Land Model-Data Assimilation/Fusion for Carbon, Water and Energy Balance

Summary of Current Status and Future Aspirations

To-date there has been groups/individuals working in somewhat isolation, with some flow of information between groups and sharing of resources (data access, software and expertise).

The aim for the future is for a cooperative approach, with free access to common modelling infrastructure and the sharing of data and know-how between CSIRO, BoM and Universities colleagues (hereafter, the *land model-data fusion* (MDF) *community*).

Active collaboration is seen to be the mechanism for achieving this.

Repository for Data Sets of Common Interest

Linkages with the Terrestrial Ecosystems Resources Network (TERN)

Seek a active commitment from TERN to make available the MDF community those data sets of common interest.

The MDF community, in turn, supply to supply the data sets they create to the Network.

Partitioning of the data sets into two categories: (1) Research Quality Products – data in final form, reviewed, uncertainty assessed and documented; (2) Experimental Products – data yet to be finalised (implicit/explicit disclaimer that these data are to be used at own risk).

Data quality control and processing stream to be transparent to all users.

Desirable data sets

- Sub-daily (hourly) meteorological forcing
    - NWP ensembles
    - point and interpolated data sets
        - e.g. rainfall, temperature, pressure, vapour pressure,

- Gridded spatial data
  - + Remote sensing radiation
  - + rainfall, intensity, VP, Ta, ...
 * Spatial maps of model parameter
  - Soil (hydraulic & texture) properties ...
  - Micro-met (canopy height, roughness, zero plane displacement)
  - land cover ... ((if too many classes, individual researcher puts reduced set back into the data pool))

- Associated uncertainty
  - Not exactly clear about how to express uncertainty for some ? not essential but highly recommended

Gaps in Capabilities

Where are the next generation of experts coming from?

Training or recruiting for earth system DA + F specialists ... Masters programme?

Make the most of existing BoM and CSIRO scholarship opportunities (CEO & Flagship) and encourage management to provide more
  Top-ups and more
  Flexible to study what student wanted as long as it is relevant to the groups research ... view this as a strategic investment.

Are the existing international "summer schools" (e.g. NCAR summer schools land, ocean, atmos.) under utilised? Should be conduct our own?

Wiki - go-to page resources for newbies to the area.

Software Resources

Toolbox for DA

... most people code up the algorithms themselves. Some packages (not a lot) exist that accessable to all. How well known?

OpenDA ... investigate exactly what it has to offers for hydrological MDF applications..

Land Information System (LIS)LIS
   Collection of land surface models in a framework designed for assimilation

Suggest embedding CABLE in LIS.

NCAR data assim. research testbed

Software repository ... contributions from this community shared for all. Open sources code repositories CRAN, matlab, PGApack, ... modular, simple little bits of code
        --- something a more controled ... asking specific questions
        --- something a little less controlled to share code

Ideas for Active Collaboration

Short-term achievables

Support (financial and man-power) planned and future field validation campaigns in support of remotely-sensed data products e.g. SMOS Tb and Soil moisture

Medium-terms goals

Recommend to management that they support the redirection of staff to address and problem of interest to the land MDF community.

Select a study area (e.g. MDB) for testing assimilation/fusion techniques.
        * define a problem of common interest (H2O and C fluxes)
        * inter-comparison of techniques ... highlighting choice of "how to"'s i.e. objective function
        * make an assessment of the state of the art

Long-term goals

Start gauging interest/support for *Centre of Excellence in DA for Earth System Science.*

Keep ear out and make the most of opportunities ARC Special Research Centre calls

- Needs a strong business case
- What is the danger to Australia is we fall behind the rest of the World in the area of land data assimilation?

Great opportunity for Australia to be a World leader in earth system data assimilation ... e.g. through the development of Australian soil moisture.