

**People Present:**

*Polcher, Jan Chair*  
*Bastidas, Luis*  
*Best, Martin*  
*Dirmeyer, Paul*  
*Houser, Paul*  
*Koster, Randy*  
*Oki, Taikan*  
*Pitman, Andy*  
*Viterbo, Pedro*

**Invited experts :**

Ken Mitchell  
Aron Boone  
Tom Philipps  
Rick Lawford  
Jared Entin  
Antonio Busalacchi

The PILPS-San Pedro and GLACÉ experiments will be posted on the GLASS web as soon as possible.

### **Meeting with CLIVAR**

In this first half day of the panel meeting a number of representatives from CLIVAR and funding agencies were present to discuss possible collaborations. A number of areas were identified in which GLASS could contribute to CLIVAR projects by providing it's expertise on land-surface processes.

From the presentations of the funding agencies and the CLIVAR projects it became apparent that there is a strong interest in the global coupled action. GLASS was also encouraged to expand on the inter-comparison of LSMs at the processes level.

### **Off-line experiments**

The planed San-Pedro experiment goes well with the NAME initiative and a close collaboration should be encouraged.

### **Proposal on data mining**

Randy Koster is proposing a study on soil moisture memory, mining the data from the AMIP-II experiment. According to Tom Philips, it may be some sort of diagnostic subproject within AMIP and promises to expedite the data acquisition.

It was recommended:

- The study would quantify soil moisture memory in the different AMIP models.
- Differences in memory between models would be related (through an established diagnostic framework) to differences in climatic forcing and land surface model characteristics.
- to check for the possible spatial autocorrelations and the possible correlations with the forcing
- to carry out the experiment within the auspices of the GMPP (GEWEX Model Prediction Panel), the GLASS panel is part of it.
- to use several models for the experiment.

### **General discussion**

- Land-surface scheme have not been sufficiently evaluated over South America. Work is required on the routing on the big rivers of South America for instance. There is no parameterization for the routing over the flood plains.
- There is a need to demonstrate that the models can track the evaporation rates during the dry seasons. Some work is being carried out in South America on the topic, mainly using the Sib 2 and the RAMS. However is not clear whether they are working on modeling or rather on vulnerability issues.
- The ECMWF is working on the low level jet. They are putting some transects to track it.
- There are problems with the availability of data for model evaluation, particularly with river gauges. No measurements of soil moisture are available. GLASS should encourage new observations and help define the needs.
- Experiments beyond GLACÉ are needed to asses the importance of the land-surface in climate variability

## GLACE

The GLACÉ project was well received and the panel encouraged that it be launched very soon. During the discussion a number of suggestions were made.

It was recommended:

- To use the Kolmogorov-Smirnov test to check the similarity of the parameter distributions.
- Because the daily average temperature does not tell you much, information on Tmax and Tmin is requested. This would allow to evaluate the impact on the diurnal cycle.
- The experiment should start in November 2002, with the distribution of the experiment plan.
- The period to be used in for the simulations should be June, July and August 1994. The analysis could focus skip the early part of the period where some scheme might still be spinning-up.

### *Ensemble simulations*

The question of how to set up the initial conditions for the ensemble simulation arose. Especially with regard to some critical surface processes like the deep soil temperature was discussed. Snow or frozen soil is only an issue for very small regions as the period is chosen to be northern summer. The issue is thus left to the participant groups.

A list, in order of preference by the panel, of possible ways to initialize the atmosphere was proposed. The preferred solution is to take restarts from June 1, 1994 form archived from an ensemble of AMIP simulations. But it was realized that not all groups will be have such a set of initial conditions and thus alternatives need to be provided. No method is a priori excluded but we strongly discourage some of them.

The panel proposed to extend the list of requested output which was in the original project. The following variables are to be required from the participants:

- Daily total precipitation
- Daily total evaporation
- Daily averaged air temperature in GCM layer closest to the surface
- Soil wetness index (as defined by ALMA)
- Dew point temperature
- Outgoing longwave

The slow component relaxation experiment lead to some debate as it was not clear how comparable they would be between difference land-surface schemes. It is not possible to impose a method for choosing the slow variables to be relaxed which will produce similar results in all schemes. It was judged not to be a critical problem as there is the full relaxation experiment to which it can be compared.

