Deutscher Wetterdienst

Improving the Simulated Precipitation Distribution in Mountainous Terrain in the Lokal-Modell of DWD: A Case Study for 20/02/2002

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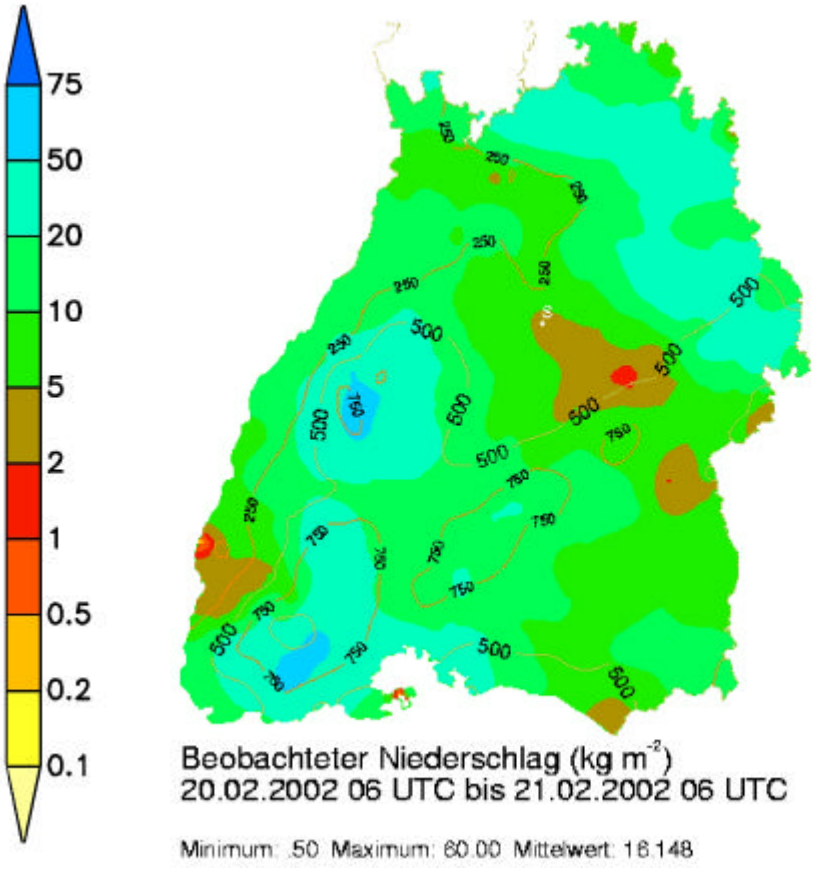
Outline

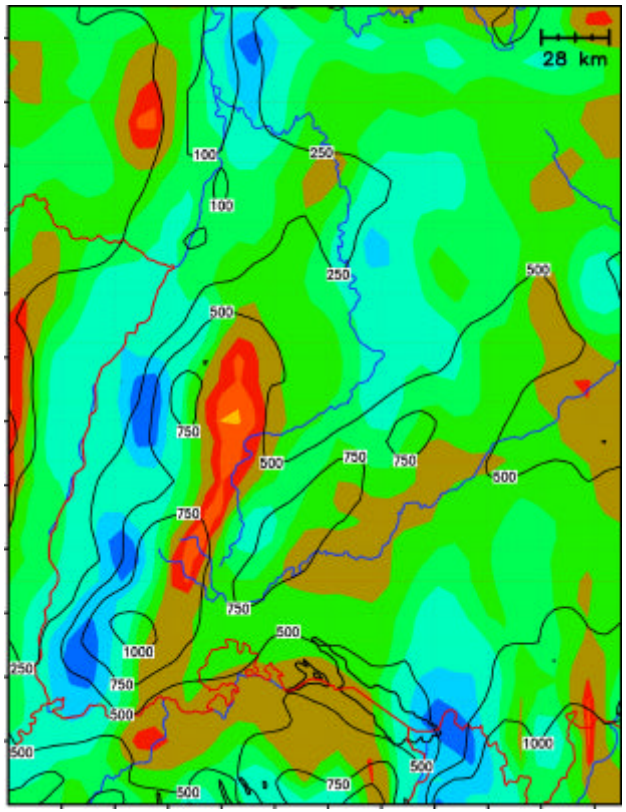
- The case of 20/02/2002
- Formation of precipitation over a mountain
- Prognostic precipitation
- Conclusions

