$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

$$\mathrm{MAE} = \frac{\sum_{i=1}^{n}|y_i - x_i|}{n}$$

$$\mathrm{MSE} = \frac{1}{n}\sum_{i=1}^{n}\left(Y_i - \hat{Y}_i\right)^2$$

$$\mathrm{NSE} = 1 - \frac{\sum_{t=1}^{T}(Q_o^t - Q_m^t)^2}{\sum_{t=1}^{T}\left(Q_o^t - \overline{Q_o}\right)^2}$$

$$\mathrm{RMSD} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_i - x_0)^2}.$$

$$\mathrm{bias}(T,\theta) = \mathrm{bias}(T) = \mathrm{E}(T) - \theta$$

Evaluation Update

Siyuan Tian

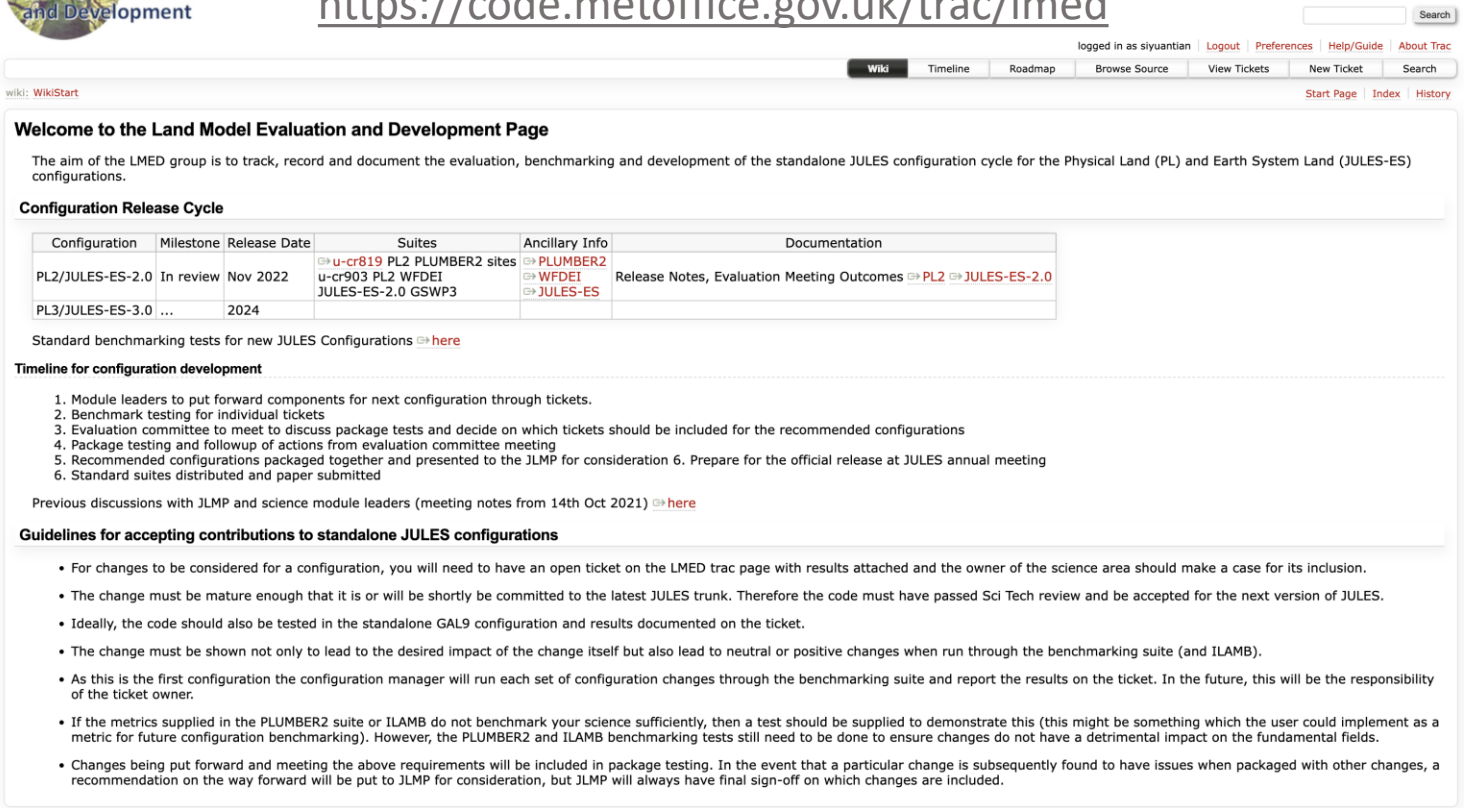
The Bureau of Meteorology

Physical Land Configuration & Benchmarking Suite

Heather Rumbold (UKMO)

