Case study of bura in high resolution

Experiments

A case of severe bura on 14th November 2004 was chosen. The experiments were performed using AL28T3 including the modifications done in Prague. All runs were performed on Maslenica domain with 2 km resolution starting from the operational 8 km resolution 42 hour forecast (00UTC run of 13th November 2004) on the Croatian domain. The model was run for 30 minutes with 1 minute timestep using same file as the initial and boundary condition (so the fields on the boundaries do not change) as in the operational set-up. Only turbulence and GWD parameterization schemes are used from physics.

The reference run is using hydrostatic dynamics, pure numerical diffusion and envelope orography and it is the most similar one to the currently used operational set-up (with AL25T1). All other experiments were run using mean orography. The second experiment is using hydrostatic dynamics and pure numerical diffusion too, orography representation is the only difference with respect to the reference. The third experiment is using SLHD (probably inproperly), hydrostatic dynamics and mean orography. The fourth experiment is using pure numerical diffusion, nonhydrostatic dynamics and mean orography and the last experiment is using SLHD (probably inproperly), nonhydrostatic dynamics and mean orography.

Results

This part of the operational suite is used to provide a high-resolution forecast of the 10 m wind. It is most important in the severe windstorm events, this usually means bura. Removal of envelope from orography resulted in stronger 10 m wind upstream from an obstacle. The other parts of the model have far less significant impact on the predicted wind speed. Introduction of nonhydrostatism had reduced wind speed on the steepest slopes. Introduction of SLHD in the nonhydrostatic run has reduced the windspeed on the upslope part just in place where the hydraulic jump should take place.

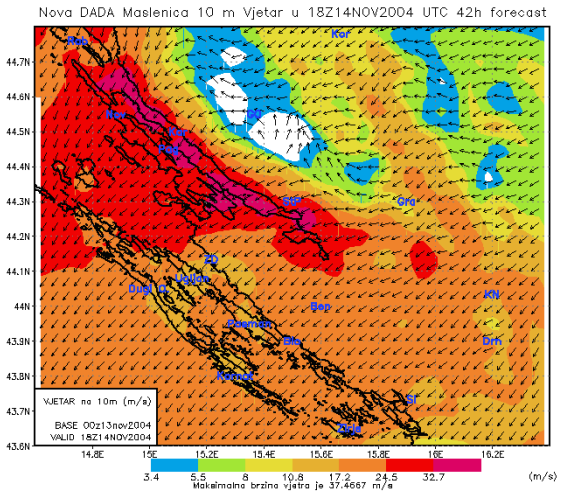
The vertical cross-sections of the horizontal wind and temperature show that SLHD reduces the speed of the downslope jet. It also reduces a feature in the temperature field just after the first obstacle about 1.5 km height.

The vertical cross-sections of vertical velocity (omega in Pa/s) also show the effect of smoothing of SLHD, especially for the area between the two peaks that produce downslope windstorms.

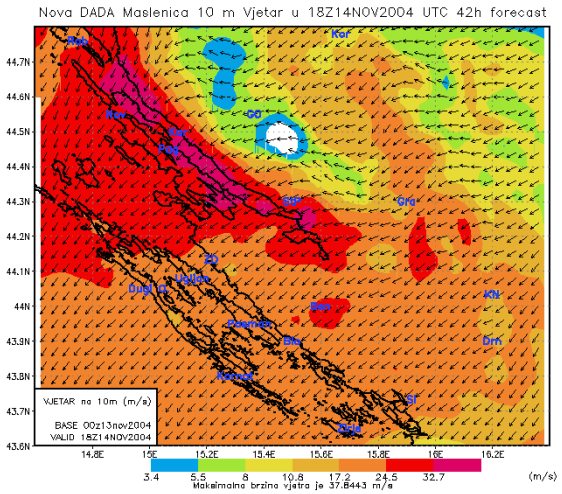
The vertical cross-sections of potential temperature show modification in the shape and reduction in the wave amplitude above the mountain peak.

The vertical cross-section of potential vorticity shows a strange pattern in the reference run, especially above mountain peaks. Its intensity above mountains is reduced when envelope is removed so the peaks become lower but increases downstream, of the obstacle above the lowlands and the sea. SLHD reduces the intensity further. The nonhydrostatic run also reduces the high PV values in 1.5 km height above mountains.

