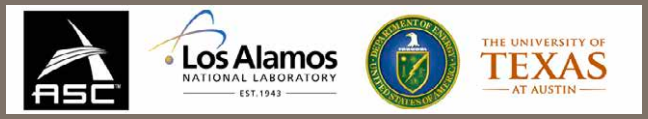
3. Easy-to Use Tools

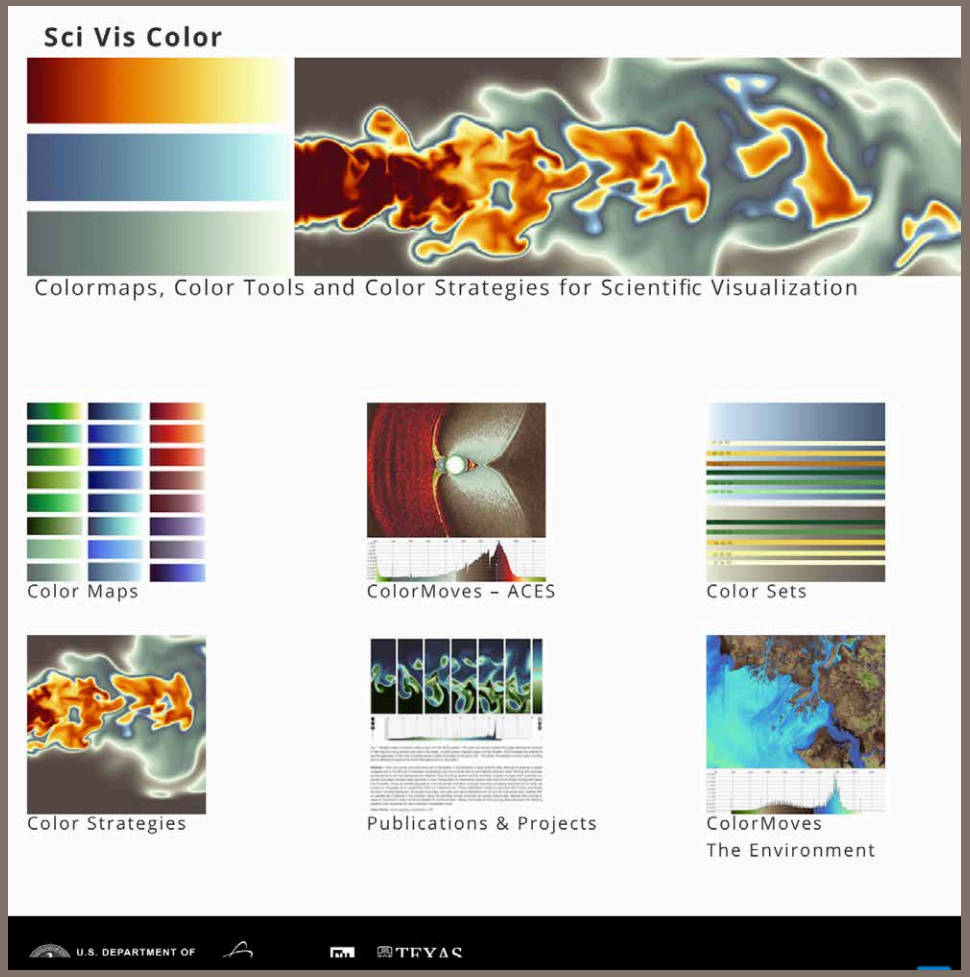
SciVisColor.org

ColorMoves

Quickly and easily creating colormaps
specific to your domain,
data distribution, task and audience

Francesca Samsel, UT Austin





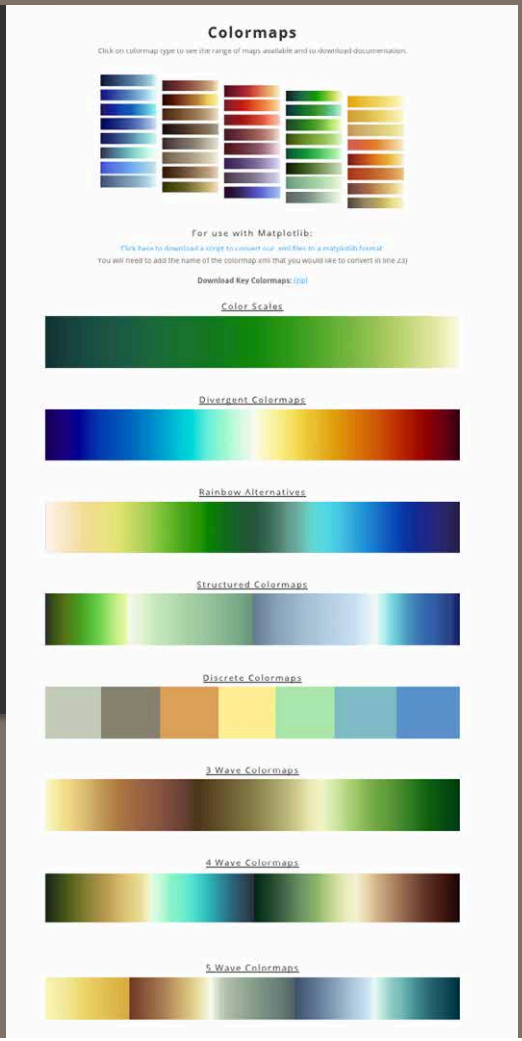
SciVisColor.Org

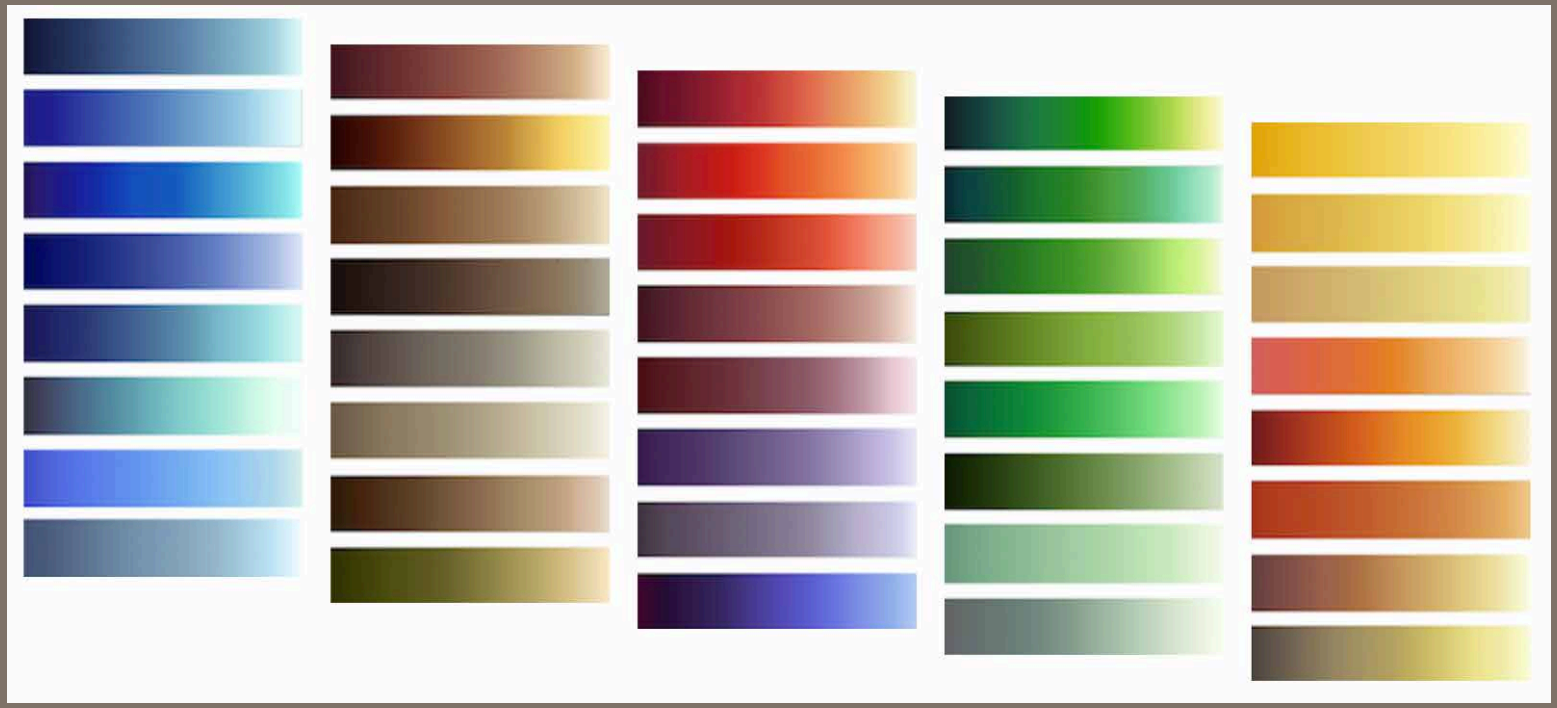
Colormaps

One size fits all will not serve you well.

Identifying or building the map tailored to your data.

Colormaps sorted by luminance distribution
SciVisColor interface





The Building Blocks, linear color scales for building data aligned maps.

SciVisColor.org

Characteristics of color scale

1. Saturated, full value range, wide hue range

2. Similar to #1 but blue in the low value

3. Mid-range hue span, saturated, almost full value range

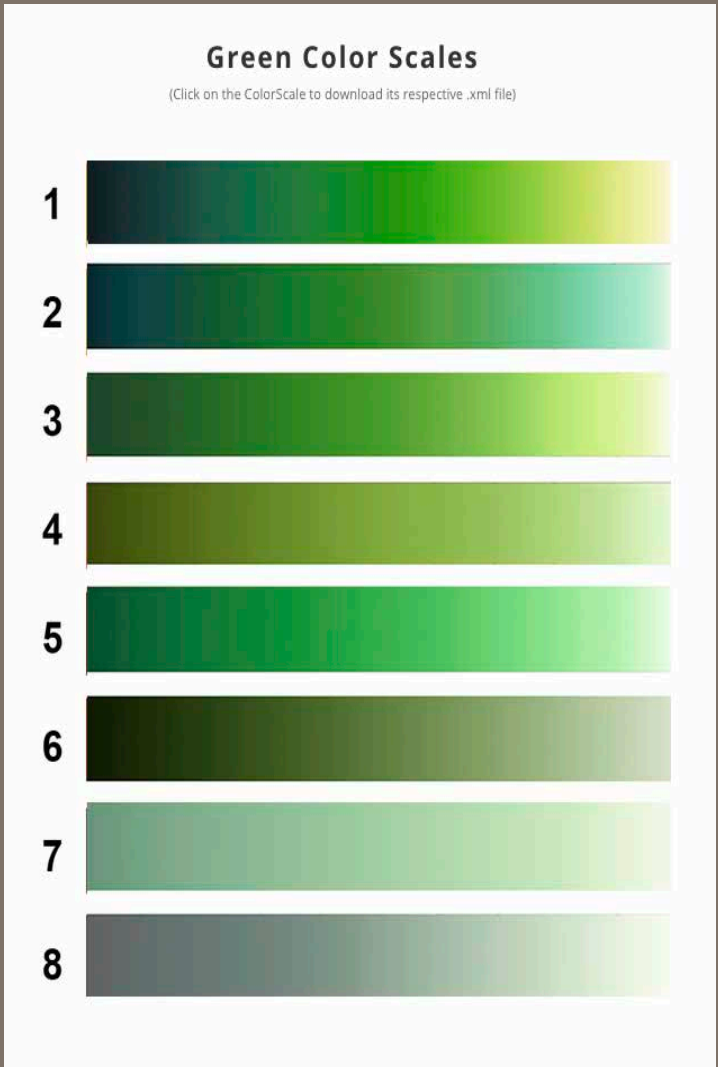
4. Narrow hue range (yellow- green) combines well with other scales

5. Bright, clear, single value, simple scale

6. Darker value range, single hue

7. Light value range, single hue, good for contrast but not detail.

8. Muted light value gray-green



Usage

1. important data

2. alternative for use with yellows.

3. accent

4. For multiscale colormaps

5. For multiscale colormaps

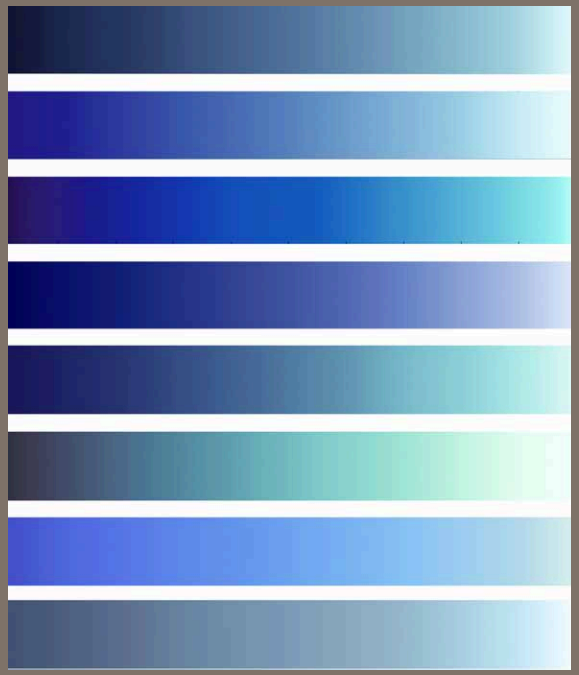
6. receding context

7. context

8. lowest priority data

greens

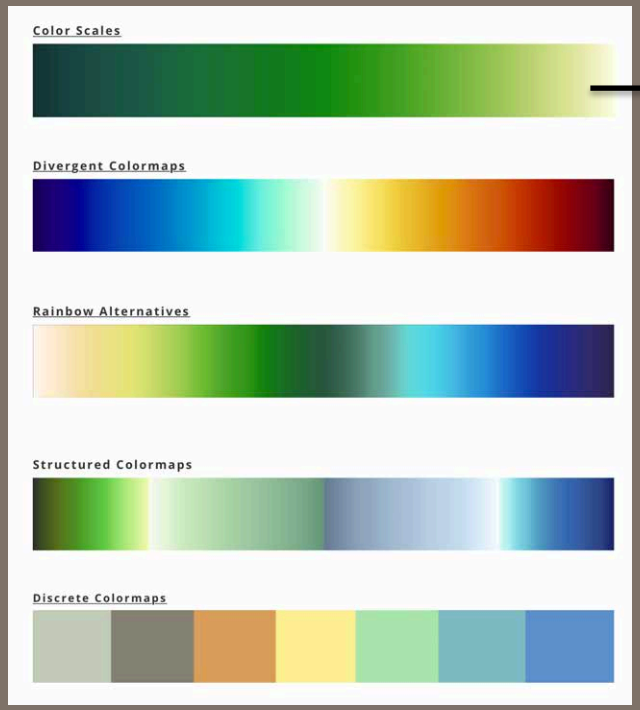
blues

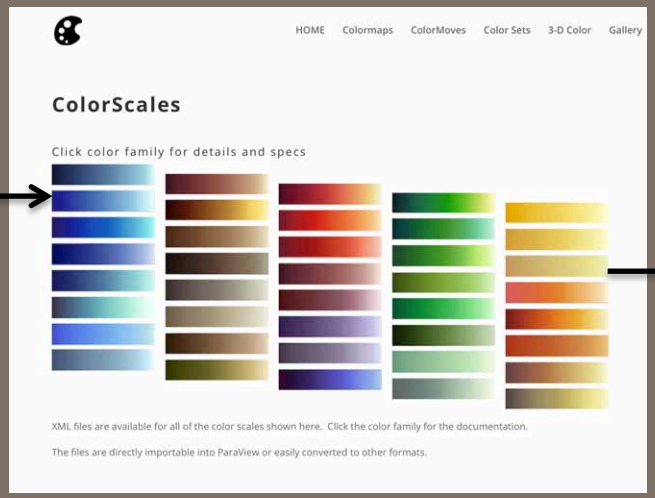


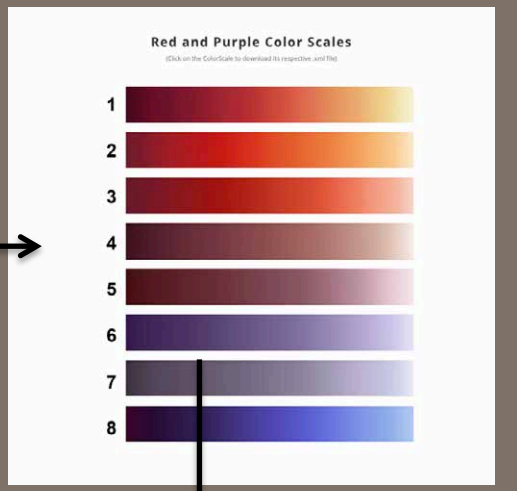
yellows and oranges

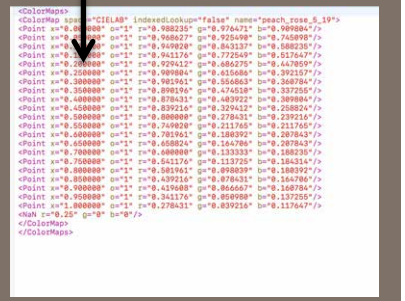
ColorMoves combines the color scales to built colormaps tuned to your task and data.

