=Assimilation window length)

Calculating forecast differences

- MEM1-MEM2, MEM3-MEM4
- NPROC=1, LSPRT=.FALSE., LFEMARSD=.TRUE.
- INPUT:
MEM1/ICMSHTURK+0003 ICMSHTURKINIT
MEM2/ICMSHTURK+0003 ICMSHTURKANIN
cp ICMSHTURKINIT ICMSHTURKFGIN
- OUTPUT: gribdiff file

B-Matrix Calculation



Covariance calculation for B-Matrix

- NCASES=Number of forecast differences, NPROC=1

- INPUT:

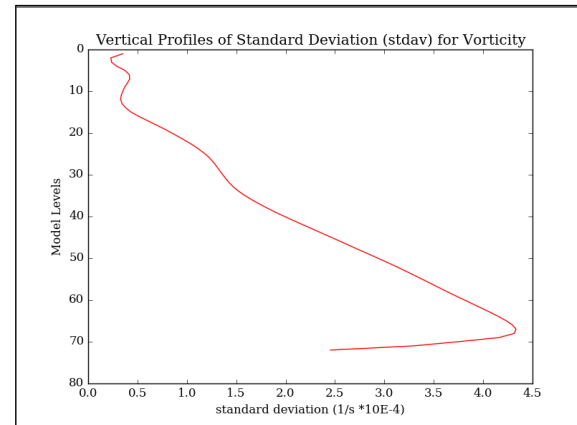
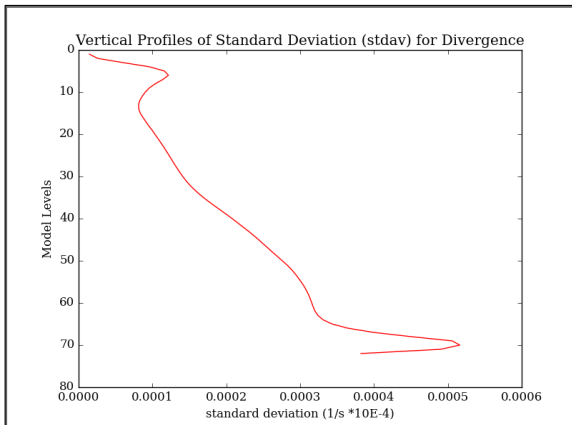
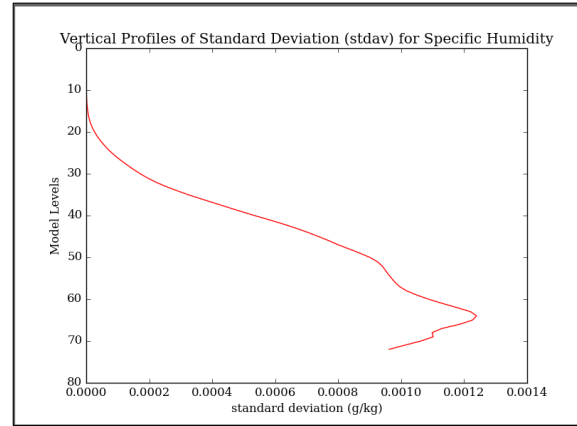
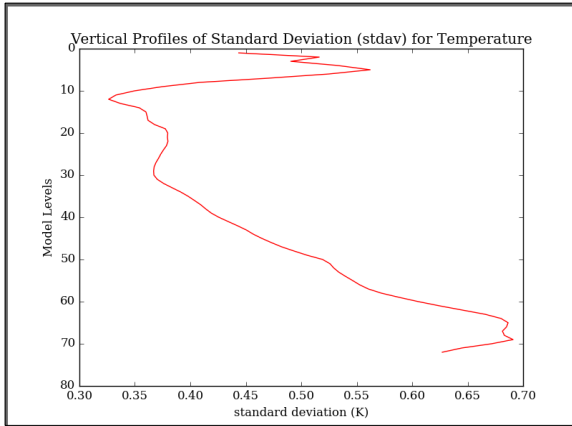
gribdiff files

- OUTPUT:

stabal.bal, stabal.cv, stabal.cvt,...

The outputs were saved to \$PERM.

Some Diagnostics of B-Matrix





Thank you for your attention!