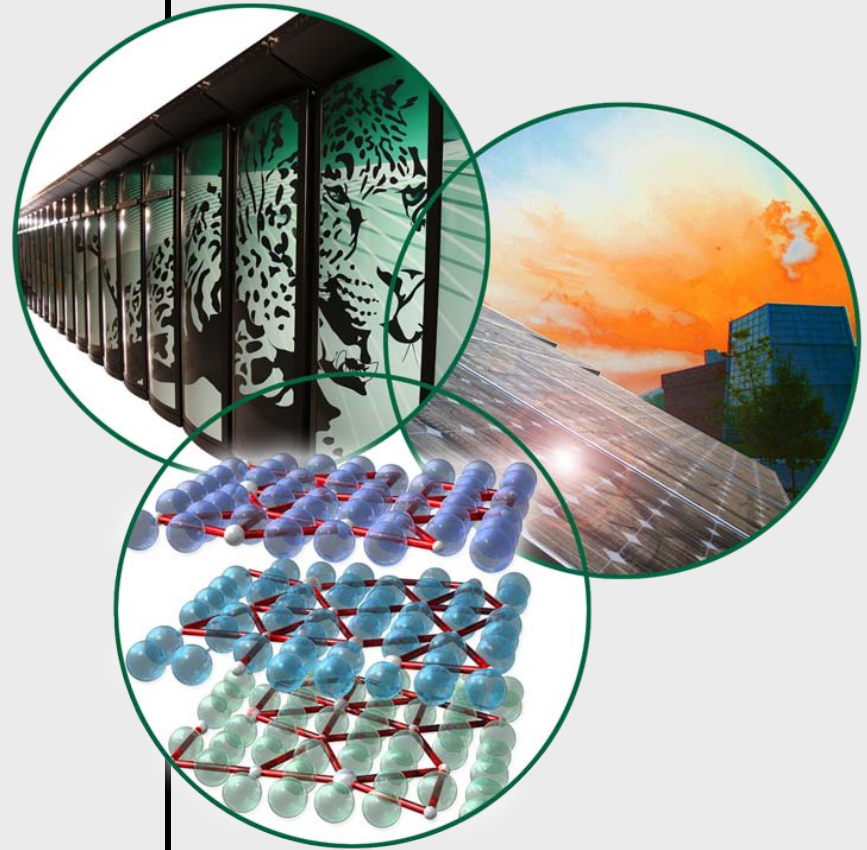# Visual Analytics for CLM4

Chad A. Steed (csteed@acm.org)

