Status of data assimilation at CHMI

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DA working days, 18-21 June 2012, Prague

Outline of the talk

- DA progress since June 2011
- Evaluation of analysis scheme on 4.7km
- Future plans

DA progress at CHMI since June 2011

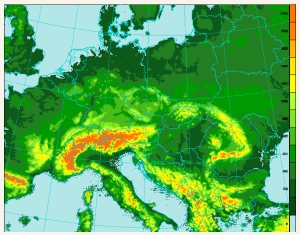
- implementation of CY36t1
- set-up on a new resolution and domain
- evaluation of DA scheme on 4.7km
  - upper-air analysis methodology
  - surface aspects
  - satellite DA - Patrik's talk
  - evolution of dispersion spectra in ensemble estimation of error statistics for LAM - Antonin's poster
- IASI data assimilation - separate talk

System description 1/2

based on ALADIN/CE operational setting from July 2011 - blending

Model part

- cycle 36t1ope
- 4.7km horizontal resolution and 87 vertical levels
- linear truncation E269x215, mean orography
- smaller domain (540x432 grid points)
- 3h coupling interval, time step 360 s



Analysis scheme (operational)

- surface analysis (performed before upper-air one) is provided by:
  - SST taken from ARPEGE analysis
  - CANARI surface analysis based on SYNOP reports (T2m & RH2m) for land
  - any other land soil variables which are not analyzed (like snow) are initialized from the ALADIN guess with the relaxation to the climatology as implemented within the CANARI configuration
- upper air analysis is provided:
  - by the digital filter spectral (DFI) blending, long cut-off 6h cycle (filtering at truncation E87x69, no DFI in the next +6h guess integration)
  - digital filter spectral blending + incremental DFI initialization (IDFI) of short cut-off production analysis

System description 2/2

Analysis scheme under testing - BlendVAR
consists of adding 3DVAR just after the digital spectral blending - all analysis steps are sequential: surface analysis-blending-3DVAR

- B matrix was computed following the lagged NMC method
  (61 days from 17 December 2010 and 99 days from 16 February 2011)
- REDNMC=1

observation assimilated (data from OPLACE only):

- SYNOP surface reports (geopotential)
- TEMP upper air reports (temperature, wind components, specific humidity)

no bias correction method applied as only conventional data were considered
verification methods

- BIAS,RMSE,STDE scores against SYNOP and TEMP (VERAL)
- BIAS,RMSE,STDE with respect to ECMWF and ARPEGE analyzes

Upper-air analysis methodology

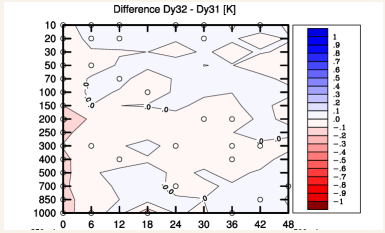
Following configuration were evaluated wrt DFI blending

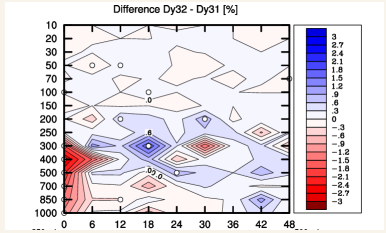
- BlendVAR = DFI blending+3DVAR (with NMC lagged Jb)
- VARBlend = 3DVAR (with NMC Jb + DFI blending)
- 3DVAR (with NMC Jb)

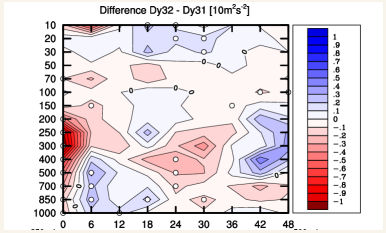
- only conventional data (SYNOP and TEMP) were assimilated
- all configs use the same surface analysis scheme and IDFI in productions
- experiments for 2weeks period (1-14 June 2011)

