Using frames for the LM lateral boundary forcing

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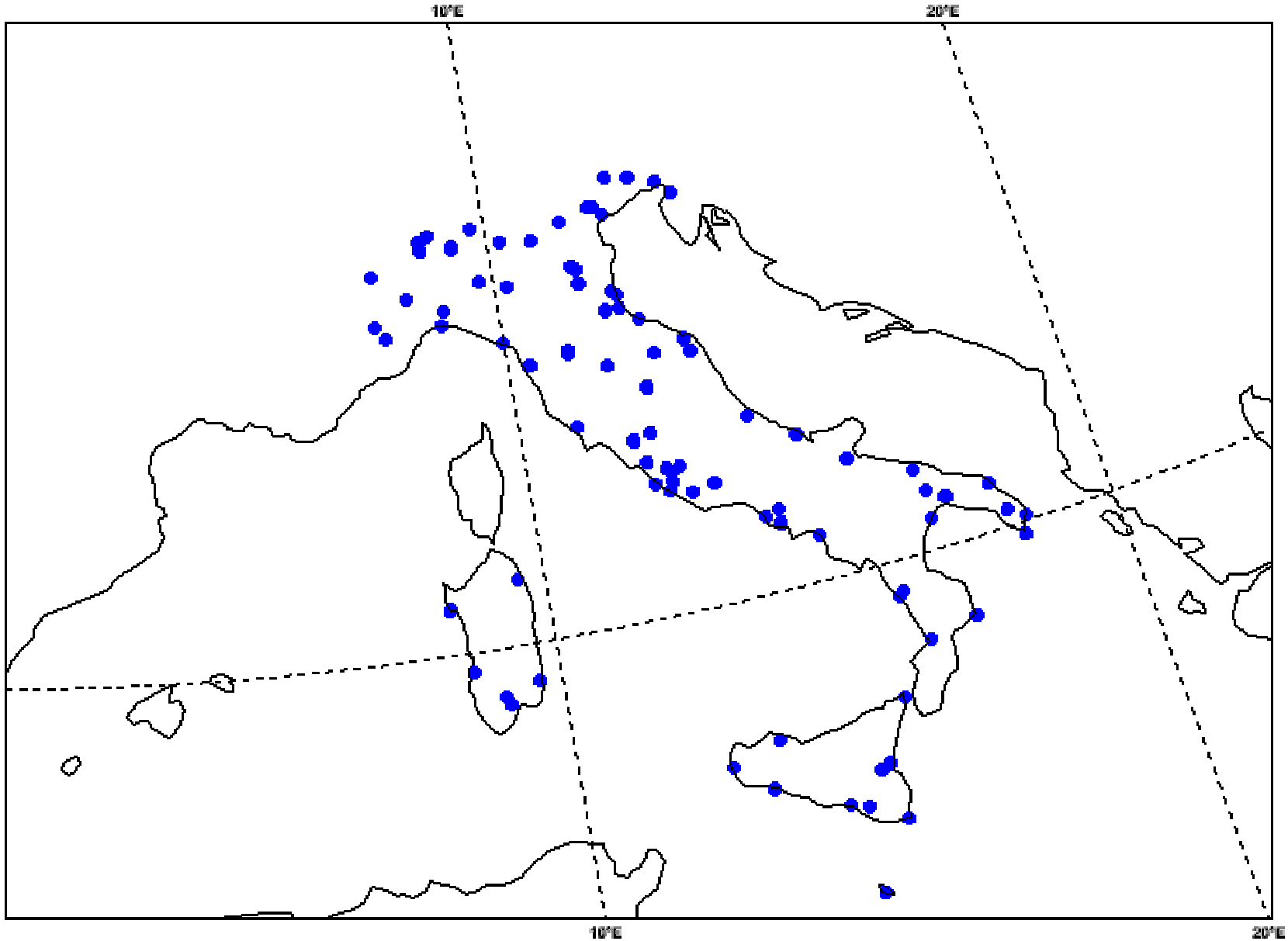
Objective verification of LM with and without frames

Period: 10/6-20/8/2002

- T,Td,U vertical profiles (7 stations)

- Surface variables (T,Td,U,MSLP) for Italian stations ($H_{station}$<700m, $|H_{station}-H_{n.grid\ p.}|$<100m)

SYNOP STATIONS



LM CONFIGURATION (v. 2.11)

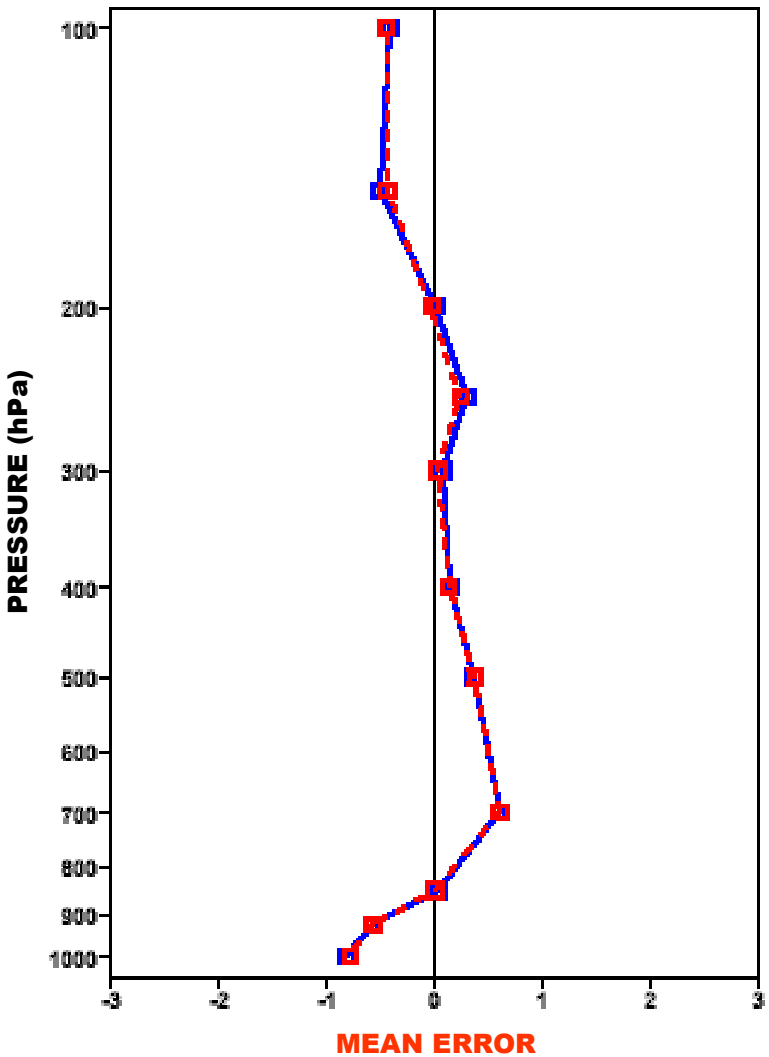
(Used until 2002/08/27, then switched on new turbulence scheme)