Galen Shipman, Peter Thornton, Daniel Ricciuto, David Erickson, and Marcia Branstetter
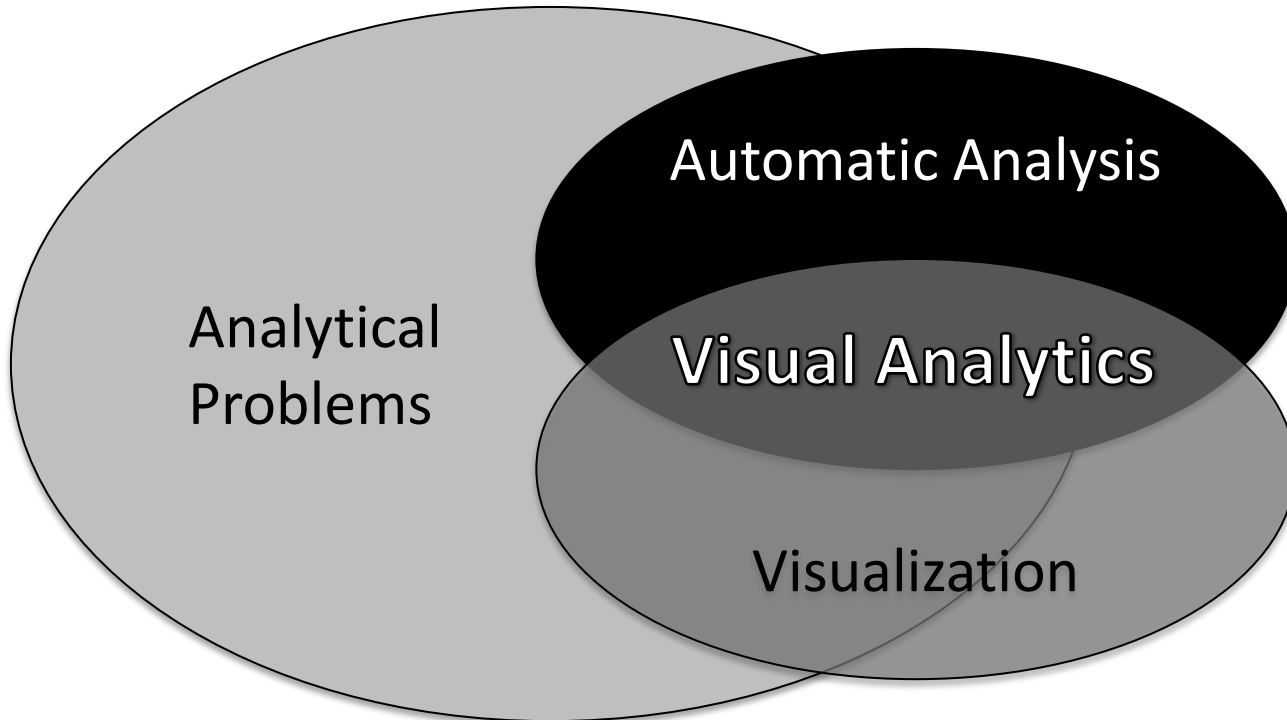
Joint Land and Biochemistry Working Group
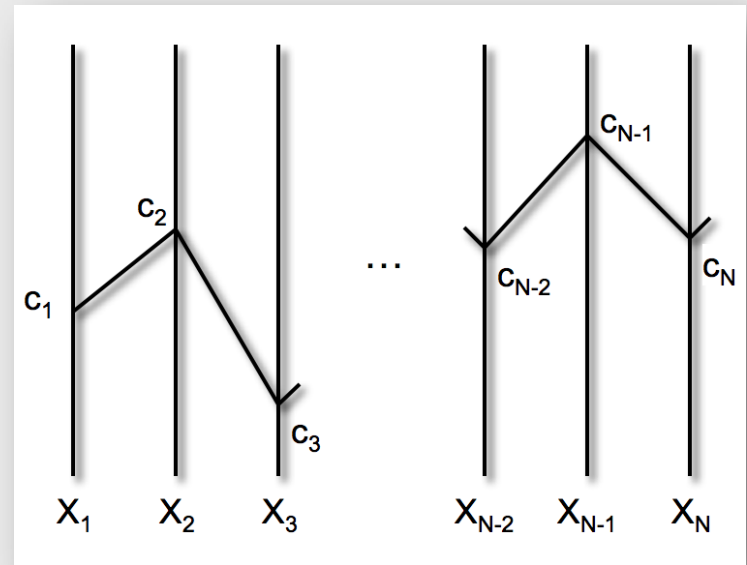
Boulder, CO