The data should be provided in netCDF format, if that cannot be done the data need to be provided in a rectangular grid. Groups not familiar with netCDF should get in

touch with Randy Koster to see if their format can be handled. The best solution would be for participants to use their ftp servers to distribute results.

The results of these simulations should be returned to Randy Koster by mid 2003. This requires that the participants be identified in early 2003.

During the discussion of GLACÉ the C4MIP was also covered. The outcome was that the panel would like to see a closer link between C4MIP and the C20C experiment. Both cover the same period and have the same scientific objective : improve our understanding of the variability of the climate of the 20th century. C4MIP would contribute the carbon cycle and help understand the link between the variability of climate and the carbon cycle.

## **PILPS C1**

The PILPS-C1 experiment is running well. The time line has slipped slightly. This considered to be a minor problem by the panel in view of the fact that many carbon scheme in land-surface schemes are under development. Still it was judged important not to let the workshop slip beyond spring 2003.

A number of recommendations were made to the PILPS-C1 experiment :

- The list of participating models is short and is missing some major groups such as MOSES, LPJ and CLM
  - Paul Houser will take care of CLM
  - Martin Best will ask somebody for MOSES participation
- To encourage the link with the C<sup>4</sup>MIP experiment (Coupled Carbon Cycle Climate Simulations)
- Nicolas Viovy needs funds for workshop which should be held in spring 2003. Jan Polcher will help with finding the funds required in France.

## **PILPS San Pedro**

The PILPS San Pedro proposal was presented by L. Bastidas and accepted by the panel. This will be the first local off-line experiment to address the following issues :

- An evaluation of the schemes in a semi-arid region.
- It will encourage all schemes to perform some kind of parameter optimization.
- Having 3 sites with similar conditions allows to test the transferability of the schemes and their parameters.

To ensure a large participation, this project should be presented as starting with a normal PILPS inter-comparison on which the parameter optimization will build. This should take out some fear of the work associated with the optimization infrastructure.

The discussion by the panel lead to some suggestions and recommendations for the organization of the project :

- To use longwave forcing from model outputs, e.g. Reanalysis or LDAS. LDAS especially should be able to provide a better estimate of this parameter.
- To provide with 'observable' parameters, i.e. albedo, LAI, roughness, vegetation height, as was done in previous PILPS experiments.
- The data handling procedure should take more strongly into account the ALMA infrastructure. Especially for the output of variables and their description.
- The data available for the end of the year 1996 should be used, together with the 8 first month of 97 for the spin-up of the schemes.
- The data available for the New Mexico site is a little short but should be enough in the context of this 3 site approach.
- The time-line is to be redefined to fit with the calendar of activities for 2003. It was suggested that before the schemes are asked to optimize their parameters a standard PILPS experiment be conducted (See table at the end for details). The workshop should combine the evaluation of the first model output and setting up the optimization procedures for the parameters.
- Optimization codes should also be provided in Fortran 90.

## **GSWP 2**

The GSWP-2 proposal and the outcome of the workshop was evaluated and discussed by the panel. The panel was very happy with the progress made by this proposal since it was last discussed at the 2001 panel meeting and it is looking forward to the start of the project in January 2003.

GSWP-2 is considered by the GLASS panel as the best attempt by the land-surface modeling community to estimate land-surface fluxes at the global scale. The diversity of models and the chosen set of sensitivity experiments should provide a good estimate of the uncertainties associated to these estimations. For this effort the work done for ocean fluxes should serve as an example ([http://www.soc.soton.ac.uk/JRD/MET/WGASF/get\\_report.html](http://www.soc.soton.ac.uk/JRD/MET/WGASF/get_report.html)).