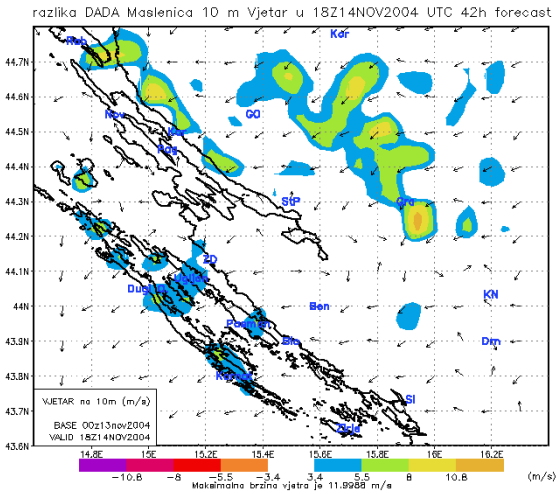
Conclusions



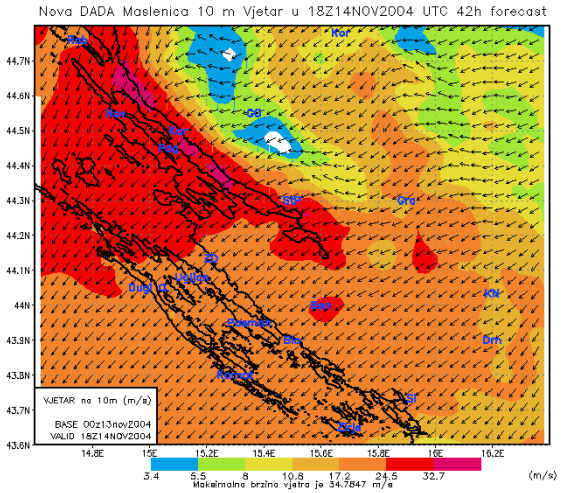
Referece run



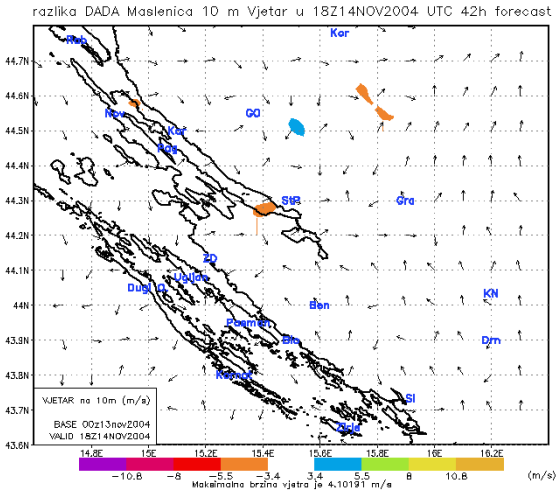
Run with mean orography



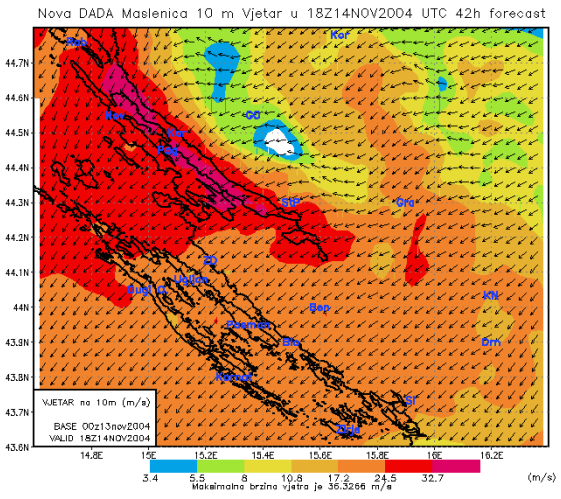
Difference with respect to the envelope run



