

## GLASS panel meeting Melbourne 22 aug 2009

### Agenda

Kick-off presentation and discussion on desirable future developments in the areas

- Benchmarking (Gab Abramowitz to present)
- Data assimilation (Rolf Reichle)
- Land-Atmosphere coupling (Eleanor Blyth and Bart vd Hurk)

Further announcements/actions

### Presence and professional interest

*Gab Abramowitz*: benchmarking and model independence

*Bart van den Hurk*: coupling diagnostics

*Luis Bastidas*: uncertainty analysis of data blended in models, hierarchy of data assimilation procedures, appropriate complexity of rainfall/runoff models

*Eleanor Blyth*: responsible for JULES (offline applications), setting up (datasets for) a benchmarking system, interested in arctic processes, WATCH (including land-atm feedbacks)

*Sonia Seneviratne*: land climate interaction in climate system, use of observations (member of GRP and iLEAPS SSC) and modelling studies, interested in Future GLACE

*Christa Peters-Lidard*: land-atm coupling with LIS (Joe Santanello); Kumar (her team) works on benchmarking

*Rolf Reichle*: data assimilation in global modelling branch at NASA, mostly offline land data assimilation; engaged in SMAP (SoilMoist Active/Passive) mission

*Michael Ek*: NOAA in (G)LDAS and regional/global NWP, interested in benchmarking, involved in LoCo

*Matt Rodell*: GLDAS to integrate data in LSM, working on many innovative projects such as DA of irrigation, MODIS snow cover, river routing, DA in Africa/Middle East, drought monitoring using GRACE; leads land model working group in CEOP

*Andy Pitman*: coupled global modelling, teleconnections from surface, iLEAPS panel member

*Venkat Lakshmi*: assimilation land surface temperature?

Missing: Gianpaolo Balsamo, Martin Best, Stephane Belair, Aaron Boone

### Benchmarking

Gab summarizes the Martin Best notes of the Exeter benchmarking meeting of July 2009, involving representatives of current benchmarking systems C-LAMP (2 US carbon models, lead by Forrest Hoffman) and I-LAMB (5 European LSMs under auspices of WATCH project).

There is still little consensus on the meaning of “benchmarking”, which is supposedly not another word for “evaluation” but should be considered as “an agreed set of levels of performance of agreed metrics”. During the workshop a separation into different interested parties was made (NWP, climate modellers, impacts modellers, hydrologists), and a long list of primary and secondary variables and available databases was constructed. However, the ultimate aim should be to agree on standard metrics and minimum performance levels for each modelling focus and variable. These may vary from (a) basic performance indicators (sensible seasonal cycle, balance closure), via (b) levels of agreement with observations within observational accuracy, to (c) actually demonstrated added value compared to empirical models driven solely by observed forcings.

Gab is developing an online benchmarking web server on which modellers can upload LSM output, starting with local Fluxnet data and fast processes (NEE, H, LE) to be evaluated using standard statistical measures. It is ensured that the evaluation data are not used by the models for calibration.

The route to an agreed set of benchmarking metrics is slippery, as outlined by presentations of Eleanor and Forrest Huffman at the GEWEX/iLEAPS joint session. It could be envisaged that such a benchmarking system would ultimately consist of performance metrics giving a score (red – orange – green) at different benchmarking levels (basic, obs.accuracy, added value to forcing signal), possibly weighted by agreed weighting factors derived from (subjective) expert judgment.

Good infrastructure to aid the route to such a benchmarking system consists of

- Gab's webbased service
- LIS, coupled to a set of datasets
- packaged evaluation data (Fluxnet, satellite) as currently compiled by the JULES and C-LAMP consortia. Condensing Fluxnet data into a limited number of data records representative for a dozen major climate/vegetation regions would be a good first reference.

The Landflux initiative (workshop taken place on 23 Aug 2009) has presented very promising developments in the direction of global covering flux data sets derived from satellite retrievals or smart extrapolations of e.g. Fluxnet data. Christa will investigate the possibility to run the couple of currently available LIS LSMs using the forcing data that will be generated by WATCH.

Another relevant development is Taikan Oki's intention to initiate a GSWP 3 project. A small submeeting during the GEWEX/iLEAPS conference generated the following ideas:

- optimally GSWP 3 should be synchronized with WATCH activities in the direction of Landflux
- apart from a longer period (Taikan's students are tired of using antique data) scientific assets could be additional focus on irrigation and/or groundwater and/or river routing schemes, inclusion of data assimilation products (ECMWF, GLDAS), or inclusion of schemes that have a PBL relaxation.
- the envisaged period of coverage would be something like 1979 – present
- Taikan wants to organise a kick-off meeting in Tokyo in June 2010.

action items

Concrete actions in the benchmarking activity are:

- *Christa* will explore the Landflux runs with LIS
- *Eleanor* will provide interfaces between WATCH and various activities:
  - provide Fluxnet-aggregates to Gab to be included in his web-based benchmarking server
  - exchange surface schemes participating in I-LAMB and C-LAMP. A workshop is planned to take place in spring 2010. NCEP (Michael Ek) wants to host this workshop, in combination with another planned scientific gathering
- *Eleanor* will attend the ECMWF/GLASS workshop in November to further promote the benchmarking ideas and developments

#### Data assimilation

Rolf Reichle reports on an extensive LDAS intercomparison study, in which synthetic soil moisture data are generated from and assimilated into a range of LSMs. The main

conclusions are that (a) models show less skill when assimilating synthetic data from other LSMs than from their own, demonstrating sensitivity to model formulation and overconfidence of twin experiments, (b) setting up an informative data assimilation intercomparison is truly demanding, in terms of trial and error to construct fair and informative set-up parameters (e.g. cross-covariance between surface and rootzone soil moisture, rescaling soil moisture values from models, perturbations applied, metrics to measure skill improvement), and (c) information is better assimilated (generates higher skill) when the coupling between top soil and root zone soil moisture is higher. A possible and certainly useful extension to this work would be to determine the impact of the data assimilation and model swaps applied to the surface fluxes, notably evaporation, which is the goal of the operational NWP data assimilation systems.