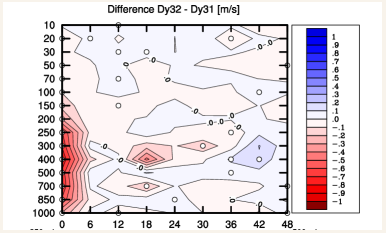
BlendVAR vs DFI blending

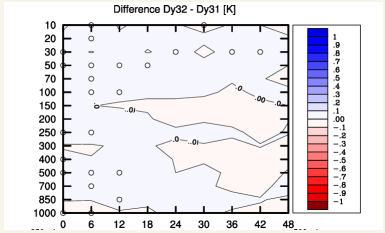
RMSE differences, scores against obs (top) and ECMWF analyzes (bottom)

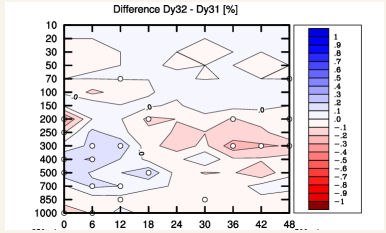


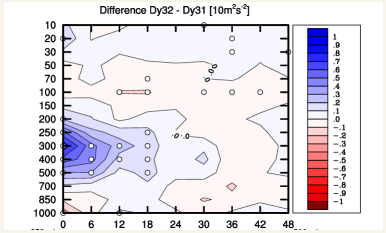


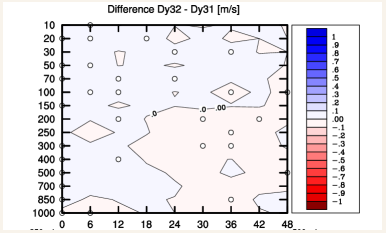












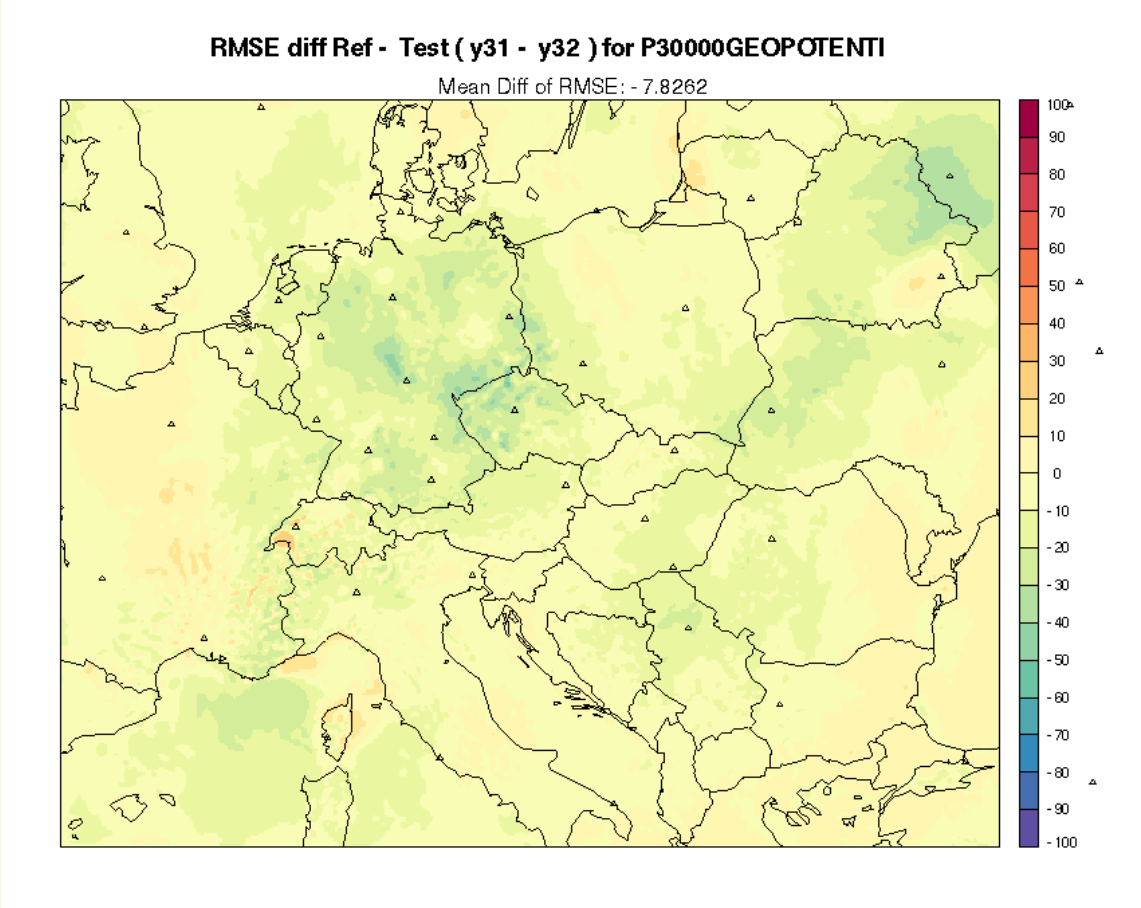
T $[K]$ RH [%] ϕ $[10m^2/s^{-2}]$ $wind$ $[m/s]$