The general discussion of GSWP-2 lead to some recommendations which should be taken up in the final version of the proposal :

- Procedures for redistributing the data to the community once the experiment is finished are to be written in the experimental plan. The recommendation is that Paul Dirmeyer and Taikan Oki manage this process and that the GLASS panel serves as a mediator in case of conflict.
- All model outputs should be available to other models. For the diagnostic groups it is important to preserve their priority on their topic until results are published.
- For the validation exercises
  - As there might be error compensations between the land-surface scheme and the routing model it was recommend that more than one routing model be used :
    - e.g. Jay Famiglietti, C. Vorosmarty encourage them to participate
  - Regional hydrological experts should be sought for the validations of GSWP 2 outputs. Through GEWEX at least some experts from the GHP continental scale experiments should be solicited.
  - Station validation is needed to check the forcing and evaluate in some sense the simulated fluxes. But it has to be said clearly that there is a big scale issue with this type of validation.
  - To use satellite information for soil moisture evaluation and skin temperature is aimed at encouraging the community to move in this direction.
    - Satellite information (soil moisture) is not entirely reliable therefore the comparison is only another source for comparison for the moment.
    - Satellite information has to be used because it is the only global data for surface conditions and it potential for future applications. It suggests research activities post-GSWP 2.
    - This validation will show under which conditions remote sensed data can discriminate between various models and it will thus reveal some of it's information content.
    - Soil moisture retrievals from microwave : Manfred Holtz asked for support
    - Eleanor Burke only to produce values that will make people used to output of observable variables from the models

- Satellite information on vegetation could also be validated, although in some schemes this variable is prescribed.
  - Use only LAI
  - NDVI dismissed as it was considered a thing of the past in view of the new sensors.
- Snow validation should use more than one product out of the following list of data sources :
  - USAF 95 onwards
  - USSR up to 91
  - NSIDC Canada for the whole period
- The contact with Alan Robock should be reestablished for the comparison with his soil moisture database.
- On some large basins with a good observational networks, the atmospheric water convergence can be derived from the NCEP and ECWMF reanalysis and serve as an extra validation of the regional water balance. It can complement well the river discharge validation with routing models.

In the presentation of these validation exercises there should be a clear distinction between those which directly contribute a validation to the overarching objective of producing a global climatology and those which are more of exploratory nature.

- Initialization
  - The spin up until 82 can be chosen by the modeler. The only requirement is that the scheme is in equilibrium. The period 82-85 should be done with the data provided so that the model goes into the right variability.
- The preparation of the forcing for control run was discussed.
  - The CRU data could be used with the gauge correction. The CRU did not do this correction because no reasonable procedure could be found for the entire period 1900-2000. This does not apply for the GSWP-2 period.
  - GPCP is also a good option and should be considered. This climatology offers the advantage of building on data from more countries
  - All atmospheric variables should be provided at the same level. To change the height of the wind the same code as for Rhône-AGG could be used.
  - SRB product needs correction for altitude. The common altitude will be provided by the CRU as it provides the 2m temperature.
  - Paul Dirmeyer will look more in detail into the products to make a final recommendation
  - Surface pressure needs to be adapted to the orography and it needs to be ensured that it is consistent for all variables.
- Sensitivity runs
  - Run without gauge correction for precipitation.
  - Run with dataset constructed with the ECMWF reanalysis.
  - Use the reanalysis without any correction
  - Using different vegetation land cover classifications
  - Models with tiling scheme turned off
  - The data size for the forcing is around 2.5 Gb/year. This is a strong limitation for the number of sensitivity experiments which can be done. It should be left to the interest of the modelers to decide which one should be done.

The table of variables and associated meta-data provided on the ALMA web-page needs to be updated for GSWP-2.

- Outputs
  - Extrema on the period over which the variables are needed in some cases :
    - Surface temperature
    - Longwave up
    - Radiative surface temperature
  - Runoff :
    - Distinguish between lateral and vertical groundwater flow
  - Potential evaporation :
    - make it recommended not required
- A table for the ancillary data needed by LSMs needs to be build for AMMA in the similar way as was done for the forcing and the output.

As with any project of this scale there are concerns in other communities about GSWP-2 moving into their turfs. Concerns were raised for the following topics :

- BAHC (or IGBP/iLEAPs now) with regards to the carbon cycle.
- IAHS program on modeling un-gauged basins and a focus on land surface parameterizations
- GSWP-2, and LDAS even more, are competing with flood forecasting agencies.

In all these cases it is for GSWP-2 and GLASS to approach these organizations and solicit their participation.

It was recommended that the following actions be taken :

- Be cautious !
- Taikan Oki will write a letter to IAHS to point to the potential use of the GSWP-2 for water resource evaluation and validation of models which attempt to predict these resources. In the meantime GSWP-2 should not get into water resources.
- State that GSWP is research, and does not produce operational products.
- Results are 10 years old.
- Involve those other groups in regional validation. Help is especially needed for runoff validation.