Precipitation 20/02-21/02/2002

Observation

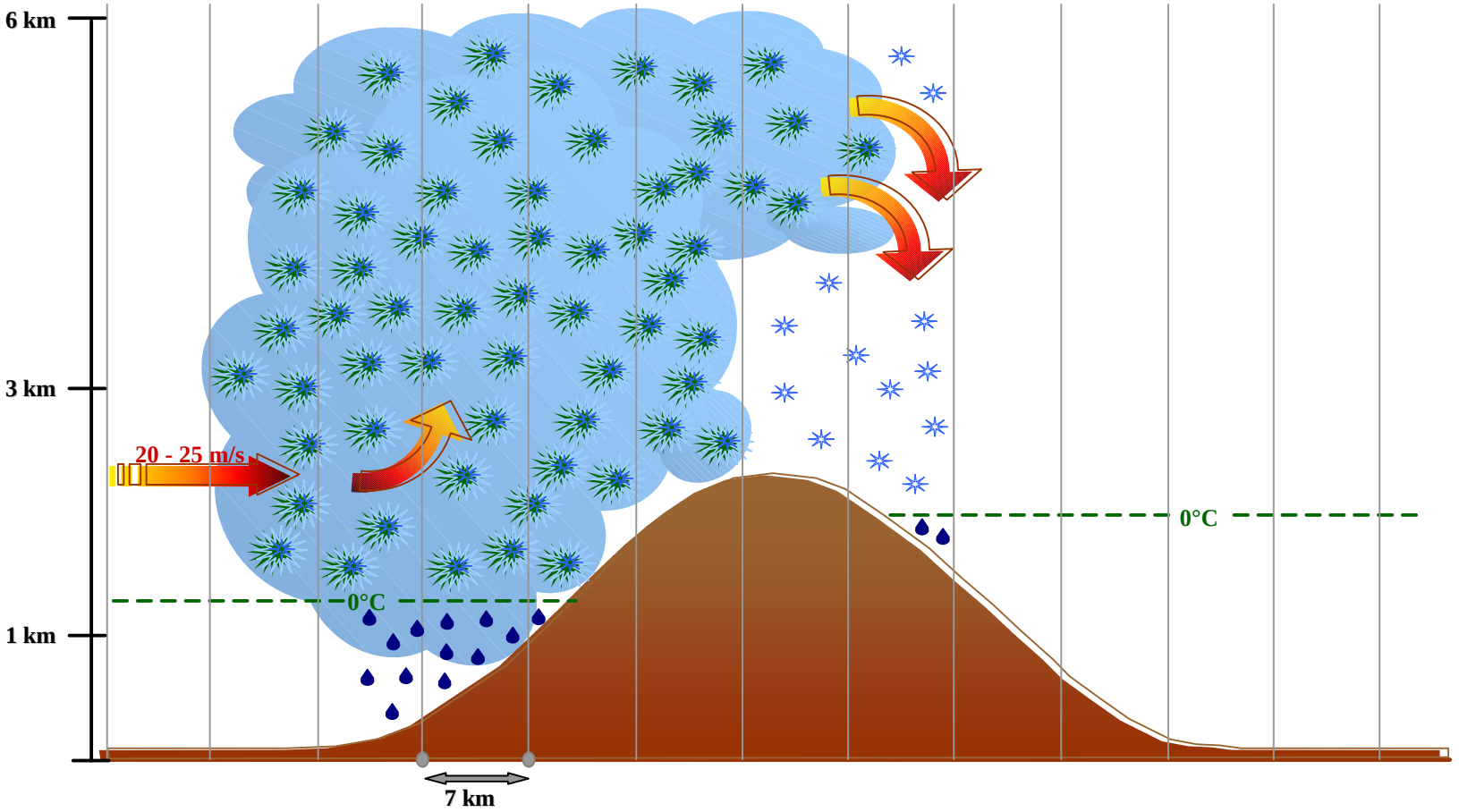


LM 00 UTC + 06h-30h



Operational LM

Formation of precipitation over a mountain



Hypothesis

While area mean values of 24-h precipitation of LM over Southwest Germany agree well with observations, the spatial distribution is wrong: Too much precipitation on the upwind side of the Black Forest, too little in the lee.

