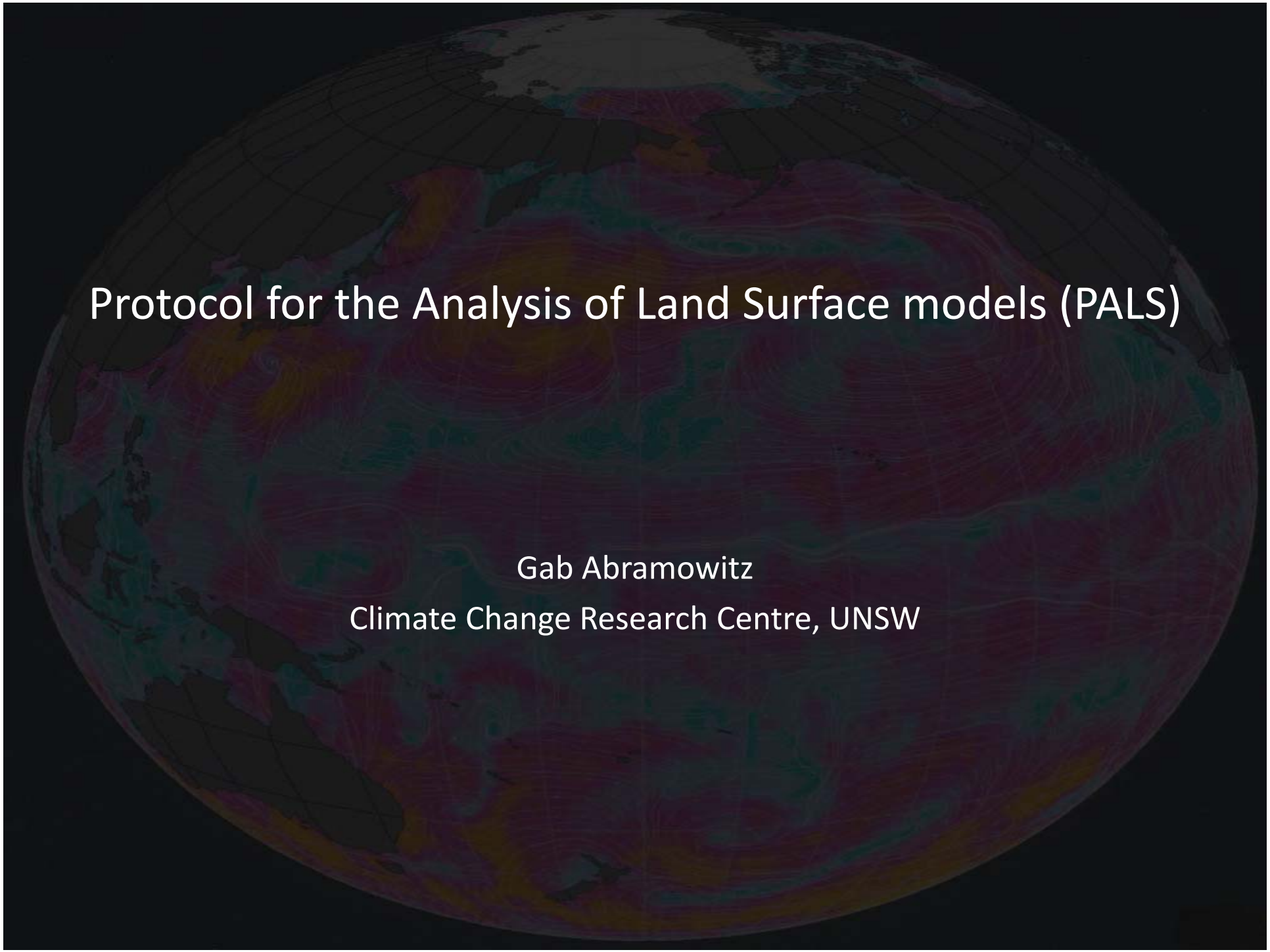


Protocol for the Analysis of Land Surface models (PALS)

Gab Abramowitz

Climate Change Research Centre, UNSW

What is PALS?

PALS is a web site/application (pals.unsw.edu.au) that aims to provide:

- Access to a range observed and model data products (e.g. gap-filled L4 flux tower data and land surface model (LSM) simulations)
- A collection of automatically generated analyses (graphs/plots) once flux tower or model output data is uploaded in a standardised format
  - No limit on the number of different analysis scripts
  - All data sets are version controlled automatically
- An ongoing automated model-data comparison experiment (think PILPS)

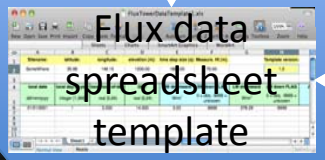
PALS is still in development – website went up end 2010