How it works….



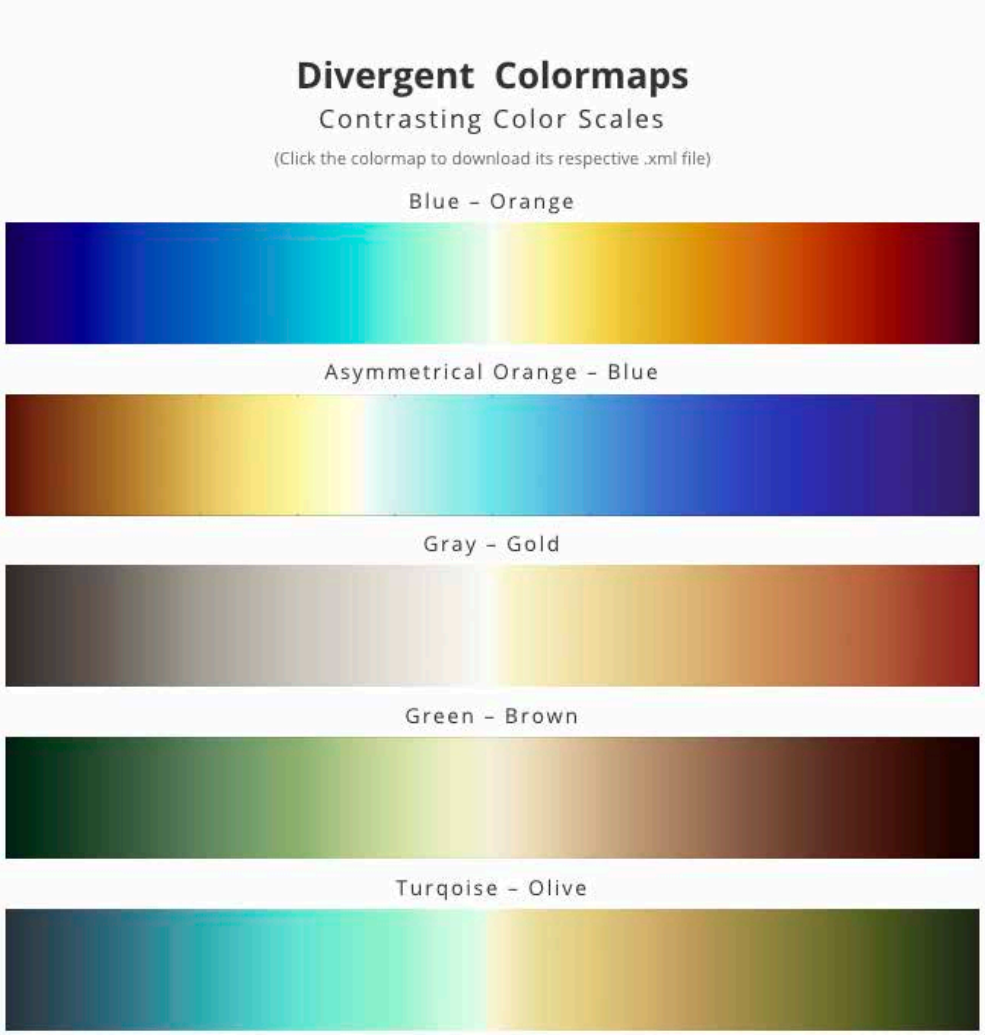






click on a colormap
and the .xml downloads

.xml imports into ParaView
or translates into other formats

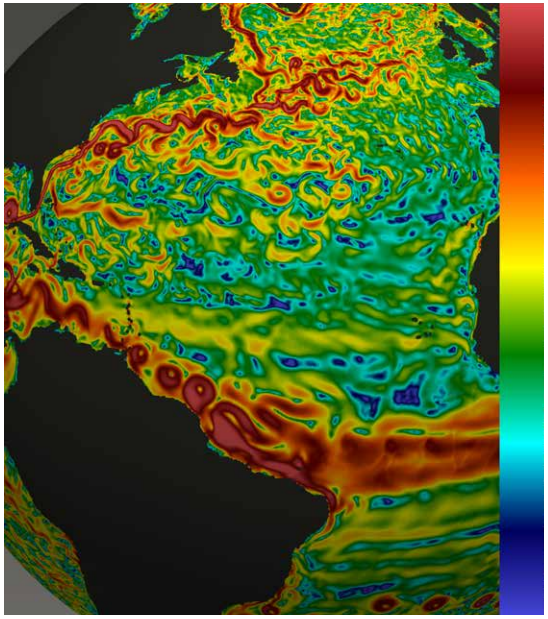


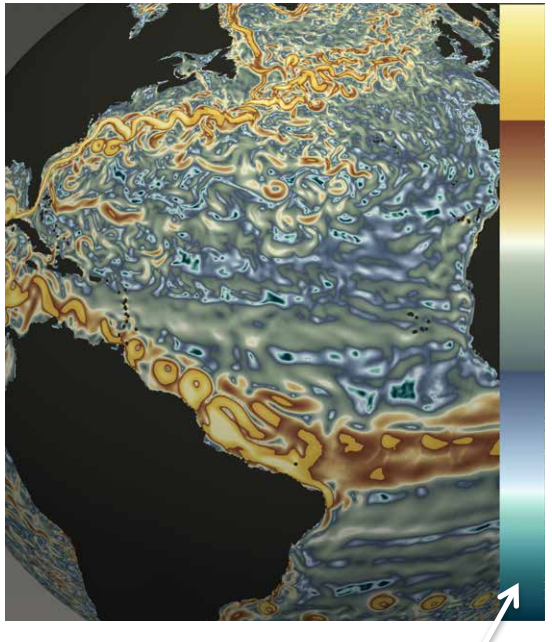
Greater discriminatory power than the standard cool / warm.

Consider an asymmetrical divergent if there is important data in the mid-range.

Think about using intuitive subject to color relationships.

Rainbow Alternatives

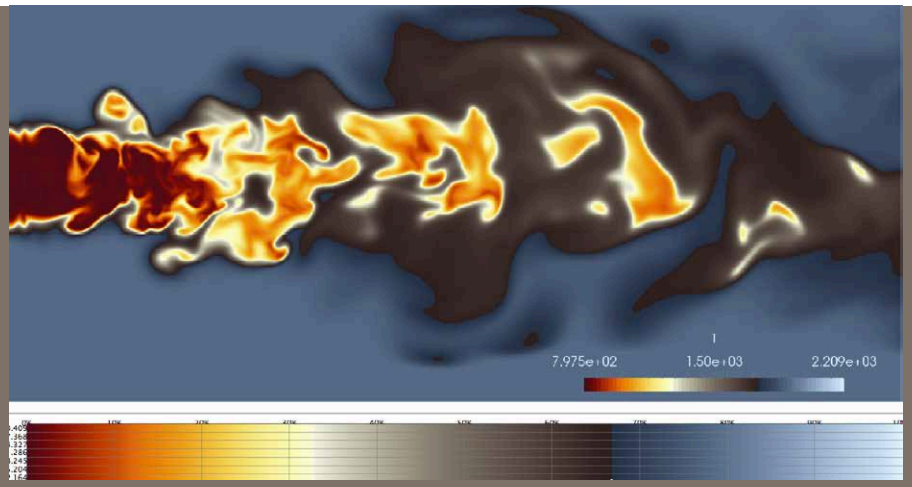




Wave colormaps are good substitutes
for the rainbow and desaturated rainbow.

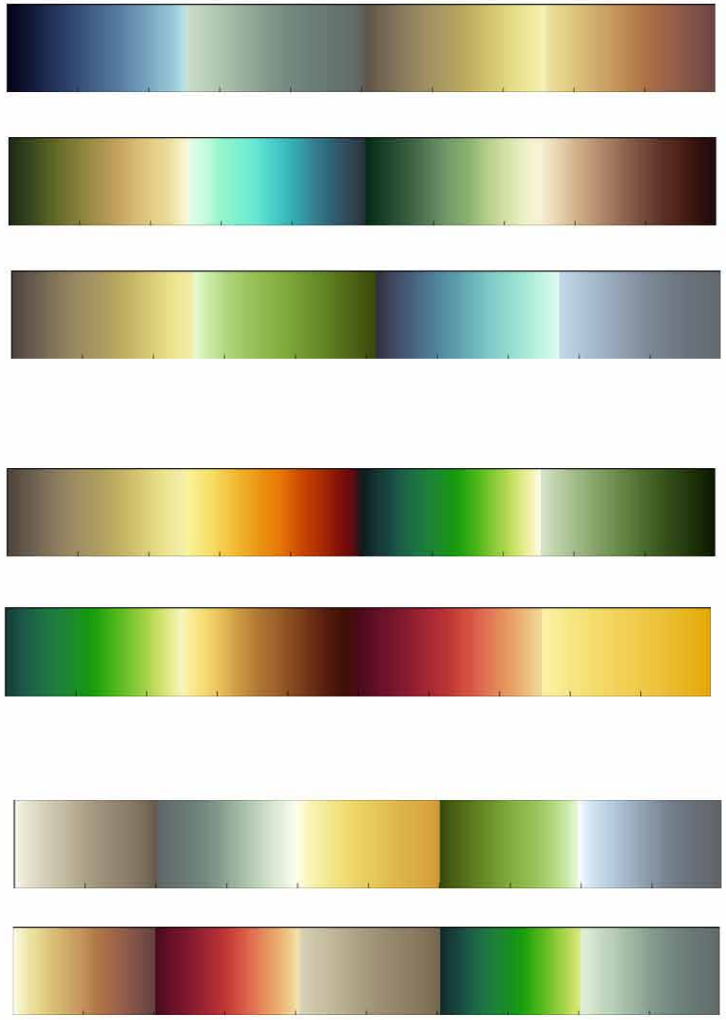
3 Wave colormaps

Very effective **starting points**…



You can see detail in the middle.

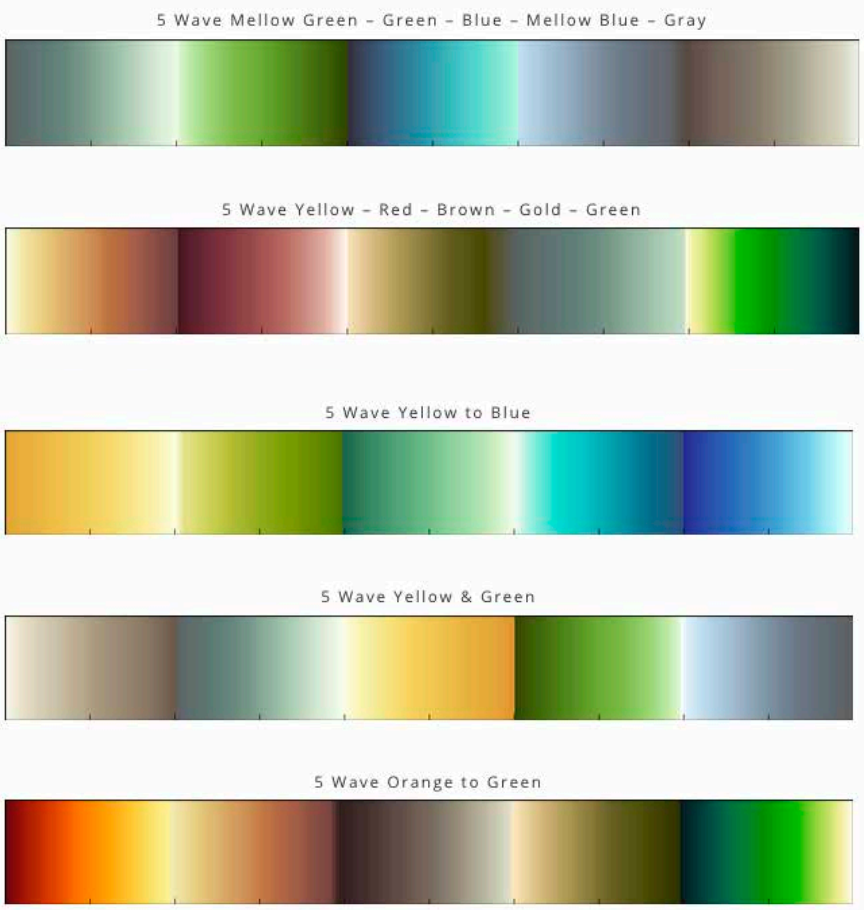
Three value ranges provides detail but not so much as to be confusing.



Colormap Waves

Multiple value spans within one colormap

These are available in the Colormap section.
Other configurations can be created in ColorMoves.
Documentation soon to be on SciVisColor.org.



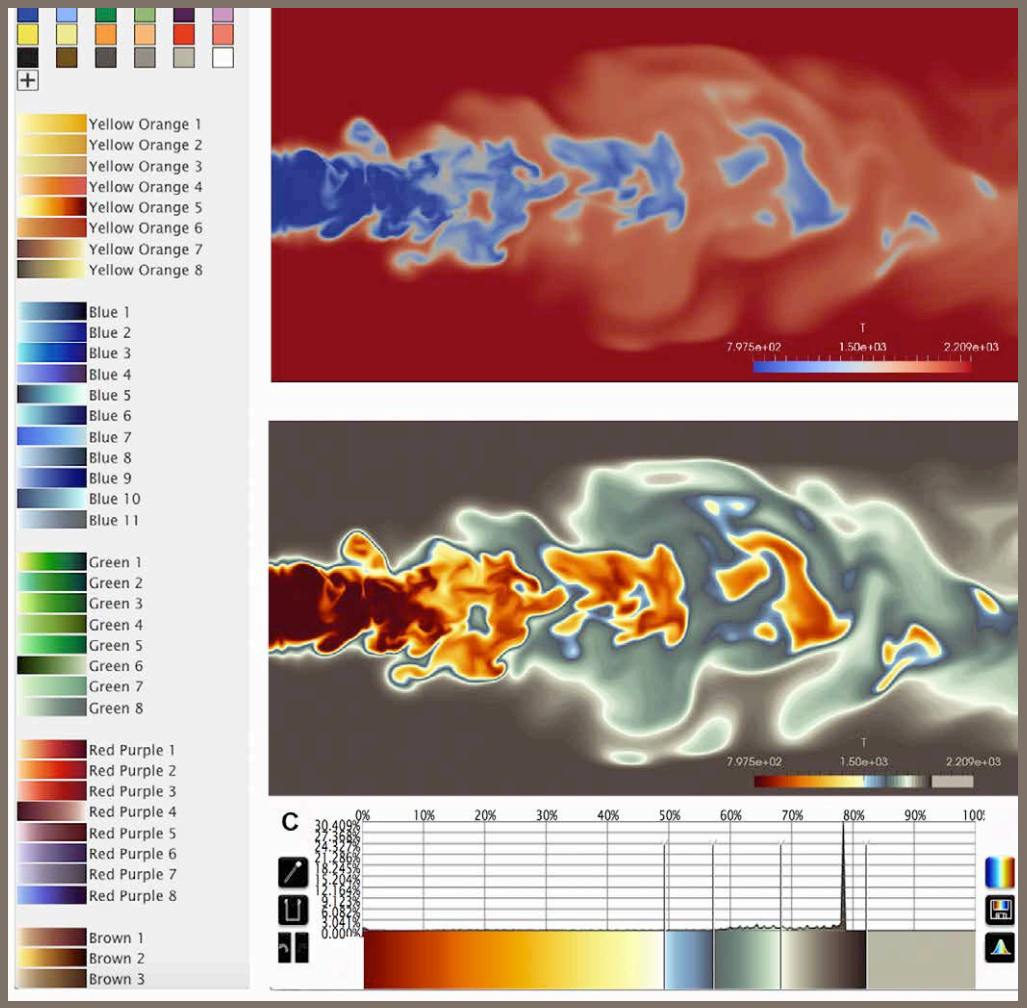
Focuses on the 20 – 60% range.