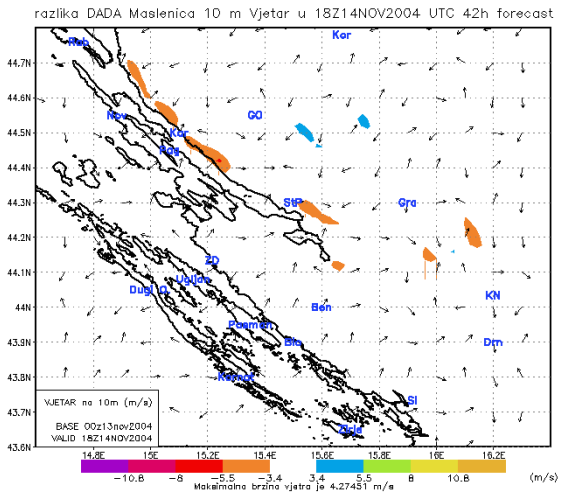
Run with SLHD



Difference with respect to mean



NH run



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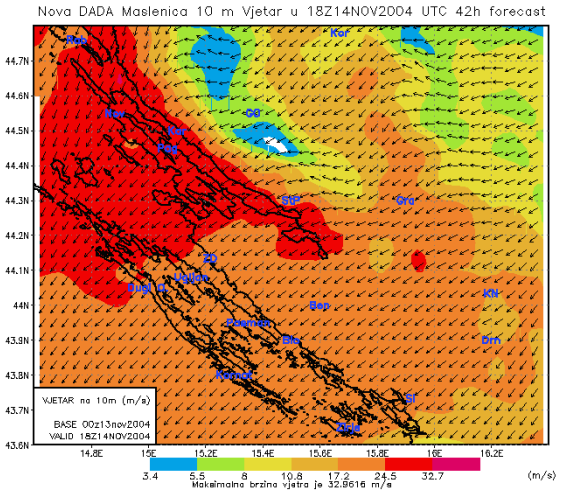
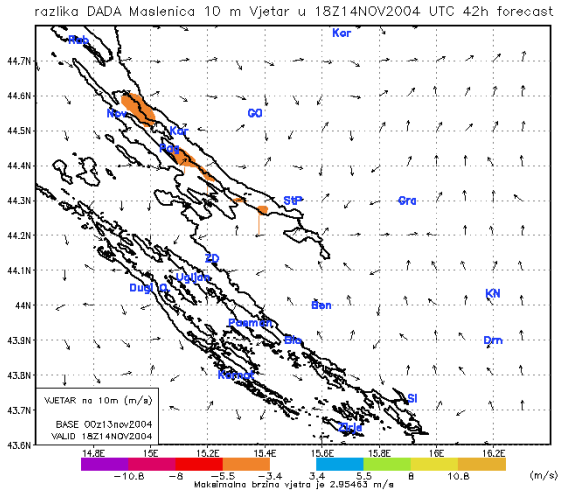
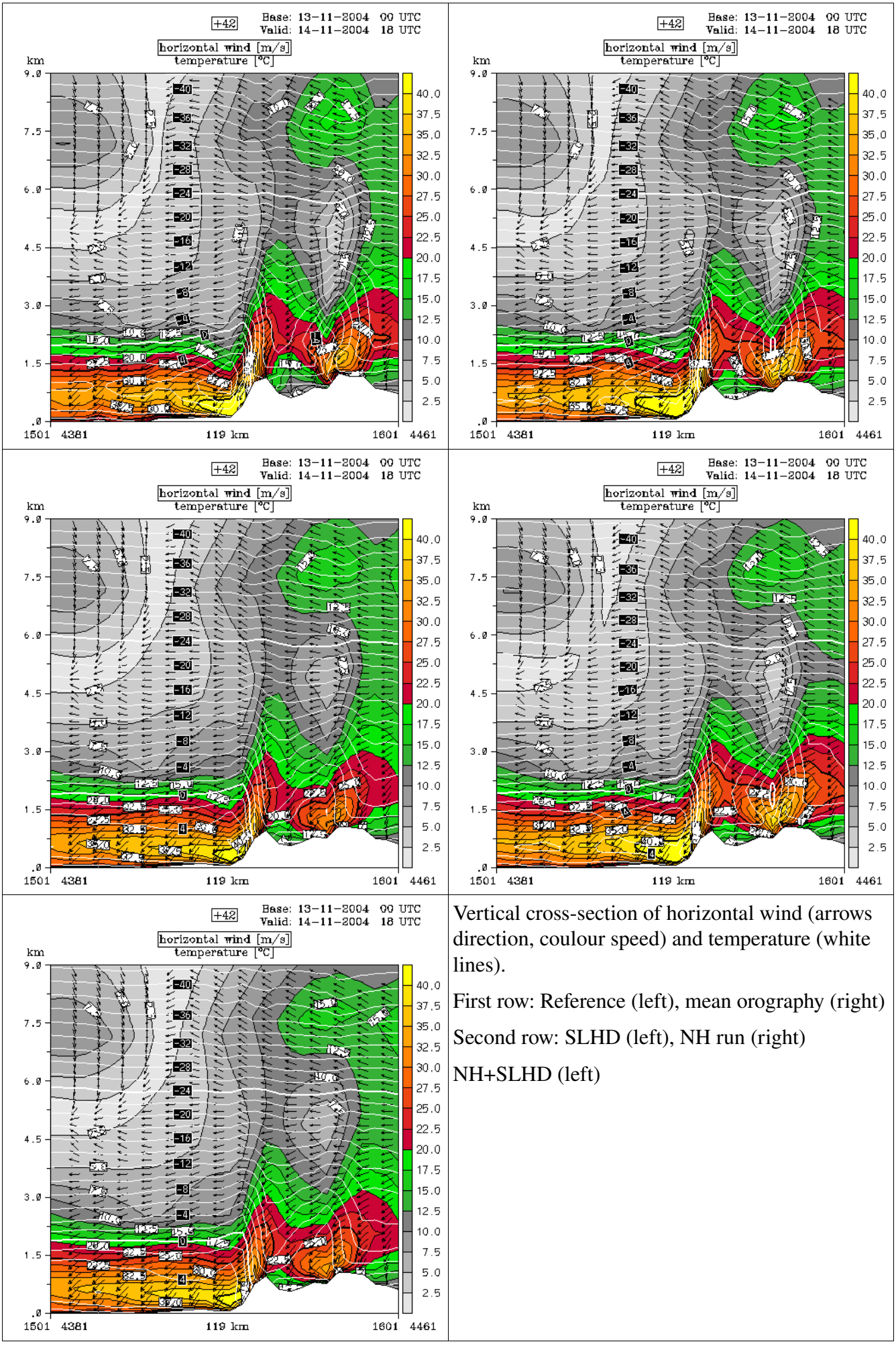