What PALS aims to achieve

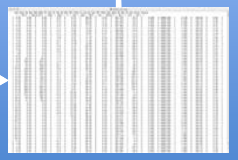
- Bridge observation and modelling communities where data formatting has been an issue
- Fast, efficient access to a large collection of flux and model output data
  - Science questions regarding: Ecosystem relationships, community-wide land surface model performance etc can be investigating simply by adding new analyses to the PALS analysis database
- Provide a fast, detailed, free evaluation procedure for model developers
  - Allows smaller research groups to develop LSMs effectively
  - E.g. soon to provide testing environment for evaluation CABLE improvements
- Provide a mechanism for the standardisation of LSM evaluation and identification of systematic performance issues in LSMs

PALS for a flux tower data provider

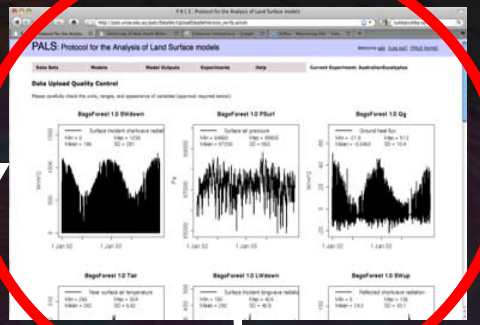
upload data



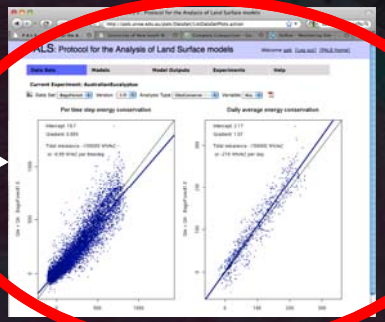
Flux data spreadsheet template



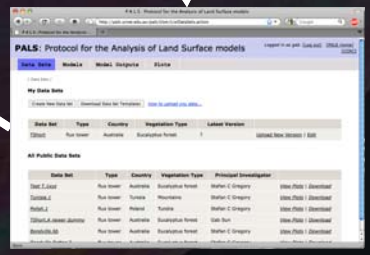
Automated quality control, version control



Data provider okays PALS' interpretation of data (e.g. units)

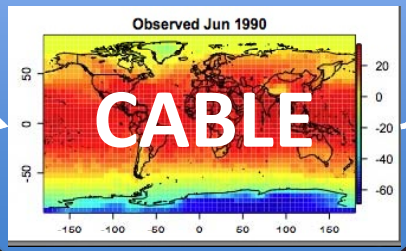


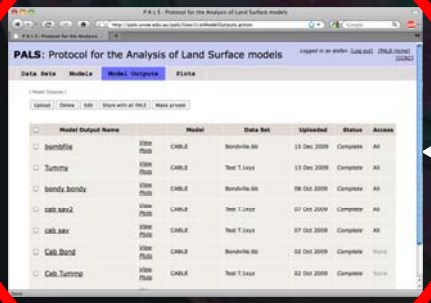
Analyses run on data set



Data set as netcdf and plots available on public data lists

Modellers download data, upload simulations



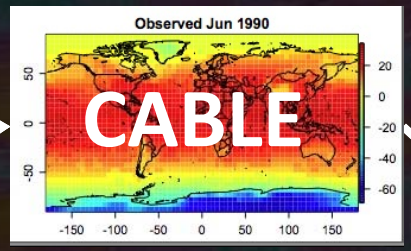


Model output and plots available to data providers

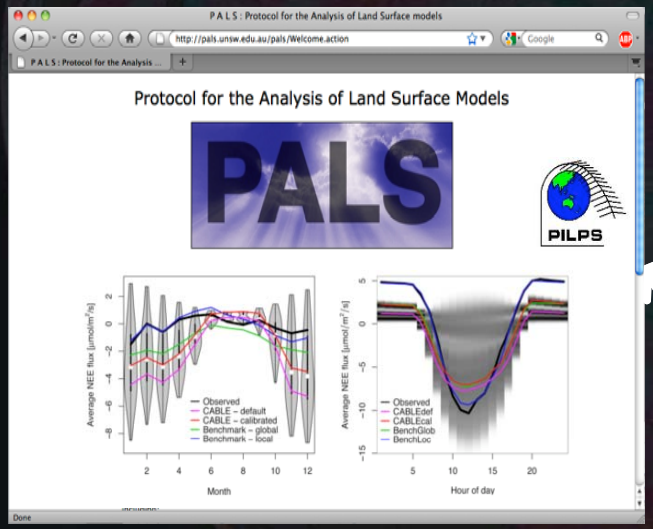
PALS for a land surface modeller

Download driving data sets, meta data and plots

Run LSM



Upload netcdf model simulation as 'private', 'provider' or 'public'