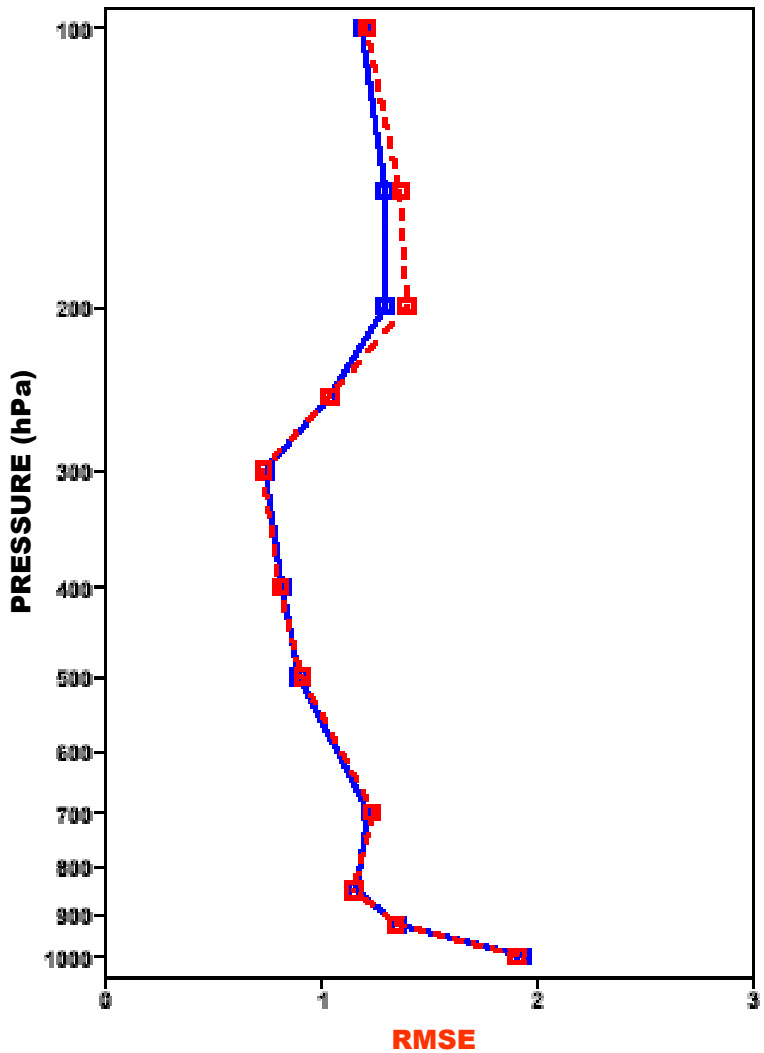
Domain size	234 x 272 (LAMI scenario)
Grid spacing	0.0625 (7 km)
Number of layers	35
Time step	40 sec
Forecast range	60 hrs
Initial time of model run	12 UTC
Lateral boundary conditions	Op. IFS (preproc. with CNMCA-IFS2LM)
L.B.C. update frequency	3 hrs
Initial state	Op. IFS (preproc. with CNMCA-IFS2LM)
Orography	Filtered (eps = 0.1)
Initialization	None
External analysis	None
Turbulence scheme	**Old**
Raylegh damping in the upper layers	**On (without frames) / Off (with frames)**
Hardware (N° of processors used)	Fujitsu VPP5000 (6)

TEMPERATURE FC +24 (12 UTC)