1 March 2012

U.S. DEPARTMENT OF ENERGY

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Visual Analytics

General Application Areas

Automatic Analysis

Analytical Problems

Visual Analytics

Visualization

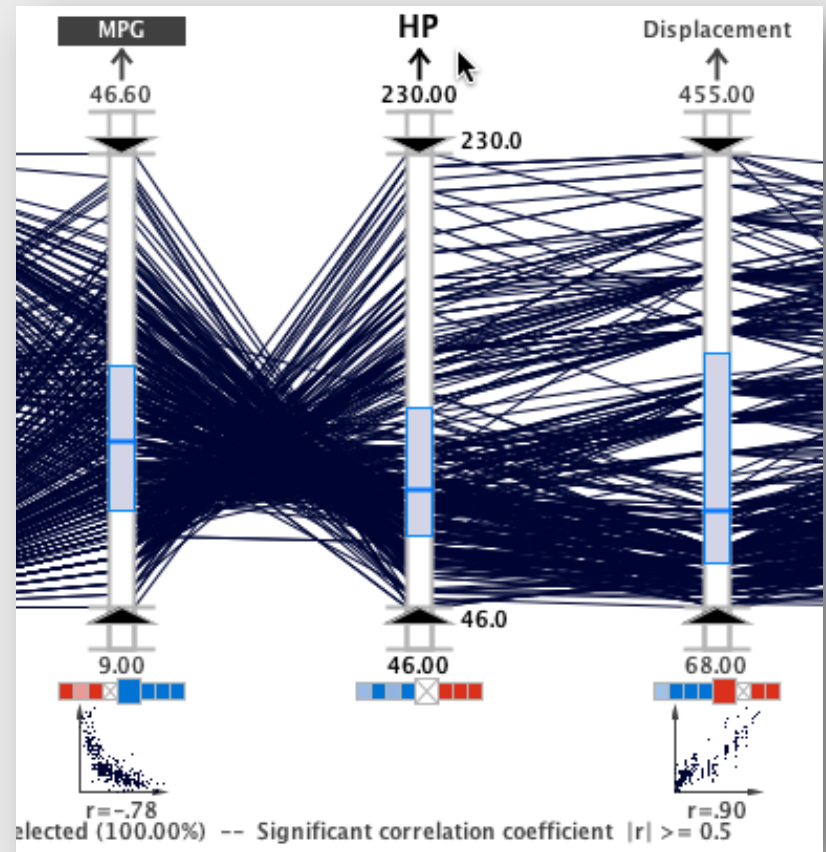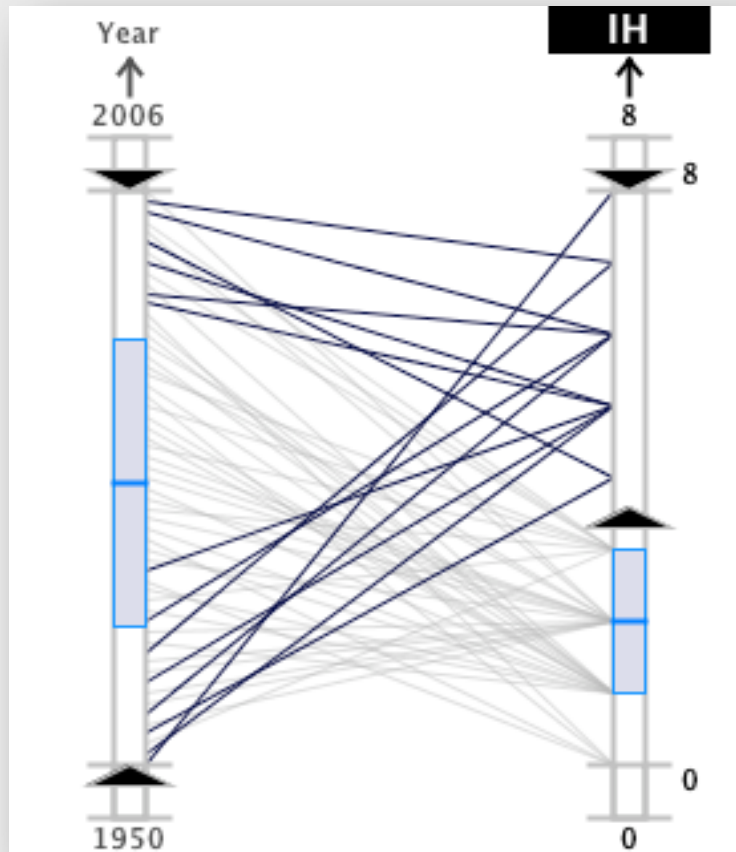Adapted from Keim et al., ACM SIGKDD Explorations, 11(2), 2009.

Parallel Coordinates

Parallel Coordinates

The polygonal line with segments connected to the parallel axes for $\mathbb{R}^n$ represents the point $C = (c_1, \ldots, c_N) \in \mathbb{R}^n$.