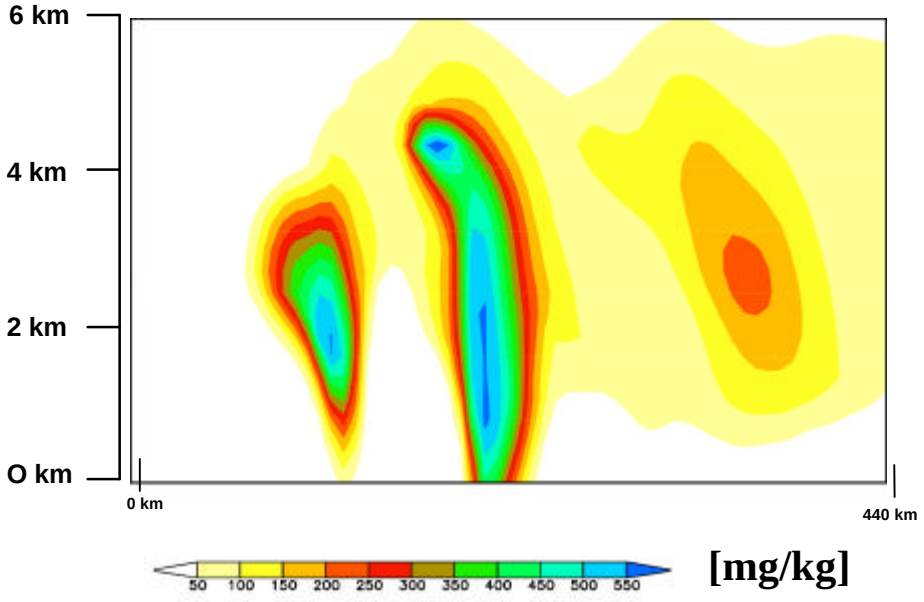
This error in the distribution might be due to neglecting the horizontal drift of snow particles in LM.

Calculation of trajectories for LM for estimating the drifting of snow

Start level [hPa]	Distance [km]	Duration of drift [min]
500	71.4	40
550	59.5	35
600	47.6	29
650	40.5	25
700	32.1	21
750	13.1	9

