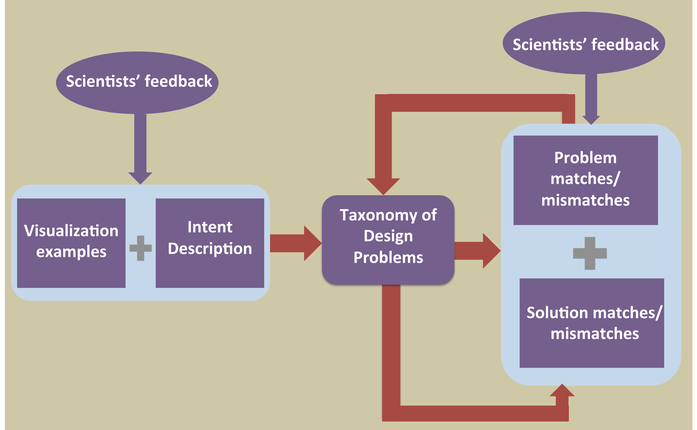
Improving Scientific Data Visualization

Aritra Dasgupta[1], Jorge Poco[1], Yaxing Wei[2], William Hargrove[3], Christopher Schwalm[4], Enrico Bertini[1], Robert Cook[2], Deborah Huntzinger[4], and Claudio Silva[1]

[1]New York University, [2]Oak Ridge National Laboratory*, [3]USDA-Forest Service, [4]Northern Arizona University

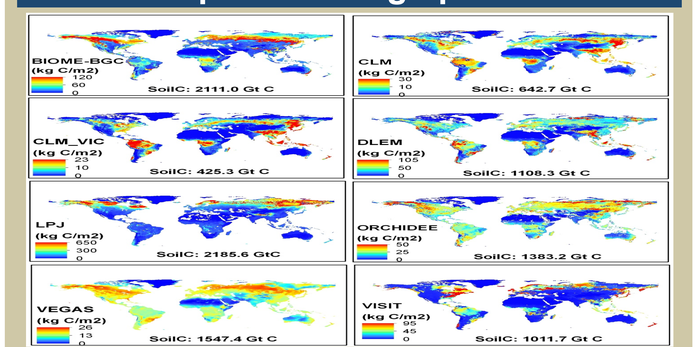
Aritra Dasgupta: dasgupta.aritra@gmail.com, Yaxing Wei: weiy@ornl.gov

Motivation



The iterative process for diagnosis and refinement of design problems in existing visualizations of terrestrial biosphere model analysis and inter-comparison.

Examples of design problems



Rainbow color maps cause inaccuracy, scale inconsistency causes misinterpretation and juxtaposing too many maps may cause inefficient comparison.

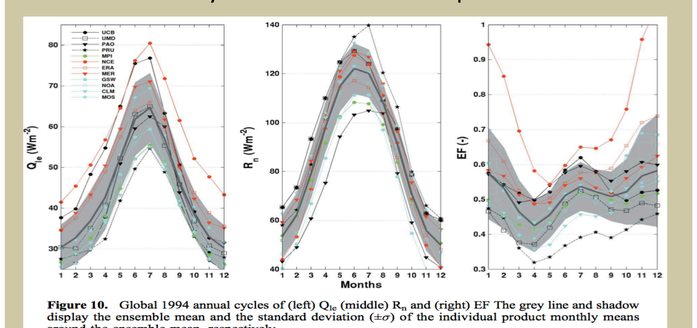


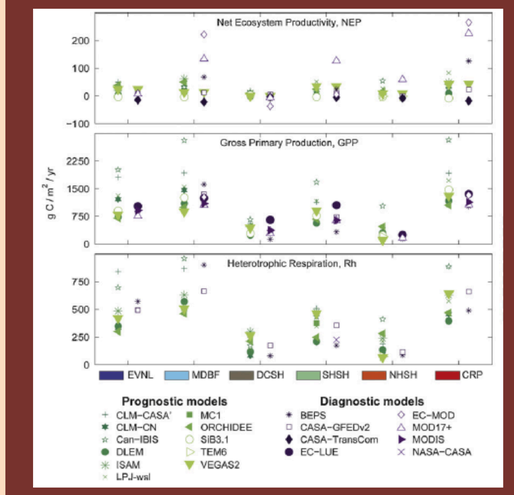
Figure 10. Global 1994 annual cycles of (left) Q_{le} (middle) R_n and (right) EF The grey line and shadow display the ensemble mean and the standard deviation ($\pm\sigma$) of the individual product monthly means around the ensemble mean, respectively.

