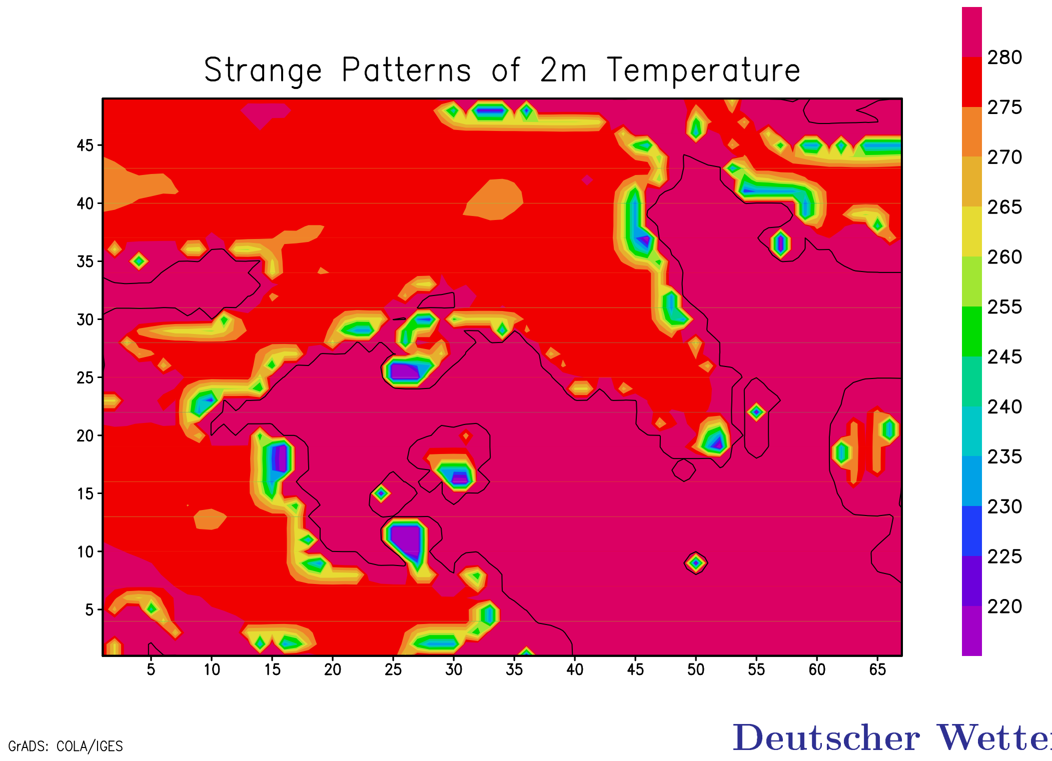
Tests and Problems with the two-way Nesting Version of LM

History:

- The two-way interactive nesting version of LM has been developed at DWD within the national TFS-project (Tropospherical Research) by Jürgen Rissmann.
- Only a test version with several problems could be finished within the project (January 2001):
  - the code is not part of the operational LM code
  - it is not running sequentially
  - there is a parallel performance problem most likely in the exchange between nests
  - the code does not vectorize (on VPPs at ECMWF)
  - the results in the nests were definitely wrong
- The last 2 problems could be solved in a collaboration between HNMS and DWD in Spring 2001 (see last COSMO meeting in Athens)

New Tests

After running the test-version for quite a time at ECMWF, HNMS placed another nest to a different area last autumn. For this nest, the 2m temperature shows some very strange patterns.

