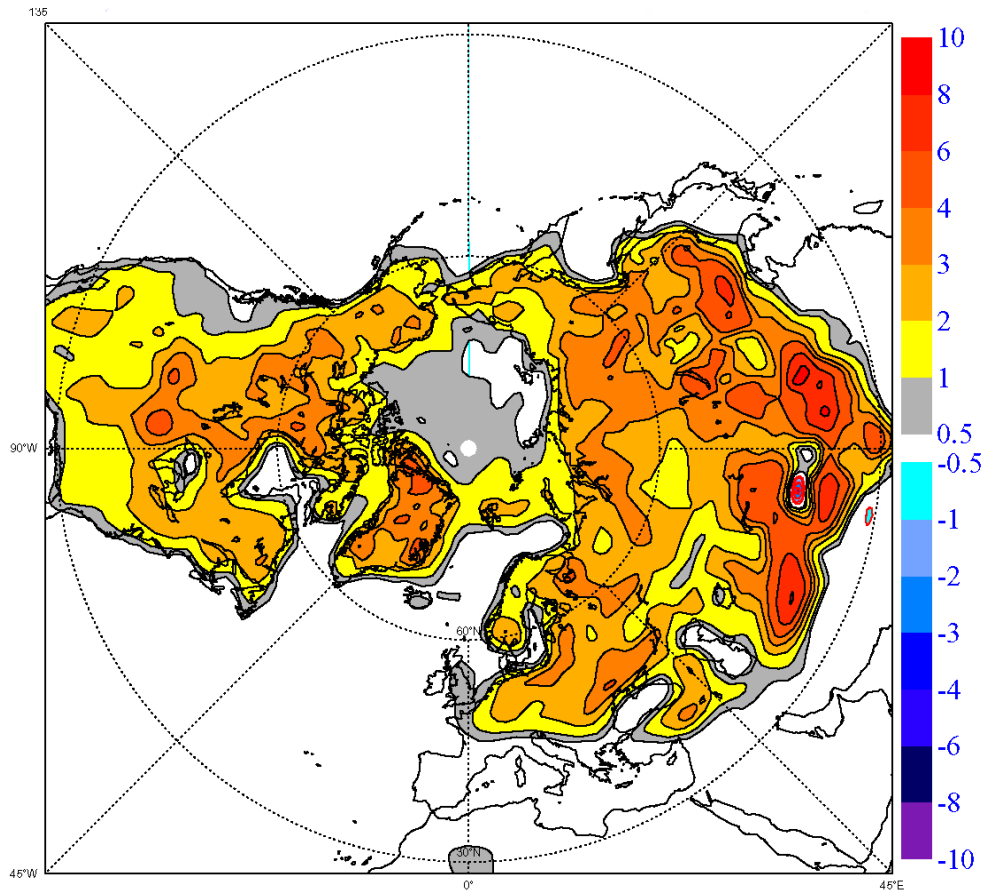


# INITIAL GABLS STUDY BEGINS WITH OVERLOOKED AREA IN CLIMATE RESEARCH

*Most IPCC Models Predict Warming  
Under Stable Conditions Over Land Where Large Model Errors Still Occur*



The first case of the GEWEX Atmospheric Boundary Layer Study (GABLS) focuses on the stable boundary layer over land. **Model differences in the mean temperatures over land areas can be larger than 10K.** The figure at the right shows the difference of the mean temperatures at a height of 2 meters for January 1996 between calculations with two versions of the stable boundary layer parameterization in the ECMWF model. *(Figure courtesy of Anton Beljaars, ECMWF)*

## GABLS INITIATES INTERCOMPARISON FOR STABLE BOUNDARY LAYER CASE

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The overall objective of the GEWEX Atmospheric Boundary Layer Study (GABLS) is to improve the understanding and the representation of the atmospheric boundary layer in regional and large-scale climate models. GABLS aims to provide a platform in which scientists working on boundary layers at different scales will interact. Such activity is important in itself and also very relevant for other activities in GEWEX, and more generally for the activities within WCRP and the International Geosphere-Biosphere Program (Holtslag and Randall, 2001).

The first focus of GABLS is on the representation of the stable atmospheric boundary layer (SBL). **It appears that much of the warming predicted by climate models occurs during stable conditions over land (either in winter or at night). This is documented in the latest Intergovernmental Panel on Climate Change report (see for example figure 9.10, pages 546-548 in Cubasch and Meehl, 2001). At the same time, it is realized that the understanding and parameterization of the SBL is still poor (e.g., Beljaars and Holtslag, 1991).** As an example, the figure on the bottom of Page 1 shows the difference in the temperature at a height of 2 meters for January 1996 as calculated from two model runs with the same forcings, but with (slightly) different stability functions in the mixing scheme of

the ECMWF model in stable conditions (after Viterbo et al., 1999). The scheme with more mixing, leads to higher temperatures over continental areas in winter. To obtain the same synoptic evolution in the two simulations, gentle relaxation towards the analysis is applied above 500 m above the surface. Also, the same prescribed values for the sea surface temperature are used (see Viterbo et al., 1999 for more details). Notice that the differences in the mean temperatures over the land areas can take values up to 10K!