NH SLHD



Difference with respect to NH

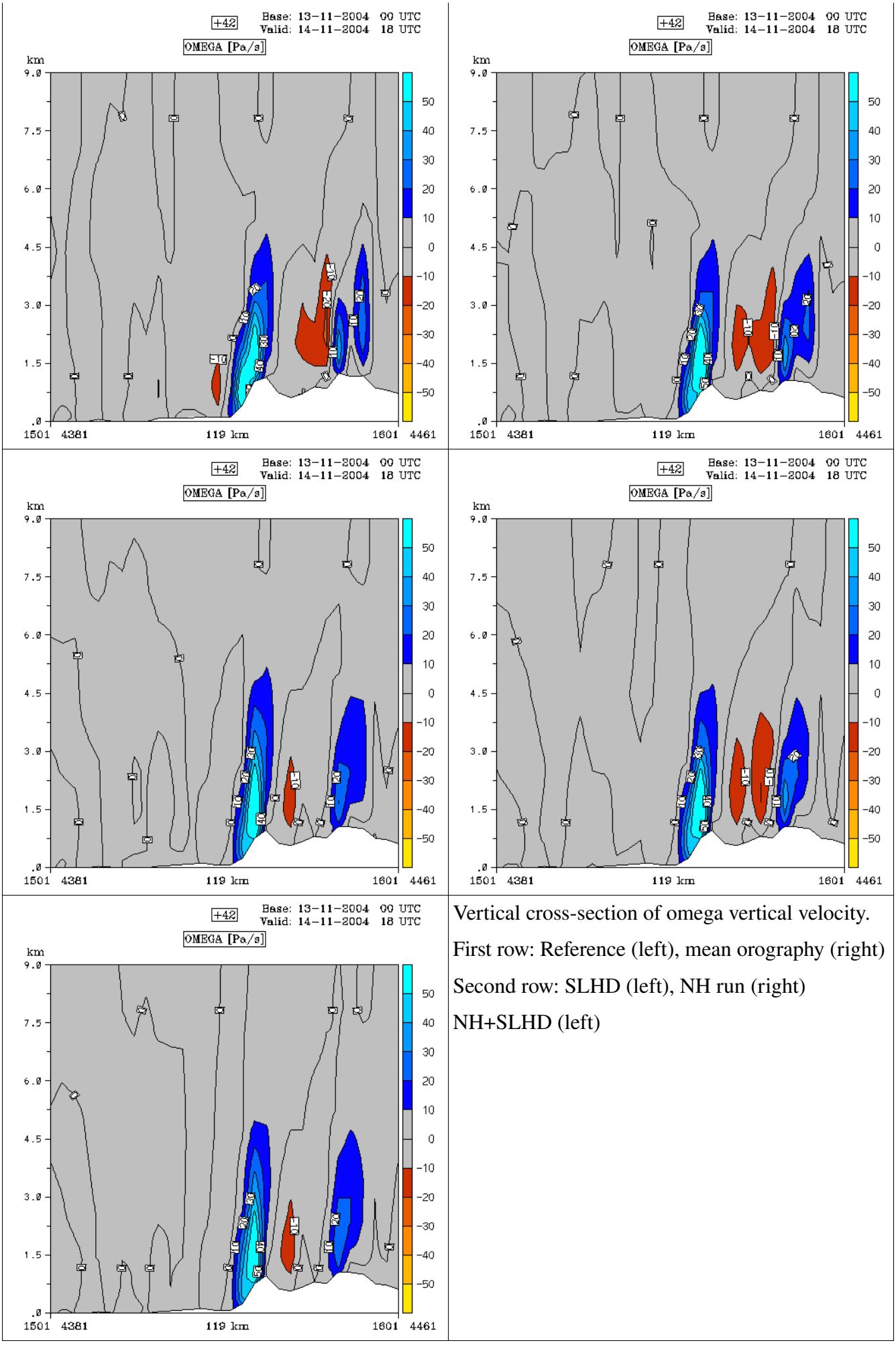


Vertical cross-section of horizontal wind (arrows direction, coulour speed) and temperature (white lines).