Land Model Evaluation and Development

https://code.metoffice.gov.uk/trac/lmed



logged in as siyuantian | Logout | Preferences | Help/Guide | About Trac

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Welcome to the Land Model Evaluation and Development Page

The aim of the LMED group is to track, record and document the evaluation, benchmarking and development of the standalone JULES configuration cycle for the Physical Land (PL) and Earth System Land (JULES-ES) configurations.

Configuration Release Cycle

Configuration	Milestone	Release Date	Suites	Ancillary Info	Documentation
PL2/JULES-ES-2.0	In review	Nov 2022	u-cr819 PL2 PLUMBER2 sites u-cr903 PL2 WFDEI JULES-ES-2.0 GSWP3	PLUMBER2 WFDEI JULES-ES	Release Notes, Evaluation Meeting Outcomes PL2 JULES-ES-2.0
PL3/JULES-ES-3.0	...	2024			

Standard benchmarking tests for new JULES Configurations here

Timeline for configuration development

1. Module leaders to put forward components for next configuration through tickets.
2. Benchmark testing for individual tickets
3. Evaluation committee to meet to discuss package tests and decide on which tickets should be included for the recommended configurations
4. Package testing and followup of actions from evaluation committee meeting
5. Recommended configurations packaged together and presented to the JLMP for consideration 6. Prepare for the official release at JULES annual meeting
6. Standard suites distributed and paper submitted

Previous discussions with JLMP and science module leaders (meeting notes from 14th Oct 2021) here

Guidelines for accepting contributions to standalone JULES configurations

- For changes to be considered for a configuration, you will need to have an open ticket on the LMED trac page with results attached and the owner of the science area should make a case for its inclusion.
- The change must be mature enough that it is or will be shortly be committed to the latest JULES trunk. Therefore the code must have passed Sci Tech review and be accepted for the next version of JULES.
- Ideally, the code should also be tested in the standalone GAL9 configuration and results documented on the ticket.
- The change must be shown not only to lead to the desired impact of the change itself but also lead to neutral or positive changes when run through the benchmarking suite (and ILAMB).
- As this is the first configuration the configuration manager will run each set of configuration changes through the benchmarking suite and report the results on the ticket. In the future, this will be the responsibility of the ticket owner.
- If the metrics supplied in the PLUMBER2 suite or ILAMB do not benchmark your science sufficiently, then a test should be supplied to demonstrate this (this might be something which the user could implement as a metric for future configuration benchmarking). However, the PLUMBER2 and ILAMB benchmarking tests still need to be done to ensure changes do not have a detrimental impact on the fundamental fields.
- Changes being put forward and meeting the above requirements will be included in package testing. In the event that a particular change is subsequently found to have issues when packaged with other changes, a recommendation on the way forward will be put to JLMP for consideration, but JLMP will always have final sign-off on which changes are included.

Release of the first standard configurations for standalone JULES

- Configurations are now “chilled”
- Require official sign off by the JLMP

Official release naming:
Earth System: JULES-ES-2.0
Physical Land: PL2

Example PL2 suites are documented on the LMED trac pages (PLUMBER2 and WFDEI, GSWP3 ES)

Met Office

Physical Land Configuration & Benchmarking Suite

Heather Rumbold (UKMO)