Focus on last 20% with
milder contrast throughout.

Fairly equal focus in the
yellow, green, blue palette.

Focuses on the 40 – 80% range.

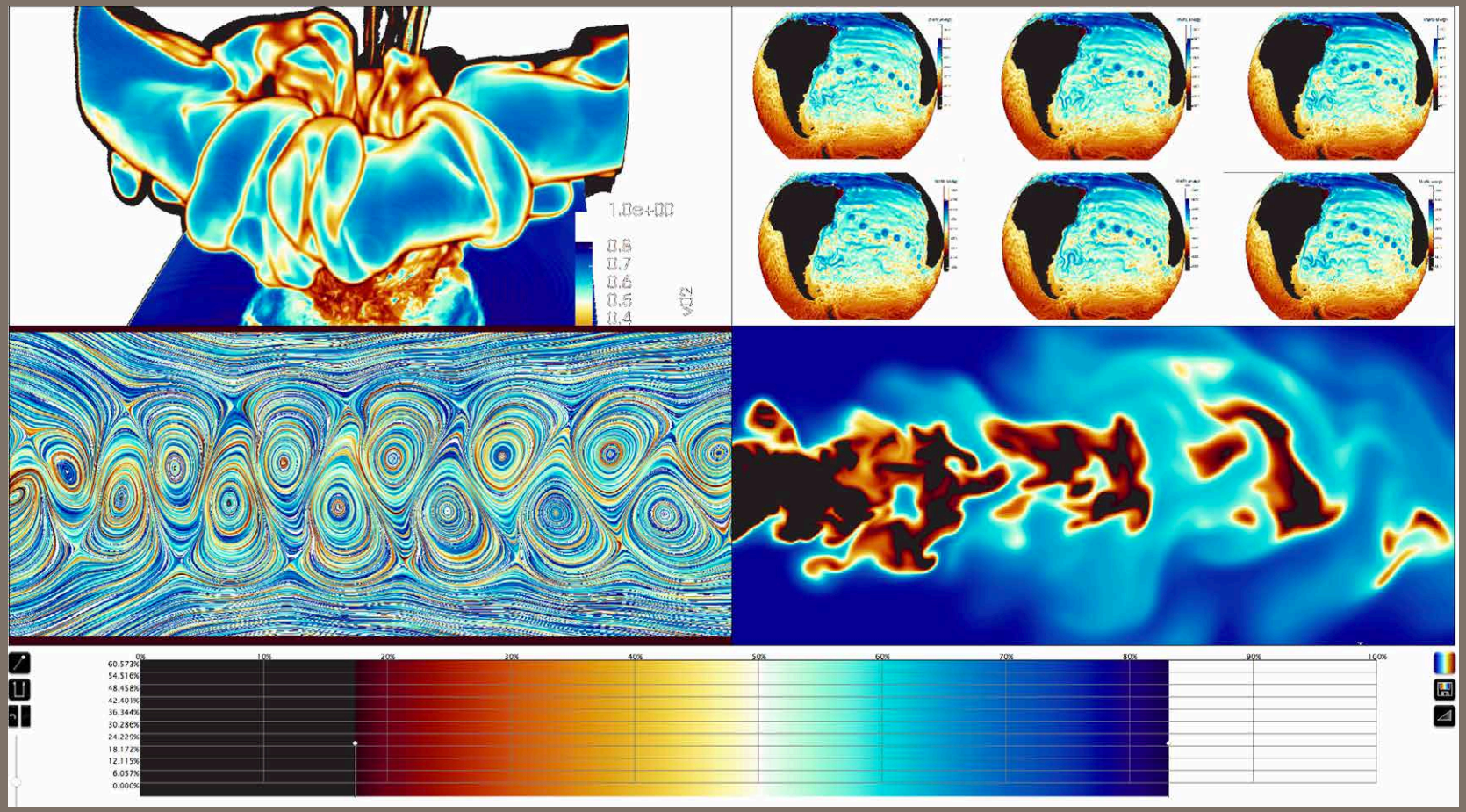
Focuses on the first and last 20%.



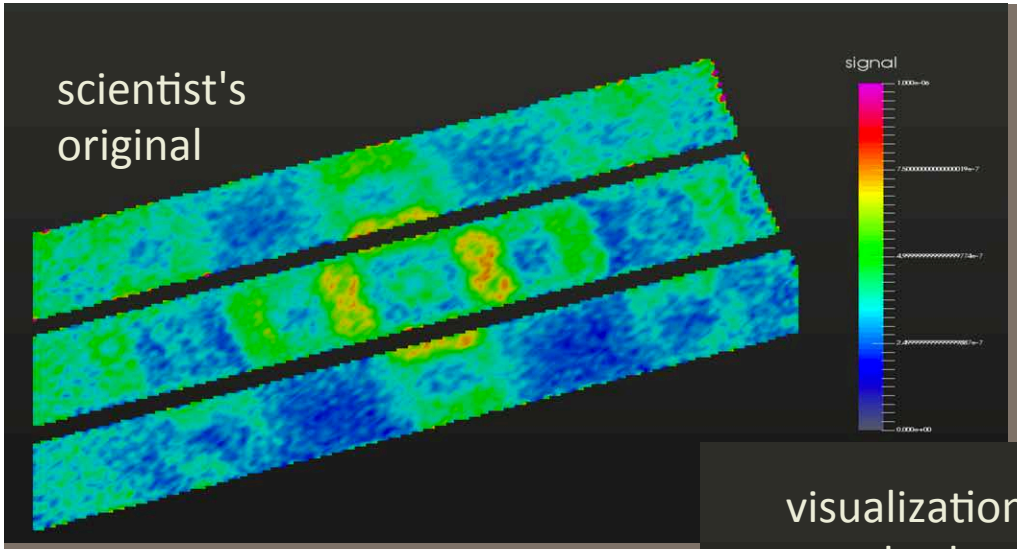
The impact of colormaps tuned to data…

Notice both
muted and saturated scales.

A good colormap is not good for all types of data.

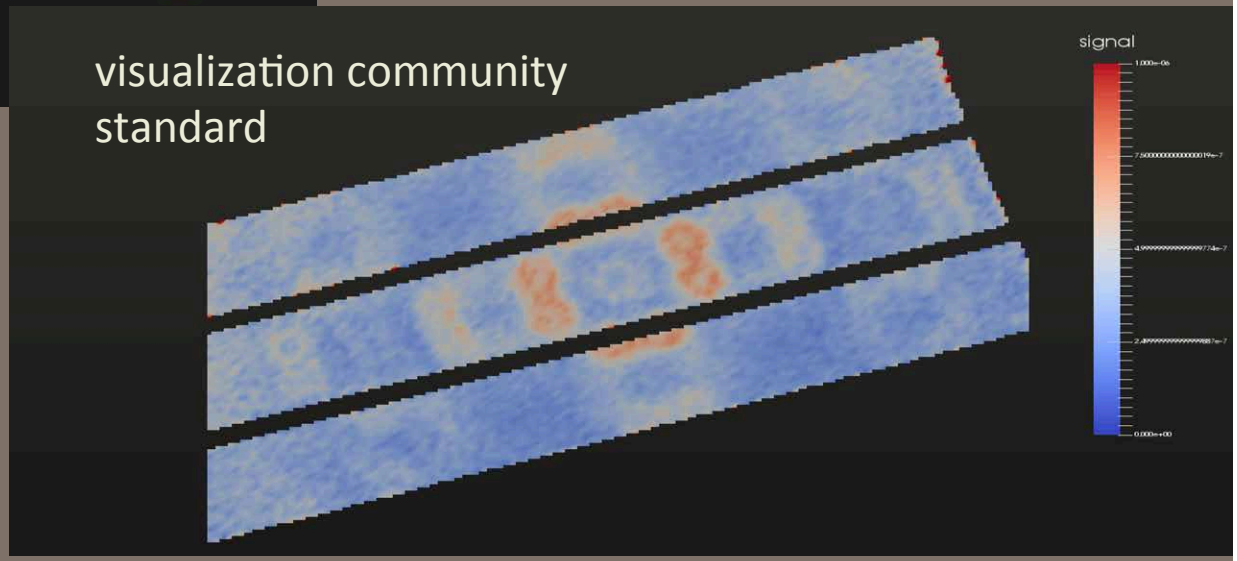


scientist's original

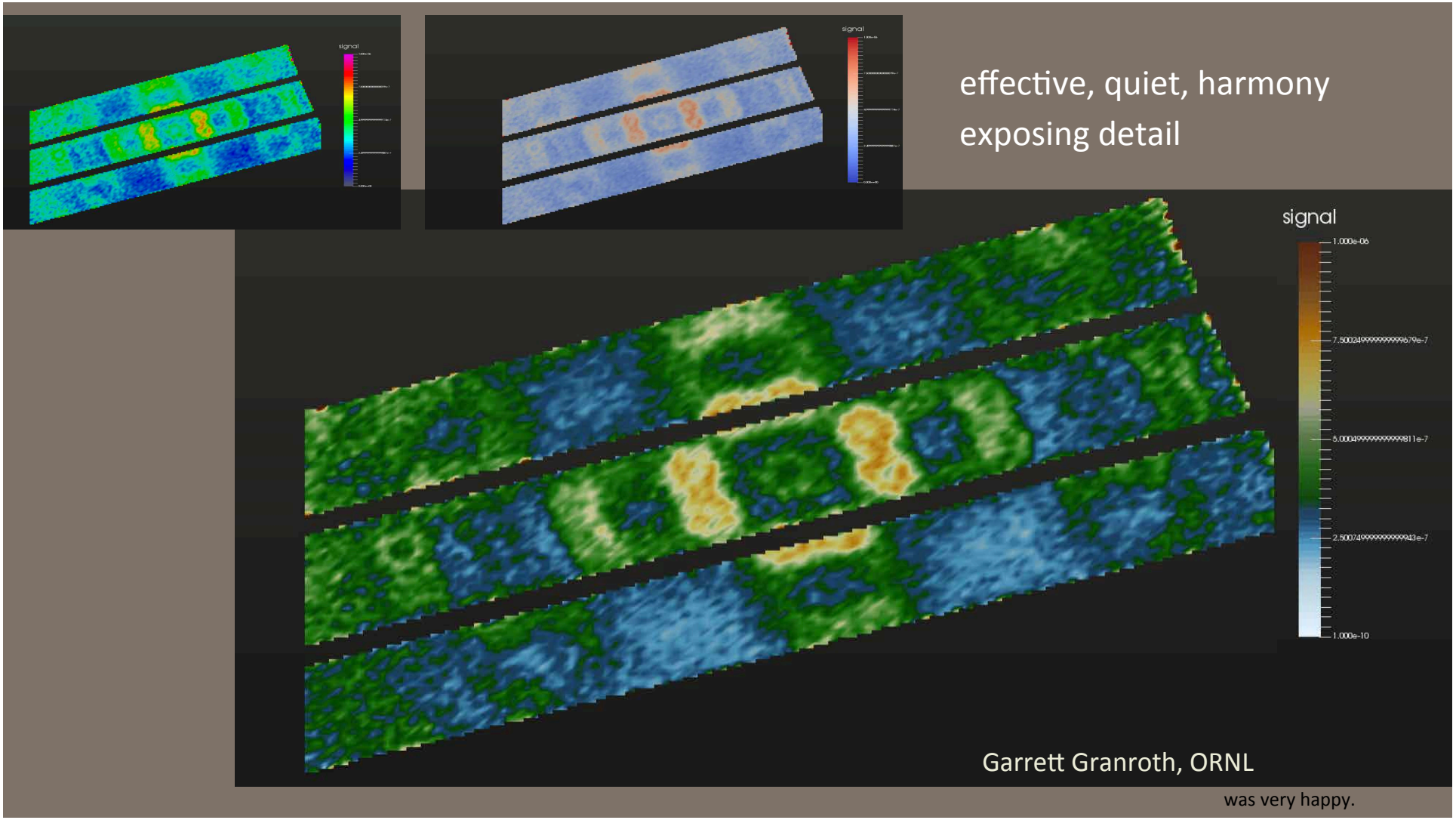


a straight forward problem

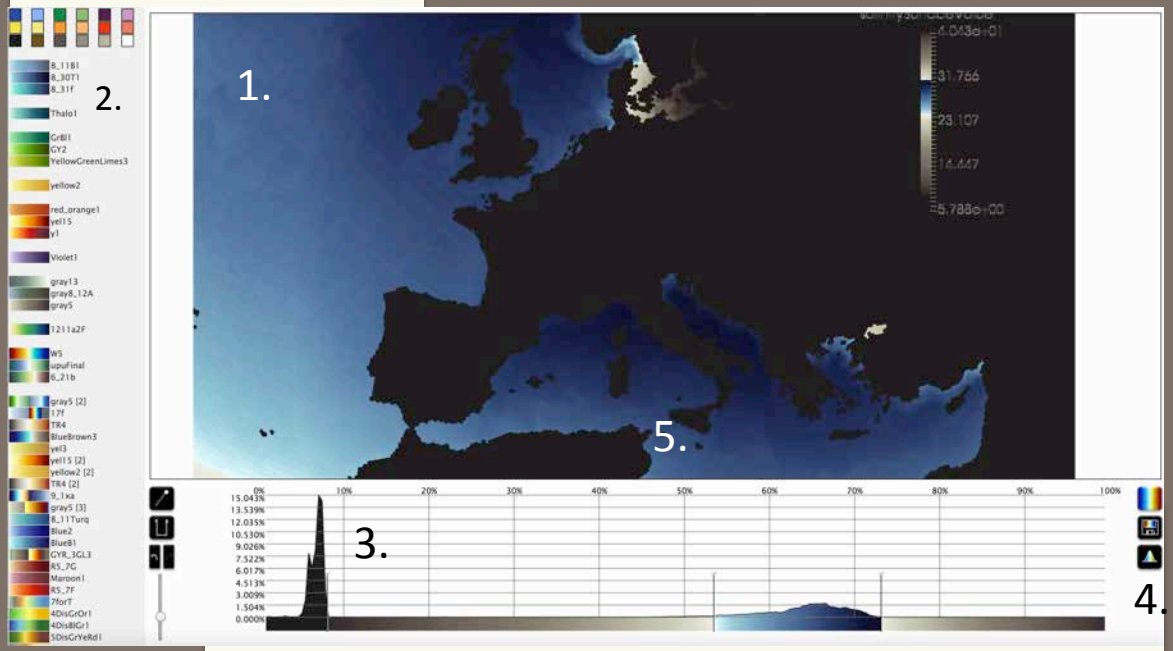
visualization community standard



Garrett Granroth, ORNL


signal
signal
effective, quiet, harmony
exposing detail
signal
1.000e-06
7.500249999999999679e-7
5.000499999999999811e-7
2.500749999999999943e-7
1.000e-10
Garrett Granroth, ORNL
was very happy.

