A New Model Evaluation Framework for the International Land Model Benchmarking (ILAMB) Project [Poster #36]

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ILAMB Goals

- Develop community-accepted benchmarks for land model performance, with a focus on carbon cycle, ecosystem, surface energy, and hydrological processes.
- Apply the benchmarks to global model results.
- Support the design and development of a new, open source, benchmarking software system for both diagnostic and model intercomparison purposes.
- Strengthen linkages between experimental, monitoring, remote sensing, and climate modeling communities in the design of new model tests and new measurement campaigns.

An Open Source Benchmarking Framework
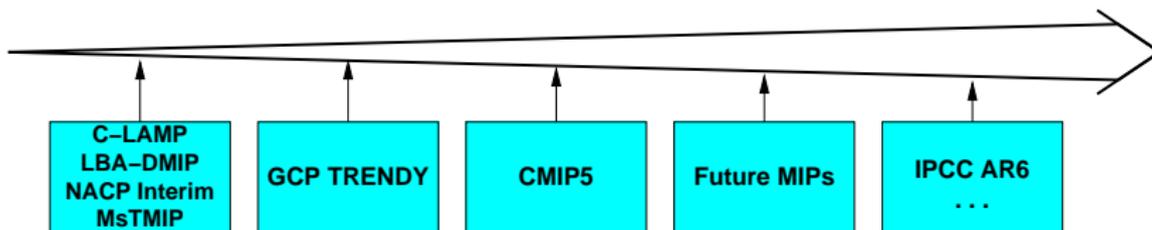
- Human capital costs of making rigorous model-data comparisons is considerable and constrains the scope of individual MIPs.

- Many MIPs spend resources "reinventing the wheel" in terms of variable naming conventions, model simulation protocols, and analysis software.

- **Need for ILAMB:** Each new MIP has access to the model-data comparison modules from past MIPs through ILAMB (*e.g.*, MIPs use one common modular software system). Standardized international naming conventions also increase MIP efficiency.

What is a Benchmark?

- A benchmark is a quantitative test of model function, for which the uncertainties associated with the observations can be quantified.

- Acceptable performance on benchmarks **is a necessary but not sufficient condition** for a fully functioning model.

- Since all data sets have strengths and weaknesses, an effective benchmark draws upon a broad set of independent observations to evaluate model performance on multiple space and time scales.

  See Poster #36 for more diagnostics from C-LAMP.
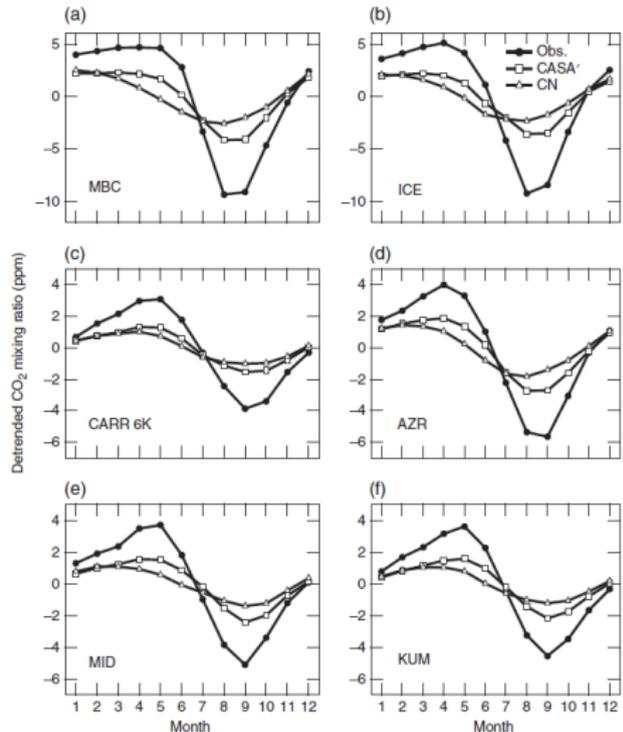
From Randerson et al. (2009)

International Land Model Benchmarking (ILAMB) Meeting
The Beckman Center, Irvine, CA, USA January 24-26, 2011

- Meeting Co-organized by Forrest Hoffman (UC-Irvine and ORNL), Chris Jones (UK Met Office Hadley Centre), Pierre Friedlingstein (U. Exeter), and Jim Randerson (UC-Irvine).
- About 45 researchers participated from the United States, Canada, the United Kingdom, the Netherlands, France, Germany, Switzerland, China, Japan, and Australia.

	Annual Mean	Seasonal Cycle	Interannual Variability	Trend	Data Source
Atmospheric CO$_2$					
Flask/conc. + transport		✓	✓	✓	NOAA, SIO, CSIRO
TCCON + transport		✓	✓	✓	Caltech
Fluxnet					
GPP, NEE, TER, LE, H, RN	✓	✓	✓		Fluxnet, MAST-DC
Gridded: GPP	✓	✓	?		MPI-BGC
Hydrology/Energy					
river flow	✓		✓		GRDC, Dai, GFDL
global runoff/ocean balance	✓				Syed/Famiglietti
albedo (multi-band)		✓	✓		MODIS, CERES
soil moisture		✓	✓		de Jeur, SMAP
column water		✓	✓		GRACE
snow cover	✓	✓	✓	✓	AVHRR, GlobSnow
snow depth/SWE	✓	✓	✓	✓	CMC (N. America)
T$_{air}$ & P	✓	✓	✓	✓	CRU, GPCP and TRMM
Gridded: LE, H	✓	✓			MPI-BGC, dedicated ET
Ecosystem Processes & State					
soil C, N	✓				HWSD, MPI-BGC
litter C, N	✓				LIDET
soil respiration	✓	✓	✓	✓	Bond-Lamberty
FAPAR	✓	✓			MODIS, SeaWIFS
biomass & change	✓			✓	Saatchi, Pan, Blackard
canopy height	✓				Lefsky, Fisher
NPP	✓				EMDI, Luyssaert
Vegetation Dynamics					
fire — burned area	✓	✓	✓		GFED3
wood harvest	✓			✓	Hurtt
land cover	✓				MODIS PFT fraction

Meeting Summary

- Five break-out groups met, one for each benchmark category, to identify cost function metrics and graphics.

- Measurement and model uncertainty must be characterized and spatial scaling mismatch considered for evaluation.

- Key objectives are to use publicly available data and freely available software.

- The R package will be used for generating statistical results and diagnostics.

- Five initial benchmarks will be implemented to evaluate existing TRENDY and CMIP5 model results.

Next Steps

- A team was identified to begin implementing 5–6 benchmarks in existing model results from TRENDY and now CMIP5.
- A draft document proposing additional new netCDF Climate and Forecast (CF) conventions, beyond those created for CMIP5, is available for comment.
- Monthly conference calls started in September.
- A development Wiki is coming soon.
- ILAMB Side Meeting at AGU Fall Meeting on Monday night.
- Next ILAMB meeting in Beijing, China, in early 2012.

International Land Model Benchmarking (ILAMB) Project
http://www.ilamb.org/

References

J. T. Randerson, F. M. Hoffman, P. E. Thornton, N. M. Mahowald, K. Lindsay, Y.-H. Lee, C. D. Nevison, S. C. Doney, G. Bonan, R. Stöckli, C. Covey, S. W. Running, and I. Y. Fung. Systematic assessment of terrestrial biogeochemistry in coupled climate-carbon models. *Global Change Biol.*, 15(9):2462–2484, Sept. 2009. doi:10.1111/j.1365-2486.2009.01912.x.