

GLASS members are also involved with a new International Geosphere-Biosphere Programme initiative to study land-use/land-cover change (LULCC). The goals of LULCC are to provide historical maps of land use and land cover change to enable simulations and impact studies from a climate perspective. Coordination with the GSWP-3 experimental design for the long-term runs (Phase-1) is planned.

#### *Cross-Cutting Activities and Next Meeting*

A number of current and developing GLASS links were identified with projects in other GEWEX Panels. In particular, the implementation of CEOP reference site data (i.e., ten to twenty LandFlux sites with additional quality control) in the PALS system. ALMIP-2 will be circulating its proposal through GHP to coordinate activities related both to the AMMA Regional Hydroclimate Project (RHP) and to GLASS modeling. Similarly, new links between the Hydrological Cycle in the Mediterranean Experiment (HyMeX) and GLASS have been identified and a starting point for collaboration will be GLASS representation at the HyMeX conference in May 2012, and inviting a HyMeX scientist onto the GLASS Panel following that. The foci of HyMeX in terms of snow, terrain, groundwater, and runoff are all identified as current gaps in GLASS.

The idea of a joint GLASS-GEWEX Atmospheric Boundary Layer Study (GABLS) project on land-planetary boundary layer (PBL) coupling was discussed. It was thought that the extension of the stable boundary layers to a full diurnal cycle analysis (in the form of a column model testbed) would interest both groups, as well as revisiting the GABLS-1 intercomparison during the Cooperative Atmosphere-Surface Exchange Study-1999 (CASE99) study in the SGP.

GLASS was represented by Joseph Santanello at the 27<sup>th</sup> Working Group for Numerical Experimentation (WGNE) meeting held in October 2011 in Boulder, Colorado. Potential cross-cutting activities were presented and discussed, mostly furthering the participation of operational centers and models in PILDAS, and investigating the potential for PALS to be used as a coupled model benchmark for operational centers. The PALS demonstration study will rely heavily on National Centers for Environmental Prediction involvement and will therefore serve as a pilot study, the results of which will be relayed to WGNE members. One hurdle will be acquiring observations in near real time for PALS, which could require saving operational model output streams. WGNE is also very supportive of a joint GLASS-GASS project, similar to the GABLS proposal discussed above, with the long-term objective of improving the diurnal cycle of convection representation in coupled models. This has long remained a challenge for the community.

The next GLASS Panel meeting will be held in conjunction with the 1<sup>st</sup> Pan-GASS Meeting on 10–14 September 2012 in Boulder, Colorado (see announcement on page 20). This will allow for a dedicated session on the GLASS-GABLS experiments and a session or workshop on LoCo and the SGP testbed.

## **ECMWF/GABLS Workshop on Diurnal Cycles and the Stable Atmospheric Boundary Layer**

**7–10 November 2011  
Reading, United Kingdom**

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Sixty participants from Europe, Japan, North and South America, and Australia attended the Workshop, which was co-sponsored by the European Centre for Medium-Range Weather Forecasting (ECMWF) and the GEWEX Atmospheric Boundary Layer Study (GABLS). The purpose of the Workshop was to review the ongoing research related to the diurnal cycles and stable atmospheric boundary layer, and to make recommendations for future work, particularly on the options for improved parameterization in large-scale models.

The Workshop was divided into two-and-a-half days of oral and poster presentations covering the topics mentioned above, and one day of working group discussions followed by a plenary discussion session. Many of the participants are actively involved in GABLS ([http://www.gewex.org/gass\\_panel.html](http://www.gewex.org/gass_panel.html)), which is an international platform for boundary layer research applied to regional and large-scale models. The GABLS Project began 10 years ago with an initial study that defined a series of cases for model intercomparison and model evaluation of the stable boundary layer (SBL). Large Eddy Simulation (LES) models and observations were used extensively as references. The Study showed that the spread between models is large and that many models have highly diffusive boundary layers schemes, mainly to avoid “decoupling” of the atmosphere from the surface in low wind conditions and to maintain sufficient drag at the surface. It was also confirmed that the more research-oriented schemes (which tend to be less diffusive) have a better boundary layer structure in terms of profiles of temperature, wind speed, and direction. The GABLS-3 LES intercomparison case is based on a moderately stratified, baroclinic, mid-latitude boundary layer observed over Cabauw in The Netherlands. Encouraging news is that intermodel dispersion between LES models is fairly low within the most recent GABLS-3 intercomparison and that it shows very realistic boundary layer structures.