ColorMoves



1. visualization area
2. color scale selection
3. interactive data range
4. structuring and exporting the color maps
5. resizing and saving


pin - splitting

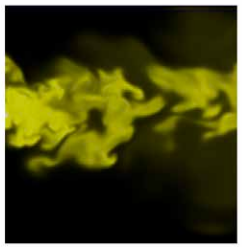

U – nesting


histogram alpha


save / export colormap


save image

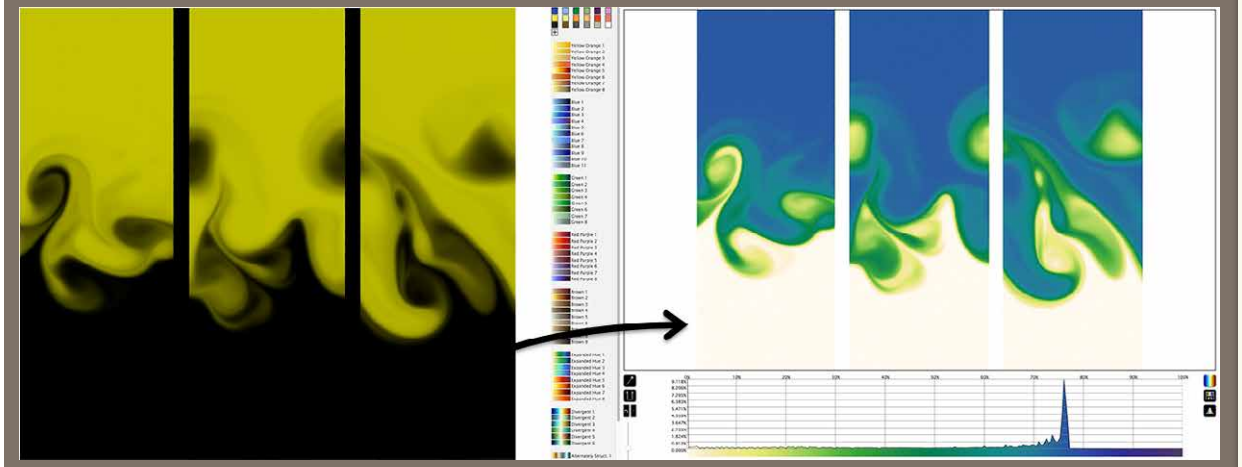

trash pins



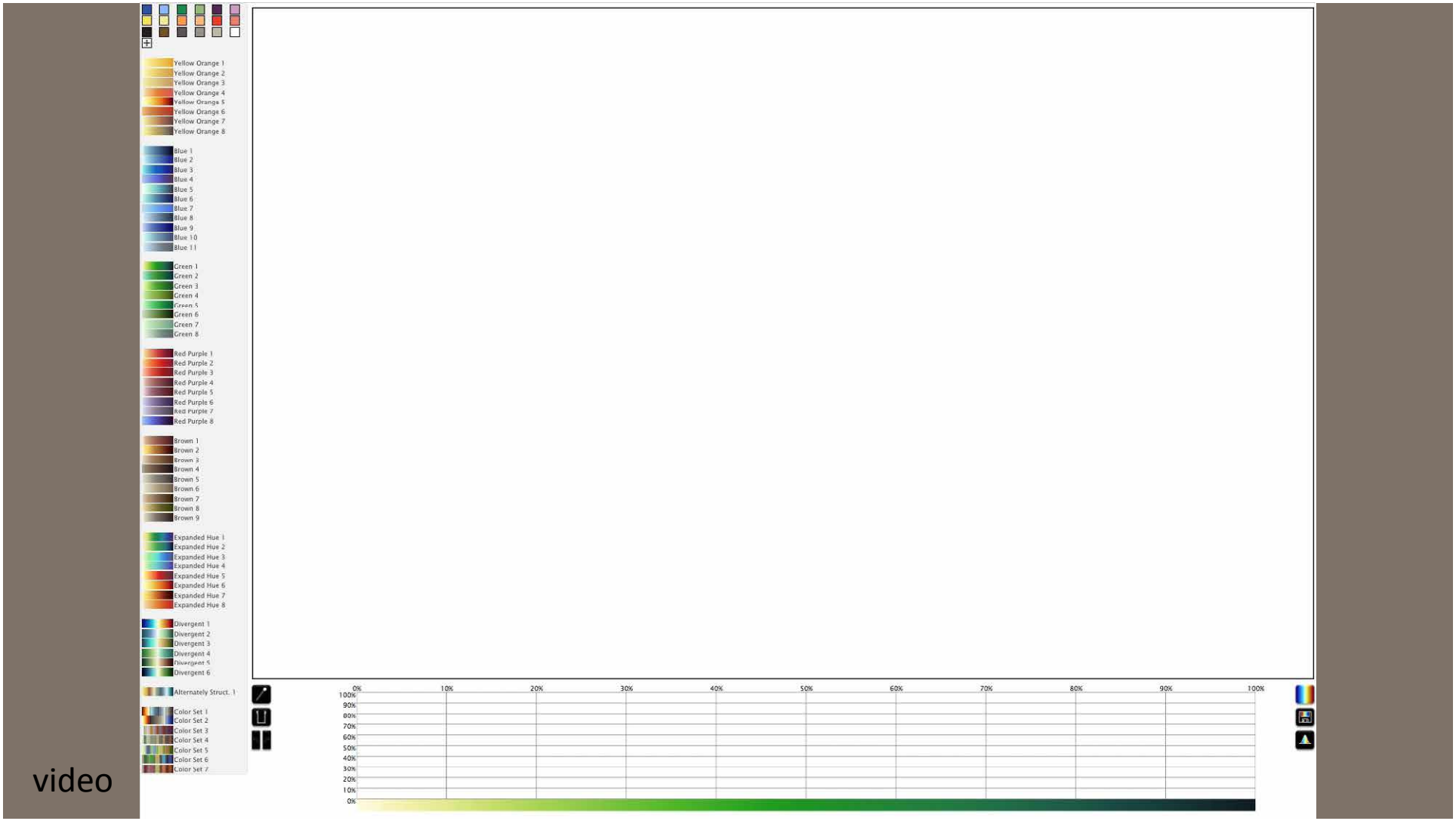
Float Files Instructions

Download Examples

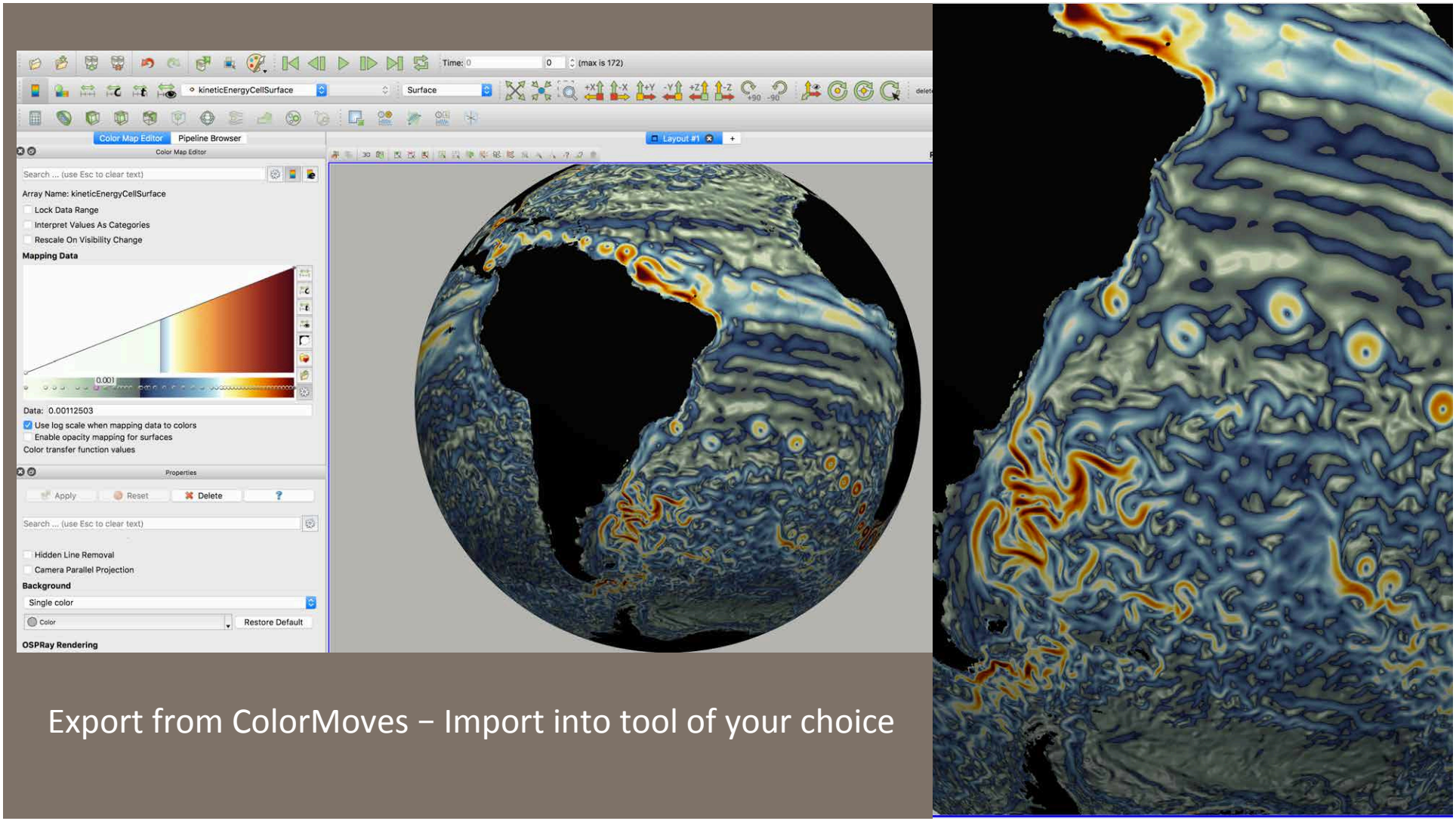
float color map



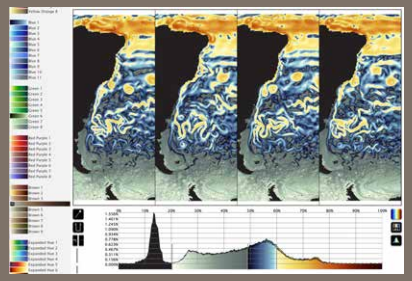
```
<ColorMaps>
<ColorMap space="RGB" indexedLookup="false" name="FloatPNG">
<Point x="0.000000000" o="1" r="0.000" g="0.000" b="0.004"/>
<Point x="0.003890932" o="1" r="0.000" g="1.000" b="0.000"/>
<Point x="0.003906191" o="1" r="0.004" g="0.000" b="0.000"/>
<Point x="0.007797183" o="1" r="0.004" g="1.000" b="0.000"/>
<Point x="0.007812441" o="1" r="0.008" g="0.000" b="0.000"/>
<Point x="0.011703433" o="1" r="0.008" g="1.000" b="0.000"/>
<Point x="0.011718692" o="1" r="0.012" g="0.000" b="0.000"/>
<Point x="0.015609683" o="1" r="0.012" g="1.000" b="0.000"/>
<Point x="0.015624942" o="1" r="0.016" g="0.000" b="0.000"/>
<Point x="0.019515934" o="1" r="0.016" g="1.000" b="0.000"/>
<Point x="0.019531193" o="1" r="0.020" g="0.000" b="0.000"/>
<Point x="0.023422184" o="1" r="0.020" g="1.000" b="0.000"/>
<Point x="0.023437443" o="1" r="0.024" g="0.000" b="0.000"/>
<Point x="0.027328435" o="1" r="0.024" g="1.000" b="0.000"/>
<Point x="0.027343694" o="1" r="0.027" g="0.000" b="0.000"/>
<Point x="0.031234685" o="1" r="0.027" g="1.000" b="0.000"/>
<Point x="0.031249944" o="1" r="0.031" g="0.000" b="0.000"/>
<Point x="0.035140936" o="1" r="0.031" g="1.000" b="0.000"/>
<Point x="0.035156195" o="1" r="0.035" g="0.000" b="0.000"/>
<Point x="0.039047186" o="1" r="0.035" g="1.000" b="0.000"/>
<Point x="0.039062445" o="1" r="0.039" g="0.000" b="0.000"/>
<Point x="0.042953437" o="1" r="0.039" g="1.000" b="0.000"/>
<Point x="0.042968696" o="1" r="0.043" g="0.000" b="0.000"/>
<Point x="0.046859687" o="1" r="0.043" g="1.000" b="0.000"/>
<Point x="0.046874946" o="1" r="0.047" g="0.000" b="0.000"/>
<Point x="0.050765938" o="1" r="0.047" g="1.000" b="0.000"/>
<Point x="0.050781196" o="1" r="0.051" g="0.000" b="0.000"/>
<Point x="0.054672188" o="1" r="0.051" g="1.000" b="0.000"/>
<Point x="0.054687447" o="1" r="0.055" g="0.000" b="0.000"/>
<Point x="0.058578439" o="1" r="0.055" g="1.000" b="0.000"/>
<Point x="0.058593697" o="1" r="0.059" g="0.000" b="0.000"/>
<Point x="0.062484689" o="1" r="0.059" g="1.000" b="0.000"/>
<Point x="0.062499948" o="1" r="0.063" g="0.000" b="0.000"/>
<Point x="0.066390940" o="1" r="0.063" g="1.000" b="0.000"/>
<Point x="0.066406198" o="1" r="0.067" g="0.000" b="0.000"/>
<Point x="0.070297190" o="1" r="0.067" g="1.000" b="0.000"/>
<Point x="0.070312449" o="1" r="0.071" g="0.000" b="0.000"/>
<Point x="0.074203440" o="1" r="0.071" g="1.000" b="0.000"/>
<Point x="0.074218699" o="1" r="0.075" g="0.000" b="0.000"/>
```

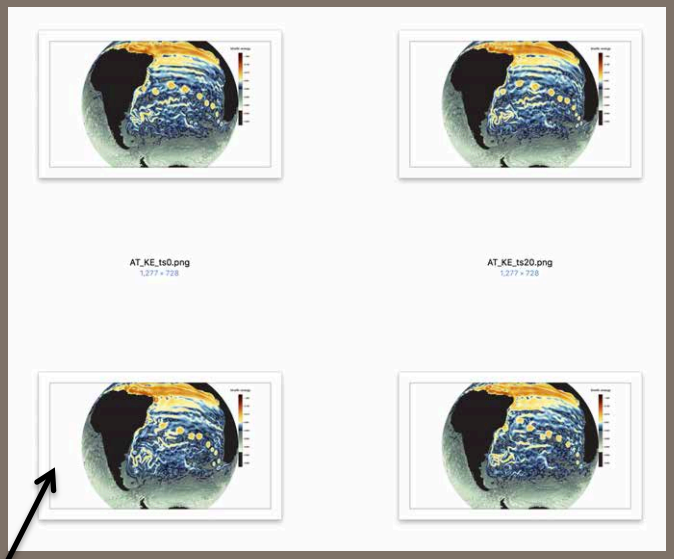

Yellow Orange 1
Yellow Orange 2
Yellow Orange 3
Yellow Orange 4
Yellow Orange 5
Yellow Orange 6
Yellow Orange 7
Yellow Orange 8
Blue 1
Blue 2
Blue 3
Blue 4
Blue 5
Blue 6
Blue 7
Blue 8
Blue 9
Blue 10
Blue 11
Green 1
Green 2
Green 3
Green 4
Green 5
Green 6
Green 7
Green 8
Red Purple 1
Red Purple 2
Red Purple 3
Red Purple 4
Red Purple 5
Red Purple 6
Red Purple 7
Red Purple 8
Brown 1
Brown 2
Brown 3
Brown 4
Brown 5
Brown 6
Brown 7
Brown 8
Brown 9
Expanded Hue 1
Expanded Hue 2
Expanded Hue 3
Expanded Hue 4
Expanded Hue 5
Expanded Hue 6
Expanded Hue 7
Expanded Hue 8
Divergent 1
Divergent 2
Divergent 3
Divergent 4
Divergent 5
Divergent 6
Alternately Struct. 1
Color Set 1
Color Set 2
Color Set 3
Color Set 4
Color Set 5
Color Set 6
Color Set 7
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

video



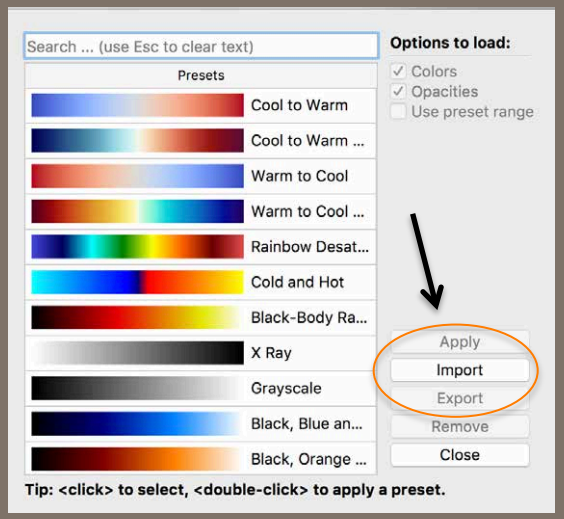
Export from ColorMoves – Import into tool of your choice