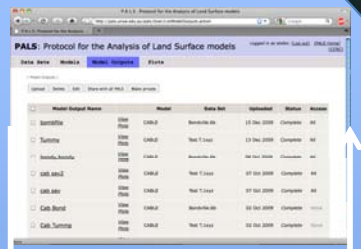
For model development

private

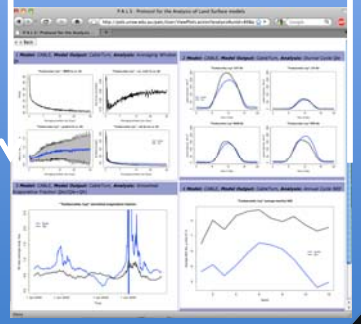
Available to data provider

public

Available to all PALS users



Automated plot generation



Ongoing model comparison experiment on website

More detail

- Ability to store meta data:
  - Ancillary files, gap filling code, model code, parameter sets, restart files, log files etc associated with data sets;
  - flexible privacy levels (i.e. who as access to it)
  - aids reproducibility
- Version history of all data is stored and is easily retrievable
- Users are able to contribute plot scripts to either data set or model output analysis script sets:
  - All plotting scripts are in R and available as an R package (on CRAN sometime 2011/12)
  - No limit on the number of plotting scripts (~50 currently take ~5 seconds)
  - New plotting scripts are executed on all uploaded model simulations in the database

PALS: Protocol for the Analysis of Land Surface models

Welcome gab [Log out] [PALS Home] [Help]

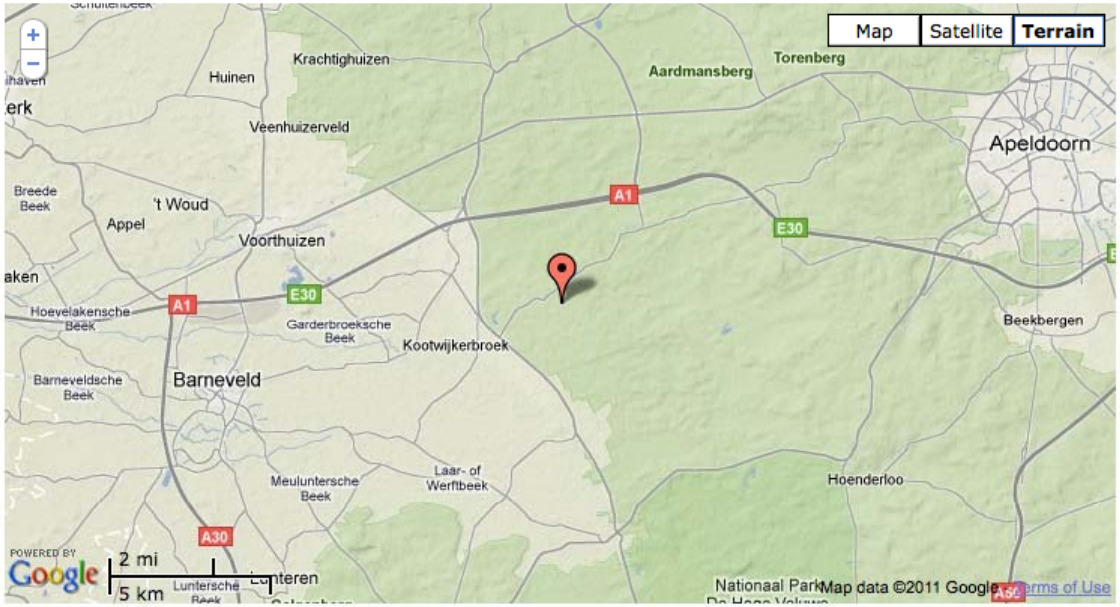
Currently showing all public data. Alternatively enter a PALS experiment.

Data Sets | **Models** | **Model Outputs**

Data Set: Loobos

Edit | Upload New Version | Download Data Set Templates

Data type:	flux tower
Created by:	Gab Abramowitz
URL:	http://www.fluxdata.org:8080/SitePages/siteInfo.aspx?NL-Lo
Latitude:	52.1679
Longitude:	5.74396
Elevation:	25.0 m
Maximum Vegetation Height:	15.0 m
Tower Height:	24.0 m
UTC offset:	2.0 h
Vegetation Type:	Evergreen needleleaf
Country:	Netherlands
Date at timestamp represents:	preceding time period



References:

A. A. Arain; N. Restrepo-Coupe. 2005. Net ecosystem production in a temperate pine plantation in southeastern Canada Agricultural and Forest Meteorology. 128:3-4, 223-241.

B. Gioli; F. Miglietta; B. De Martino; R. W. A. Hutjes; H. A. J. Dolman; A. Lindroth; M. Schumacher; M. J. Sanz; G. Manca; A. Peressotti; E. J. Dumas. 2004. Comparison between tower and aircraft-based eddy covariance fluxes in five European regions Agricultural and Forest Meteorology. 127:1-2, 1-16.