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Parallel Coordinates

CLM4 Harvard Forest Site Data

CLM4 Parameter Variables

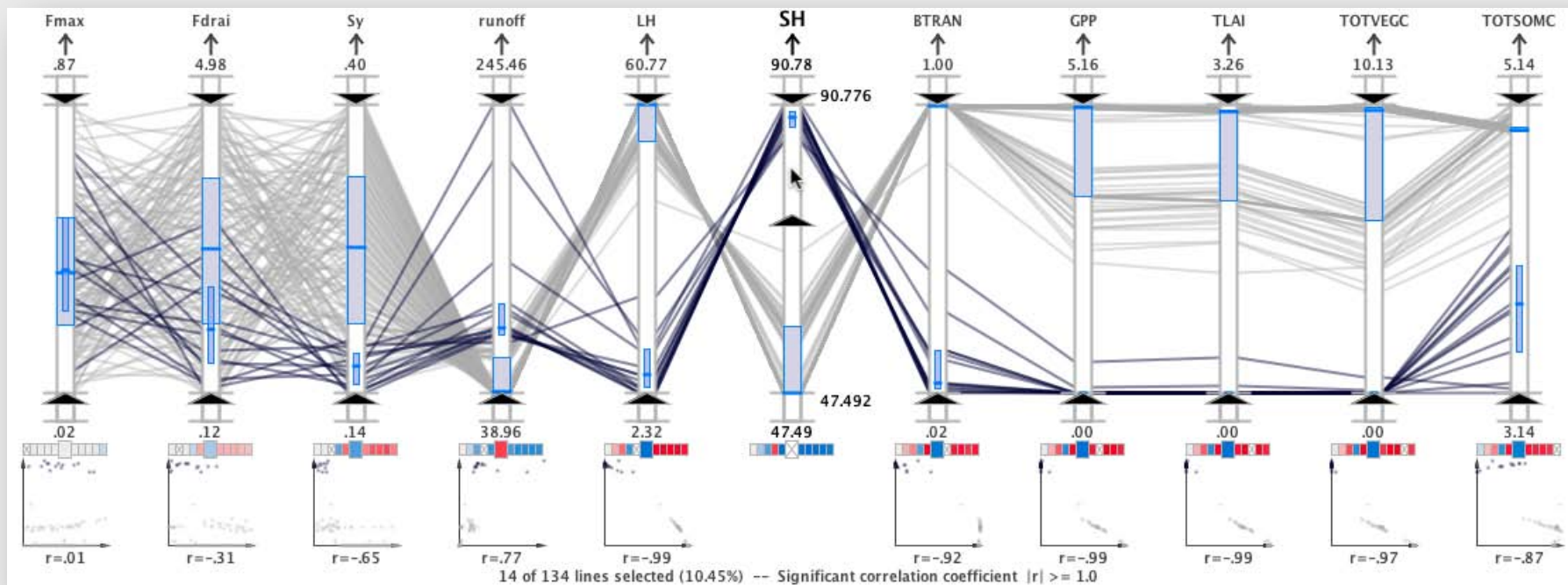| Parameter	Units	Description
Fmax	none	maximum fractional saturated area
Fdrai	$m\ s^{-1}$	decay factor for subsurface runoff with depth
Sy	none	average specific yield

CLM4 Output Variables

| Output	Units	Description
runoff	$mm\ s^{-1}$	total runoff
LH	$W\ m^{-2}$	latent heat flux
SH	$W\ m^{-2}$	sensible heat flux
BTRAN	none	transpiration scaling factor
GPP	$gC\ m^{-2}\ s^{-1}$	gross primary productivity
TLAI	$m^2\ m^{-2}$	total leaf area index
TOTVEGC	$kg\ C\ m^{-2}$	total vegetation carbon
TOTSOMC	$kg\ C\ m^{-2}$	total soil organic matter carbon