red areas denote a positive impact of BlendVAR, white circles significance 95% two-side confidence interval

- only conventional data (SYNOP,TEMP) assimilated
- NMC lagged Jb
- REDNMC=1

BlendVAR vs DFI blending

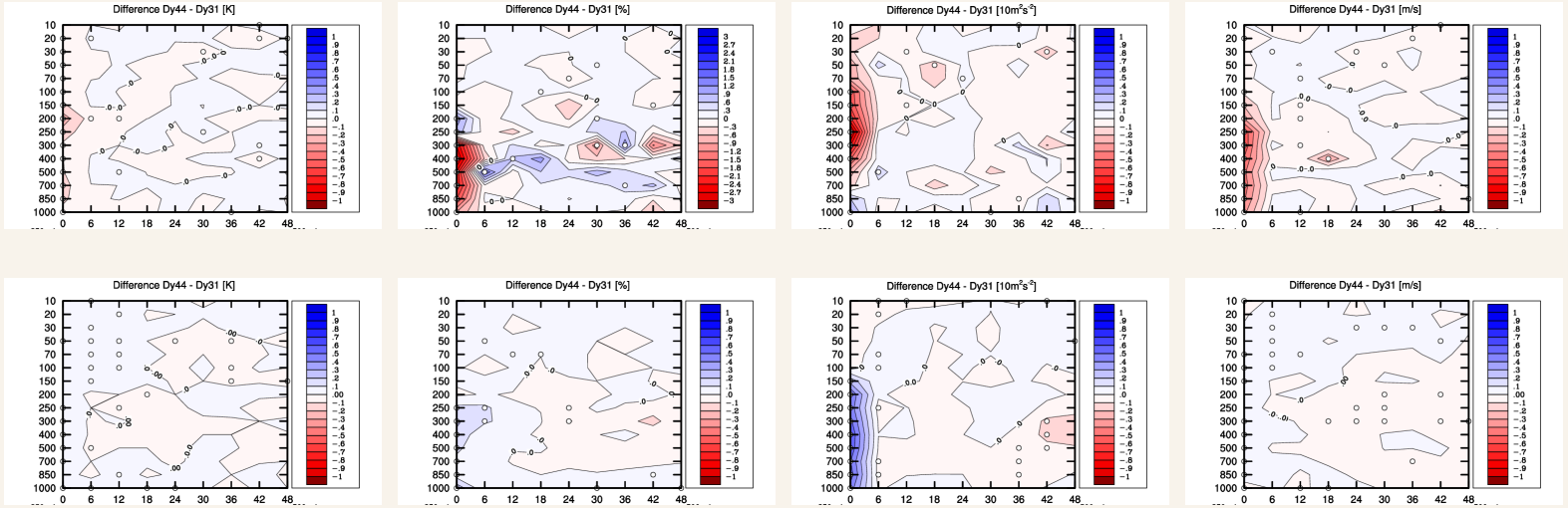
2D RMSE differences at analysis time, scores against ECMWF analyzes



triangles (TEMP stations), green areas denote negative impact of BlendVAR wrt ECMWF analysis