Data from 10/06 to 20/08/02

Control: Blue Frame: Red

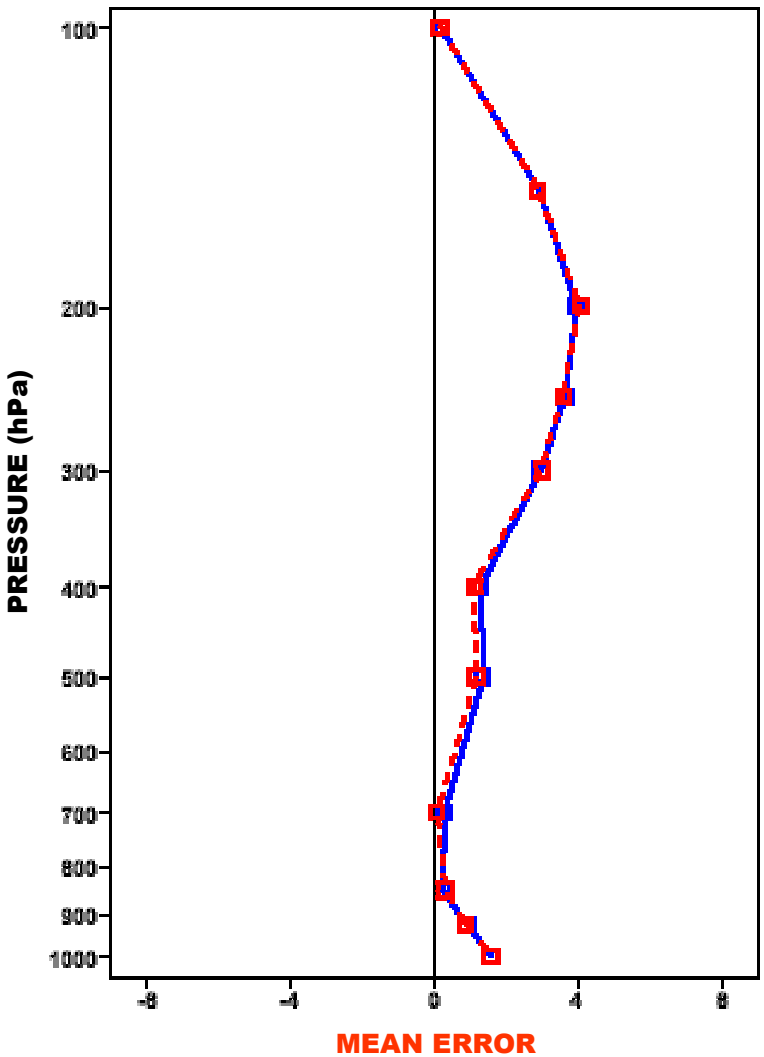


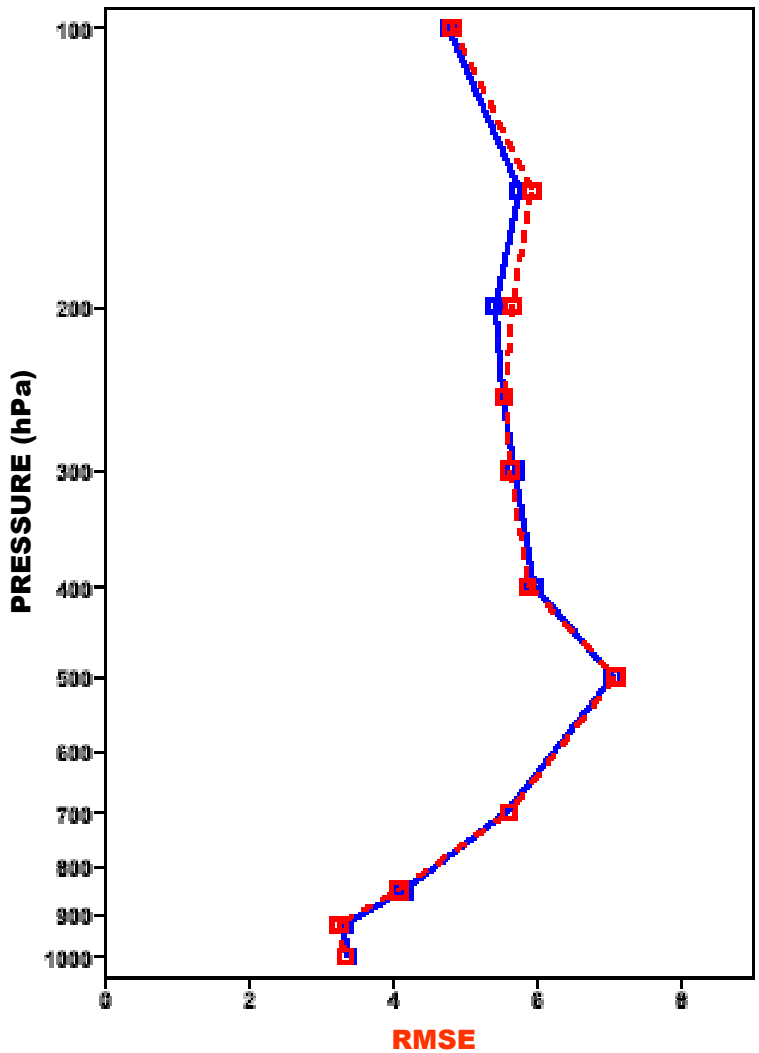


DEW.POINT FC +24 (12 UTC)