To review our understanding and to discuss future directions on stable boundary layers, a workshop was held at the European Center for Medium-Range Weather Forecasting (ECMWF) in Reading, UK, on March 25-27, 2002. The workshop agenda covered the following topics: Modeling and parameterization experiences at the large-scale modeling centers; progress in theory and understanding of SBLs; Large-Eddy Simulation (LES); and observational data sets (Cabauw, CASES, ARM, Lindenberg, and others). Discussion sessions were held on each of the above topics, and a planning session concluded the meeting. In total about 20 presentations were given by leading scientists and about 30 people attended the workshop.

At the ECMWF-workshop many questions were raised, such as: Why do (most) models like enhanced mixing in stable cases? What is the role of the atmosphere-land surface coupling for SBLs (see also Van de Wiel et al., 2002a, b)? How do models compare with the new data available (such as from CASES-99; see Poulos et al., 2002)? How important is model vertical resolution? Subsequently, the GABLS plans were presented at a meeting during the AMS 15th Symposium on Boundary Layers and Turbulence in Wageningen, the Netherlands. About



*The participants at the first GABLS workshop at ECMWF, March 25-27, 2002.*

80 conference participants joined that meeting and overall very positive feedback was received.

Initially a case study of a night in the CASES-99 data set (Poulos et al., 2002) was prepared for a benchmark study of one dimensional column and LES models over land (prepared by staff members at the Meteorology and Air Quality Section of Wageningen University, NL). However, it became clear that a benchmark case for a stable boundary layer over land is rather complex to start with and to compare the skills of LES and single column models. Therefore, it has been decided to first focus on a case for a SBL with less complexity. This case is based on the results presented in a study by Kosovic and Curry (2000). As such the boundary layer is driven by an imposed, uniform geostrophic wind, with a specified surface-cooling rate, which attains a quasi-steady state SBL. The case for the LES inter comparison is prepared and convened by Malcolm MacVean (Meteorological Office, UK). In addition, Joan Cuxart Rodamilans (University of the Balearic Islands at Mallorca) convenes the intercomparison of the single-column models for this case.

The selected case has already been distributed for a LES intercomparison, where the basic aim is to contribute towards a quantification of the reliability of stable boundary layers in LES. About 10 groups have already agreed to participate in this exercise. The purpose of this single-column intercomparison is to check the performance of any turbulence or vertical diffusion scheme for this shear-driven stably stratified case. The basic philosophy of this exercise is to make a run with every single-column model at exactly the same conditions as the LES, including physical setup and vertical resolution. This will make the comparison to the LES outputs more trustable. Single-column versions of operational models (either weather forecast or climate studies) are very welcome to participate.

**The outcome of the model intercomparison study will be presented at a the GABLS Workshop on Model Intercomparison and Future Direction in Mallorca, Spain, 22-25 September 2003 (hosted by the University of the Balearic Islands).** We strongly encourage the large-scale modeling centers to take part in the 1D model intercomparisons studies, as well as motivate their scientists to contribute and take part in the proposed activities.

In the future we hope that GABLS may also present an important opportunity for the set up of adequate data sets to be collected and for the consistent analysis of existing data for the improve-

ment of stable atmosphere parameterizations in various conditions. Such improvements are of utmost importance to the study of regional and global climate change scenarios, among other important modeling uses. This issue will also be addressed in the upcoming workshop.

If you would like to participate in the model intercomparisons and/or in the workshop please send an e-mail to Bert Holtslag (Bert.Holtslag@wur.nl) for general information, to Joan Cuxart Rodamilans (joan.cuxart@uib.es) for the single-column model study or to Malcolm MacVean (malcolm.macvean@metoffice.com) for the LES inter comparison. Please also consult <http://www.gewex.org/gabls.htm> for updates on GABLS activities in the near future.

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This is a community effort, which needs the activity and creativity of many people to make real progress! In this respect, I thank all participants at the various meetings for their inputs and comments. In particular, I would like to acknowledge Ric Cederwall, Anton Beljaars, Malcolm MacVean, Joan Cuxart Rodamilans, Greg Poulos, and my staff members at the Meteorology and Air Quality Section of Wageningen University for their help and comments.

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