Aijm Van Dijk; A. J. Dolman. 2004. Estimates of CO2 uptake and release among European forests based on eddy covariance data Global Change Biology. 10:9, 1445-1459.

M. K. van der Molen; J. H. C. Gash; J. A. Elbers. 2004. Sonic anemometer (co)sine response and flux measurement - II. The effect of introducing an angle of attack dependent calibration Agricultural and Forest Meteorology. 122:1-2, 95-109.

G. Churkina; J. Tenhunen; P. Thornton; E. M. Falge; J. A. Elbers; M. Erhard; T. Grunwald; A. S. Kowalski; U. Rannik; D. Sprinz. 2003. Analyzing the ecosystem carbon dynamics of four European coniferous forests using a biogeochemistry model Ecosystems. 6:2, 168-184.

UTC offset:	10.0 h
Vegetation Type:	Evergreen broadleaf
Country:	Australia
Date at timestamp represents:	proceeding time period

References:

Leuning, R., H. A. Cleugh, S. J. Zegelin, and D. Hughes, 2005: Carbon and water fluxes over a temperate Eucalyptus forest and a tropical wet/dry savanna in Australia: Measurements and comparison with MODIS remote sensing estimates. Ag- ric. For. Meteor., 129, 151–173.

Comments:

The forest is classified as wet sclerophyll, the dominant species is Eucalyptus delegatensis, and average tree height is 40 m. Elevation of the site is 1200 m and mean annual precipitation is 1000 mm. The Bago and Maragle State Forests are adjacent to the south west slopes of southern New South Wales and the 48,400 ha of native forest have been managed for wood production for over 100 years.

The instrument mast is 70 m tall. Fluxes of heat, water vapour and carbon dioxide are measured using the open-path eddy flux technique. Supplementary measurements above the canopy include temperature, humidity, windspeed, wind direction, rainfall, incoming and reflected shortwave radiation and net radiation. Profiles of temperature, humidity and CO2 are measured at seven levels within the canopy. Soil moisture content is measured using Time Domain reflectometry, while soil heat fluxes and temperature are also measured. Hyperspectral radiometric measurements are being used to determine canopy leaf-level properties.

Latest Version

Version name	Upload date	Description of changes	QC	Met	Flux	Original	Public	
TumbaTest.0.1	22 Nov 2010 2:56	First version.	*View*	*.nc*	*.nc*	*.csv*	true	
TumbaTest.0.2	10 Feb 2011 11:13	There are no actual changes, this is just to demonstrate the nature of version control on PALS.	*View*	*.nc*	*.nc*	*.csv*	true	
TumbaTest.0.2.5	10 Feb 2011 11:32	As before, there are no actual changes, this is just to demonstrate the nature of version control on	*View*	*.nc*	*.nc*	*.csv*	true	

P A L S : Protocol for the Analysis of Land Surface models

http://pals.unsw.edu.au/pals/DataSet/ListDataSetPlots.action

DECRA

Google Docs – Home | PALS Features/Bugs | Important Dates – Australian R... | P A L S : Protocol for the Analys...