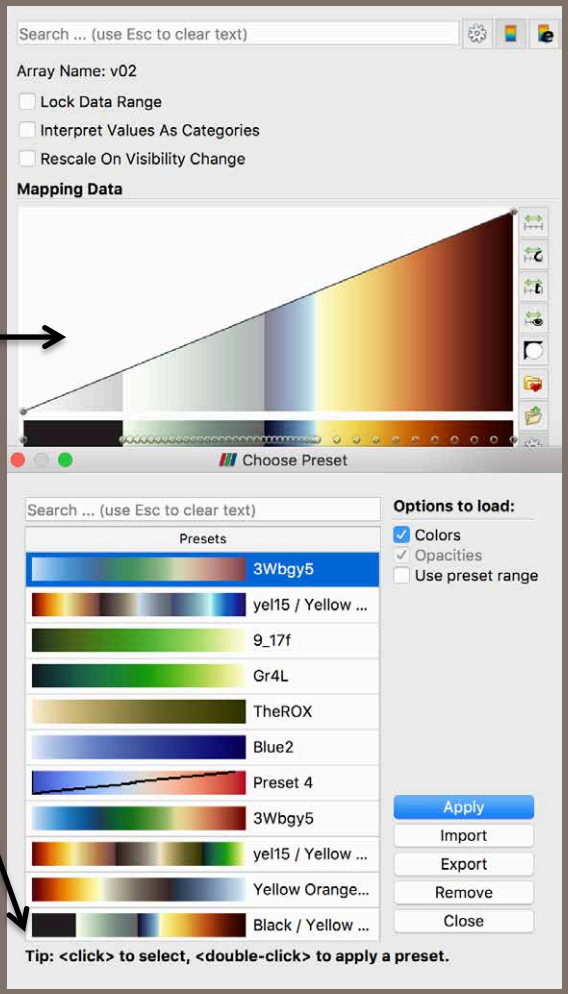


imports into Paraview

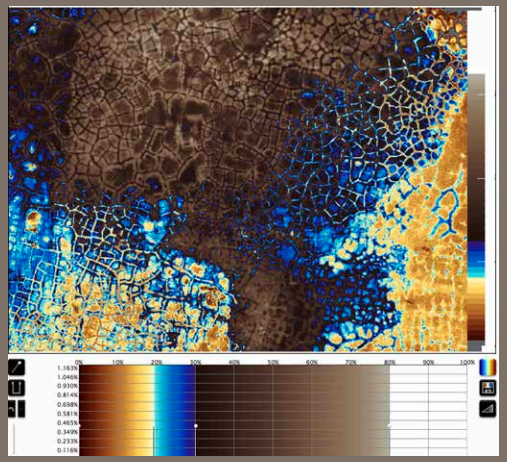
ParaView color editor



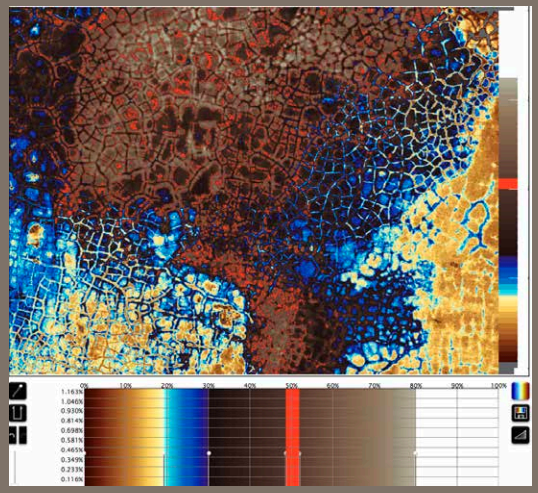
import .xml or .json

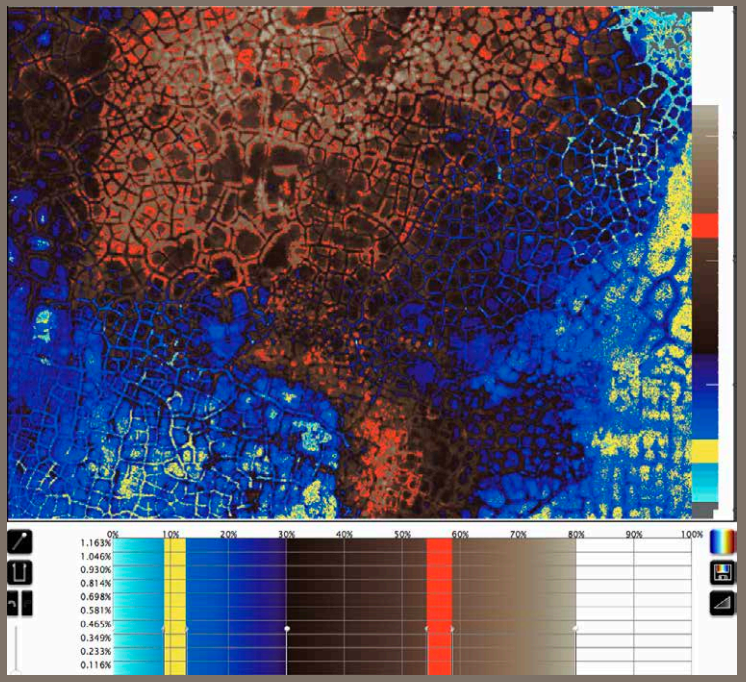


water and arid land



highlight area of concern

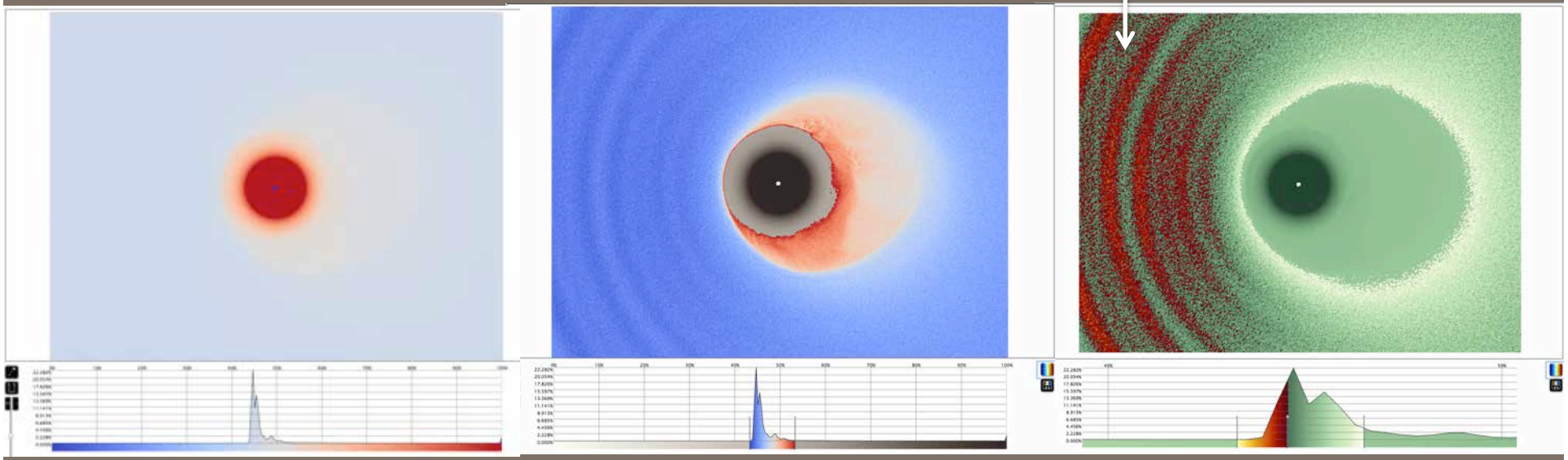




Highlight second area expand blue map to enable clarity yellow highlight

Communication

Honing the data range



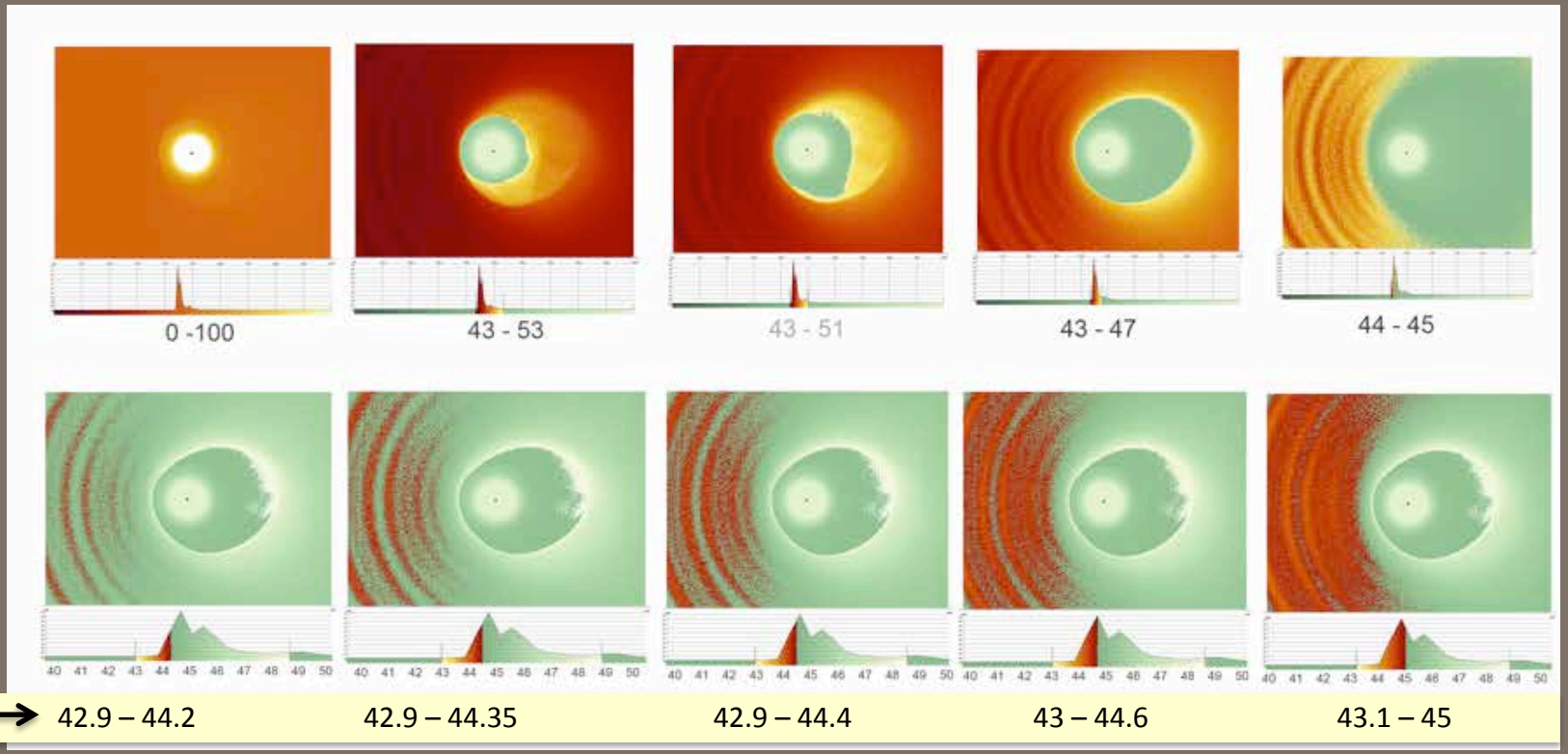
default in full data range

focused data range

optimal, task-driven data range

H3D Ganymede bow fronts
Daughton, LANL

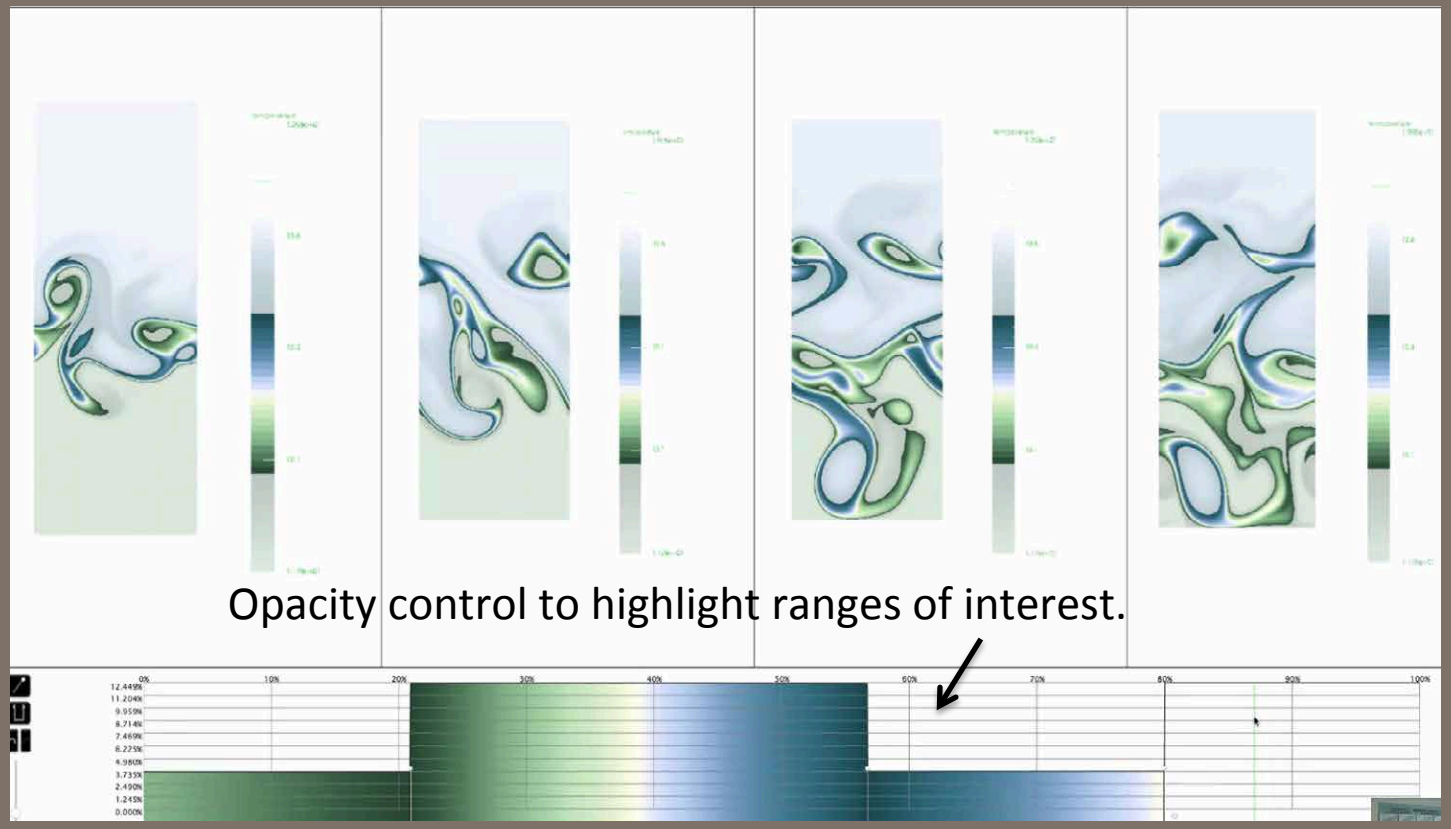
Finding the optimal data range