### **EXPECTATIONS FROM ISLSCP-III**

Following the GSWP-2 review, the panel discussed what we would expect from a future ISLSCP project. As GSWP is the biggest user of the atmospheric forcing data which is distributed by ISLSCP, GLASS should express it's needs early on.

We believe that the true added value ISLSCP can bring to the data it collects and distributes is to the perform a more critical evaluation. This is especially true for the variables describing the state of the surface. This will set ISLSCP apart from the Internet which provides the same data but without any critical review.

Clearly the production of the atmospheric forcing should be reorganized. We suggest that it be done in collaboration with the GLDAS project. GLDAS could, for each ISLSCP phase, produce a re-analysis of it's operational products which would then be distributed by ISLSCP and used for GSWP experiments. One of the main advantages



would be that the forcing data would benefit from the expertise gained in the Land Data Assimilation Systems to improve the forcing data.

This recommendation sets GLDAS apart from the other LDAS's within GLASS. It means that GLASS will promote GLDAS and encourage the entire community to contribute. This positioning of GLDAS within the community was agreeable to LDAS (Ken Mitchell) and ELDAS (Pedro Viterbo).

Within GEWEX we need to promote the evaluation by other groups of GLDAS's forcing and simulated fluxes. This is already the case for CEOP period but should be expanded to previous GHP and GRP activities. Compared to GSWP, GLDAS offers the advantage of being closer to present and thus better suited for a comparison with data from the various continental scale experiments which were underway in the second half of the 90's. This evaluation will then be beneficial for a future GSWP experiment.

## **DISCUSSION WITH KEN MITCHELL**

The issue of land memory and the model initialization was brought up because it affects:

- Weather and seasonal time scales
  - Impact of land anomalies in changes of large scale moisture convergence
  - Soil moisture anomalies, soil heat anomaly affect wind patterns
  - Mean fluxes dominant – eddy fluxes small
  - Effect on surface recycling
  - Soil moisture anomaly -> soil temperature anomaly -> air temp anomaly
  - Anomaly in soil moisture -> anomaly in precipitation recycling.
- 
- Modeling
    - Land modeling and land initialization (Global, North American, European LDAS)
    - Coupled and uncoupled reanalysis
    - Seasonal predictability
    - Transferability
    - Embedded regional climate models, e.g. [www.atmos.umd.edu/~berbery/etasam](http://www.atmos.umd.edu/~berbery/etasam)
  - Initialization issues
    - How similar are soil moisture fields from different LDAS LSMs?  
Answer: not too similar
    - Can the soil moisture from one LSM be used to initialize another?
      - Not good to transplant, always problems
      - Models do not recover from wrong initialization even after 20 years of spin up (Gao et al, JGR 96).
    - How long should the model spin-up period be?
      - The idea is to make sure that the initialization is properly done and to define how long the spin-up has to be. Optimizations allow for shorter spin-ups.
      - Do we need a soil moisture transplant experiment? UK Met Office is doing some transplant for soil initialization. A function has been identified to transform the input into the operational model.
      - The problem is difficult and requires a consistent solution because intermediate solutions are not optimal.
    - The problem is similar and parallel to that of C<sup>4</sup>MIP

## **SOIL MOISTURE INITIALIZATION**

Following the discussion with Ken Mitchell it was felt that the GLASS panel needs to take action on this issue. The aim is to raise the awareness on problems associated to land-surface initialization in models and express the panel's opinion on the best method available. The typical audience for such a message would be the atmospheric modeling community which uses land-surface models without being fully aware of the issues of initialization.

Such a paper would start with illustrating the problem using some NWP cases (Martin Best and Pedro Viterbo volunteered) . It would then include a description of the fundamental reason for this problems which lies in longer scales involved in surface processes and the conceptual nature of the land-surface schemes (Jan Polcher volunteered).

The paper would then proceed with a ranked list of preferred solutions to initialize surface conditions. The most satisfactory solution is to spin-up the land-surface scheme decoupled from the atmosphere over a longer period using the best possible estimation of the atmospheric conditions. In case such a forcing is not available it would be preferable to spin up the coupled (land/atmosphere) system. After that, the solutions left are all based on linear proxies of the land-surface schemes as proposed by Koster and Milly. The latter method can only be justified by the minimization of the spin-up of some fluxes and they do not solve the general problem.