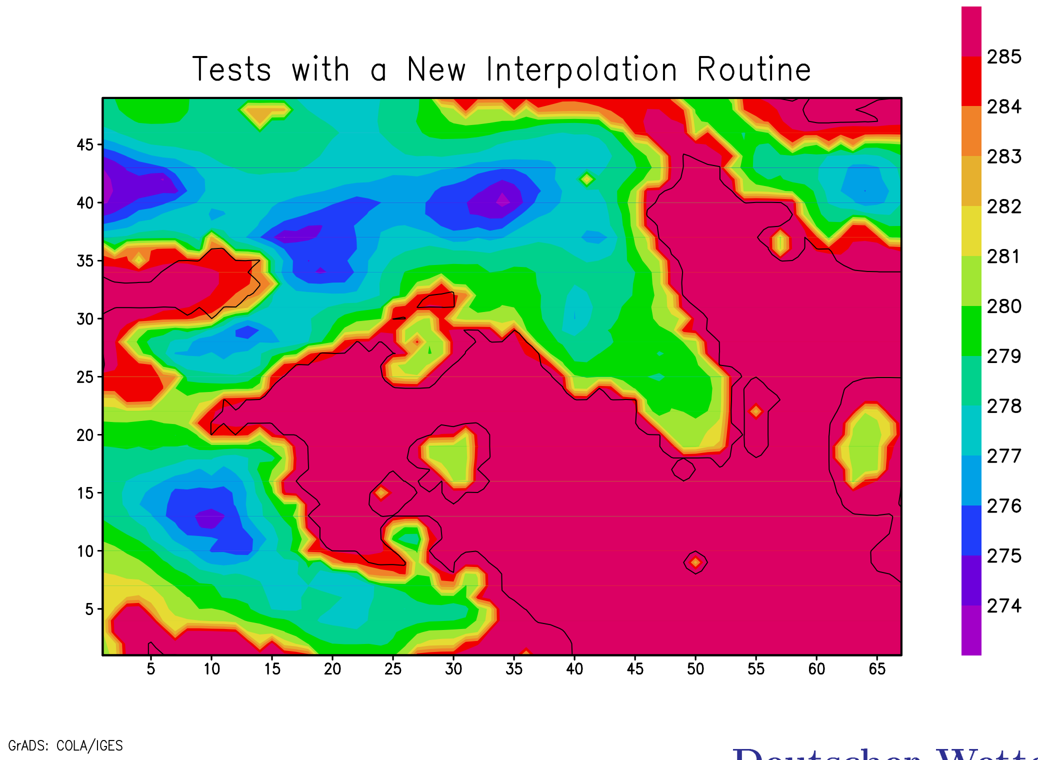


The Problem and a possible Solution

- The variables defined on land points are interpolated with the same (very sophisticated) procedure as the atmospheric variables.
- The land-sea mask is not taken into account!!
- Therefore the values of the soil temperatures (e.g.) along the coastlines are calculated using correct values (on coarse grid land points) and values of 0.0°K (on coarse grid sea points, where these temperatures are not defined).
- Remedy: Try a new interpolation routine for the land variables taking into account the coarse-grid and the fine-grid land-sea mask.
- A student of mathematics is working on this right now during his internship at DWD.

Very First Results

Manuel Werner wrote a new interpolation routine. Because of the parallelization this is not straight-forward! The following is a first result for the same nest as before:



Remaining Problem: Parallel Performance

- Another problem is the parallel performance on massively parallel computers (with $O(100)$ processors)
- A first technical improvement was to split the big source modules that could only be compiled with low optimization options

	T3E (128 PEs)	IBM (90 PEs)	IBM-opt (90 PEs)
Dynamical Computations	53.07	68.28	18.65
Dynamical Communications	7.86	14.33	8.16
Physical Computations	14.40	14.41	6.06
Physical Communications	1.52	2.09	1.59
Nest Interpolation	34.33	306.30	7.28
Nest Exchange	410.38	274.27	88.22

- Another possible improvement: replace the point-to-point communications for the nest exchange by a global communication routine
- BEWARE:
  The whole organization of the parallelization for the nests and the data exchange between the nests has to be restructured for this!
- We are working on this, but have no results yet

Conclusions

- The interactive nesting version still has to be tested intensively
- But nevertheless results are promising
- Last year:
  An operational implementation (join it with the LM) is necessary and will require about 3 months (and knowledge in parallel programming)
- This year:
  An operational implementation (join it with the LM) is necessary and will require about 6 months (and good knowledge in parallel programming)