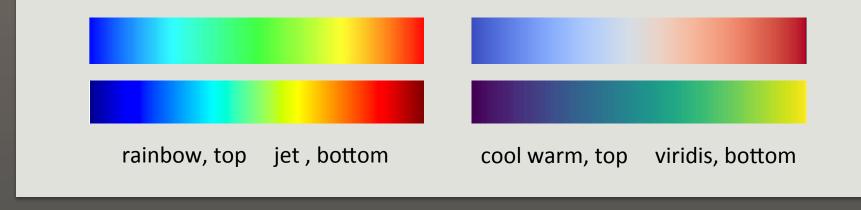
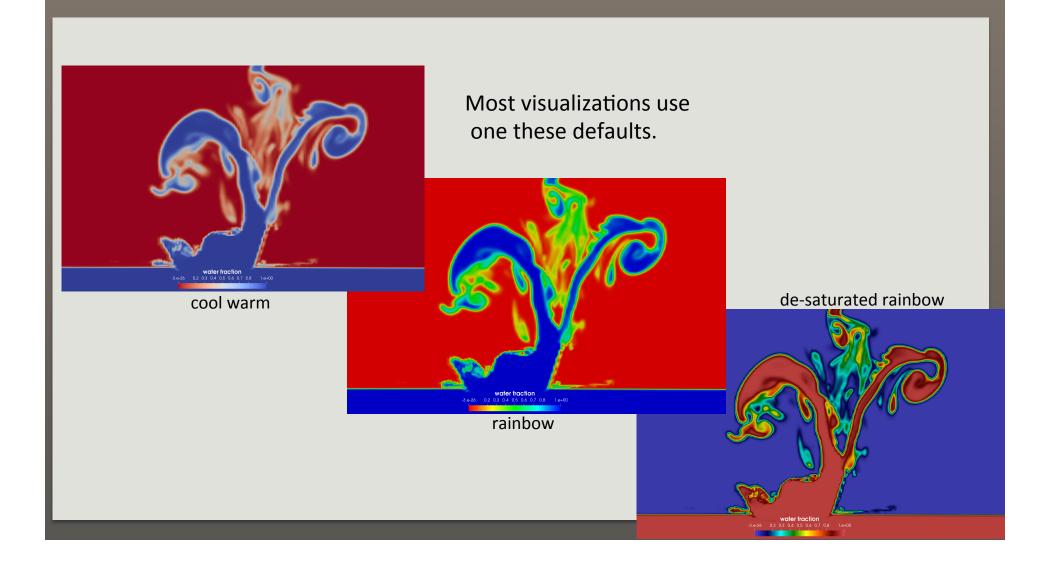
A bit of colormap background so that we can move forward

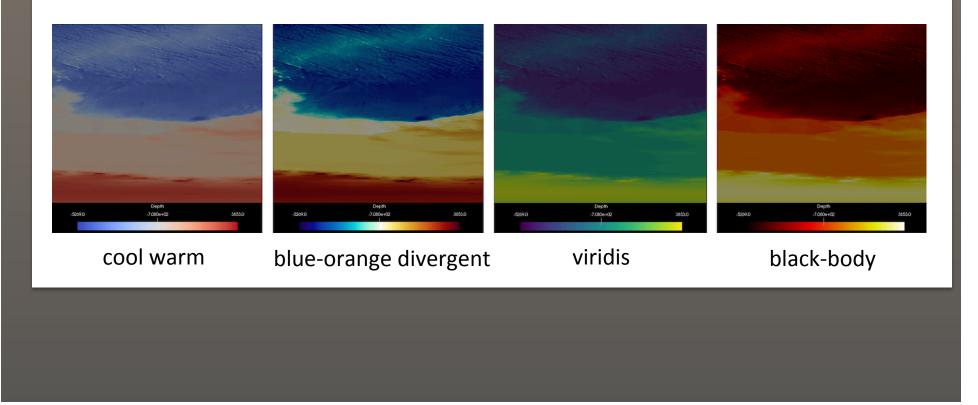
Colormap Defaults

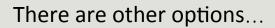
Defaults are necessary and good for many purposes but data varies widely and one-size does not fit all. In this brief tutorial we provide alternatives that provide either more discriminatory power or redistribute the the contrast allocation to align with the data ranges of interest.