Fall speed: 2 m/s

Fall down to the melting zone » 850 hPa

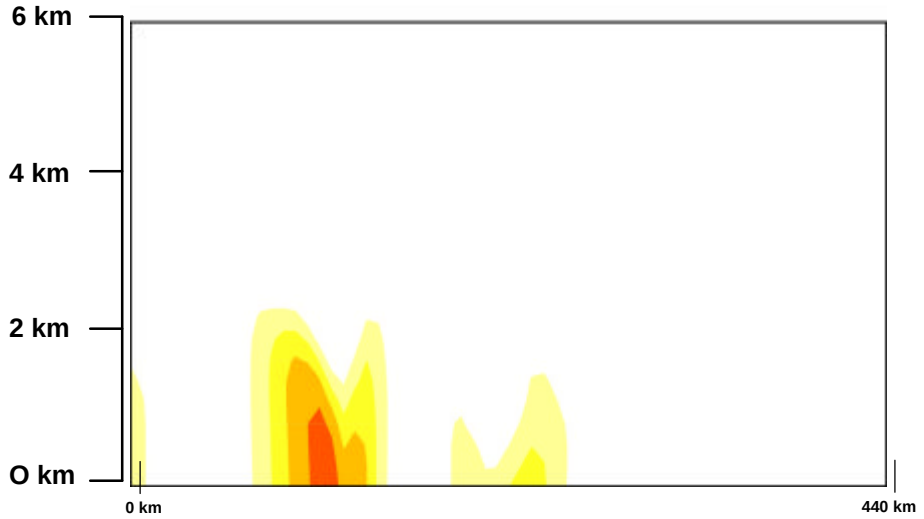


Vertical cross sections at 48.4°N

LM with drifting of precipitation

00 UTC + 15h

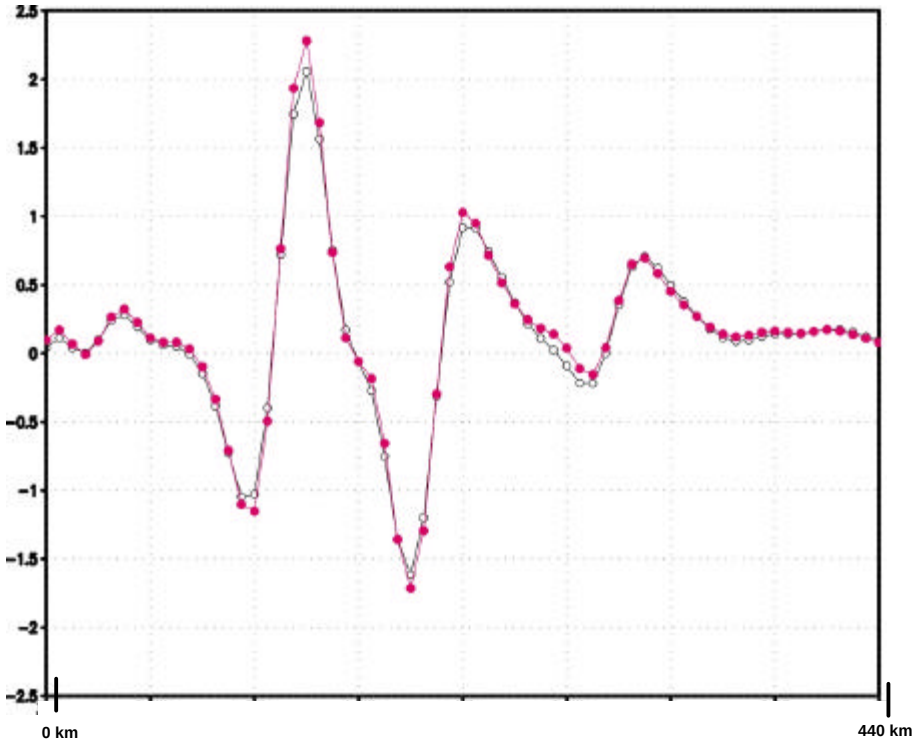
Specific water content of snow



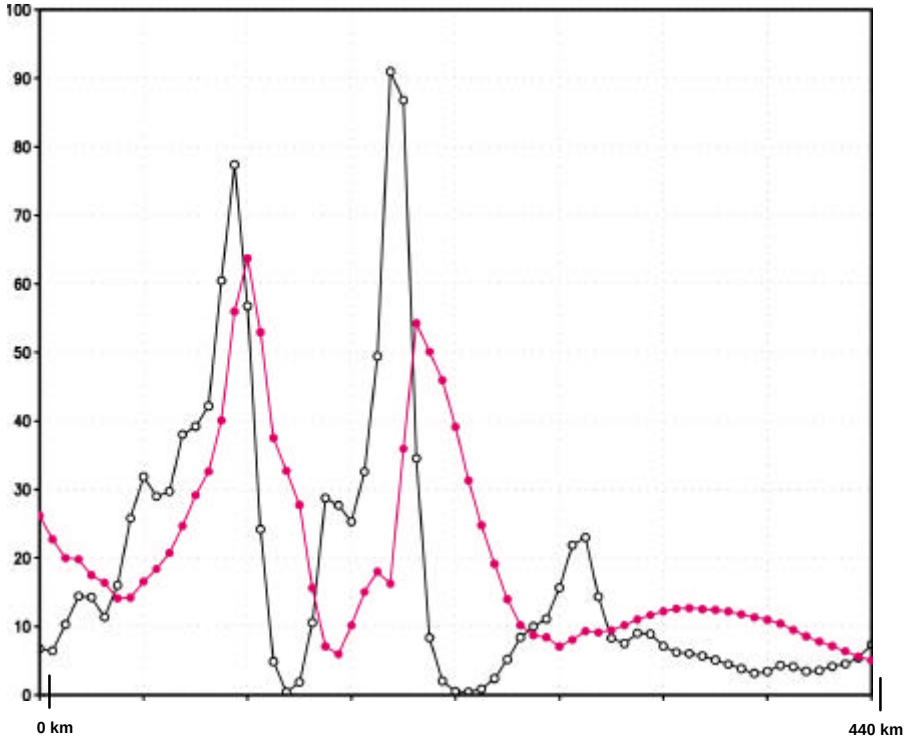
Specific water content of rain

Cross sections at 48.4°N

Mean vertical motion [Pa/s] at 600 hPa



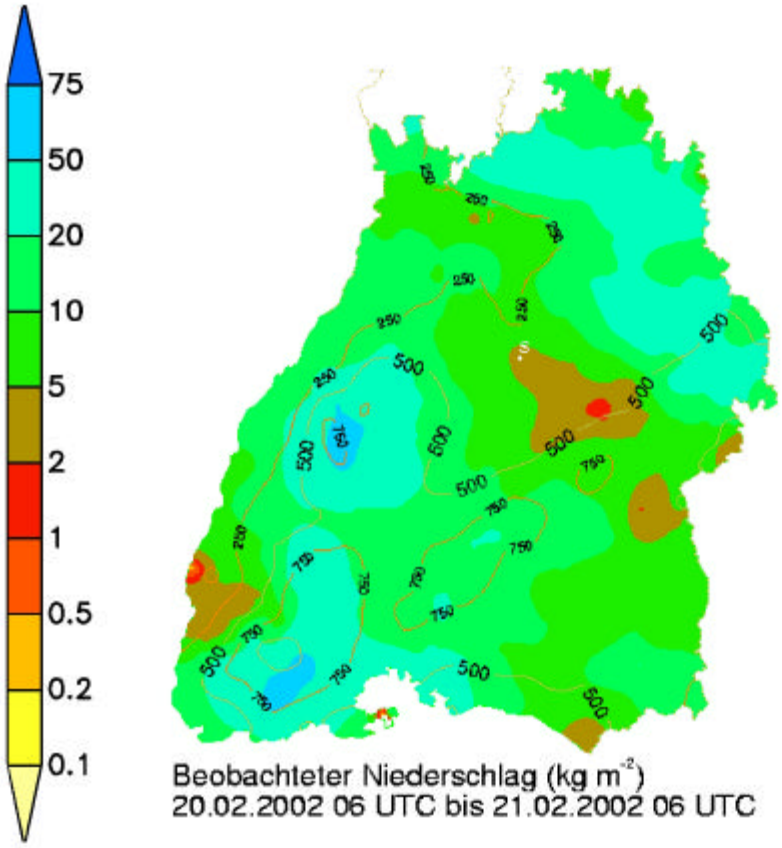
Precipitation [mm] 00 UTC + 06h-30h



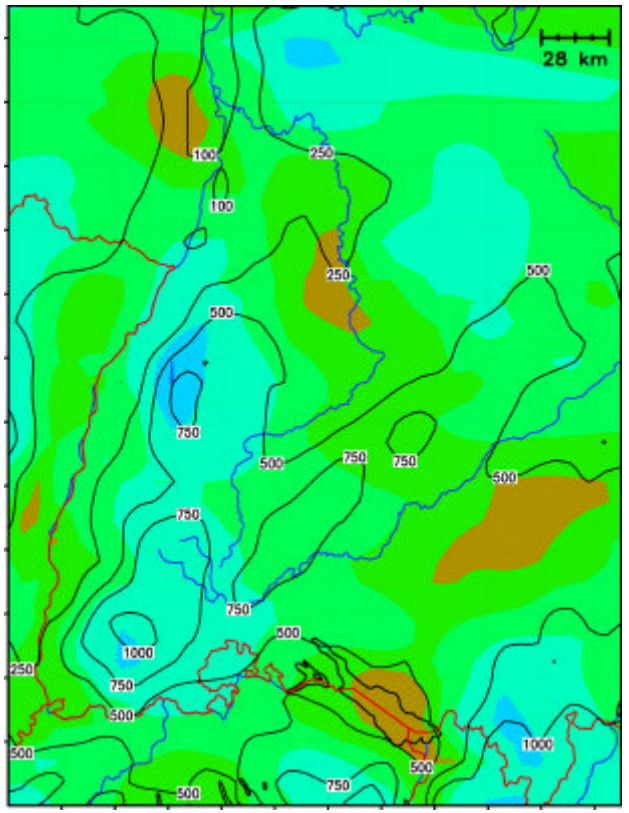
Black: Operational LM
Red : LM with drifting of precipitation

Precipitation 20/02-21/02/2002

Observation



LM 00 UTC + 06h-30h



LM with drifting of precipitation

Conclusions

Including the horizontal drifting of precipitation (in particular of snow) appears to significantly improve the distribution of precipitation on the upwind side and in the lee of mountains in LM, but

- only one case study Þ more case studies are necessary,
- other reasons for erroneous distribution of precipitation need to be excluded (e. g. vertical motions, seeder-feeder-effect, ...),

- prognostic treatment of precipitation needs about 50% more computing time for the total LM,
- new numerics (2-time-level scheme) have to be tested thoroughly,
- final solution will presumably need 9 to 12 months of research and development activity at DWD.