In all cases, the externalization of the land-surface surface scheme, from the atmospheric model, according to the PILPS-4c proposal, will greatly facilitate the generation of proper initial conditions. This should be one of the recommendation of the paper so that atmospheric models move into this direction.

Randy Koster volunteered to take the general leadership for this paper.

**Related event** : Jan Polcher presented informally this project during the WGNE/GMPP. The atmospheric modeling community present at this meeting, expressed a great interest in such information. Especially the group preparing the transposed AMIP experiment, in which climate models are intended to be evaluated in a NWP environment would like to have advice. For this experiment they are still pondering the best way to initialize the land-surface conditions of the climate models in accordance with what is provided by the NWP models.

## **ILEAP**

A short part of the meeting was dedicated to prepare the meeting of iLEAP/IGBP which was to take place mid October. The panel asked Andy Pitman and Jan Polcher to carry to the meeting the following message :

- GLASS has been launched with the support of BACH and has always benefited from this close collaboration.
- BACH was key in making ISLSCP and GSWP happen.
- GLASS represents essentially the community of large scale land-surface modelers and is thus complementary to BACH.
- GLASS has a privileged link to the NWP centers through it's participation in the WGNE/GMPP panel.

GLASS is open to experiments proposed by iLEAP/IGBP. Such experiments would either be coordinated by the local off-line, local coupled or global off-line actions of GLASS together with iLEAP.

## **LOCAL COUPLED**

The panel shared the conclusions of the workshop organized by Bart van den Hurk and Paul Houser in de Bilt in April 2002. The conclusion of the workshop are published in GEWEX News, May 2002.

Paul Houser and Luis Bastidas need to put together a proposal to make progress beyond the ideas expressed during the workshop. The suggestion was made to look at Y. Sud's single column model which seems to work well over the ARM site.

## **COMMON LAND SURFACE MODEL ISSUE**

Following the discussions last year in Toulouse Chris Milly was contacted on the possible distribution of his model by GLASS.

- The LaD (Land Dynamics) model is distributed under the GNU license license and Chris would welcome it's distribution by GLASS as an acceptable minimal land-surface scheme. Chris would be happy to offer a scientific support for his model.
- This model does not yet use the PILPS4c interface. For the moment it is not known who could implement this interface or who could fund such work.
- The interest for such a model is rising within GMPP. GABLS would also need such a model for it's PBL studies.
- Martin Best presented an update of the PILPS 4c coupler which can handle an implicit coupling with a tiling scheme and a more complex parametrization of the turbulent diffusion.
- Within the European PRISM project an approach similar to the PILPS4c is being examined by the sea-ice community and the oceanographers.

## **TIME LINES**

The schedule of experiments for 2003 is very busy but should be manageable.

- PILPS-C1 is already underway and a large part of the work is already done. But it needs to conclude during the spring 2003.
- GSWP-2 will take the entire year but we expect models to be run before the summer vacations of the Northern Hemisphere.
- GLACÉ will solicit a slightly different group of modelers than the other experiments. Thus a return of results at about the same time as GSWP-2 seems feasible
- PILPS San Pedro will start to generate work, the off-line simulation in early autumn 2003. The work associated to the parameter estimation will come after the workshop in 2003.

The next GLASS panel meeting should take place in October 2003 in Tucson just after or just before the PILPS San Pedro experiment. This will be the 4<sup>th</sup> and last meeting of the panel in it's current form. It will thus be an important issue on the agenda to select the next membership of the panel. The panel also needs to find a new head to take over from Jan Polcher on the 1<sup>st</sup> of January 2004.

Planning for 2003				
Experiment	DJF 03	MAM03	JJA03	SON03
PILPS-C1	Results should be back in that period	Workshop in France		
GSWP-2	Distribution of beta version of forcing data (Feb 03)	Release of forcings	Control simulations should be back by Aug 03.	Sensitivity exp.
GLACÉ	Experimental plan distributed		Results should be back by July 03	{ Control simulation should be back in Sep 03 Workshop for param. estimation and GLASS panel meeting (Oct 03)
PILPS-San Pedro		The forcing data should go out		