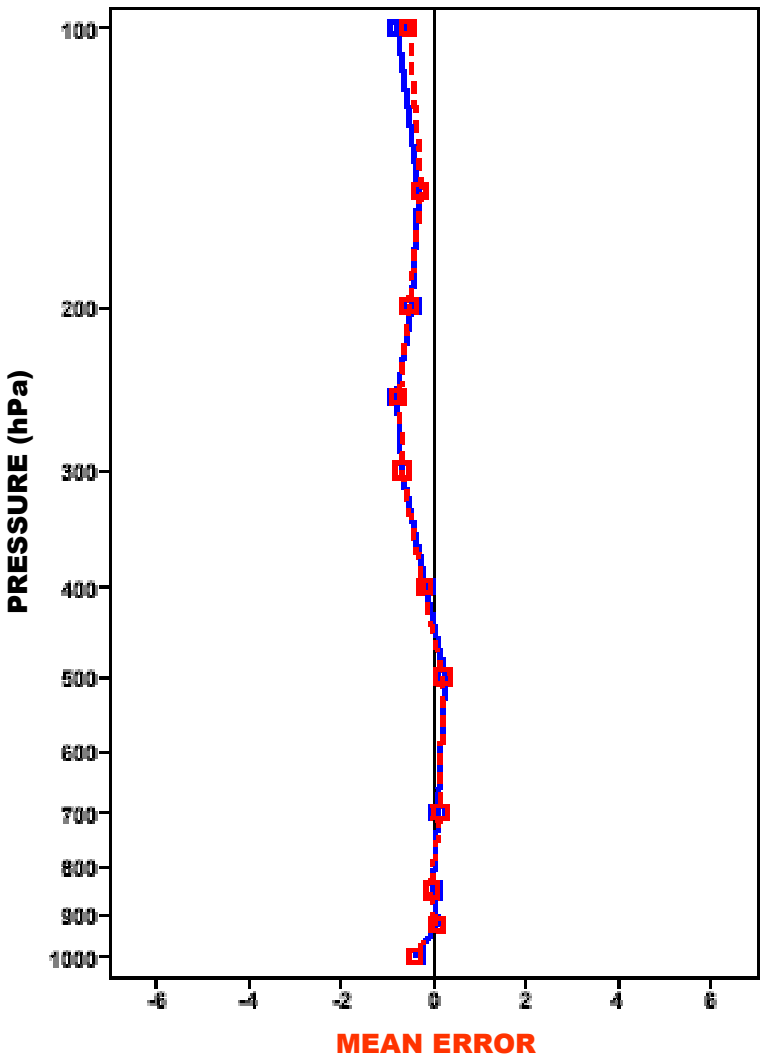
Data from 10/06 to 20/08/02

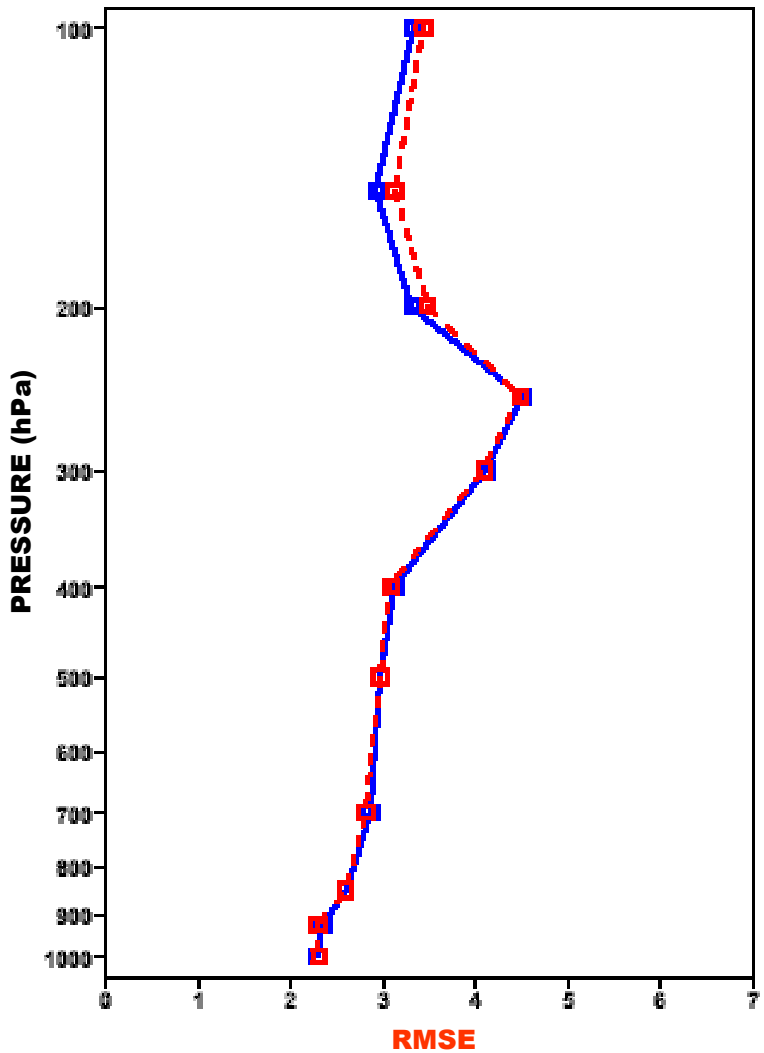
Control: Blue Frame: Red



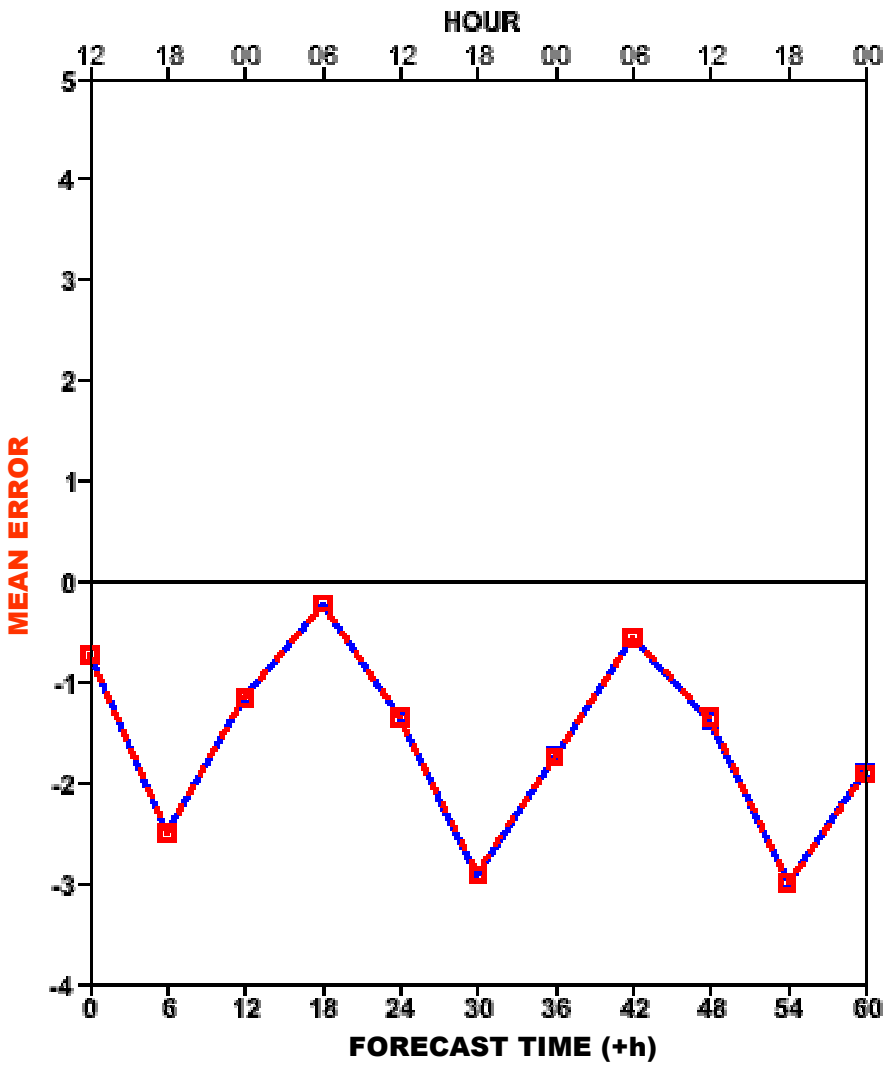


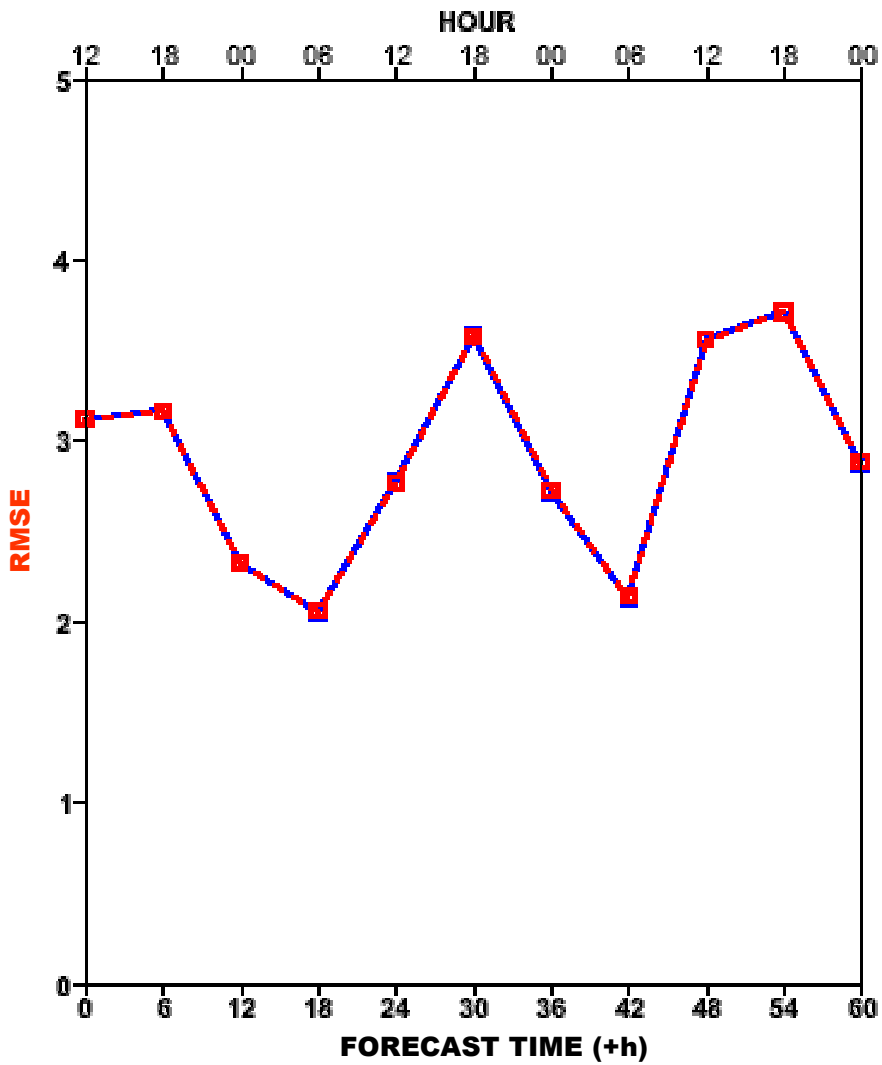
WIND.SPEED FC +24 (12 UTC)
Data from 10/06 to 20/08/02
Control: Blue Frame: Red