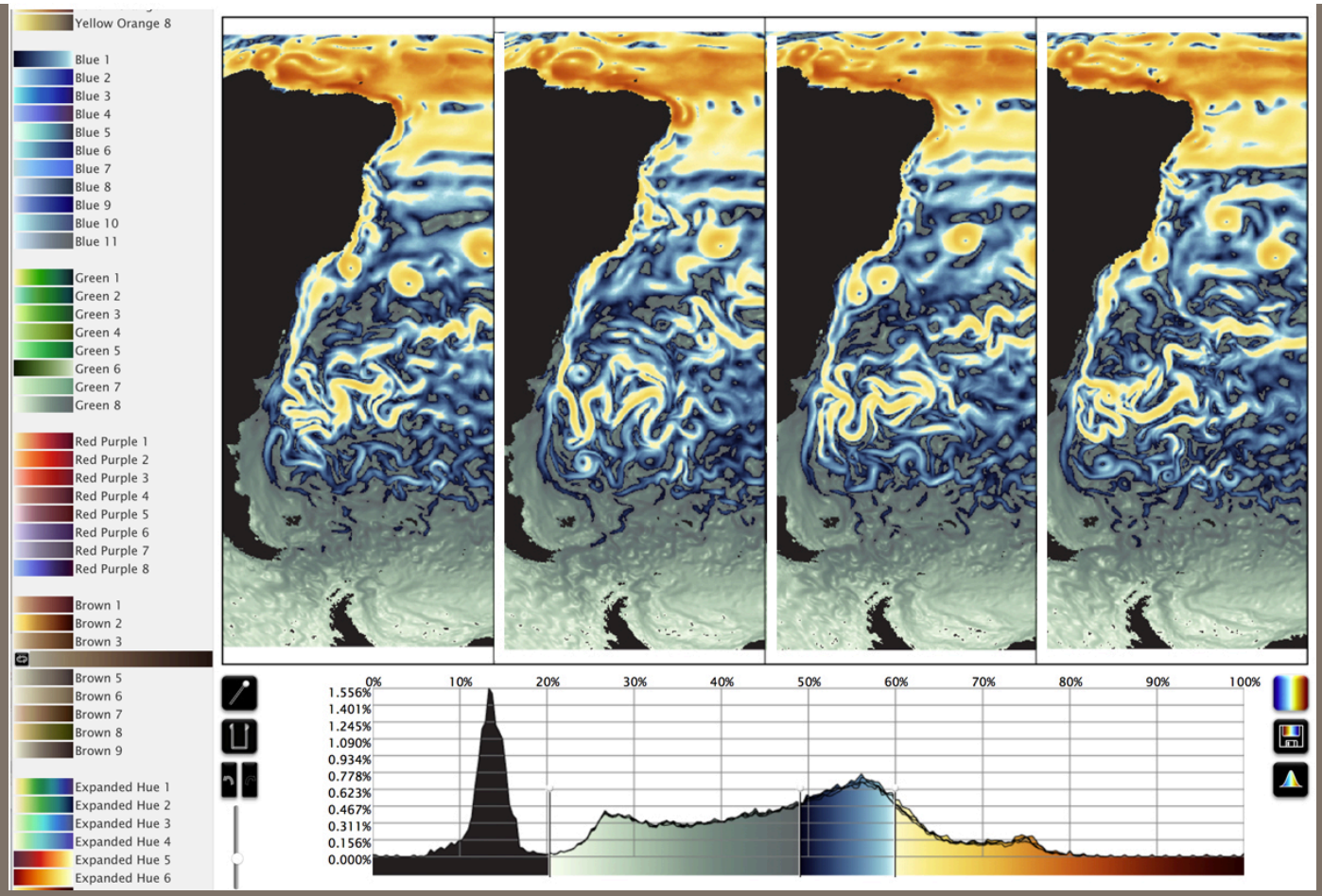
42.9 – 44.2 | 42.9 – 44.35 | 42.9 – 44.4 | 43 – 44.6 | 43.1 – 45

The interactivity enables the fidelity of control.

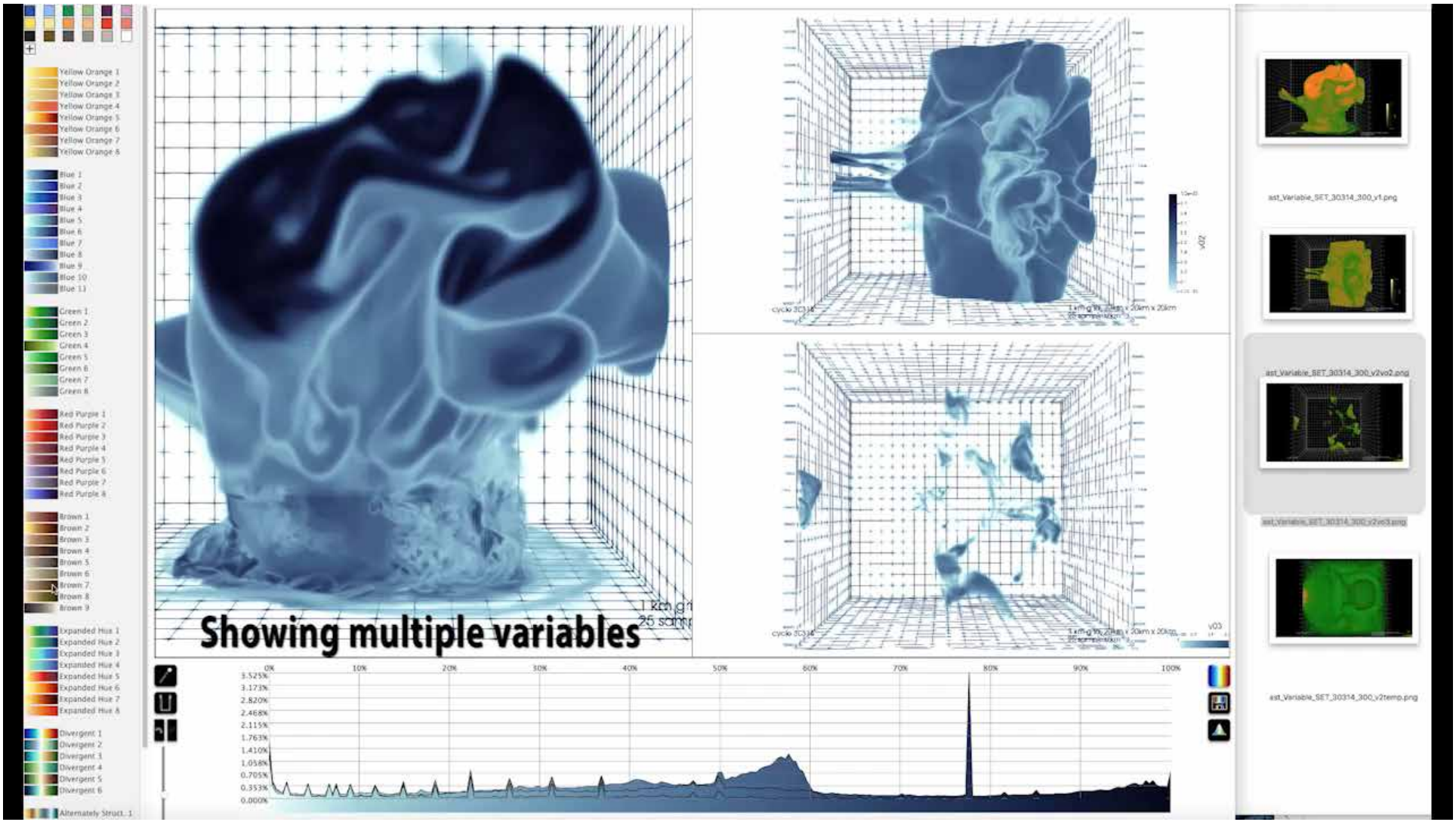
Opacity control



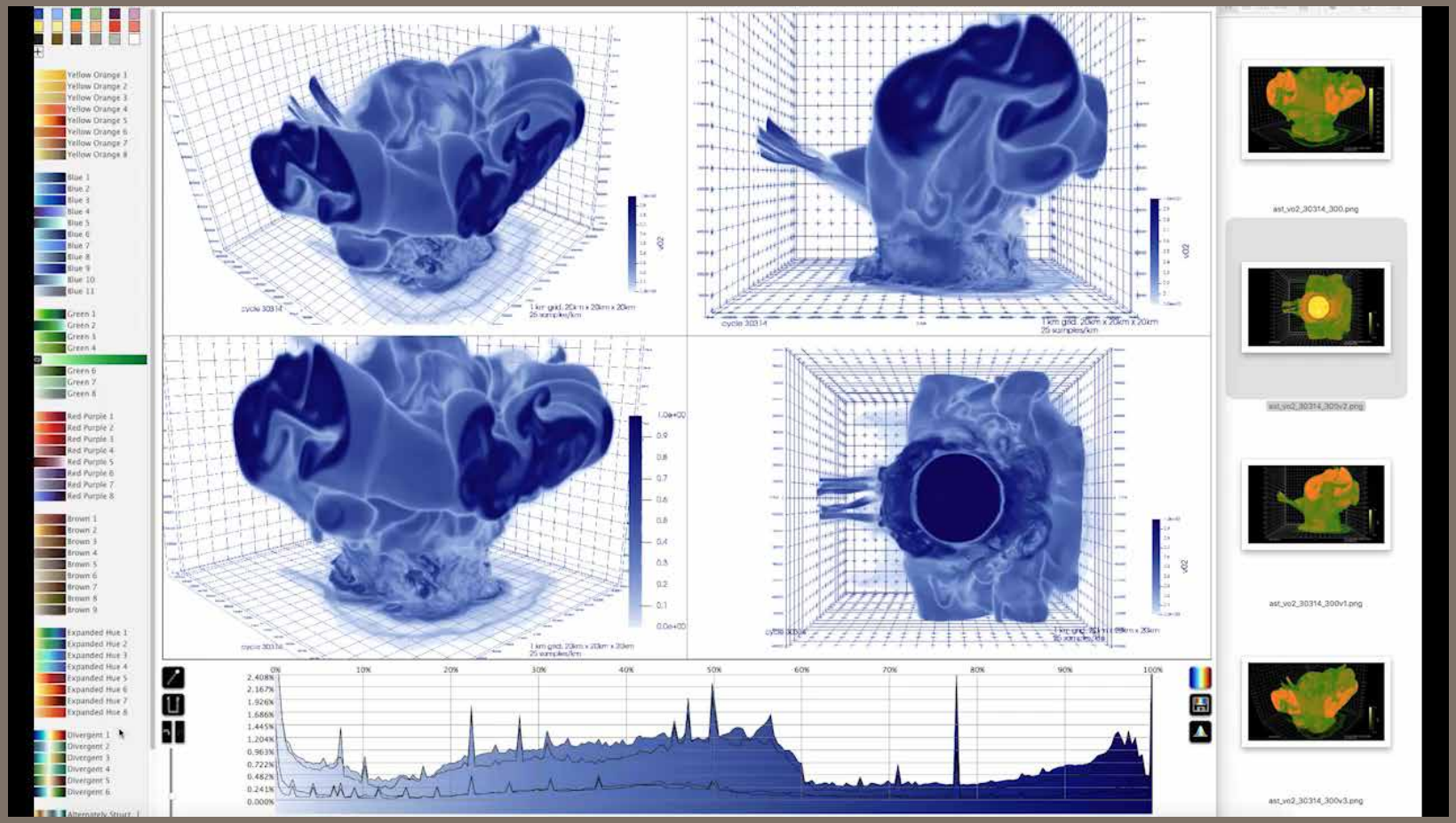
The ability to control the opacity of each color scale individually
enable one to focus attention without the cacophony of multiple colormaps.



Enables crafting a colormap to work across time steps.

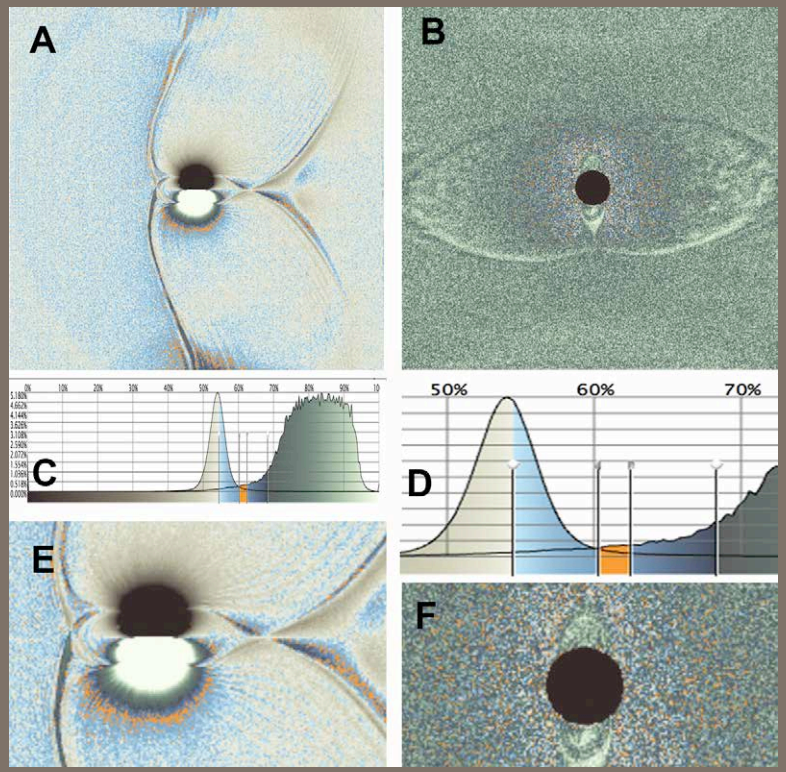

Showing multiple variables

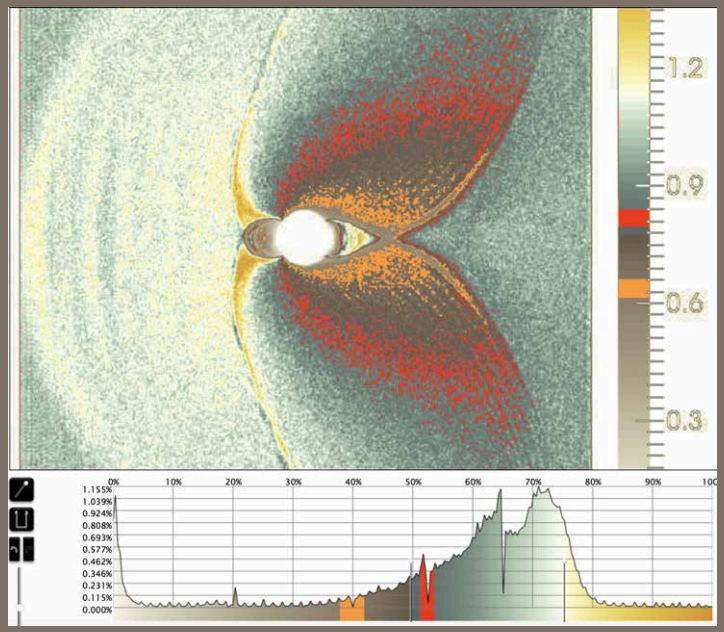
Multiple views



video

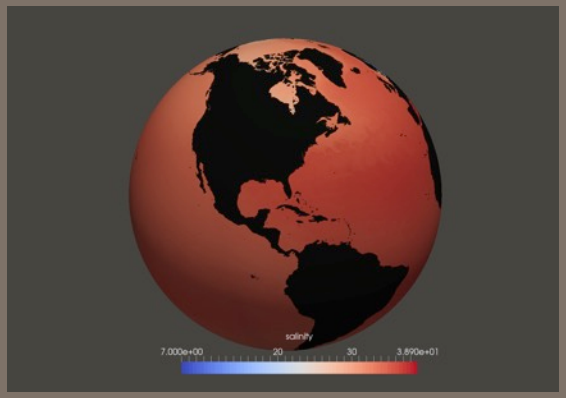
ColorMoves, showing the value of narrow data range identification within context