VARBlend vs DFI blending

RMSE differences, scores against obs (top) and ECMWF analyzes (bottom)



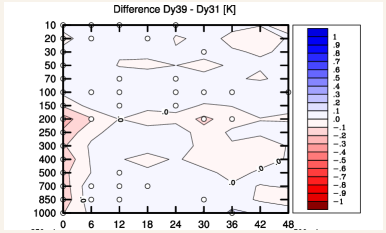
T $[K]$ RH [%] ϕ $[10m^2/s^{-2}]$ $wind$ $[m/s]$

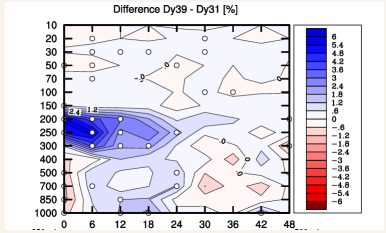
red areas denote a positive impact of **VARBlend**, white circles significance 95% two-side confidence interval

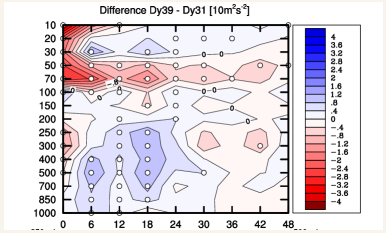
- only conventional data (SYNOP,TEMP) assimilated
- NMC Jb
- REDNMC=1

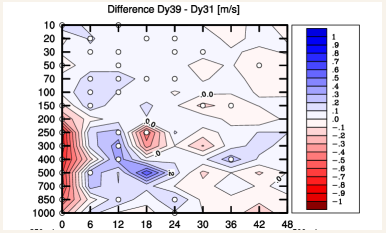
3DVAR vs DFI blending

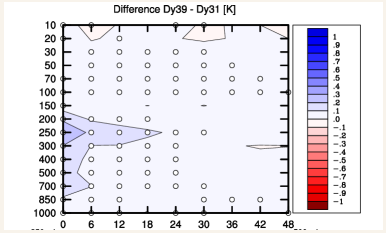
RMSE differences, scores against obs (top) and ECMWF analyzes (bottom)

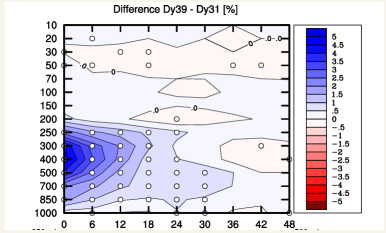


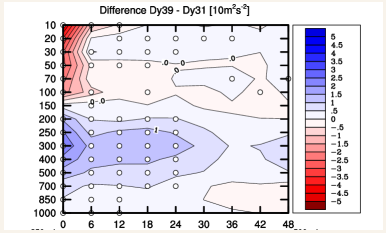


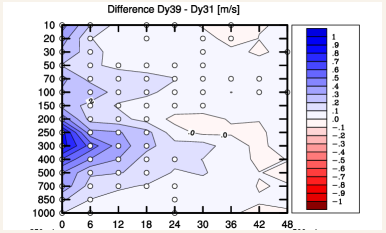












T $[K]$ RH [%] ϕ $[10m^2/s^{-2}]$ $wind$ $[m/s]$

red areas denote a positive impact of 3DVAR, white circles significance 95% two-side confidence interval **scale has changed for RH and ϕ**