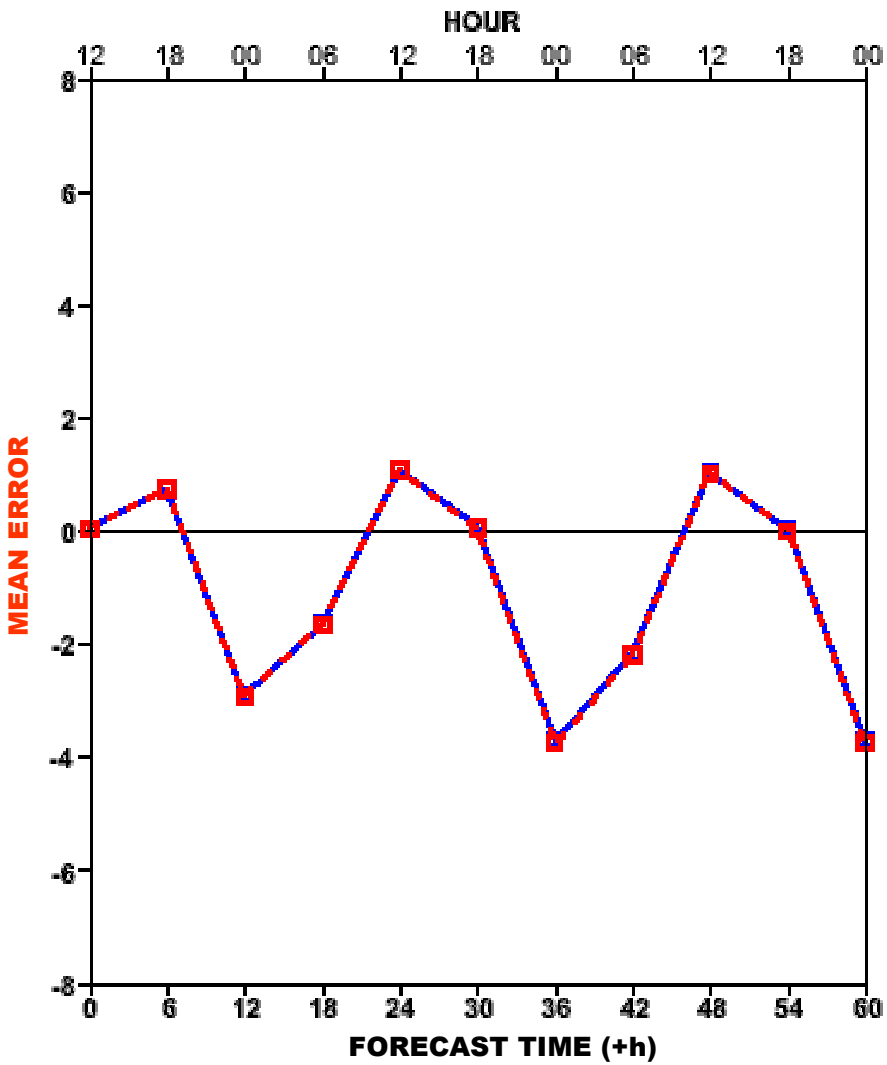


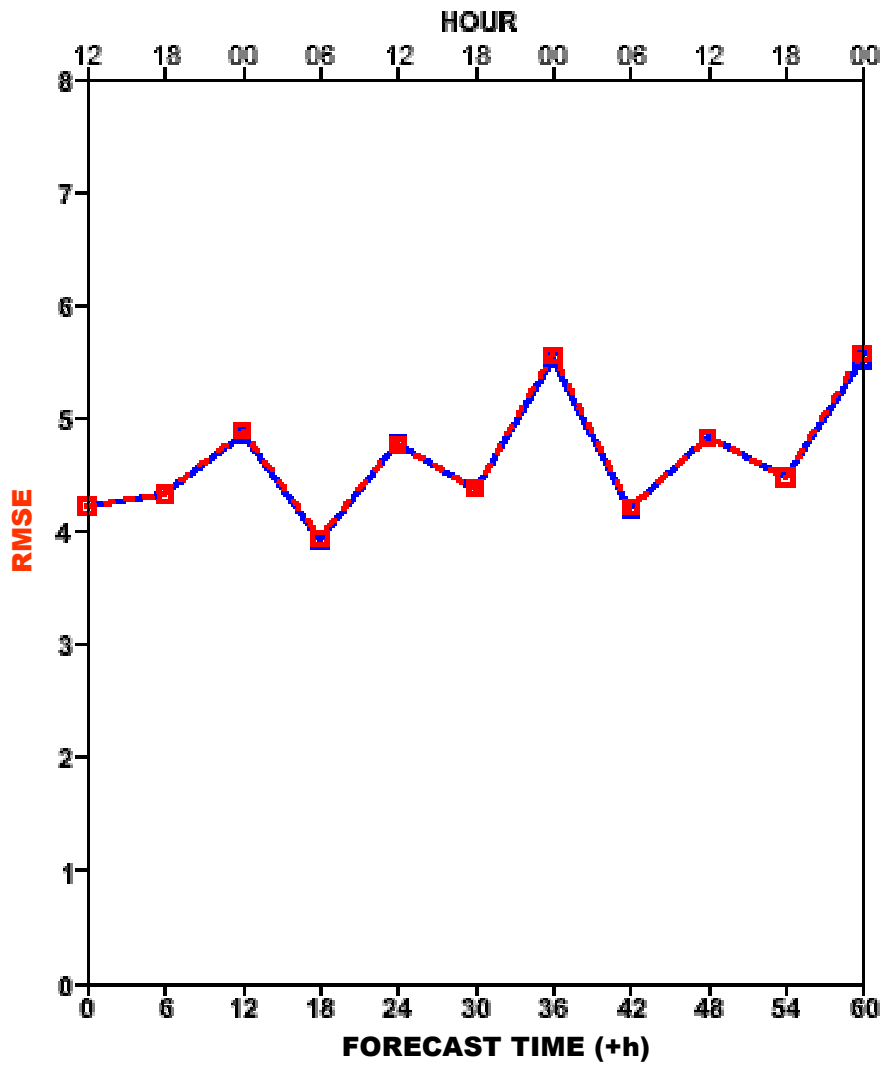
TEMPERATURE
Verification from 10/06 to 20/08/02
Control: Blue Frame: Red