One of the strategic goals of ECMWF is to improve the quality of near-surface weather products, such as temperature, wind, and atmospheric composition. It is well known that the diurnal cycles of temperature and wind are strongly influenced by small-scale atmospheric processes in the SBL, and in particular by turbulent diffusion, gravity waves, and radiation, but also by the thermal coupling with the underlying soil through vegetation and snow. Most large-scale atmospheric models use rather diffusive boundary layer schemes that result in SBLs that are too thick and show too little wind turning. Climate projections also show strong temperature signals at high latitudes that are affected by these processes.

The Workshop presentations focused on all the physical aspects relevant for a realistic simulation of the SBL. The scientific issues were further discussed in the working groups covering: (1) processes; (2) tools (e.g., LES) and observations; (3) parameterization schemes; and (4) land-surface interactions. The working groups were asked to make recommendations for large-scale modelers and for further research in GABLS.



*Participants at the ECMWF/GABLS Workshop.*

#### Conclusions from the Workshop:

- Uncertainty in the formulation of diffusion in stable situations remains high, and no clear way forward was identified. However it is obvious that the effects of mesoscale variability and terrain heterogeneity are important and need further study.
- Because it is now well accepted that the SBL is highly interactive with the underlying surface, it was recommended to base further study on the coupled system. For LES models it was recommended to have at least a simple representation of the surface energy balance in future simulations.
- The uncertainty in the momentum budget is large in models. Sensitivity experiments show a direct impact of drag over land on the planetary scales. To diagnose this aspect further, a model intercomparison study was proposed.
- Many models have biases in long wave downward radiation even in clear sky situations. Verification studies using Baseline Surface Radiation Network data were recommended.
- More diagnostic studies of large-scale models are needed to assess the behavior of the boundary layer and its interaction with the surface. It was recommended to use super-sites [e.g., the Coordinated Energy and Water Cycle Observations Project (CEOP) and the Flux Tower Network (FluxNet)] with a comprehensive set of observations, such as those in the context of the planned Coordinated Regional climate Downscaling Experiment (CORDEX)-Europe Initiative or a possible Arctic activity.
- Large-scale modelers are encouraged to use turbulent energy equations to support the turbulence closure.
- Recommendations for the land-surface include: (1) the use of a shallow top soil to represent fast time scales; (2) the introduction of multi-layer snow schemes to replace slab models; (3) full exploitation of as many observational sites as possible to derive relevant model parameters; and (4) the use of data assimilation techniques to “inverse model” land-surface parameters.

To view the presentations, poster abstracts, and working group reports, see: <http://www.ecmwf.int/newsevents/meetings/workshops/2011/GABLS/index.html>.

### GEWEX/WCRP Calendar

*For the complete Calendar, see the GEWEX website:  
<http://www.gewex.org/>*

- 22–26 January 2012—92<sup>nd</sup> AMS Meeting—New Orleans, Louisiana, USA.
- 20–24 February 2012—Chapman Conference on Remote Sensing of the Water Cycle—Kona, Hawaii, USA.
- 12–15 March 2012—CLiC SSG Meeting—Innsbruck, Austria.
- 20–23 March 2012—Workshop on the Physics of Climate Models—Caltech, Pasadena, California, USA.
- 26–29 March 2012—ICSU/IGBP/IHDP/WCRP Conference: Planet Under Pressure: New Knowledge, New Solutions—London, UK.
- 2–4 April 2012—WCRP Polar Climate Initiative Workshop—Toronto, Canada.
- 11–13 April 2012—Global Drought Information System Workshop—Frascati, Italy.
- 22–27 April 2012—EGU General Assembly 2012—Vienna, Austria.
- 7–11 May 2012—4<sup>th</sup> WCRP International Conference on Reanalyses—Silver Spring, Maryland, USA.
- 7–11 May 2012—6<sup>th</sup> HyMeX Workshop—Primosten, Croatia
- 14–16 May 2012—GEWEX/GRACE Workshop on application of GRACE data to climate modeling and analysis—WHOI, Woods Hole, Massachusetts.
- 14–17 May 2012—GDAP Water Vapor Assessment Workshop—Frankfurt, Germany.
- 28 May – 2 June 2012—5<sup>th</sup> International Conference BALWOIS 2012 on Water, Climate and Environment—Ohrid, Republic of Macedonia.
- 2–6 July 2012—4<sup>th</sup> AMMA International Conference—Toulouse, France.
- 16–20 July 2012—33<sup>rd</sup> Session of the WCRP Joint Scientific Committee—Beijing, China.
- 1–3 August 2012—12<sup>th</sup> Meeting of the GEWEX Baseline Surface Radiation Network (BSRN) Project—Potsdam, Germany.
- 10–14 September 2012—1<sup>st</sup> GEWEX Pan-Global Atmospheric System Studies (GASS) Meeting—Boulder, Colorado.
- 10–14 September 2012—GEWEX/GLASS LoCo Workshop and Panel Meeting—Boulder, Colorado.