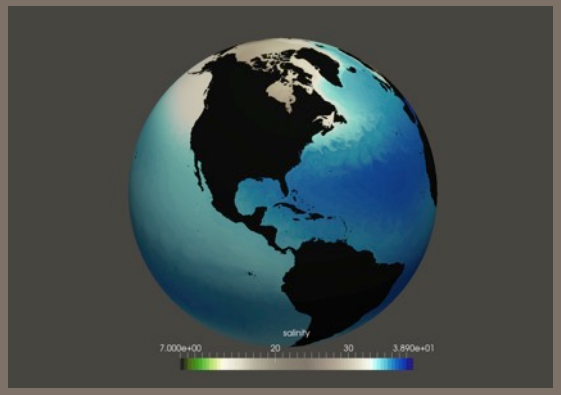


Focal points

Enable viewing of subtle data shifts, in varying ranges

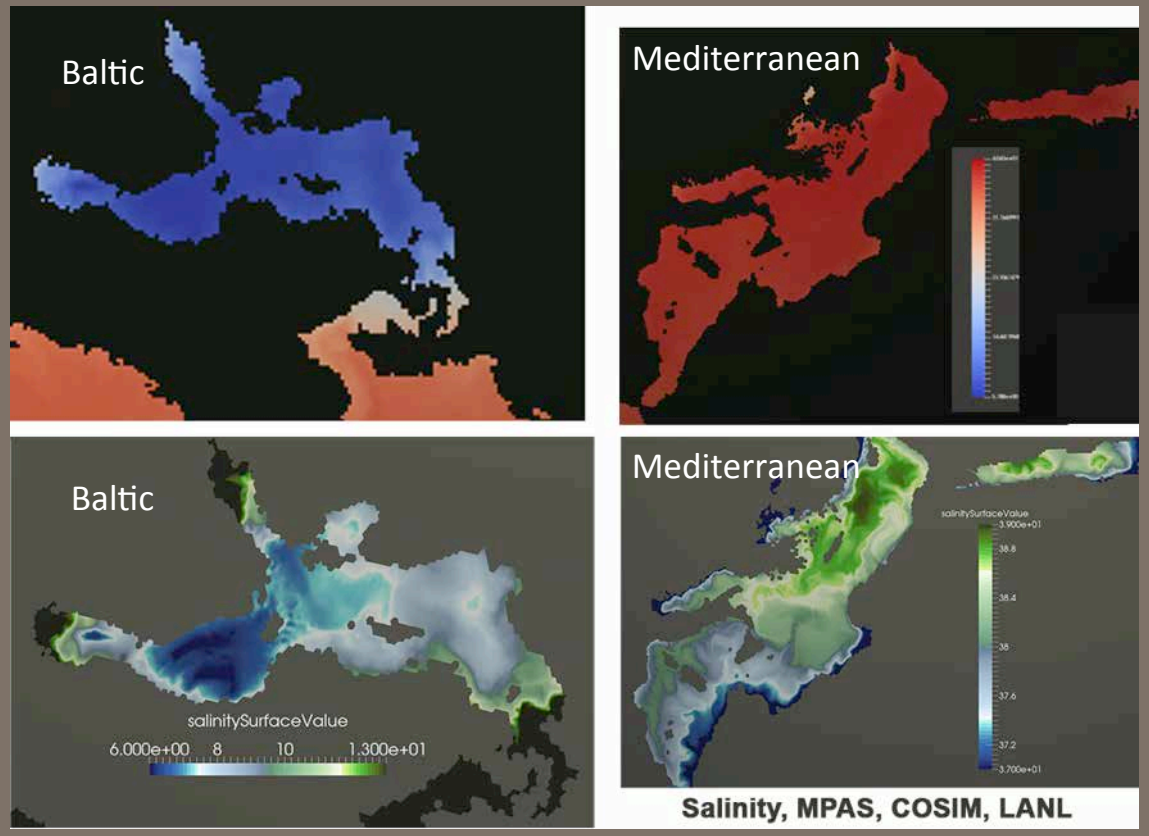


ParaView cool-warm colormap



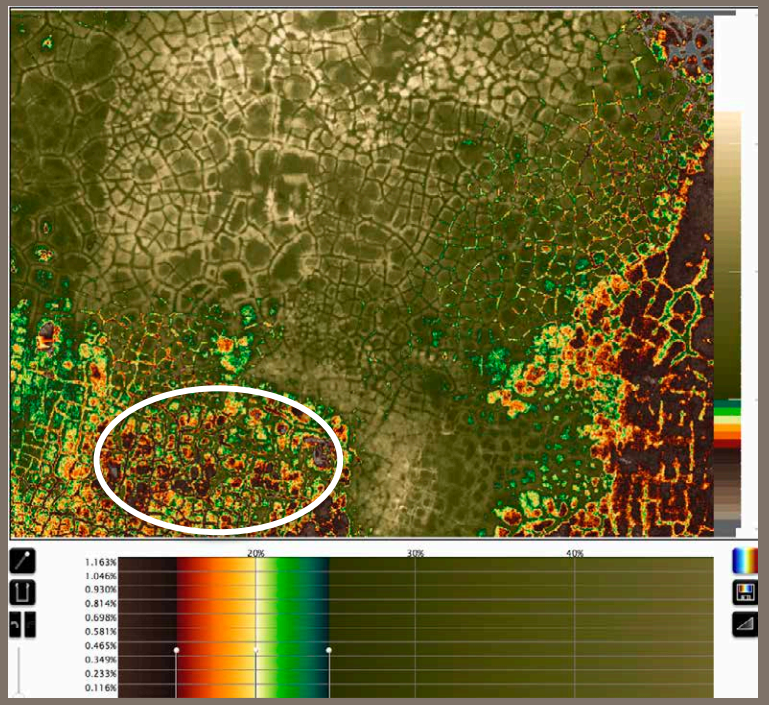
Structured colormap

top: ParaView customized data range

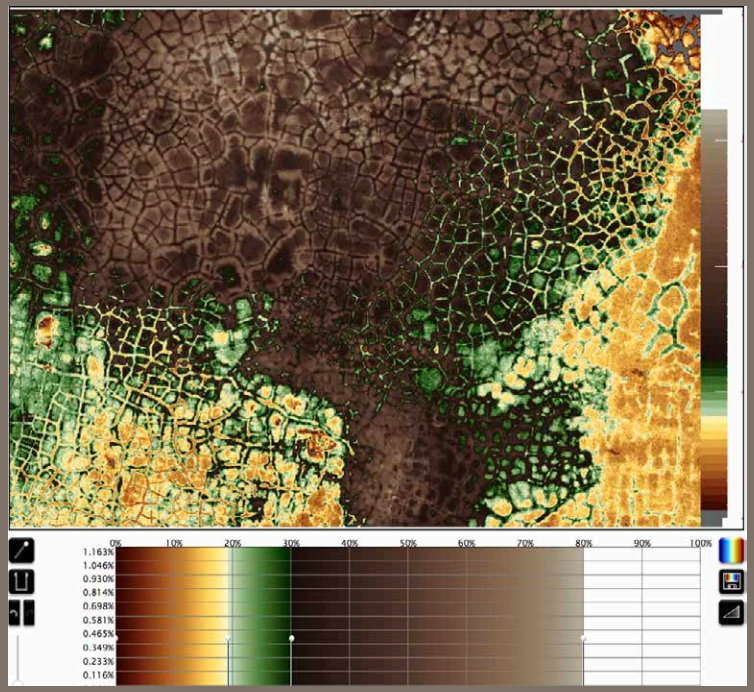


bottom: ColorMoves customized data range

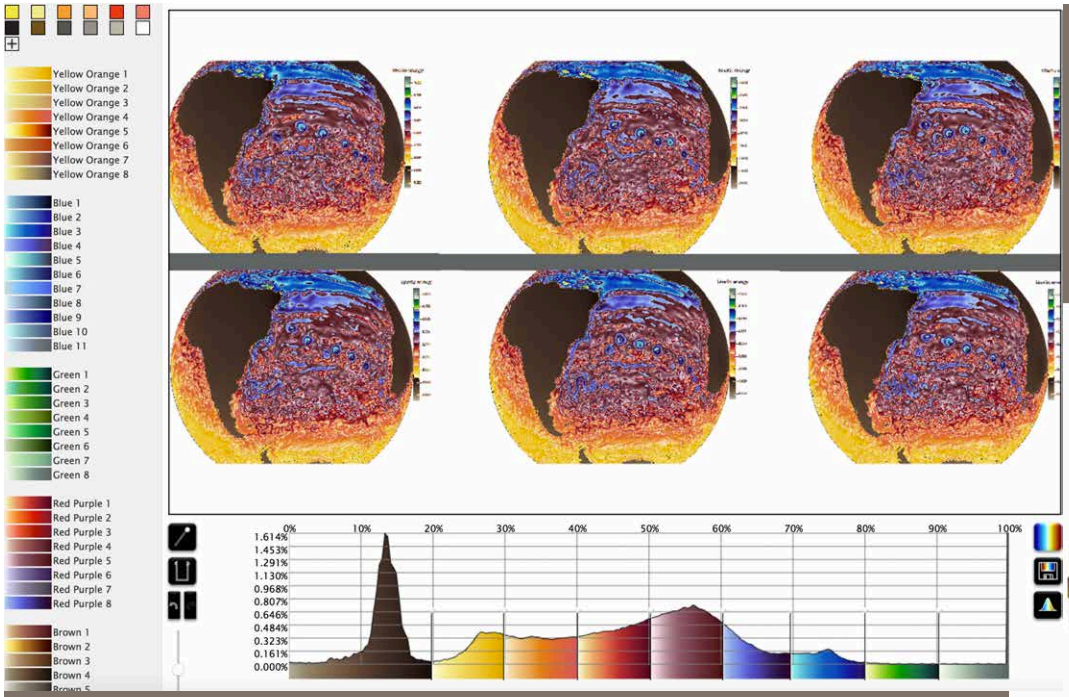
Caution…



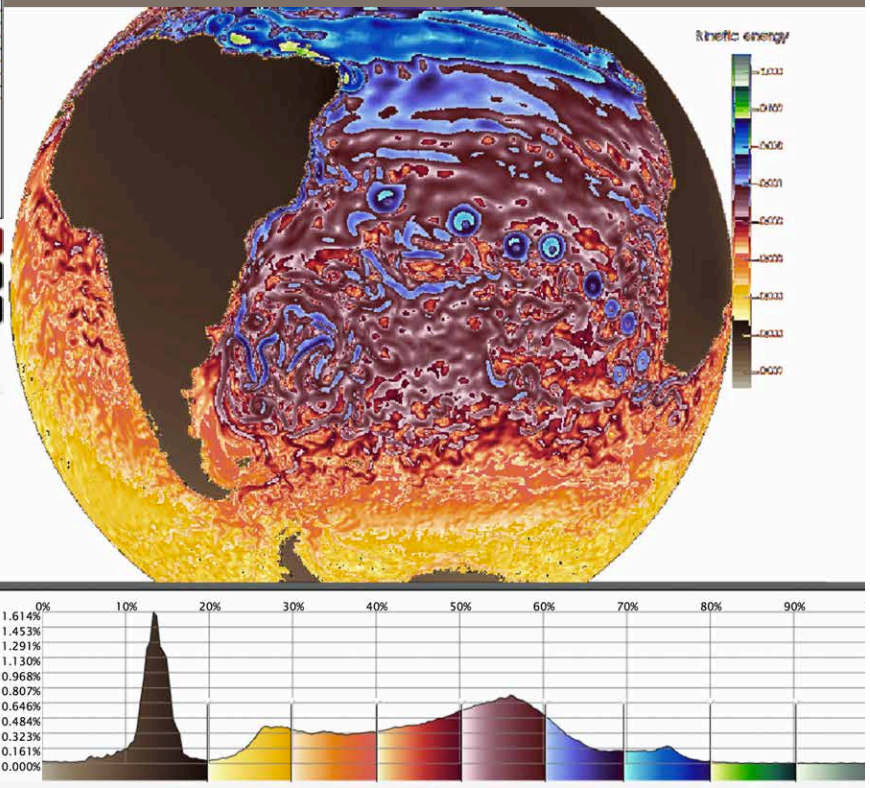
an example of too much contrast on small features



two neutral colors and a mellow green accent

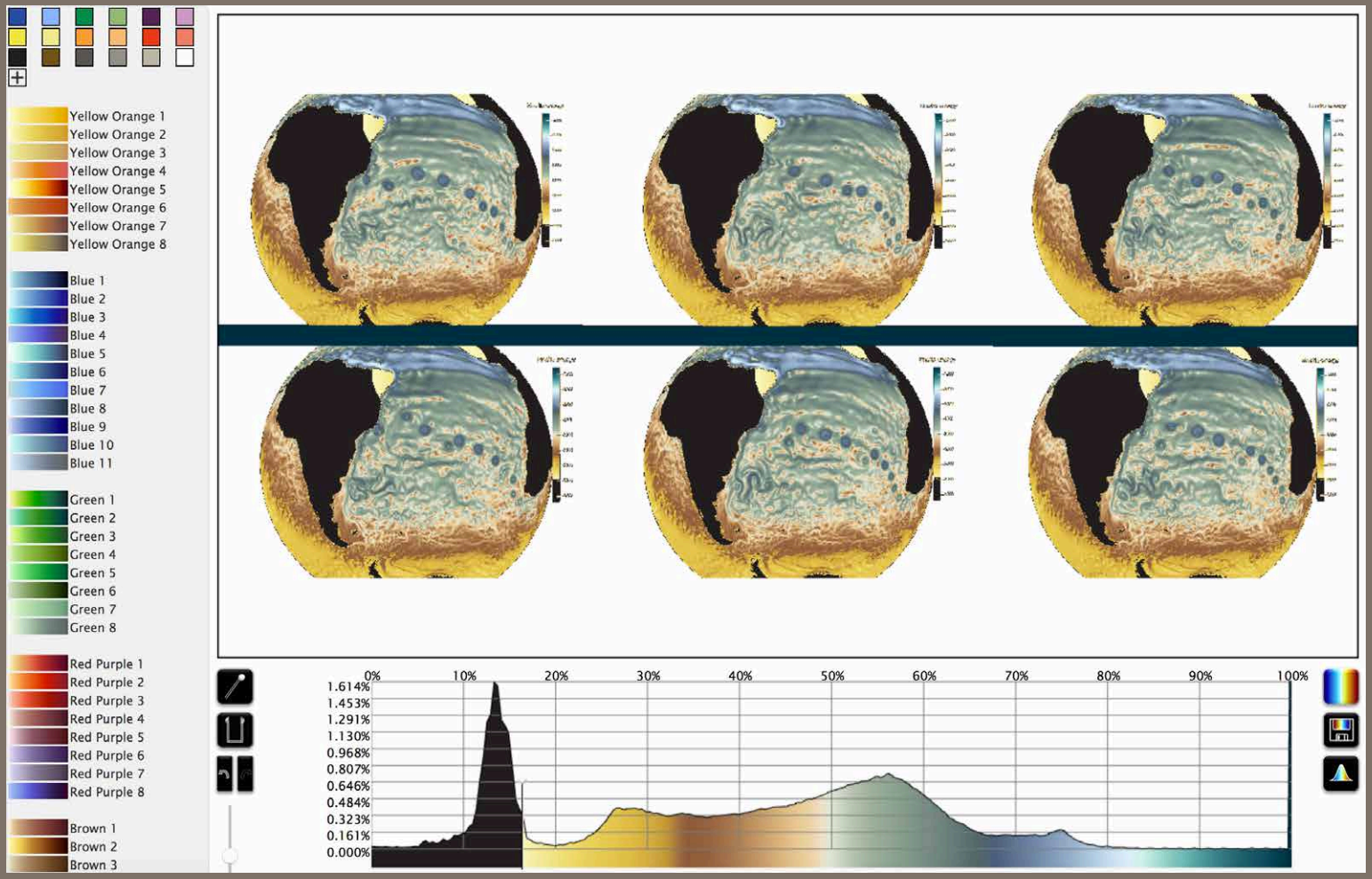


How many is **too many**
depends on the feature size.