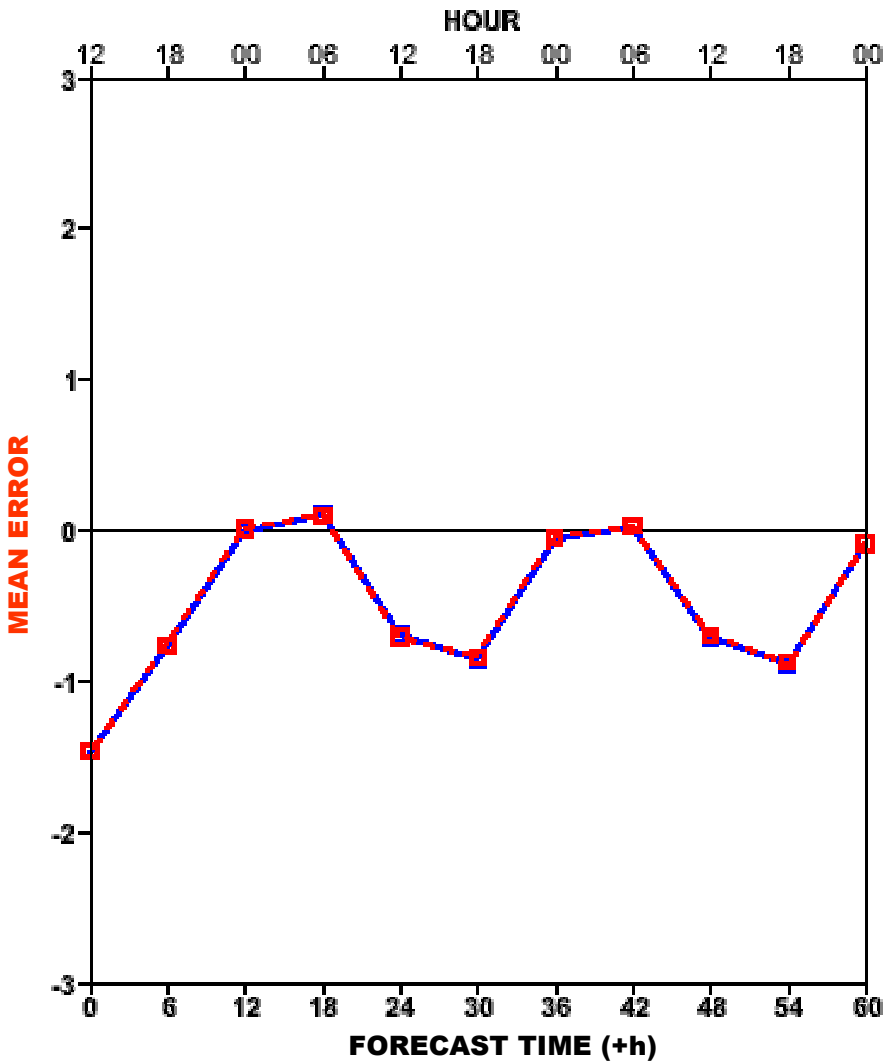


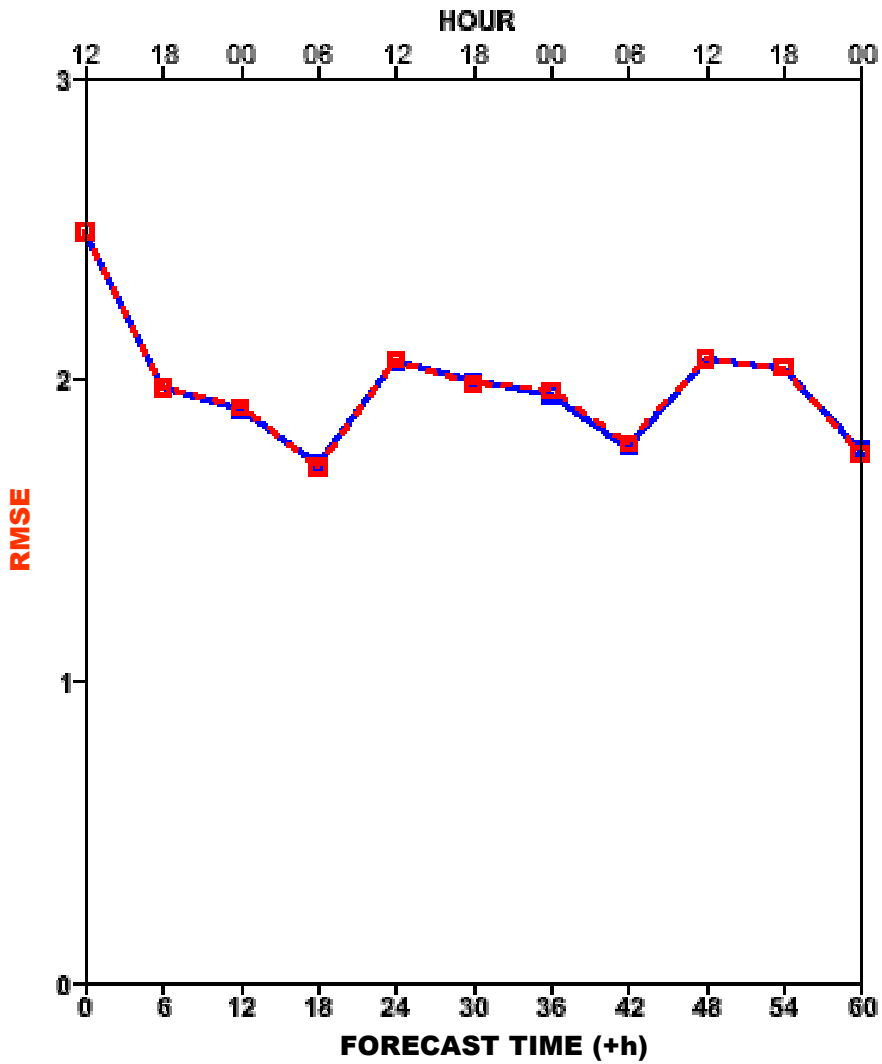
DEW.POINT
Verification from 10/06 to 20/08/02
Control: Blue Frame: Red



