Verification of the New LM Version LM 2.18 with Prognostic TKE and Multi-Layer Soil Model

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In COSMO Newletter 2, p. 197-202 there was already a report concerning verification of the new TKE-scheme. In 2002 a new testchain for three different synoptic periods run not only with the TKE-scheme but also with the new multi-layer soil (LM version 2.18). The three periods (each with 6-7 forecasts) chosen are:

(1) 17-23.08.01: Summer convective (high and low pressure)

(2) 25-30.12.01: Winter advective (cold then mild with precipitation)

(3) 10-15.01.02: Winter high pressure (stratus).

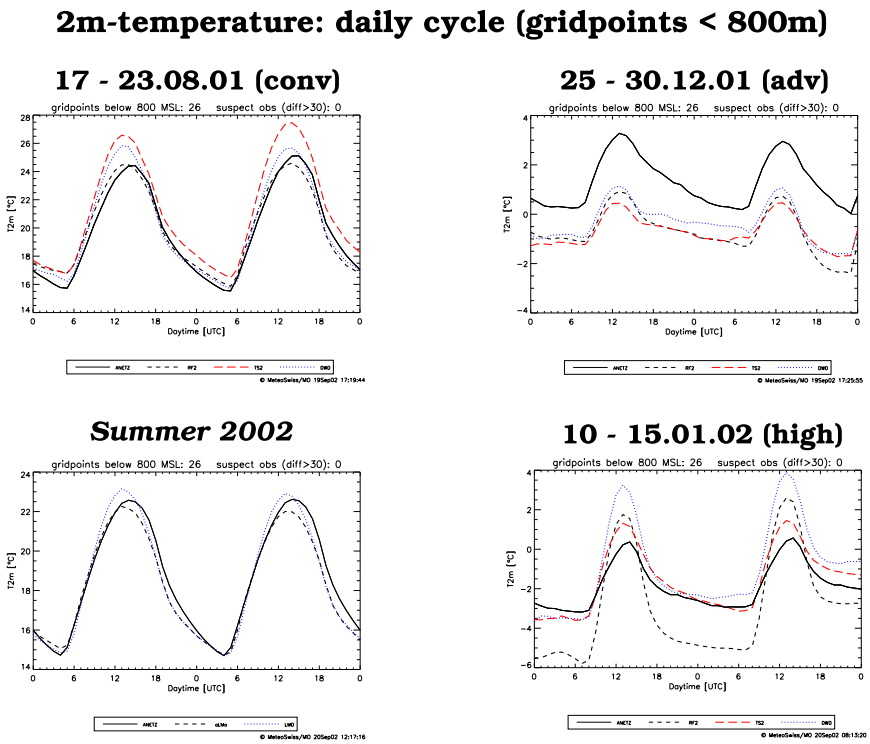

Figure 1: Verification of the daily cycle of 2m-temperature over Switzerland (gridpoints < 800m) for the three testperiods. Observations (ANETZ): full line (black). The three model configurations are: (1) aLMo with LM 2.17 (black dashed line), (2) aLMo with LM 2.18 and TKE and multi-layer soil (red dashed line) and (3) operational LM at DWD at that time (blue dotted line). The left bottom panel shows the operational aLMo (2.17) and LMD (2.18 with TKE) in Summer 2002.

LM 'version 2.17 without TKE' and LM 'version 2.18 with TKE and multi-layer soil' run on the operational domain of aLMo, each with an own continuous assimilation cycle for these three periods (starting one day earlier). The two configurations were also compared to the operational LM version at DWD (running at that time: i.e. with TKE, but not with multi-layer soil, since 08.11.01 with a new horizontal diffusion scheme and since 09.04.02 with a new calculation for 10m-windspeed).

Figures 1-3 show results of these three model configurations for the three periods. For Summer 2002 the operational aLMo (2.17 without TKE) and LMD (2.18 with TKE) is also presented for comparison purposes. The following points are of main interest:

- 2m-temperature: TKE gives a slightly increased diurnal amplitude in summer. The multi-layer soil increases this diurnal amplitude in summer, but in winter (during high pressure) reduces substantially the exaggerated cycle (see the two TKE-versions: blue without and red with multi-layer soil).
- 2m-dewpoint depression: TKE gives a much more realistic diurnal cycle. In Winter, above 800m, the values are much too low with TKE (i.e. too wet). The multi-layer soil