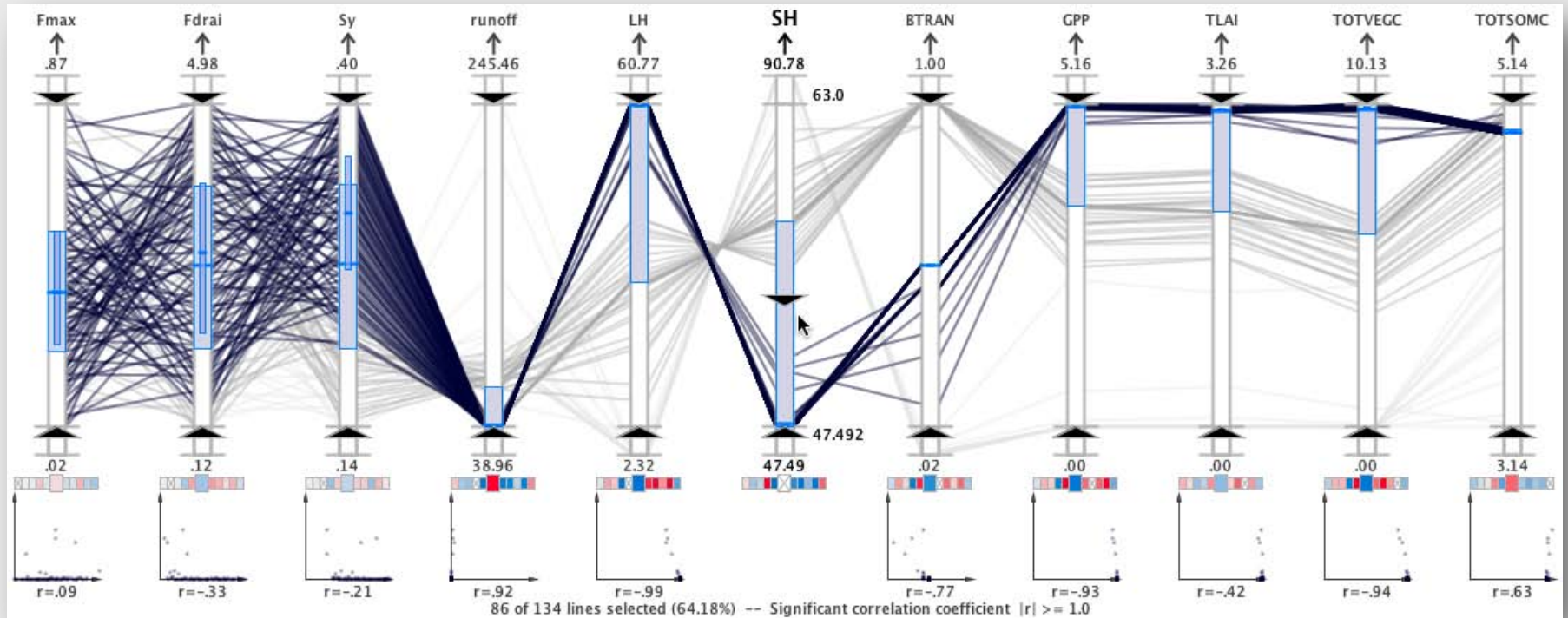# CLM4 Analysis with EDEN:
Initial Plot
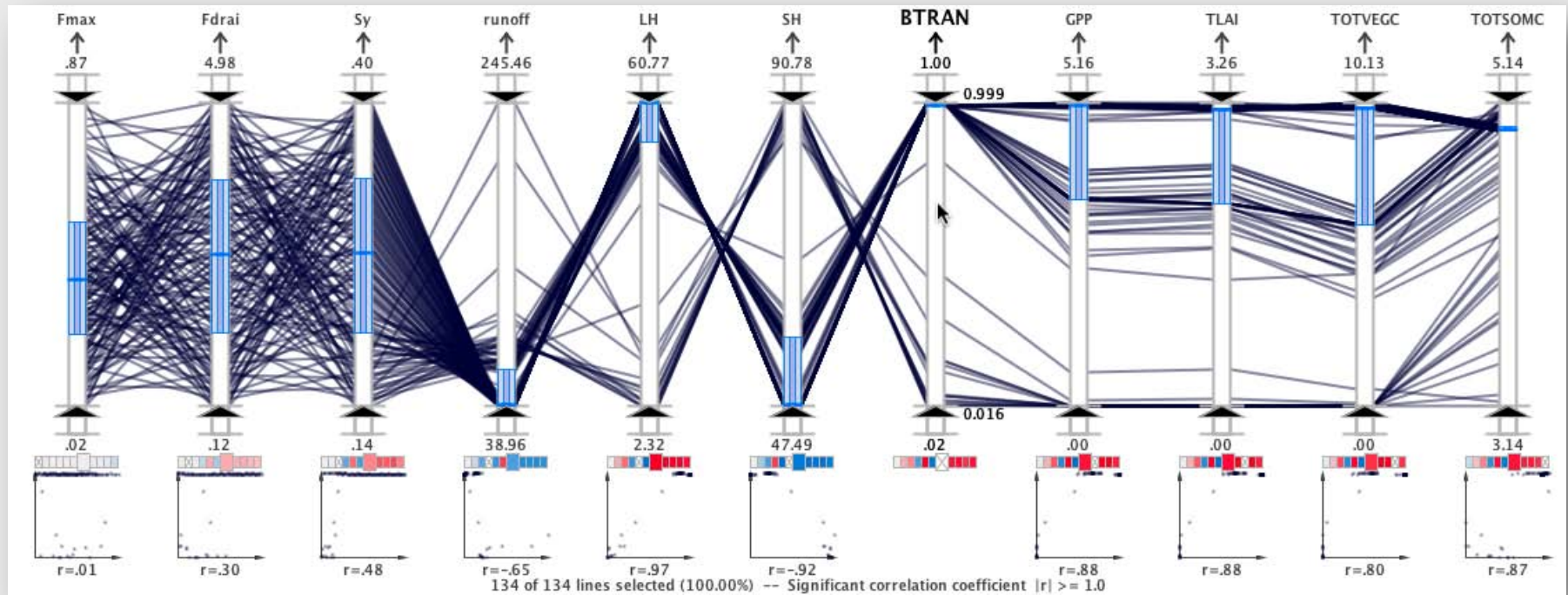