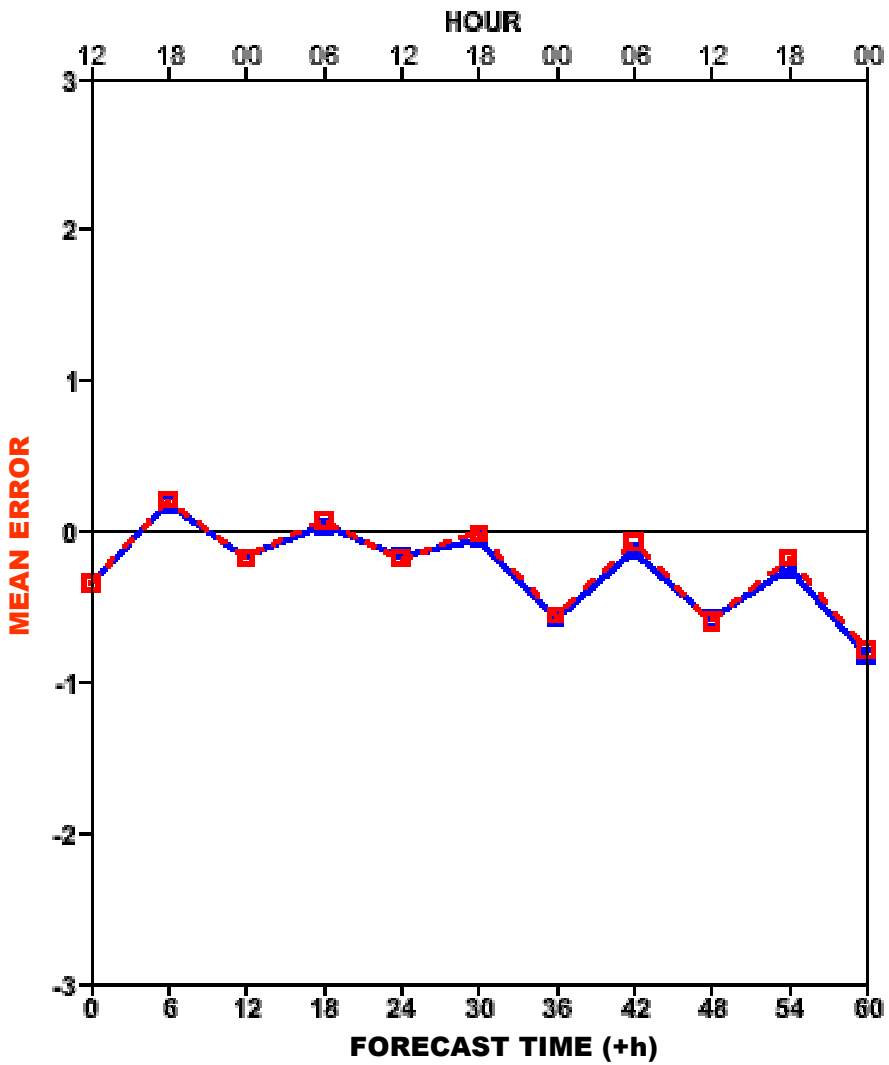


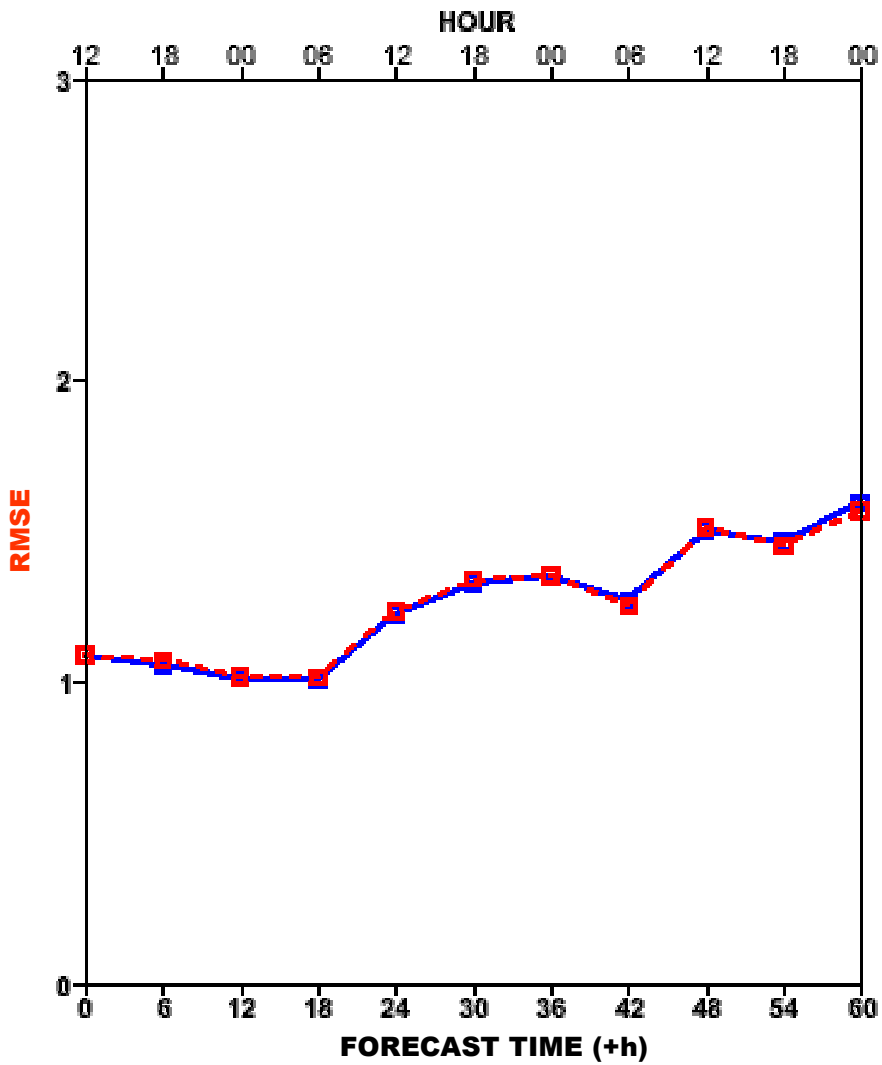
WIND.SPEED
Verification from 10/06 to 20/08/02
Control: Blue Frame: Red