First row: Reference (left), mean orography (right)

Second row: SLHD (left), NH run (right)

NH+SLHD (left)

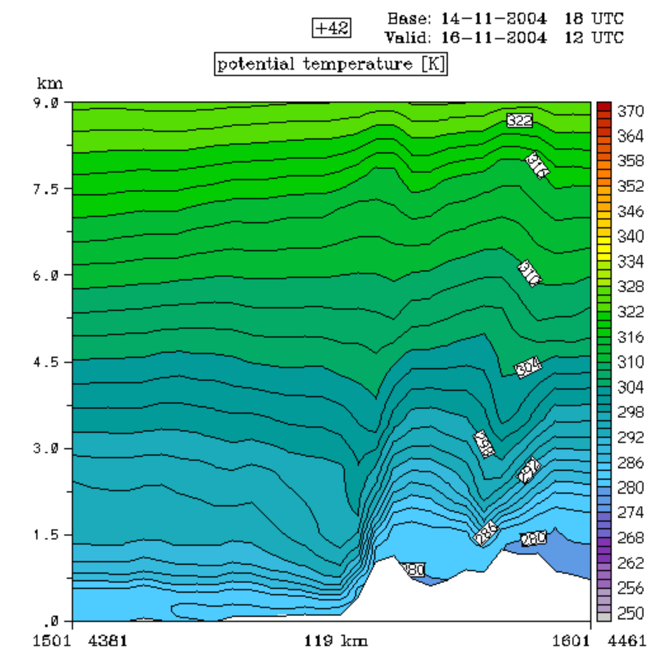


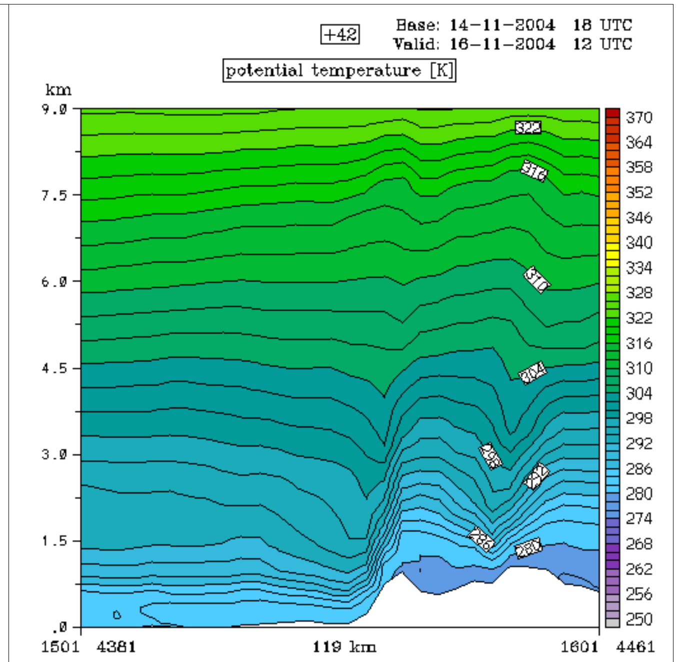
Vertical cross-section of omega vertical velocity.