The original idea to generate a new optimal hybrid land surface state/flux product by combining multiple models and various observations is far from realistic. Aiming at such a product (e.g. within Landflux time lines) is not a useful strategy for GLASS. Options to continue this work are:

- Extend Rolf's analysis to surface fluxes, and formulate optimal soil/flux coupling strengths for data assimilation
- Extend the analysis to determine the optimal configuration to support seasonal predictability, and/or do seasonal predictability intercomparisons with LDAS systems
- Further develop assimilation of satellite based LAI/greenness or albedo products. ECMWF is currently on its way to implement such a scheme operationally, probably within the next 2-3 years.
- Promote the assimilation of GRACE (under development in GLDAS), probably relevant for groundwater models
- Engage ECMWF and JRA into LDAS comparison actions.

*action items*

Action items are

- *Bart* will figure out who in Japan could/should be involved in this activity
- *Rolf and Gianpaolo* are to synchronize their activities, and come up with a sensible LDAS-intercomparison and/or development activity, possibly open to access for other centres like JRA.

Land atmosphere coupling

Eleanor summarizes the WATCH/LOCO workshop of July 2009 in Wallingford. During this half-day workshop progress on many areas were reported:

- Obbe Tuinenburg is carrying out a convective triggering analysis (Findell & Eltahir, 2003) for the Indian monsoon. Ahead of the monsoon the atmosphere is made rainfall ready, which makes the Findell diagnostic possibly more outspoken than solely due to land-effects. Ideas exist to run 3D models over this area. Also the West-African monsoon is identified as an interesting domain for additional 3D runs (Bart has completed an analysis of various West-African coupling diagnostics using an RCM)
- Chris Taylor argues that dynamic responses surface temperature anomalies due to past rainfall events may induce rainfall effects over thousands of km.
- Michael Ek and Cor Jacobs are completing the formulation of a single McNaughton-like coupling parameter in the context of Ek's earlier relative humidity tendency framework. Also ideas exist to express (Fluxnet) flux data into a simple surface conductance, capturing the primary impact of the soil on the atmosphere

- Joe Santanello is booking progress with the Betts-diagram. Ideas were formulated to derive a coupling strength parameter from the relative contribution of advection to the local atmospheric state. Also earlier SGP work is statistically extended with longer runs (2006-2007) covering a larger area (still SGP) in the context of the NEWS program
- Sonia uses the correlation between sensible and latent heat to diagnose surface control on fluxes from Fluxnet and AR4 model data.
- Andy is aiming at running high resolution WRF runs over the Murray Darling basin to diagnose recycling.

How to coordinate progress? There is no need for promotion, lots of good science is currently being developed. A synthesis of all this is aimed for by running regional versions of WRF or RCMs over the AMMA region, and apply all diagnostics to create the envisaged set of coupling maps. WATCH funding is probably sufficient to cater for a first set of runs and analyses.

Bart presents the preliminary results of GLACE2. The skill improvement is smaller than was hoped for (but could be anticipated from earlier work by Randy), implying that a strong coupling strength in a given model does not guarantee that this land-atmosphere connection is used to pass the proper information through the model. Promising results are attained when conditionally sampling on extreme soil moisture content. Additional analyses and runs will come, including repetition of GLACE2 over a subset of interesting years in a longer climate record (e.g. using the WATCH-driven LSMs), and desires to launch a GLACE-future.

#### action items

Action items include

- *Eleanor* to coordinate the WATCH actions directed towards running an analysing regional projections over the AMMA area
- *Bart and Sonia* to formulate a GLACE-future experiment
- *Joe, Michael, Obbe and Cor* to merge the various diagnostics further, and as much as possible formulate them in “mappable” units
- *Christa* to explore participating in the GABLS 3<sup>rd</sup> testcase, encompassing a number of days with varying advection conditions over the Cabauw tower.

Further announcements/actions

- Bart will soon upgrade the GLASS website, providing up to date information on relevant activities in the new workinggroup structure, such as links to Landflux, WATCH, Fluxnet, C-LAMB, RAMI4PILPS etc
- Please consider attending the GLASS/ECMWF workshop on land data processes (modelling, data assimilation, predictability) between 8-11 November in Reading.
- A next GLASS panel meeting will be coupled to a relevant workshop somewhere mid 2010, and not be split up as past year. A candidate is Taikan Oki's GSWP3 meeting in Tokyo, June 2010. Please let me know if there are other venues that could serve as a travel trigger.
- Officially next year my three-years chairmanship is over, and Martin needs to be provided with a new co-chair. If you feel inclined to take this challenging task upon you, please let me know.