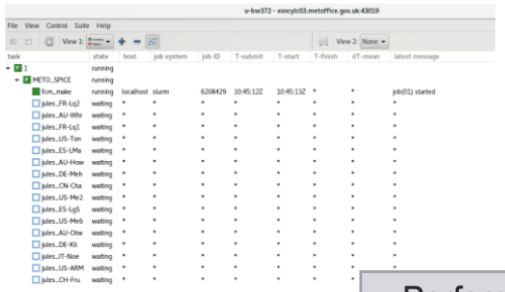
u-bx465

PLUMBER2 data
170 sites from FLUXNET2015, FLUXNET La Thuile & OzFlux
+
canopy height, LAI reference height & IGBP vegetation
+
HWSD soils

Python script → convert jules input variables into json file


```
{
  "AR-SLu": {
    "data_start": "2010-01-01 00:00:00",
    "data_end": "2011-01-01 00:00:00",
    "data_period": 1800,
    "drive_file": "/data/users/hashton/PLUMBER2/met_f
    "latitude": -33.4648,
    "longitude": -66.4598,
    "spinup_start": "2010-01-01 00:00:00",
    "spinup_end": "2011-01-01 00:00:00",
    "main_run_start": "2010-01-01 00:00:00",
    "main_run_end": "2011-01-01 00:00:00",
    "timestep_len": 1800,
    "z1_tq_in": 11.0,
    "z1_uv_in": 11.0
  },
```


Rose suite
Run JULES for all sites in json file

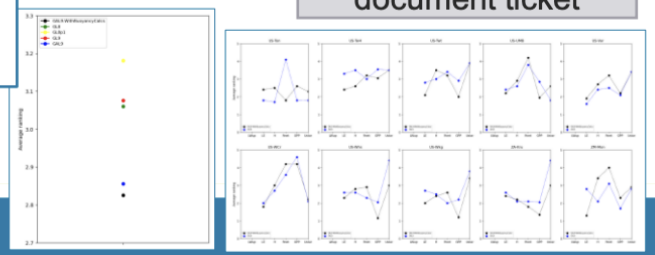


Calculate output metrics*:
JULES vs. Obs for every site, for LWup, LE, H, Rnet, GPP & Ustar, for each configuration

Configuration/ benchmark are ranked for each metric, var, site

Perform the average ranking of metrics for every site and variable

Plot output and document ticket



Benchmark configurations:
Standalone versions of GL8, GL8.1, GL9 & GAL9

PLUMBER2 (PALS Land Surface Model Benchmarking Evaluation Project 2)

* Metrics: RMSE, MBE, NME, StdDevdiff, Correlation, 5thdiff, 95thdiff, PDFoverlap, Skewness, kurtosis

Future plans:

- Portability to other HPC systems (NCI gadi in progress)
- Including urban-plumber sites
- Upload outputs to ME.org
- Normalized metric value

Abramowitz G; Ukkola A; Hobeichi S; Cranko Page J; Lipson M; De Kauwe M; Green S; Brenner C; Frame J; Nearing G; Clark M; Best M; Anthoni P; Arduini G; Boussetta S; Caldararu S; Cho K; Cuntz M; Fairbairn D; Ferguson C; Kim H; Kim Y; Knauer J; Lawrence D; Luo X; Malyshev S; Nitta T; Ogee J; Oleson K; Ottlé C; Peylin P; de Rosnay P; Rumbold H; Su B; Vuichard N; Walker A; Wang-Faivre X; Wang Y; Zeng Y, 2024, On the predictability of turbulent fluxes from land: PLUMBER2 MIP experimental description and preliminary results, , http://dx.doi.org/10.5194/egusphere-2023-3084