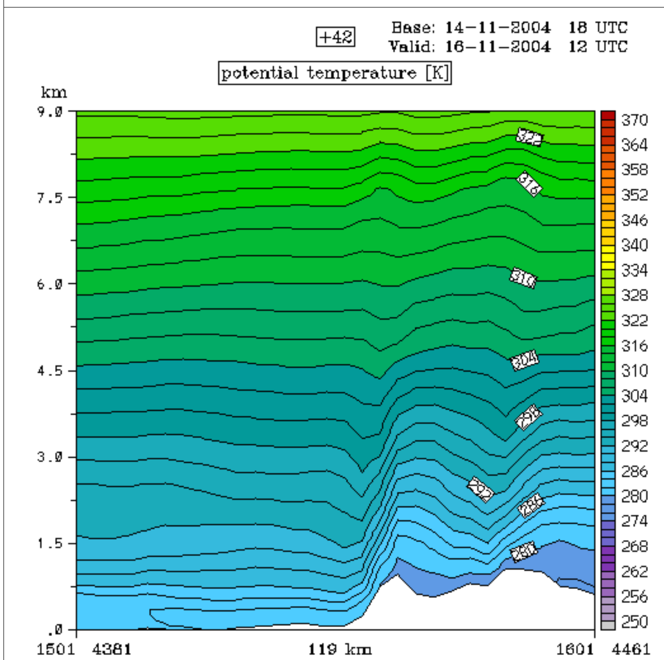
First row: Reference (left), mean orography (right)

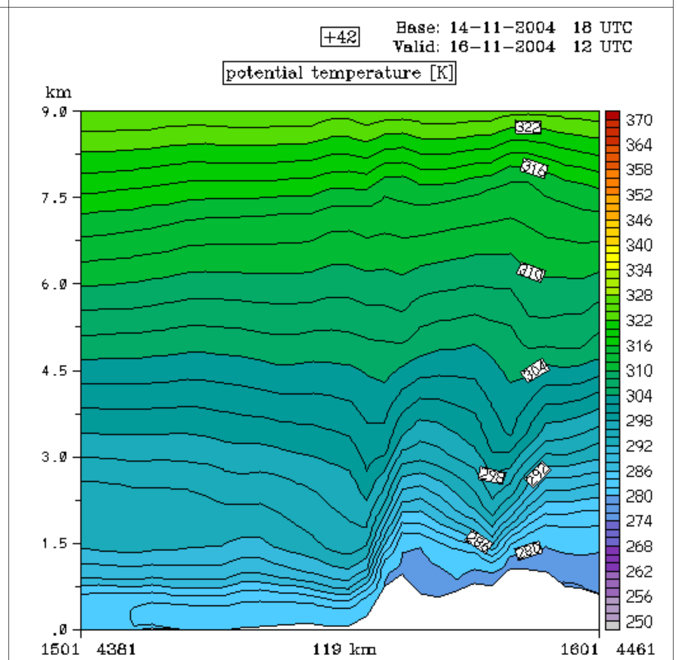
Second row: SLHD (left), NH run (right)

