The new Lokal-Modell LME of the German Weather Service

Jan-Peter Schulz

Deutscher Wetterdienst, Offenbach am Main, Germany
E-mail: jan-peter.schulz@dwd.de

1 Introduction

In order to fulfill new requirements of both external and internal customers, for instance in aviation, sea traffic or air pollution modelling, the German Weather Service (DWD) decided to expand the model domain of the operational limited area model, the Lokal-Modell (LM, Doms and Schättler 2002). The new version has successfully been introduced in the operational numerical weather prediction system of DWD on 28 September 2005.

2 The model LME

The former version covered basically Central Europe, including Germany and its neighbouring countries. The new version covers almost entire Europe and therefore got the name LM Europe (LME). The integration domain of LME is shown in Fig. 1.

The number of grid points per layer is enhanced from 325×325 to 665×657, while the mesh size is kept unchanged at 7 km $\times$ 7 km. The number of vertical layers is increased from 35 to 40. The additional layers are mainly located in the lower troposphere, the height of the lowest layer is reduced from 33 m to 10 m. This is in accordance with the new 40-km version of the driving global model GME which started operation at DWD in September 2004. The poles of the rotated LME coordinate system are different from the LM system. The LME system is rotated in a way that the equator is located within the center of the model domain. This has the advantage that the grid cells have a similar size and shape throughout the entire domain or, in other words, the divergence of the longitude rows is minimal. The main non-technical model change is the introduction of a new multi-layer soil model, the same that was incorporated into GME in 2004.

3 Results

The introduction of LME at DWD was done in several steps. First of all, two experiments were set up in 2004, namely LME and LM, running daily forecasts initialized and driven by GME. Here, the influence of the domain size or the distance between the boundaries and the region of interest, respectively, can be tested. It turns out that in most weather situations there is very little influence. But, there are sporadic cases where for example the development of a cyclone evolves significantly differently. The results of an objective verification show some advantage for LME forecasts for precipitation and gusts and some disadvantage for mean sea level pressure.

In January 2005 a full LME data assimilation cycle was set up in an operational parallel suite at DWD. This parallel suite also includes two 78h-forecasts (00 and 12 UTC) per day. Hence, LME could be tested in operational mode against LM and GME during spring and summer 2005. All postprocessing procedures had to be adjusted. A verification showed similar results as the earlier experiments in 2004.

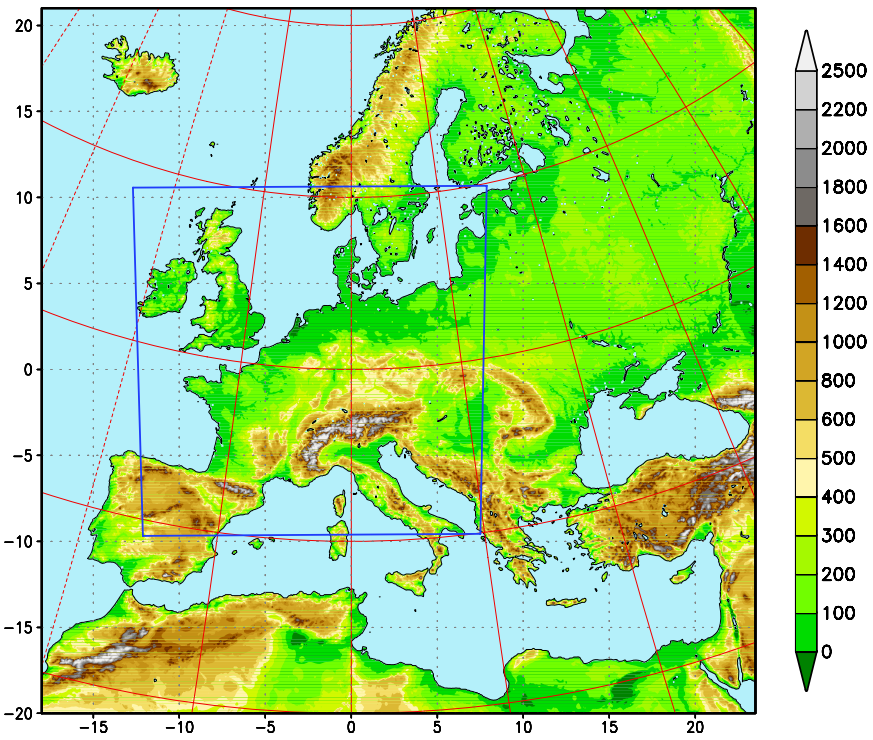

Figure 1: Model domain of LME. Topographical height (m) for land fractions > 50% (for the operationally used filtered orography). The frame in the figure depicts the integration domain of the former LM.

More detailed comparison revealed that the evaporation over sea in LME is up to 30% higher than in GME. Furthermore, precipitation in LME tends to show a systematic positive trend during the forecasts, even on a monthly mean basis, while precipitation in observations and also in GME is balanced. This behaviour indicates that evaporation over sea in LME is likely to be overestimated. Some sensitivity tests were carried out at DWD and a parameter tuning led to a LME version with reduced evaporation over sea. A verification of this version showed an improvement in the simulated moisture budget and also the mean sea level pressure.

4 Conclusions

In order to fulfill the requirements of several customers the German Weather Service (DWD) decided to expand the model domain of its operational limited area model, the Lokal-Modell (LM). The new LME, covering almost entire Europe, has successfully been introduced in the operational numerical weather prediction system of DWD on 28 September 2005. Current verification results look reasonable, further subjective and objective verification is carried out.

Reference

Doms, G. and U. Schättler, 2002: A description of the nonhydrostatic regional model LM. Part I: Dynamics and Numerics. *Deutscher Wetterdienst*, Offenbach, 134 pp. (Available at: www.cosmo-model.org).