Suboptimal choice of colors cause clutter, inappropriate choice of visual variables cause inefficient visual search

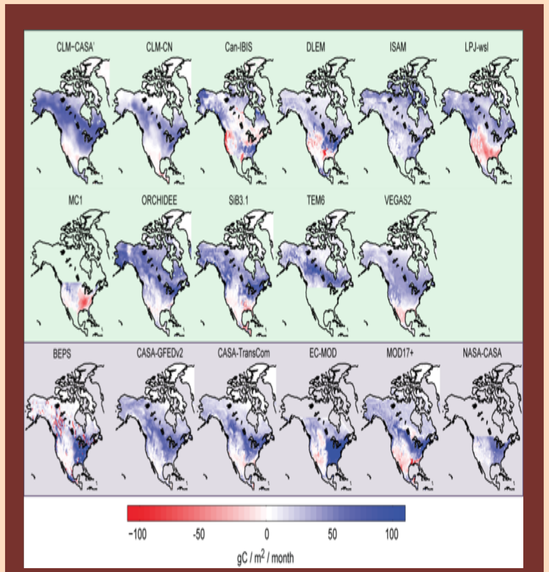
Contacts

Aritra Dasgupta: dasgupta.aritra@gmail.com, Yaxing Wei: weiy@ornl.gov

Original Visualizations



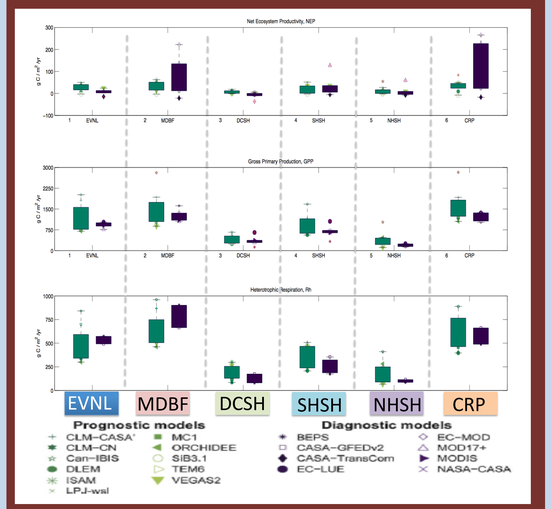
Compare spread of multiple output variables (productivity, respiration, and net ecosystem productivity) for different eco-regions for prognostic and diagnostic models.



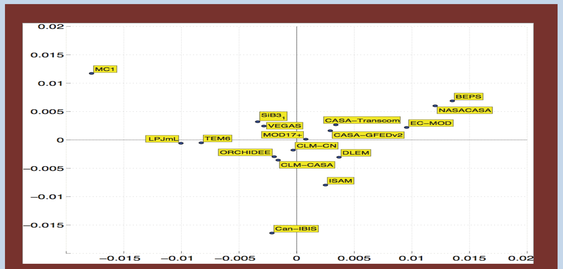
Prognostic (green background)and Diagnostic models(purple background)

Compare long-term mean summer Net Ecosystem Productivity(NEP) for different prognostic and diagnostic models.