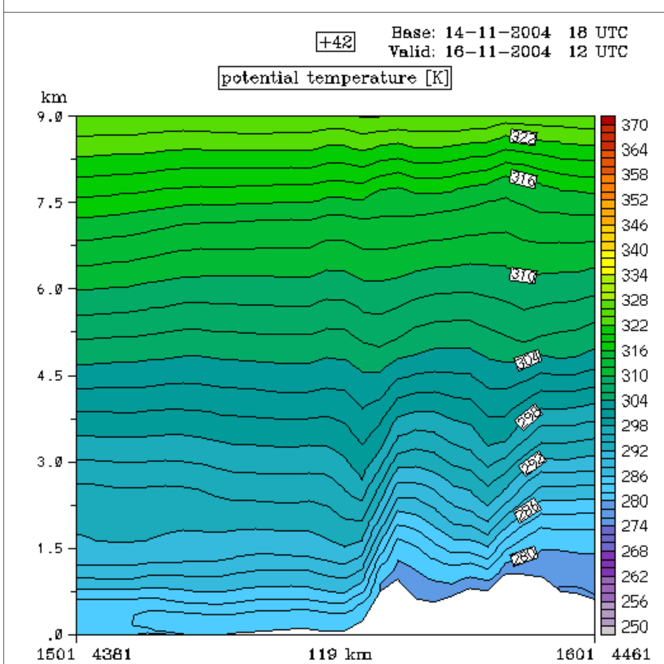
NH+SLHD (left)









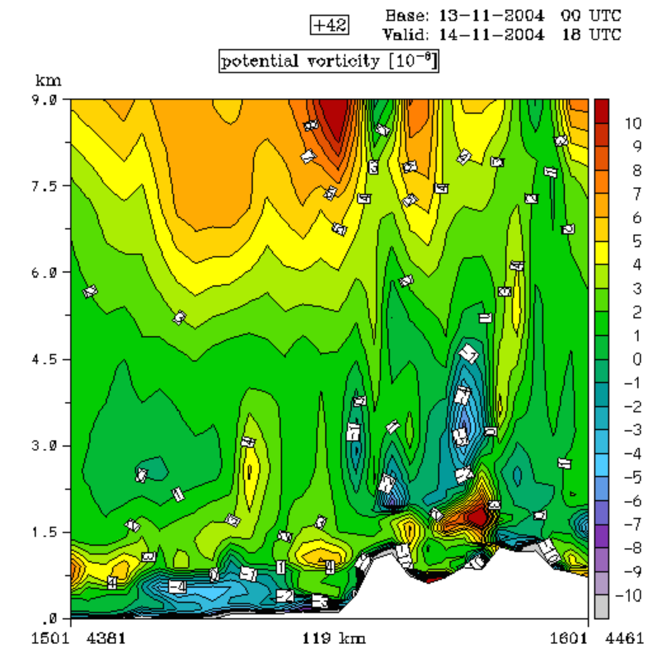


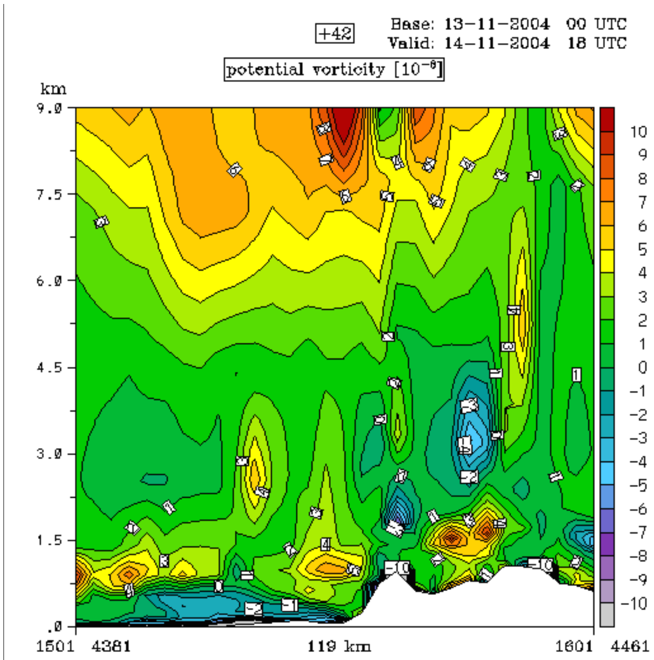
Vertical cross-section of potential temperature.