PALS: Protocol for the Analysis of Land Surface models

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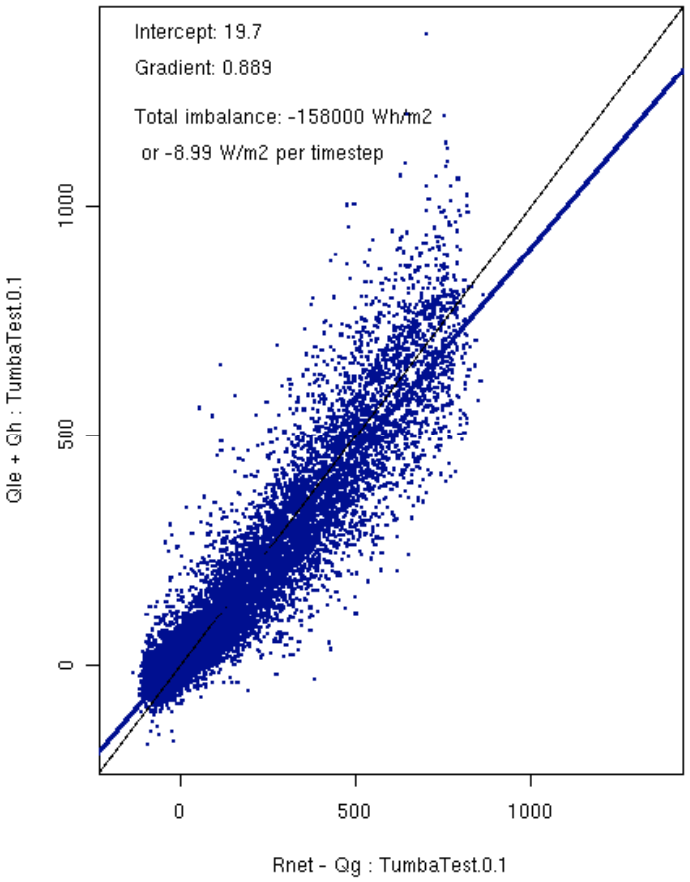
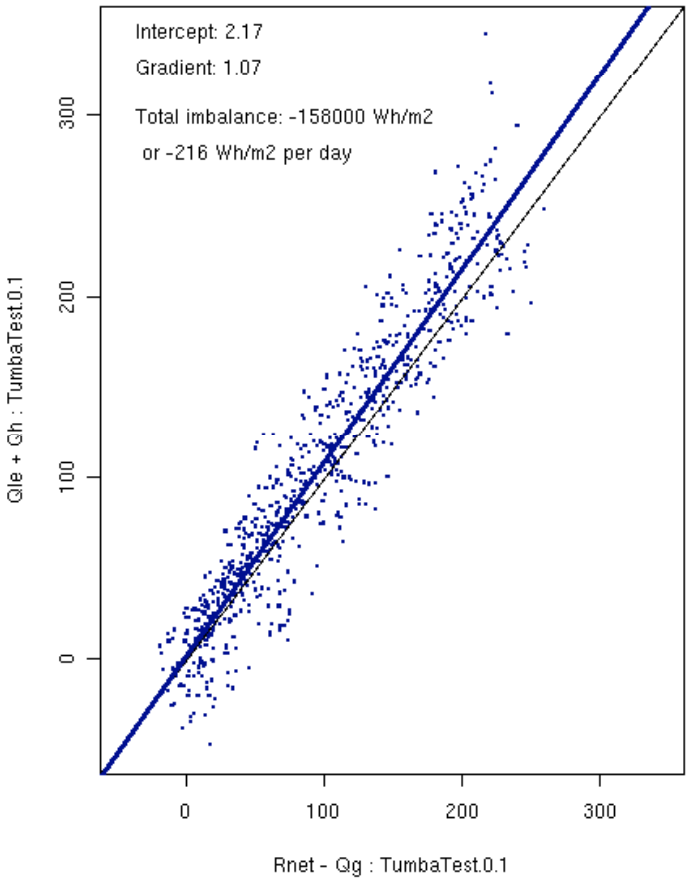
Data Sets | **Models** | **Model Outputs**

Data Set TumbaTest Version 0.1 Analysis Type ObsConserve Variable ALL

Per time step energy conservation



Daily average energy conservation



Done

PALS: Protocol for the Analysis of Land Surface models

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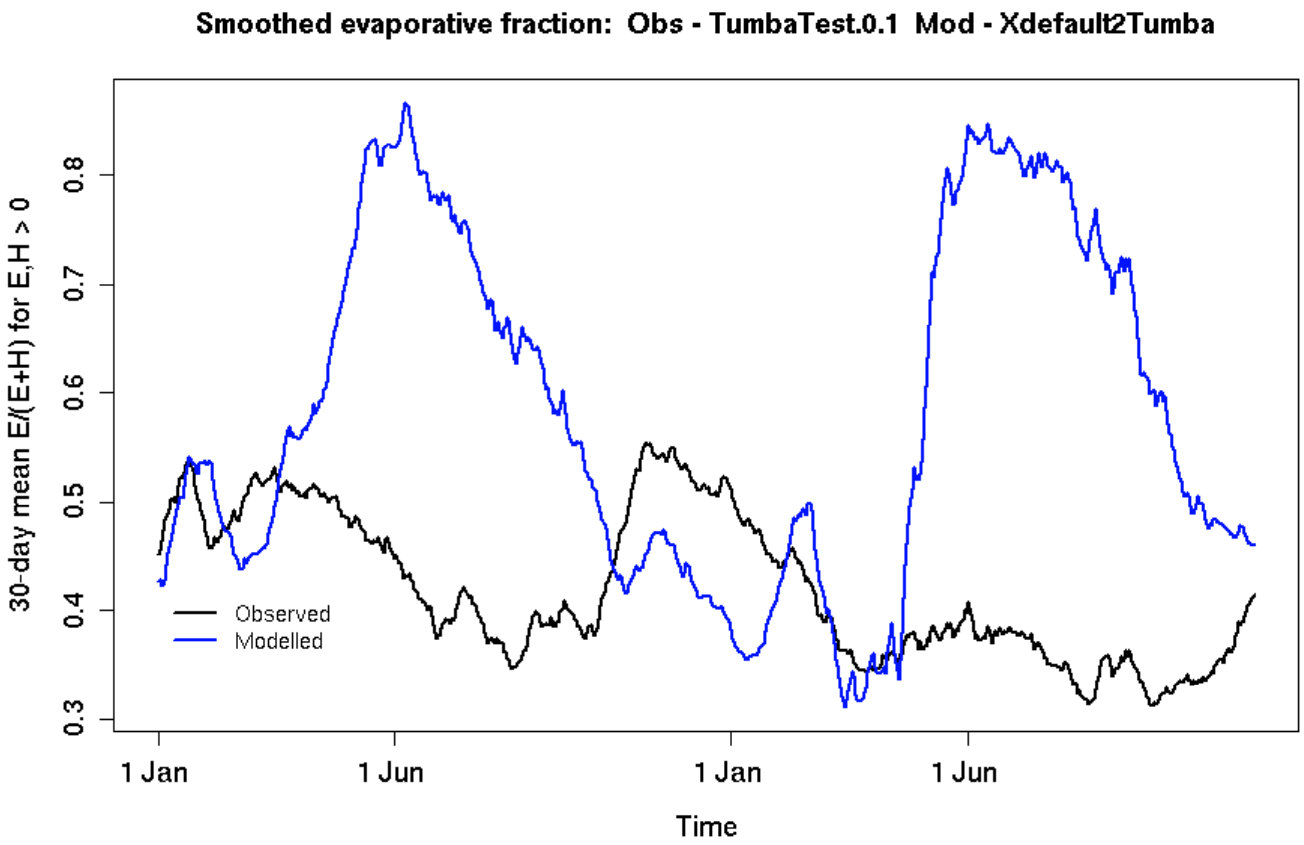
Data Sets | **Models** | **Model Outputs**