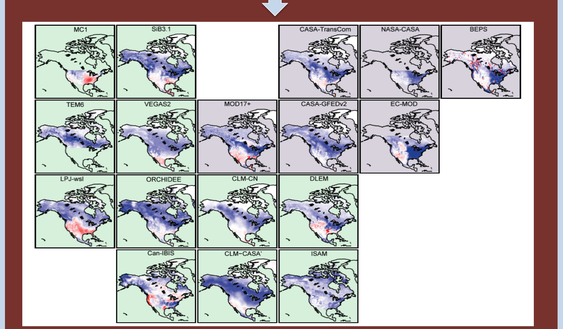
Improved Visualizations



Converting the scatter plot into a box plot enables user to clearly compare the spread and addition of grid lines focuses our attention along the columns, which are the eco-regions.

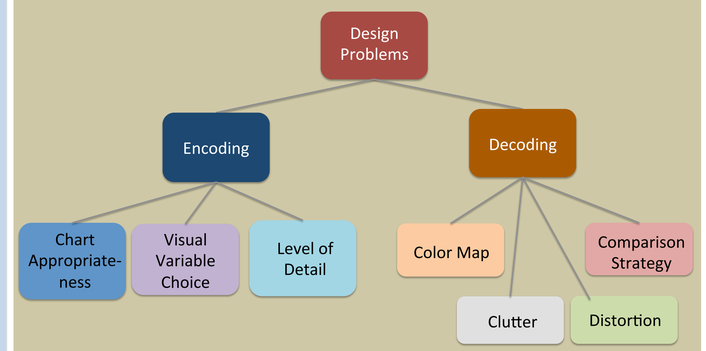


Multi-dimensional projection of pairwise model correlation; relative distances show similarity.



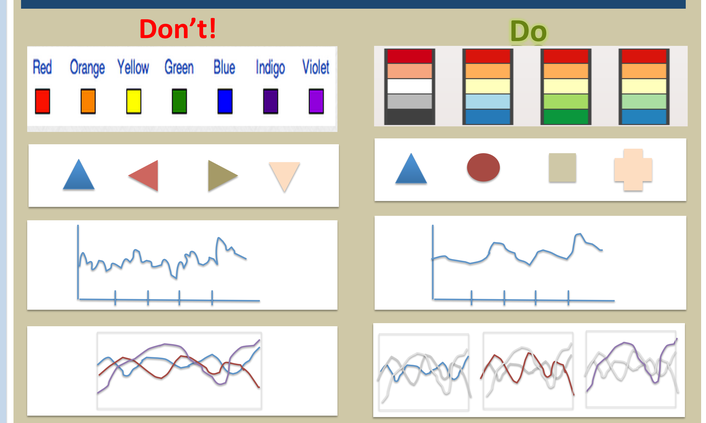
Optimized layout of the maps conveys the degree of similarity, with similar model outputs are plotted closer to each other.

Snapshot of Taxonomy

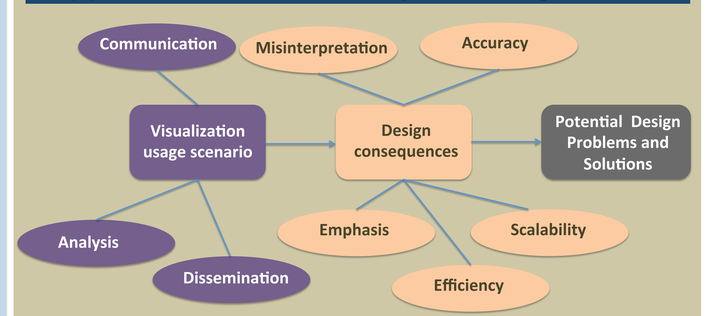


The taxonomy helped us apply visualization best practices for improving existing designs

Visualization Best Practices



Application of Taxonomy: The Big Picture



Systematization of design problems can enable terrestrial biosphere modelers to avoid certain design consequences for specific visualization usage scenarios.

For Additional Information

Dasgupta, A., J. Poco, Y. Wei, R.B. Cook, E. Bertini, and C. Silva. An Exploratory Study of Visualization Design For Climate Data Analysis. IEEE Transactions on Visualization and Computer Graphics.

*ORNL is managed by the University of Tennessee-Battelle LLC under contract DE-AC05-00OR22725 with the U.S. Department of Energy.