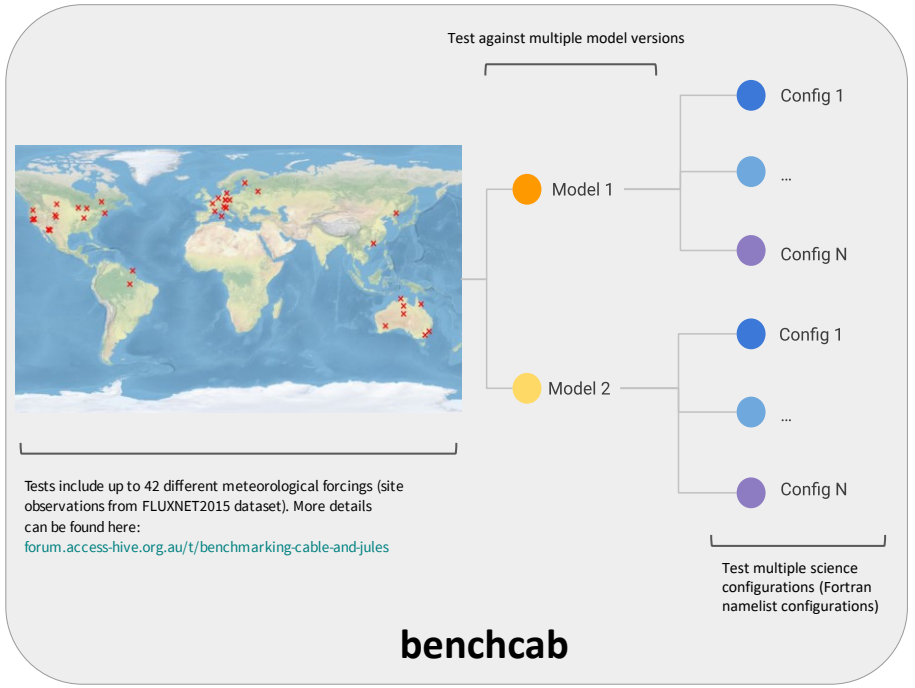
CABLE evaluation standardised with benchcab and modelevaluation.org

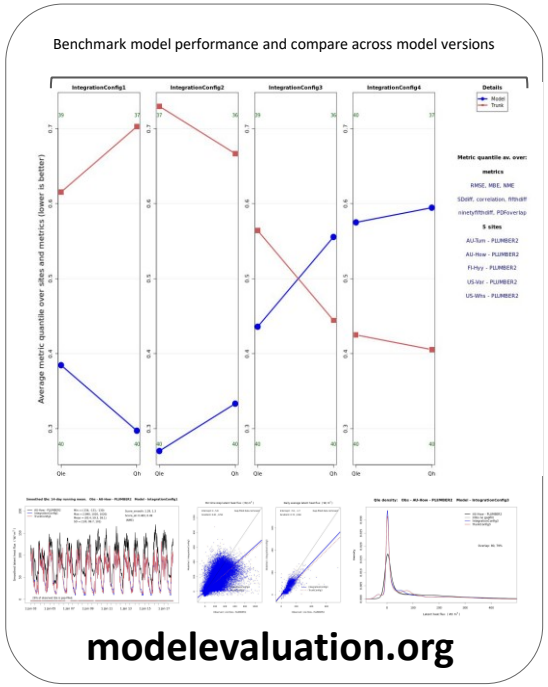
Claire Carouge (ACCESS-NRI)

benchcab creates a set of standardised simulations and evaluation plots.

1 command to:

- Compile the model versions (base and dev)
- Setup and run simulations for 42 sites x 2 model versions x 4 science configurations
- Perform regression testing
- Upload outputs to me.org and launch analysis
- Provide code coverage information (optional)





Future plans:

- Connect to ILAMB for spatial configurations
- Expand modelevaluation.org API for a fully automated process
- Improve modelevaluation.org figures.
- Expand to urban, ice and water "sites" (possibly synthetic data sites)
- Expand to other land models and platforms