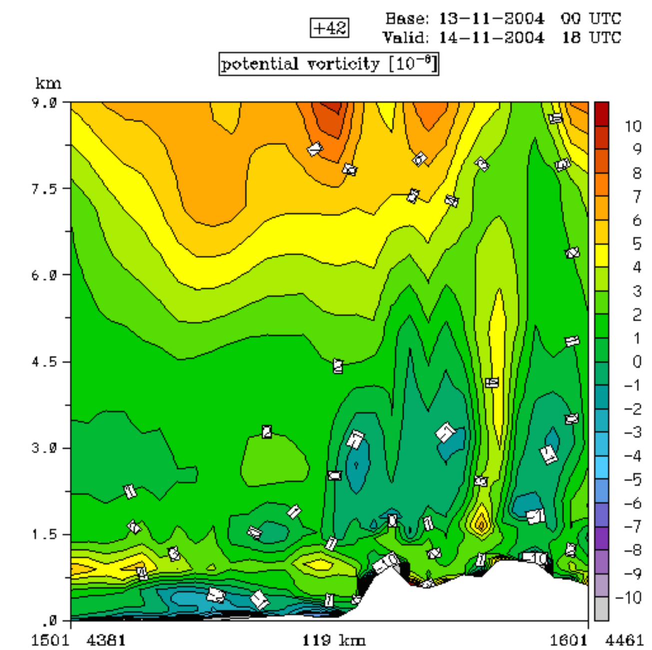
First row: Reference (left), mean orography (right)

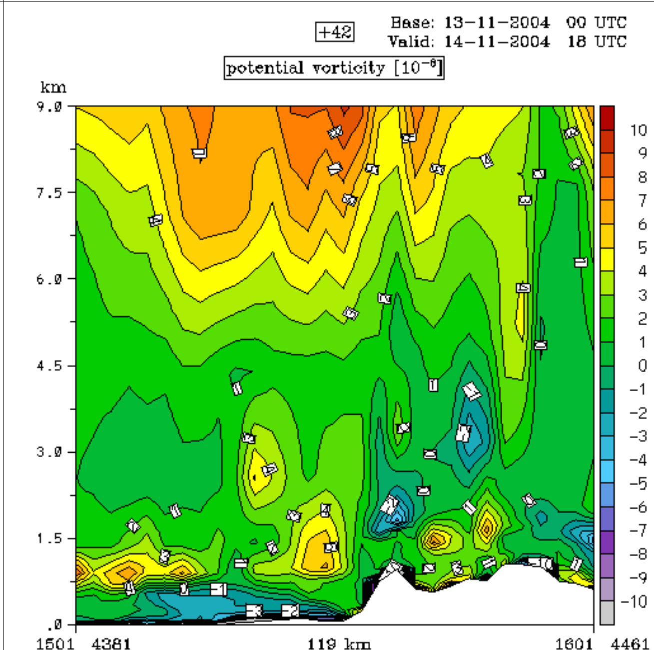
Second row: SLHD (left), NH run (right)

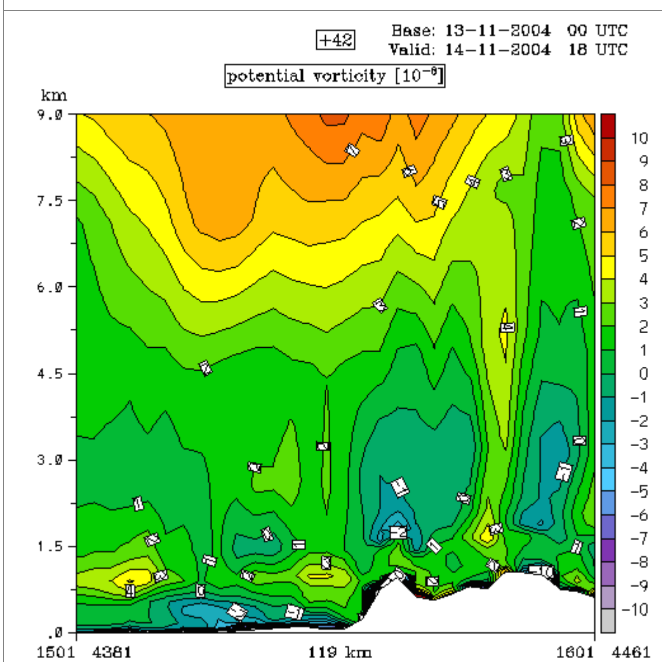
NH+SLHD (left)











Vertical cross-section of potential vorticity

First row: Reference (left), mean orography (right)

Second row: SLHD (left), NH run (right)

NH+SLHD (left)

Namelist

(quite possibly requites modifications)

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