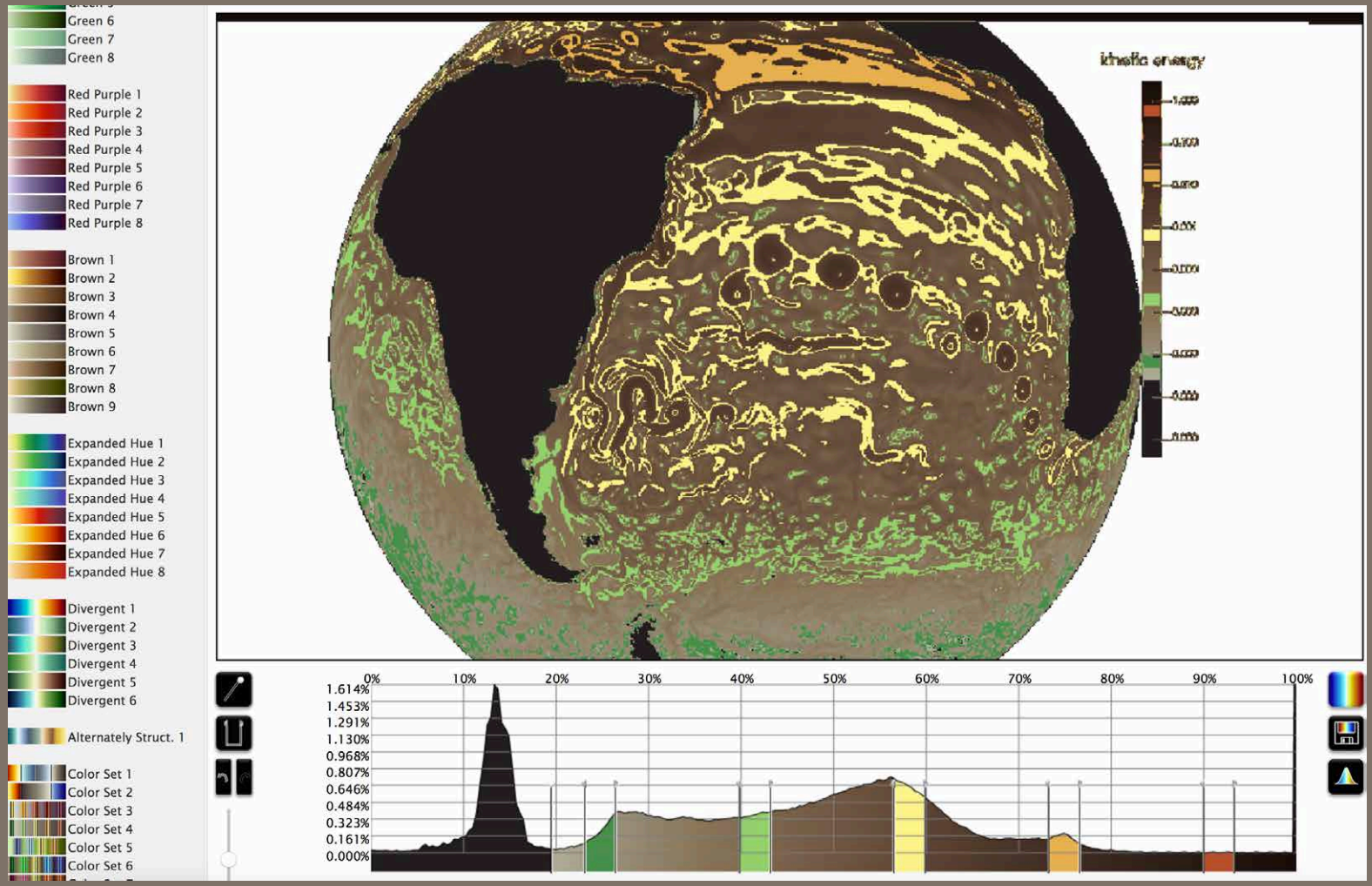


If you must used ten,
start with the muted color scales.

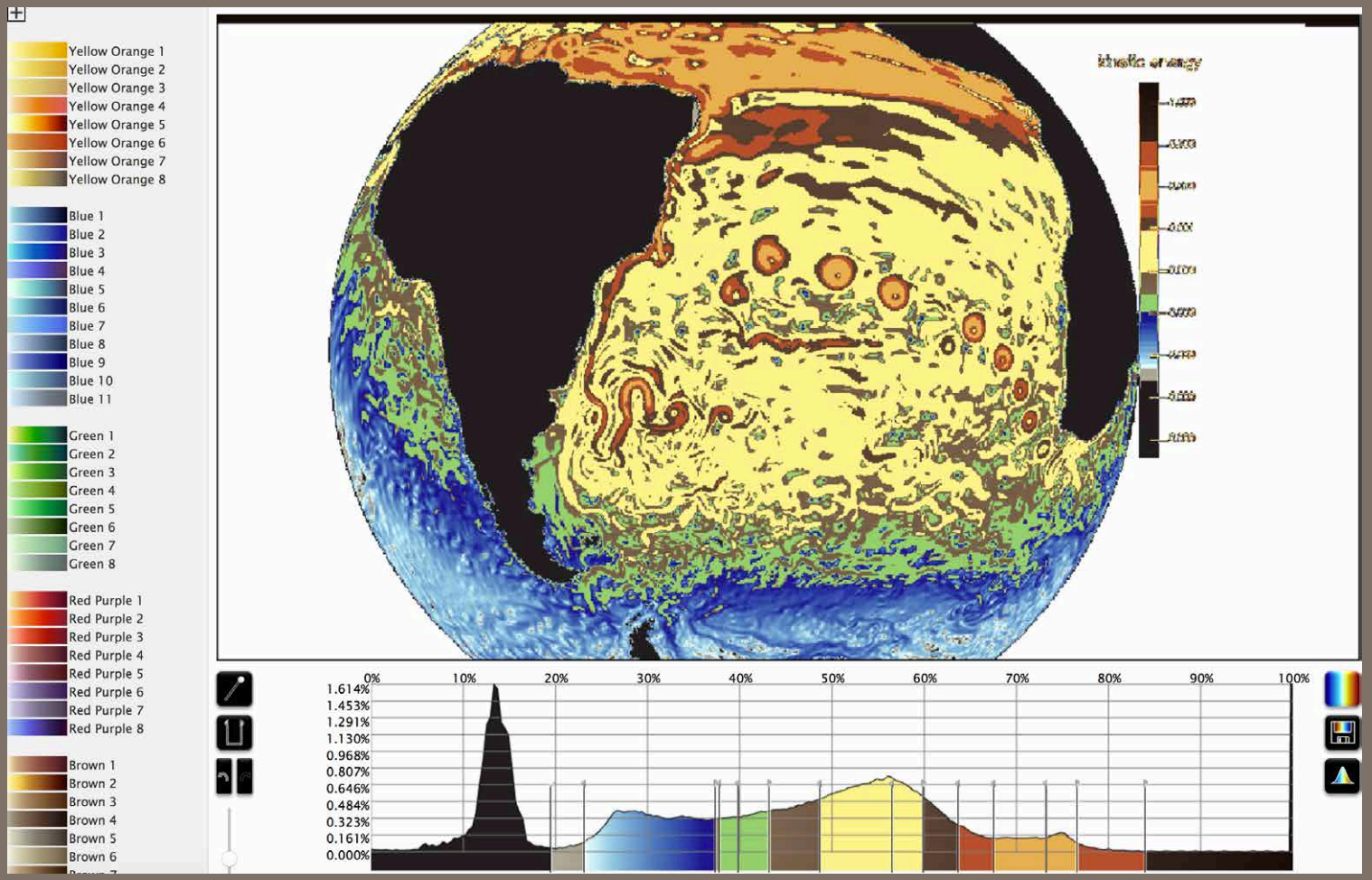
Or start with a **wave map**

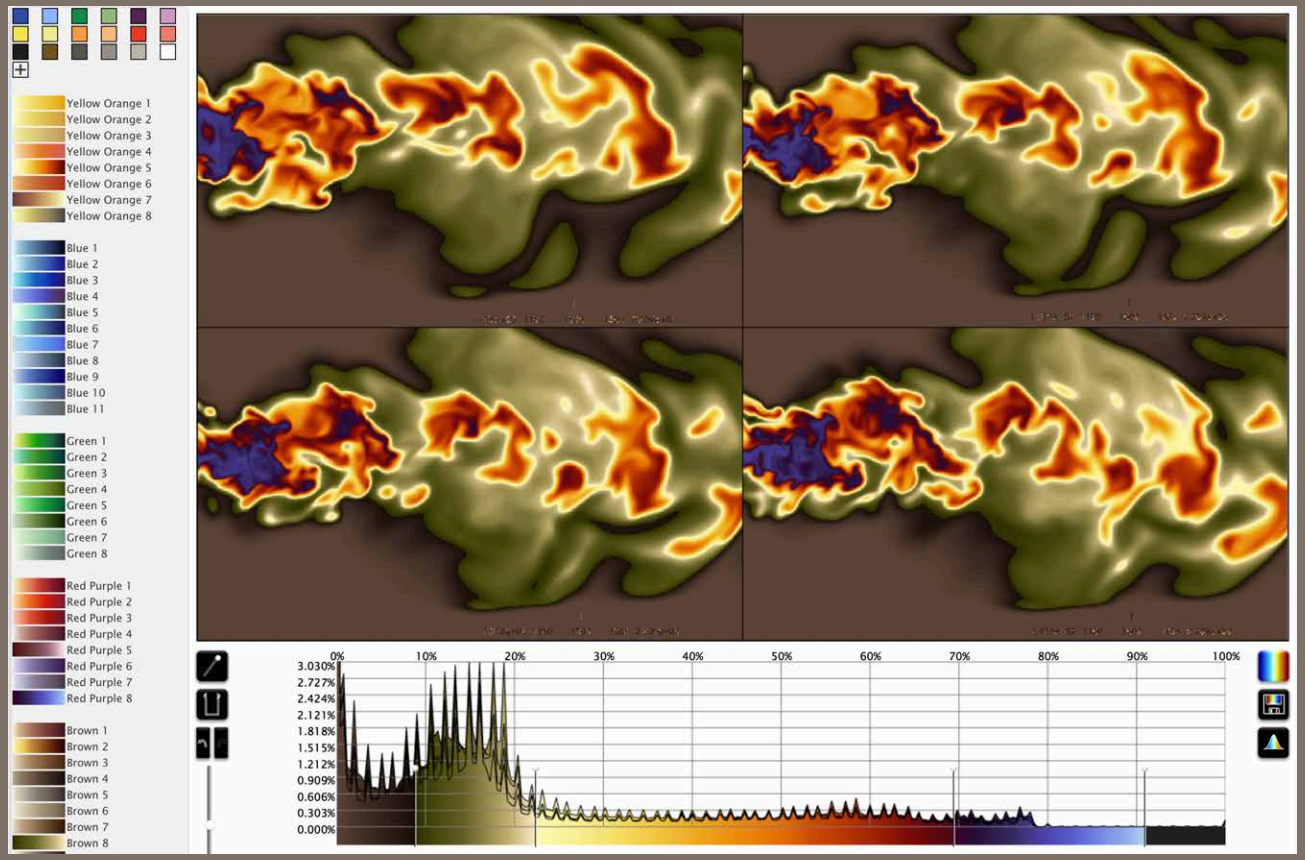


Or the "set" maps



and customize the set map.





Beautiful isn't bad, it is an artifact of good design.

ColorMoves: Real-time Interactive Colormap Construction for Scientific Visualization

Francesca Samsel, Sebastian Klaassen, David H. Rogers

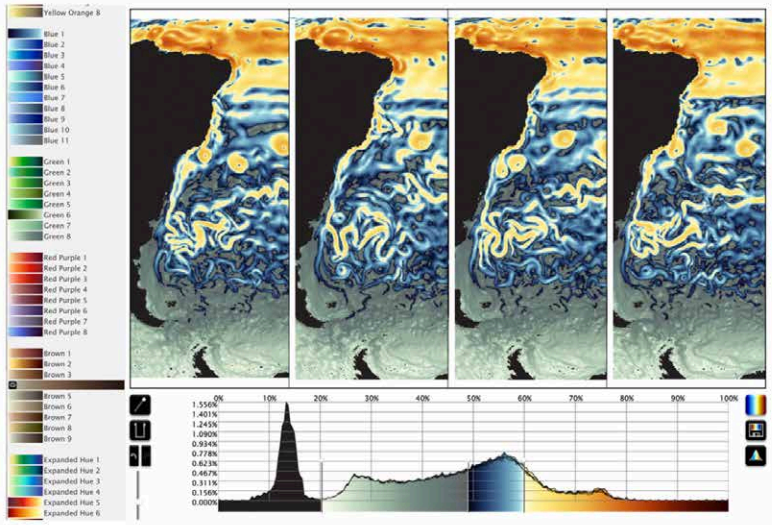
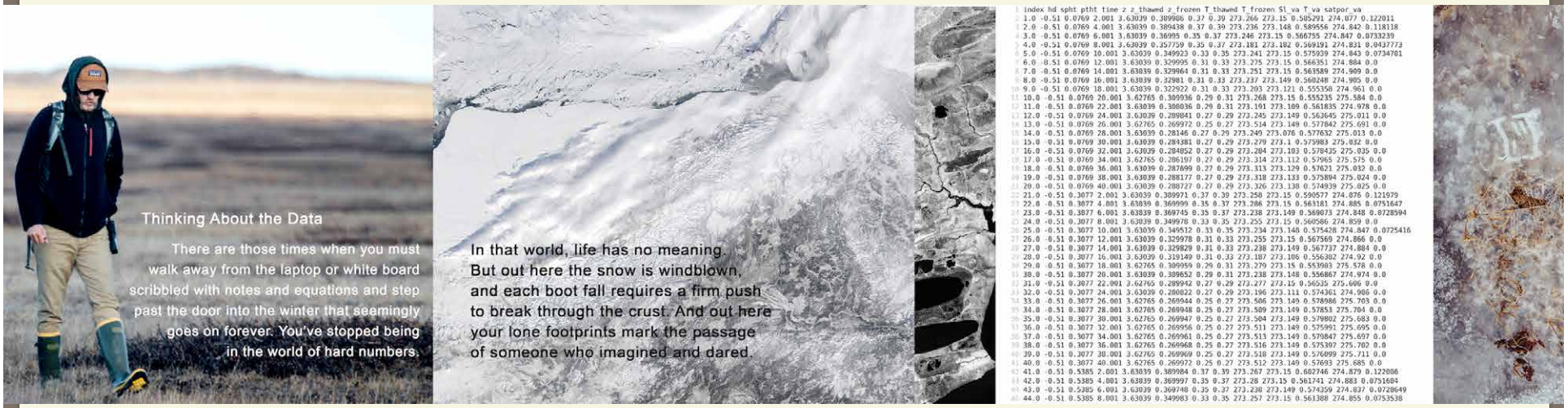


Fig. 1. Four timesteps of an MPAS–Ocean kinetic energy simulation is shown in the ColorMoves interface. ColorMoves is an interface that enables scientists to construct colormaps with contrast applied to regions of greatest interest. It also promotes interactive *exploration* of data through color. The ability to load several images into the interface window enables scientists to construct colormaps that are effective across time ranges, camera views, variables and more.

Abstract—The visualization of scientific data is both a science and an art, in which many tools are used to explore, discover and communicate the information within the data. This process is increasingly difficult, as the size and complexity of data is constantly advancing. Color is a potent tool in scientific data visualization, and has been well studied. However, color's full potential for communication and discovery remains untapped. Effective use of color requires a depth of understanding and experience employing color and color relationships, in combination with tools to translate that knowledge into scientific visualization workflows. In this paper, we present ColorMoves, an interactive tool that promotes exploration of scientific data through color in a unique and transformative way. We discuss the power of contrast in scientific visualization, the design of the ColorMoves tool, and the tool's application in several science domains.

IEEE *Computer Graphics & Applications*
January 2018

Thinking About Data by Michael G. Smith



Drawn from the work of the NGEE-Arctic research team, LANL