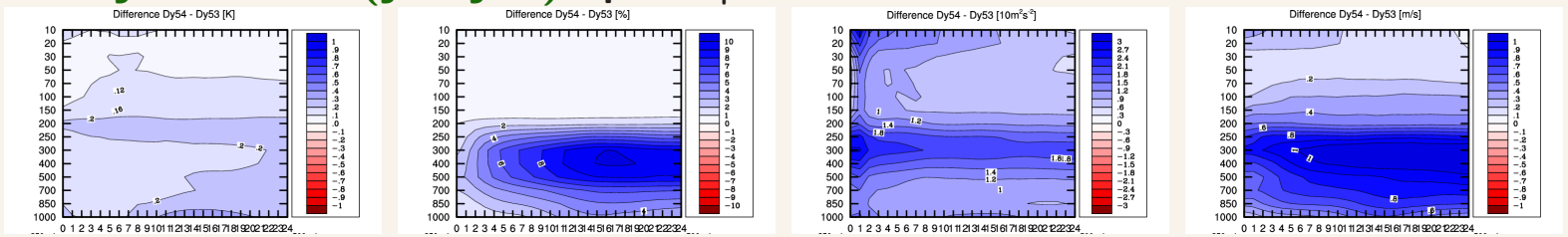
- only conventional data (SYNOP,TEMP) assimilated
- NMC Jb
- REDNMC=1

Diagnostic experiments

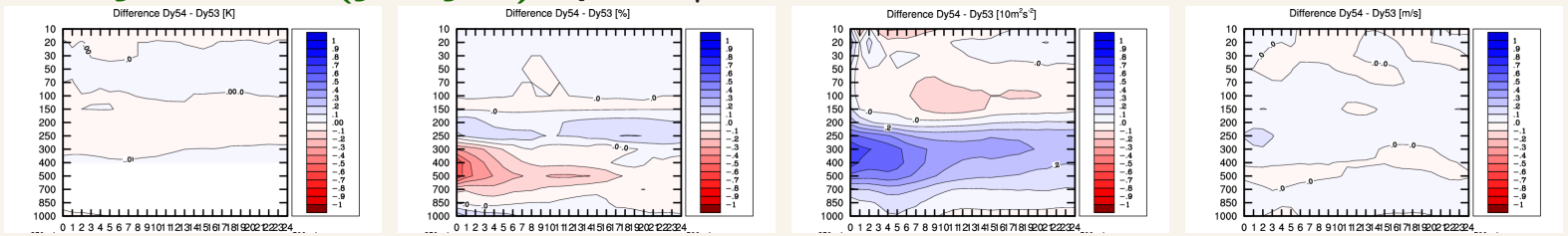
in order to understand the results and (save CPU) a special diagnostics experiments were without assimilation cycle

- y53 - dynamical adaptation (without DFI and surface analysis)
- y54 - dynamical adaptation = 3DVAR with lagged NMC Jb (without DFI and surface analysis)

Hourly RMSE of (y54-y53) up to +24H



Hourly BIAS of (y54-y53) up to +24H



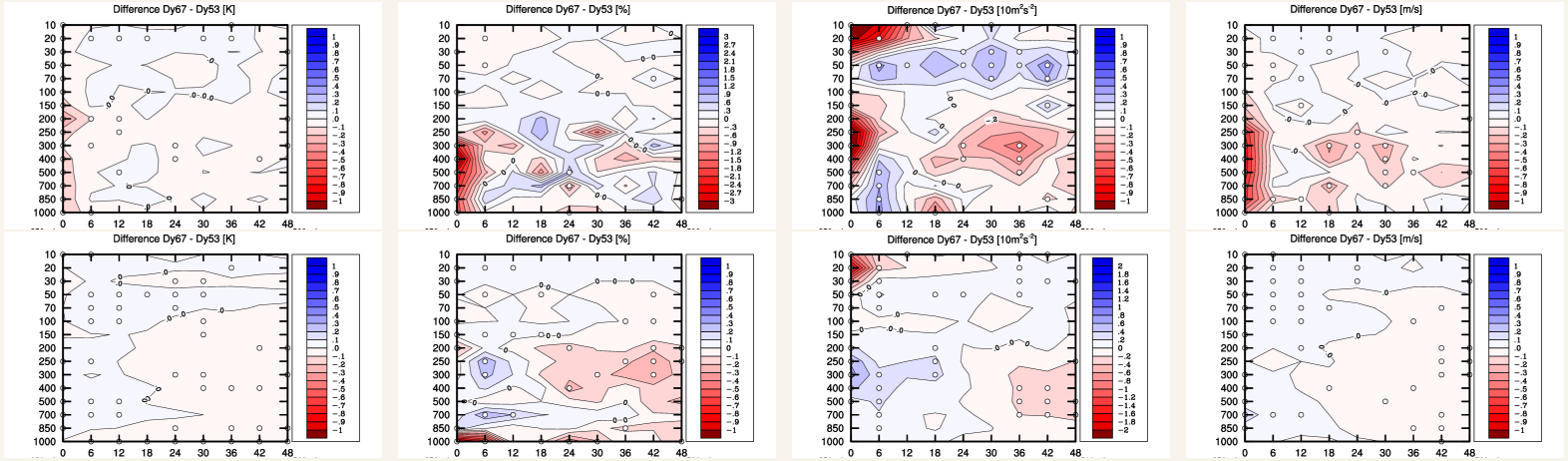
T [K] RH [%] ϕ [$10m^2/s^{-2}$] $wind$ [m/s]