CLM4 Analysis with EDEN: Outliers
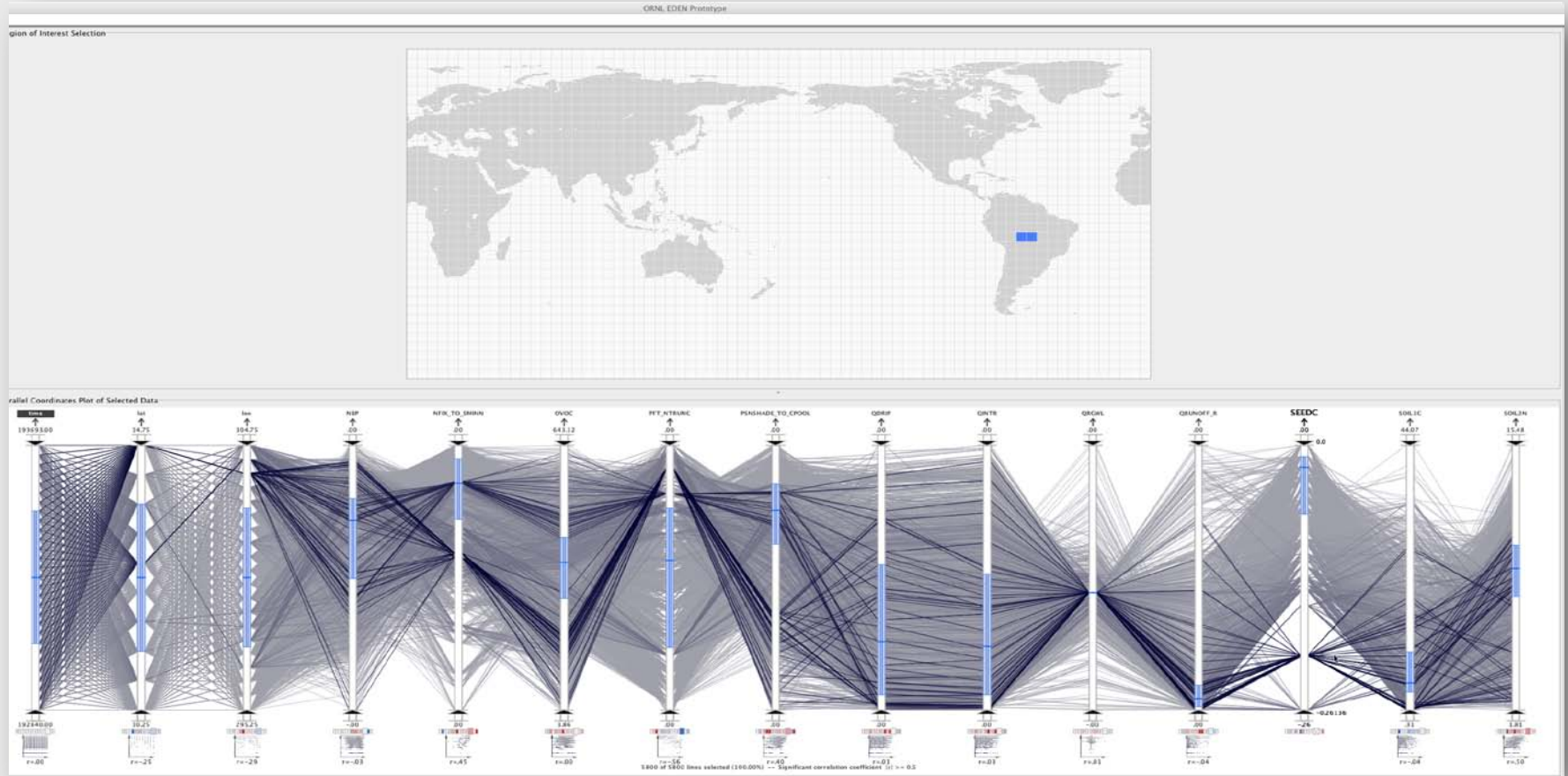
CLM4 Analysis with EDEN:
Axis Scaling