Australia's climate simulator

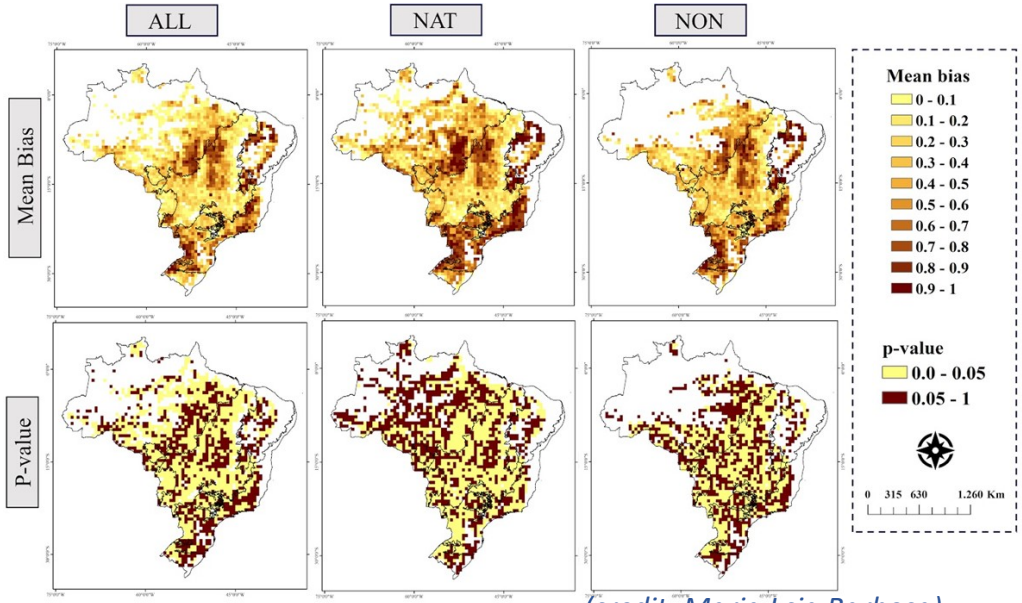
ACCESS National Research Infrastructure

Fire Module Evaluation

Chantelle Burton (UKMO), Douglas Kelley (UK CEH), Maria Lcia Barbosa

Evaluation of INFERNO, both in JULES and in UKESM:

- Burnt area global totals and distributions
- Fire emissions global totals
- Trends over time
- Impact of fire on vegetation and carbon cycle over time
- Use of ilamb, fireMIP benchmarking (designed by Doug)
- OptimESM project: evaluating fire in UKESM against 2 other Earth System Models (EC-Earth and CNRM)
- Bayesian/large ensemble model evaluation techniques



(credit: Maria Lcia Barbosa)

How do you use fire models?

Help us collect good practices for using global fire model outputs

Interview
Doug Kelley
doukel@ceh.ac.uk
Chantelle Burton
chantelle.burton@metoffice.gov.uk
Stacey New
stacey.new@metoffice.gov.uk

Questionnaire
https://forms.gle/ct5EV5MtdWQpgjXUA

Jamboards
https://jamboard.google.com/d/1airwbvhyAzmlGsSKNEPBFUKUQ-mZwQsllnztfDlkilw/edit?usp=sharing

SCIENCE

July 8, 2024

Three challenges for the future of transdisciplinary fire science

Announcing the release of the FLARE White Paper on Fire Science

As fire events become more intense and frequent, the urgency for **effective** and **proactive fire science** grows. The FLARE (Fire science Learning AcRoss the Earth System) Working Group, consisting of scientists from 14 countries and various disciplines, has produced a white paper to address the complexities of fire science from a holistic perspective. This paper compiles discussions from a workshop - organised by the Surface Ocean-Lower Atmosphere Study (SOLAS) and supported by the European Space Agency-Future Earth Joint Programme, PAGES, and BIOS - held in September 2023 at the Bermuda Institute of Ocean Science, summarising the current state of fire science and identifying future challenges. The document, titled *"Igniting Progress: Outcomes from the FLARE workshop and 3 challenges for the future of transdisciplinary Fire Science"* is now available for download.

Key highlights

Transdisciplinary collaboration: The FLARE initiative highlights the importance of collaboration across different fields to understand and address the challenges of fire science. This approach is particularly crucial for fire science as it crosses academic disciplines and societal actions, with Earth Observation (EO) playing a significant role.

Other Evaluation Studies

- Hashmi Fatima (NCMRWF): Soil Moisture Analysis over Hilly terrain for landslide warning during Heavy Precipitation

- Beiyao Xu (University of Leeds): calibrating and evaluating the rice parameters in JULES-crop based on O3-FACE datasets

- Fitsum Woldemeskel (Bureau of Meteorology): Evaluating JULES/UM-CaMa streamflow simulation for selected catchment worldwide

- Siyuan Tian (Bureau of Meteorology): Evaluating the impact of changing vegetation fraction and leaf area index in standalone JULES and coupled model over Australia

Thank you

siyuan.tian@bom.gov.au