Diagnostic experiments

in order to understand the results and (save CPU) a special diagnostics experiments were without assimilation cycle

- y53 - dynamical adaptation (without DFI and surface analysis)
- y67 - dynamical adaptation = 3DVAR with lagged NMC Jb (without DFI and surface analysis) with all observation assimilated (SYNOP,TEMP,AMDAR,wind profiler,AMV,ATOVS,SEVIRI)

RMSE differences, scores against obs (top) and ECMWF analyzes (bottom)



T [K] RH [%] ϕ [$10m^2/s^{-2}$] $wind$ [m/s]

Summary and future plans

- with SYNOP and TEMP assimilated the impact is lost after +6H

Future plans

- further evaluation of upper-air analysis methodology
- check more deeply the initialization (IDFI, analysis=LBC0,...)
- test assimilation of more observations

Surface aspects

Maintenance and development of local CANARI apps

- surface analysis
- verification package (VERAL)

Surface analysis - technical modification

Technical modification of the surface analysis procedure

Old scheme :

- SST copied from global analysis (via blending tool)
- soil analysis performed via CANARI configuration
- prognostic GFL fields (except qv) copied from the guess (via blending tool)

New scheme:

- everything done within CANARI configuration

  - SST updated via relaxation if SST towards external file (ICMSHANALESST) via namelist switches LECSST=.T.,RCLISST=1. The SST file is ARPEGE analysis interpolated to ALADIN resolution with SURFTEMPERATURE field renamed (via home-made facalc utility) to SURFSEA.TEMPERA and SURFSEA.ICECONC fields (the fields required by the routine caclsst.F90)

  - prognostic GFL fields (except qv) are requested from the guess to the analysis via GFL namelist attributes (NREQIN=1, LREQOUT=T)

Next independent modification was an increase of packing for grid-point fields to 30 bits, except for the prognostic GFL fields, where 16 bits are considered