Model: Xmodel.1.4b | Model Output: Xdefault2Tumba | Analysis Type: EvapFrac | Variable: ALL



More information about this analysis type...

Smoothed evaporative fraction

This plot is a smoothed time series of evaporative fraction - latent heat flux divided by the sum of latent and sensible heat fluxes (Qle/(Qle+Qh)). At current settings, it shows the moving average of a 30-day window, and only includes times when both fluxes are positive (daytime).

Interpretation: this plot is commonly interpreted as a proxy for soil moisture - it gives an indication of how closely model soil moisture dynamics track those of the site. In very wet densely forested sites, it may also provide information about a model's canopy interception parametrisation. Both top layer (through evaporation) and below surface soil moisture (through transpiration) contribute to Qle, as well as direct canopy evaporation in the time immediately following rainfall events.

Temporal Requirements: latent (Qle) and sensible heat flux (Qh) time series

Spatial Requirements: single site.

PALS: Protocol for the Analysis of Land Surface models

Currently showing all public data. Alternatively enter a PALS experiment.

Help

Contact
Disclaimer
What's New?
Suggestions / Improvements
Submitting new analysis scripts
List of PALS users

Flux tower community:

Why contribute my data?
Data requirements
Who has access to my data?
Data uploading instructions

Modelling community

Why use PALS with my LSM?
Who has access to my data?

Experiments

What is a PALS Experiment?

Why would I contribute my flux data to PALS?

Free analysis. Each time you upload a version of your data set, PALS will run a set of analysis scripts on your data, producing a collection of graphs that you can view on PALS or download. This collection of analyses is expanding all the time, in fact we encourage you to submit additional types of analyses to run.

Access to model simulations. As a data provider for PALS, you will have access to at least one model simulation from each model that uses your data as a driver on PALS. You also of course also have access to all the PALS analyses that compare these model simulations to your flux data. As with analyses on data sets, all users are encouraged to submit additional analysis scripts.

Free data management. You are welcome to maintain as many versions of your data set as you'd like on PALS - analyses will run on all uploaded versions. You can choose which of your data set versions will be available to other PALS users to drive model simulations. PALS will automatically version control all the data set versions you upload.

Raise your site's profile in the modelling community. PALS gives you the opportunity to have your data widely used in the land surface modelling community. It converts your flux data from a spreadsheet to a standardised netcdf format that is widely used in the modelling community. This aids collaboration both within PALS and externally.

Collaborate with modellers. PALS aims to both give model users a better understanding of the flux data they use and give data providers a better understanding of land surface modelling.