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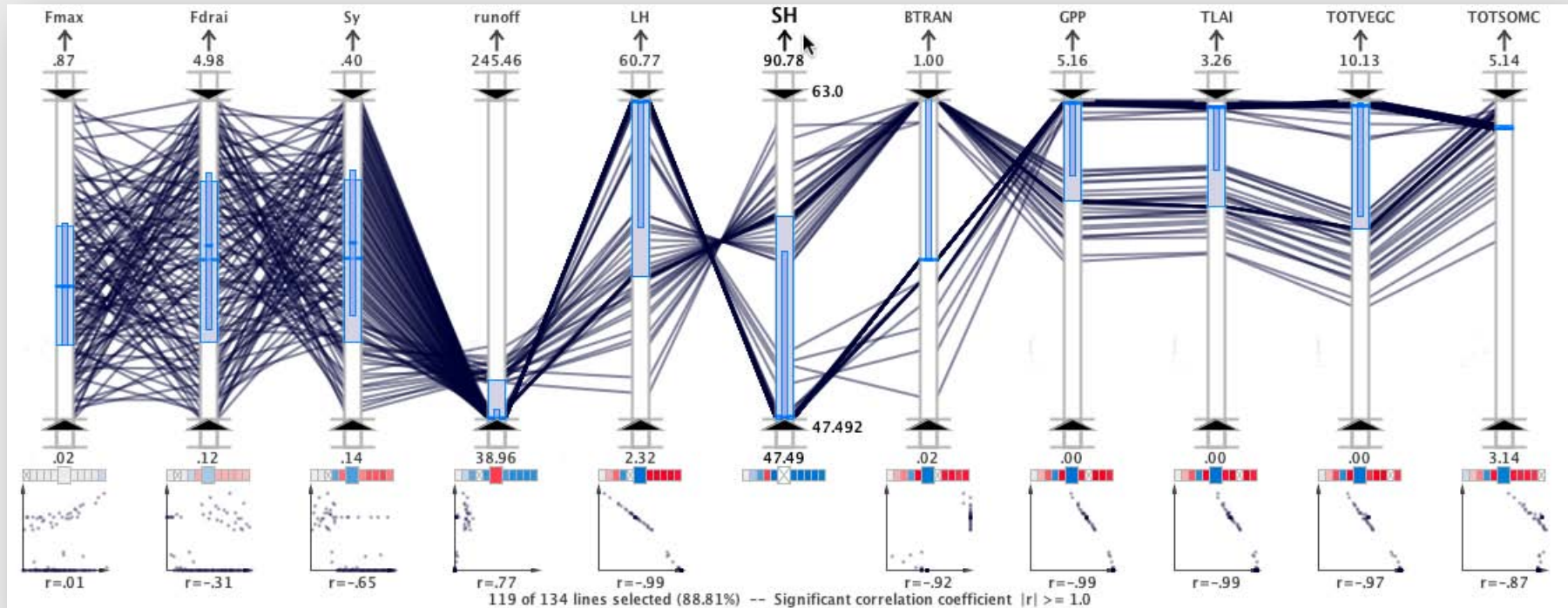
CLM4 Analysis with EDEN:
Axis Scaling

CLM4 Analysis with EDEN:
Global CLM4

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Questions

Visualization of 1000 CLM4 runs, 81 parameters, and 7 outputs on ORNL's EVEREST facility (11,520 by 3,072 pixels or a total of 35 million pixels).