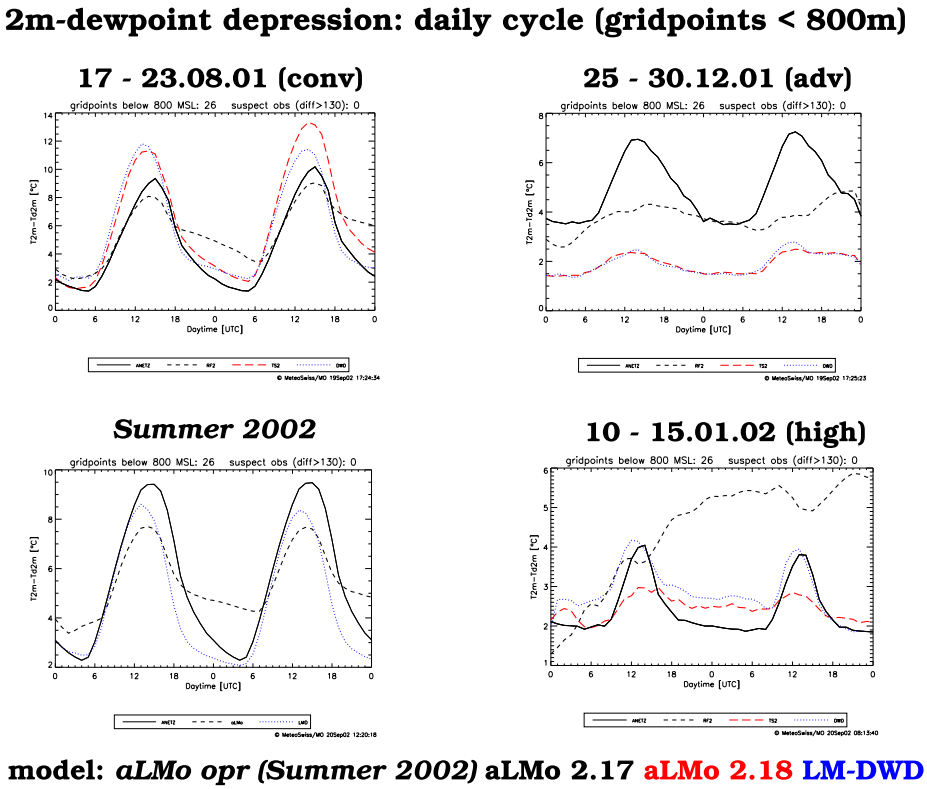

Figure 2: Verification of the daily cycle of 2m-dewpoint depression over Switzerland (gridpoints < 800m) for the three testperiods. Observations (ANETZ): full line (black). The three model configurations are: (1) aLMo with LM 2.17 (black dashed line), (2) aLMo with LM 2.18 and TKE and multi-layer soil (red dashed line) and (3) operational LM at DWD at that time (blue dotted line). The left bottom panel shows the operational aLMo (2.17) and LMD (2.18 with TKE) in Summer 2002.

increases slightly the diurnal amplitude in summer for gridpoints < 800m, otherwise it reduces it (i.e. improvement).

- 10m-windspeed: more realistic diurnal amplitude with TKE, but higher values during daytime (i.e. greater positive bias). Above 1500m the values with TKE were much too low before the new calculation for 10m-wind speed (reduced influence of roughness length) introduced at DWD in April 2002. For the period of Summer 2001 this new calculation was already introduced in aLMo testchain 2.18 and in Summer 2002 LMD gives even higher values than aLMo for the mountain gridpoints.

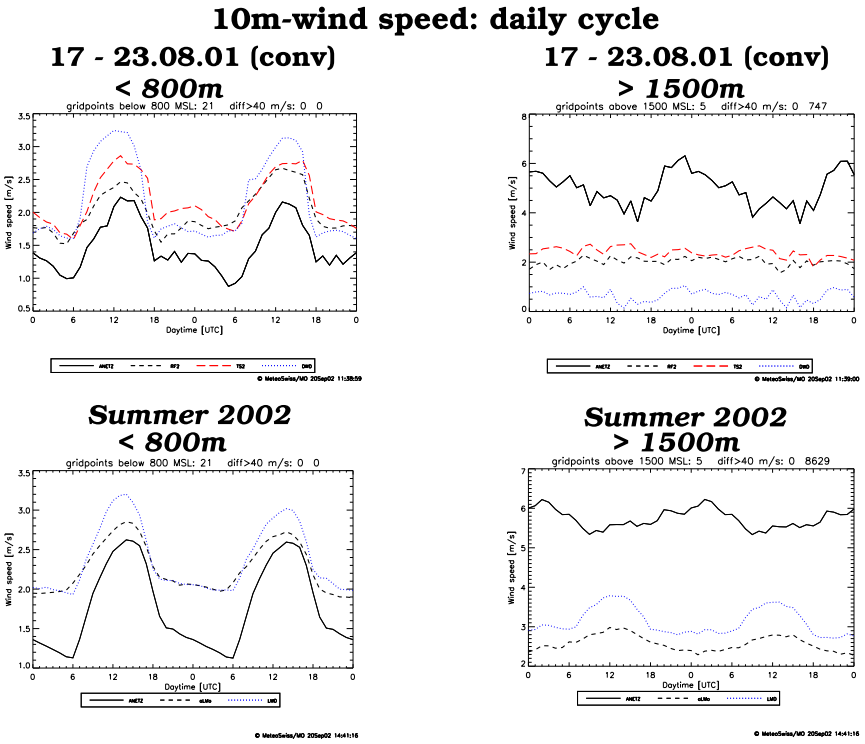

Figure 3: Verification of the daily cycle of 10m-wind speed over Switzerland for gridpoints < 800m (left) and gridpoints > 1500m (right) for the summer convective period 2001 (above). Observations (ANETZ): full line (black). The three model configurations are: (1) aLMo with LM 2.17 (black dashed line), (2) aLMo with LM 2.18 and TKE and multi-layer soil (red dashed line) and (3) operational LM at DWD at that time (blue dotted line). The two bottom panels show the operational aLMo (2.17) and LMD (2.18 with TKE) in Summer 2002.