Beginnings…

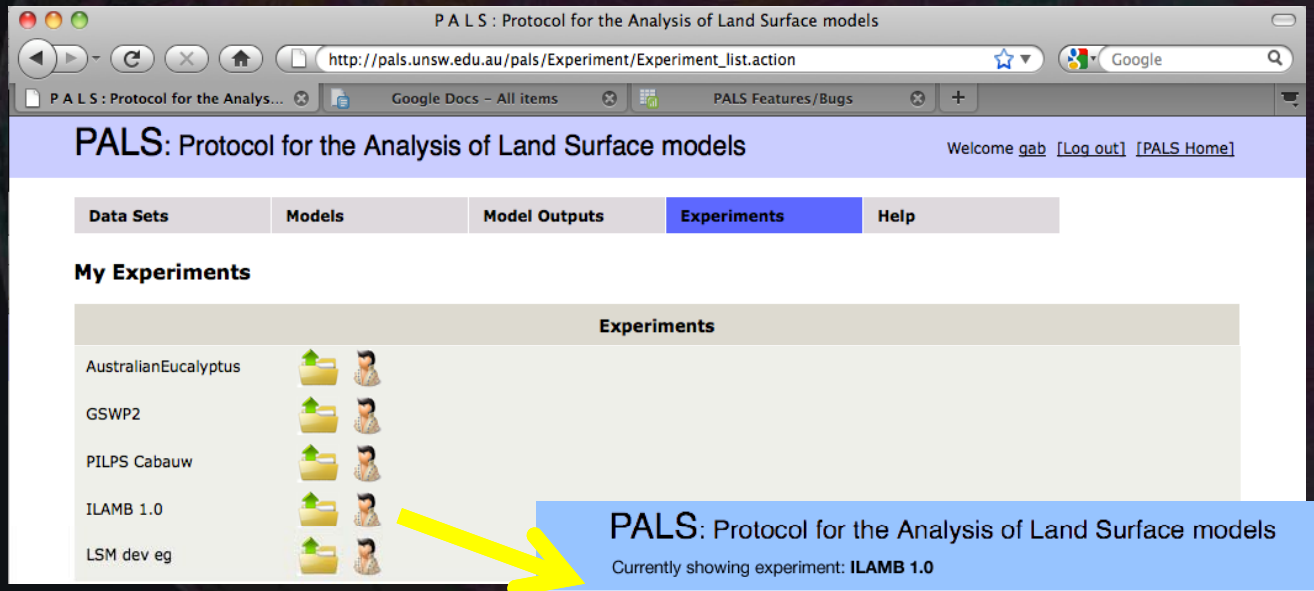
- First stage / proof of concept for PALS uses flux tower data an single-site model simulations
  - Small file sizes
  - High temporal resolution
    - many possible metrics
    - good process evaluation potential
  - Many data providers
  - Under-utilised modelling resource
  - Good spatial distribution of sites