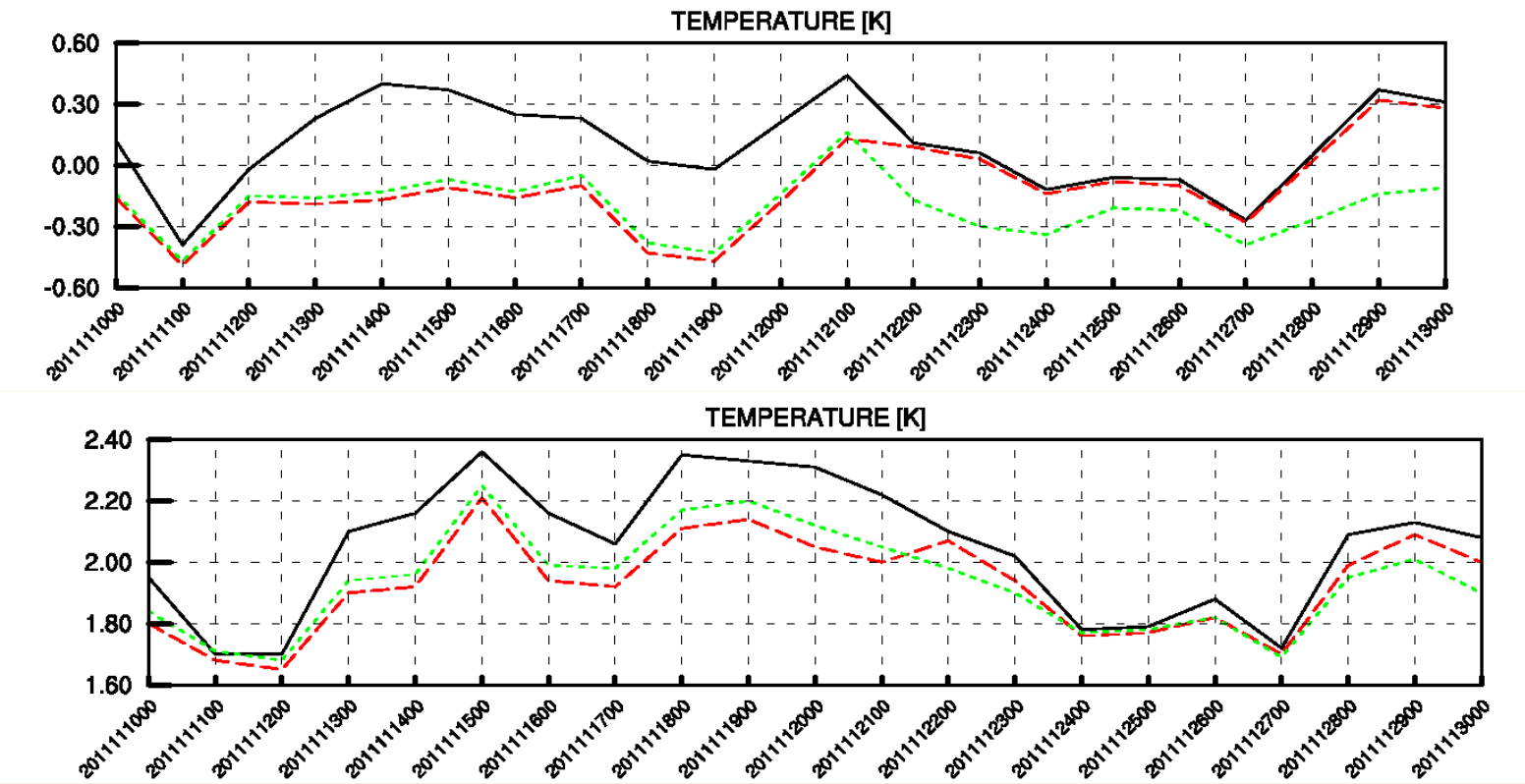
became operational 13 February 2012

VERAL modification (LDIRCLSMOD)

- form CY36 is available option LDIRCLSMOD (&NAMDPHY), which allows to read 2m diagnostics directly from the input file
- option could simplify verification especially for testing of 2m diagnostics modifications
- VERAL recomputes the 2m diagnostics so one has to use the same version of 2m diagnostics in VERAL as in the model integration experiment
- direct reading from the file does not give bit-identical results; - in case LDIRCLSMOD=F all the input parameters are interpolated at first and only then the observation operator (ACHMT) is applied, while in case LDIRCLSMOD=T one reads 2m values (output from ACHMT) from the file and those values are interpolated. There is a signal on the scores (weak negative BIAS and obvious RMSE and STD signal !
- for relative comparsion of two experiments it is acceptable and with regards to simplification of the verification procedure we decided to use it operationally

VERAL modification (LDIRCLSMOD)

- on 21st November 2011 we changed 2m diagnostics from ALAD to Av02
- ALAD (black) and Av02 (green) experiments with LDIRCLSMOD=F
- ALdi (red) with 2m diagnostics the same as Av02 but with LDIRCLSMOD=T



The End

Thank You for Your attention.

Further slides

Future plans

-
- verification package (VERAL)