MSL.PRESSURE
Verification from 10/06 to 20/08/02
Control: Blue Frame: Red





Verification results of LM with and without frames

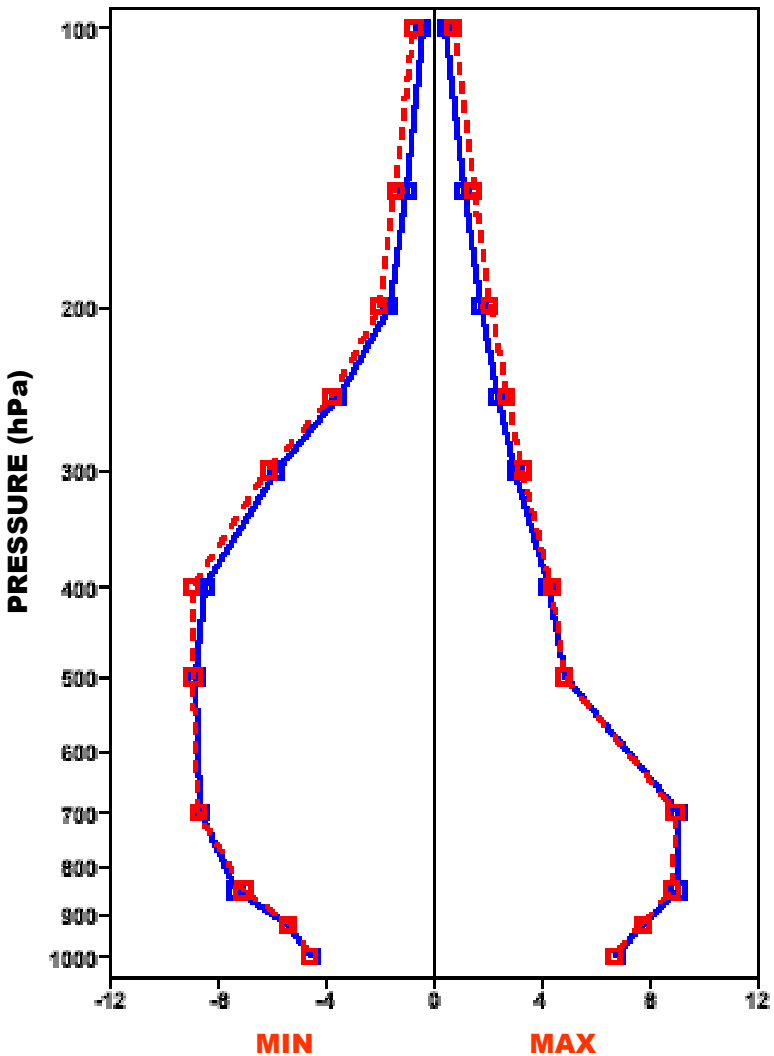
- Vertical profiles (T,Td,U):

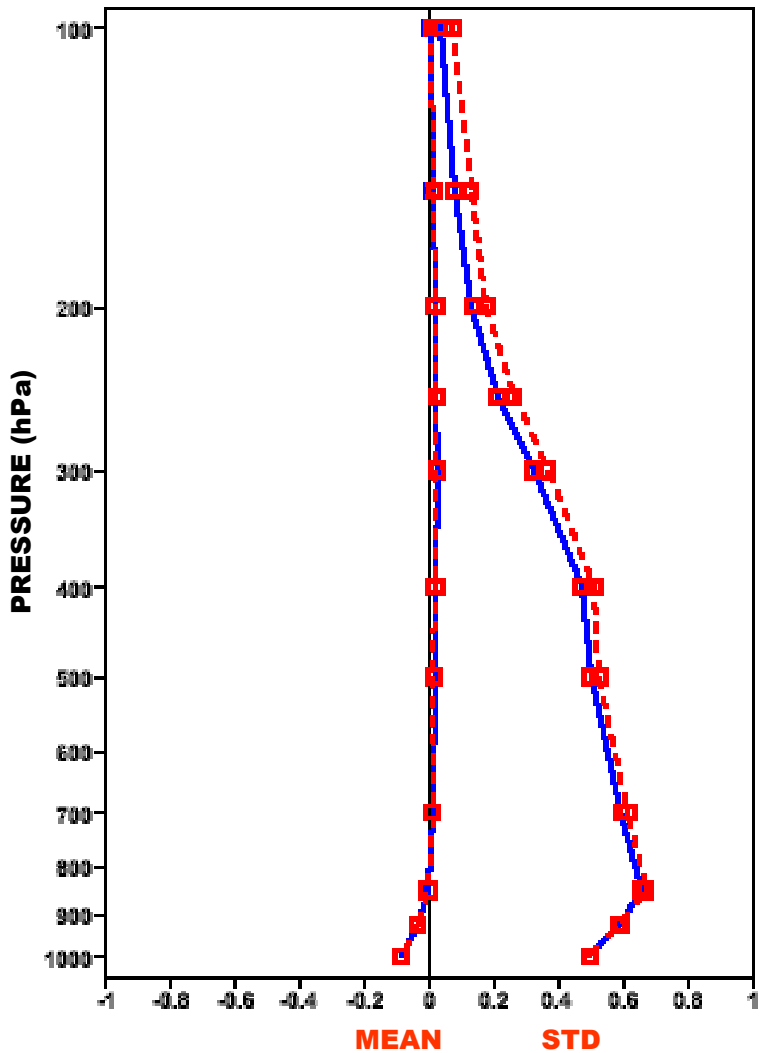
runs with frames have greater RMSE than runs without frames above 300hPa (at 00 UTC smaller than at 12 UTC for T and U - not shown); no differences in mean errors.

- Surface variables (T,Td,U,MSLP):

no significant differences.

VERTICAL.VELOCITY FC +24
Data from 10/06 to 20/08/02
Control: Blue Frame: Red





Comparison results of vertical velocity with and without frames

Vertical velocity in runs with frames have greater max-min ranges than runs without frames above 400hPa at 12 UTC; greater standard deviations above 500 hPa.

The Raylegh damping (relaxation towards the large scale boundary condition fields) is responsible for the differences in the upper layers.

Conclusions

- No significant differences are found for T,Td,U in the lowest levels and for MSLP in lowland stations, therefore runs with frames could be used for weather forecasting.

- Surface variables in mountain stations and total precipitation need to be investigated.

- A radiative upper boundary condition (2002, Purser and Kar) could be tested, but it is too expensive from the computational point of view.