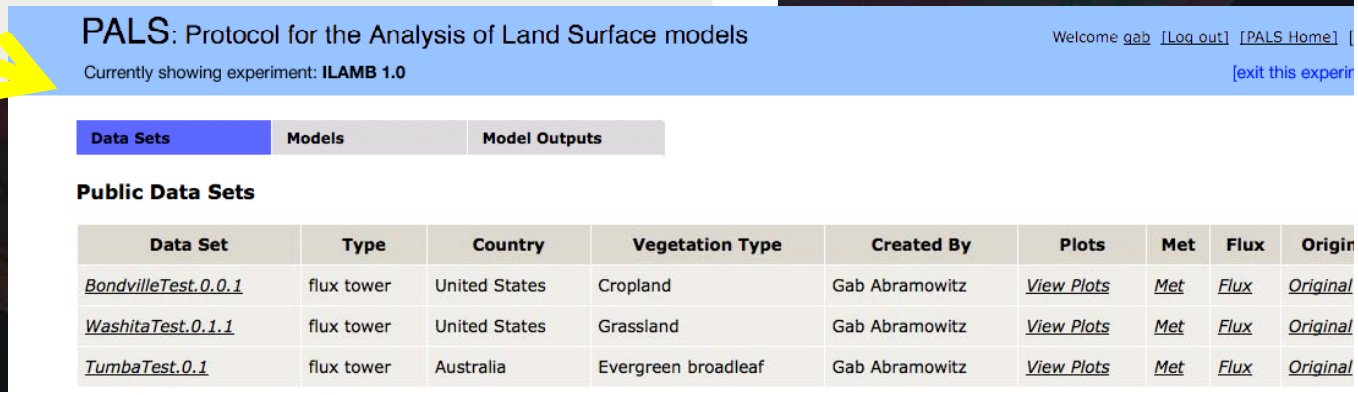
What's missing / PALS future

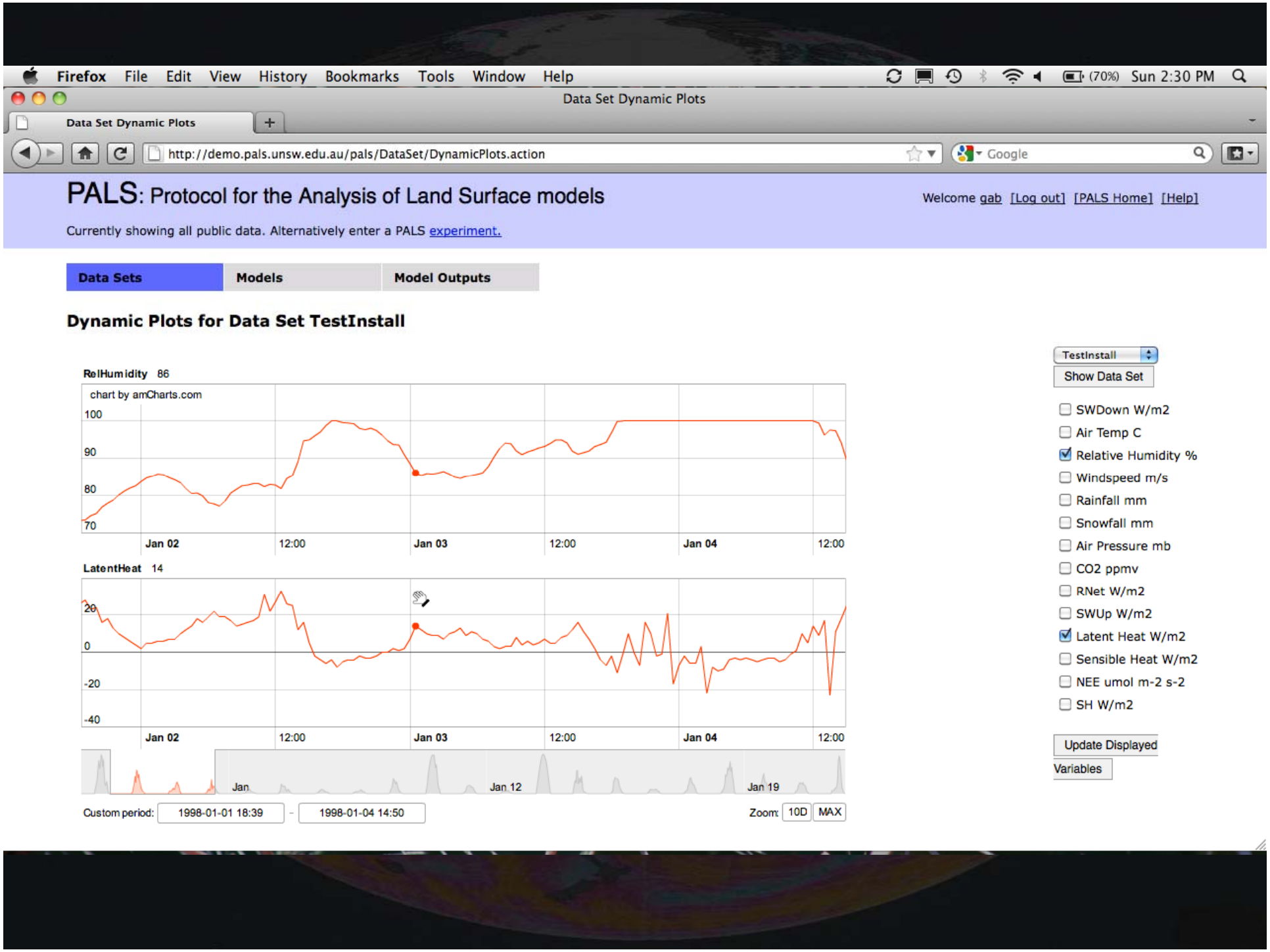
- PALS is currently essentially content empty – in that sense just starting
  - Starting to directly engage flux data collectors / porting from Fluxnet
  - AWRA keen to support development for benchmarking hydrological models (van Dijk)
- PALS wants you – it's ready for data upload and feedback
- Better representation and use of uncertainties in flux tower data
- Expansion beyond single-site analysis
- Empirical benchmarking of LSMs using flux tower data
- Designing ongoing model comparison in some analysis types
- If you like the idea please help to shape or even drive it…

PALS experiments

- A PALS ‘experiment’ is a private implementation of the PALS site
  - New database of Data Sets, Models, Model Outputs and Analyses
  - Data Sets and Analyses can be imported from the main PALS site
  - Can be available to only a subset of PALS users






Firefox File Edit View History Bookmarks Tools Window Help
(70%) Sun 2:30 PM
Data Set Dynamic Plots
Data Set Dynamic Plots
http://demo.pals.unsw.edu.au/pals/DataSet/DynamicPlots.action
Google
PALS: Protocol for the Analysis of Land Surface models
Welcome gab [Log out] [PALS Home] [Help]
Currently showing all public data. Alternatively enter a PALS experiment.
Data Sets
Models
Model Outputs
Dynamic Plots for Data Set TestInstall
RelHumidity 86
chart by amCharts.com
100
90
80
70
Jan 02
12:00
Jan 03
12:00
Jan 04
12:00
LatentHeat 14
20
0
-20
-40
Jan 02
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Jan 03
12:00
Jan 04
12:00
Jan
Jan 12
Jan 19
Custom period: 1998-01-01 18:39 - 1998-01-04 14:50
Zoom: 10D MAX
TestInstall
Show Data Set
SWDown W/m2
Air Temp C
Relative Humidity %
Windspeed m/s
Rainfall mm
Snowfall mm
Air Pressure mb
CO2 ppmv
RNet W/m2
SWUp W/m2
Latent Heat W/m2
Sensible Heat W/m2
NEE umol m-2 s-2
SH W/m2
Update Displayed Variables