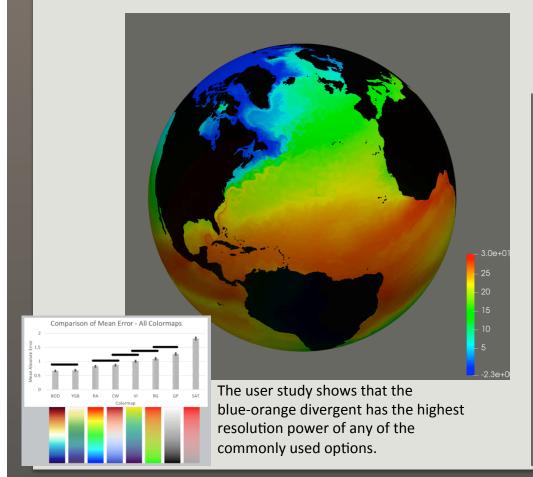


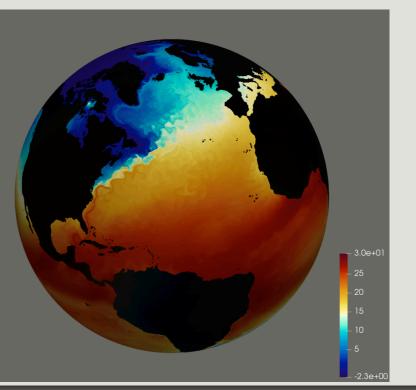


Other Common Colormaps



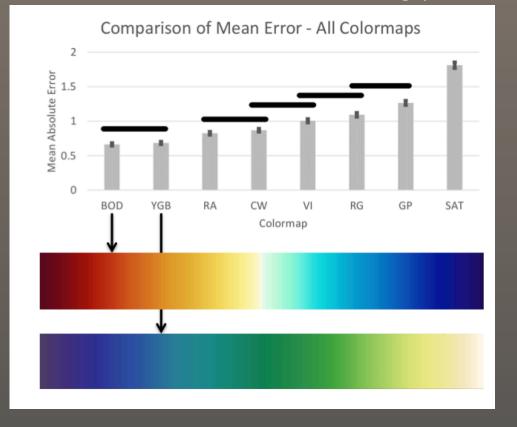


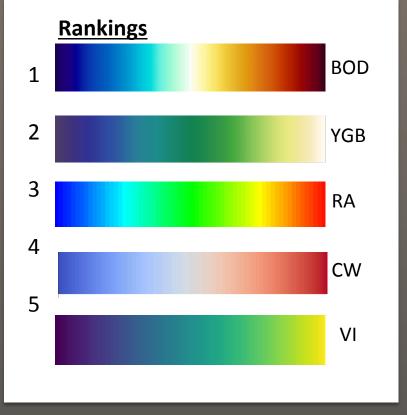




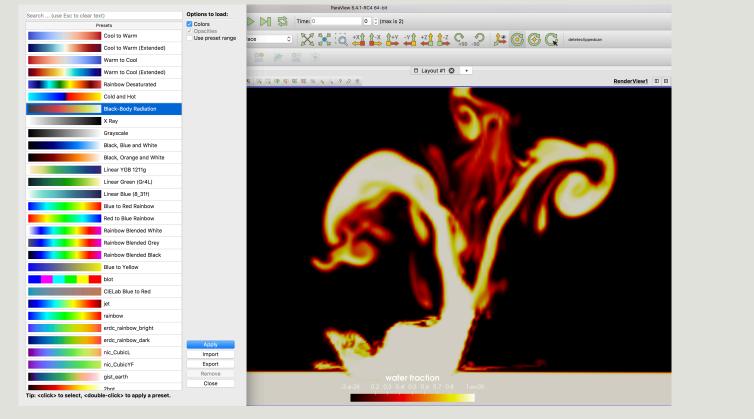
Tested options:

for discriminative or resolving power





But there are other choices,

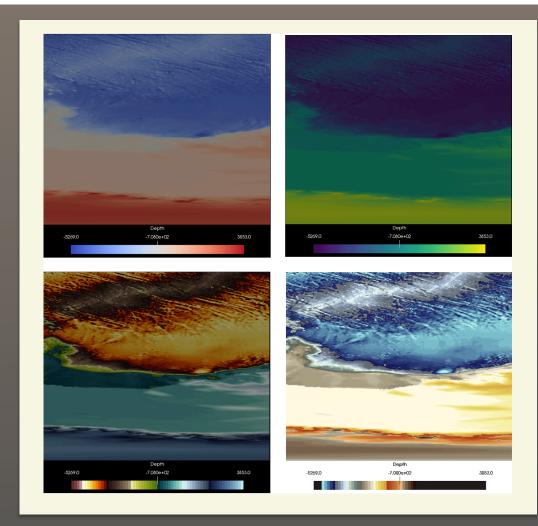


many, many other choices....

esets Cool to Warm
Cool to Warm (Extended)
Warm to Cool
Warm to Cool (Extended)
Rainbow Desaturated
Cold and Hot
Black-Body Radiation
X Ray
Gravscale
Black, Blue and White
Black, Orange and White
Linear YGB 1211g
Linear Green (Gr4L)
Linear Blue (8_31f)
Blue to Red Rainbow
Red to Blue Rainbow
Rainbow Blended White
Rainbow Blended Grey
Rainbow Blended Black
Blue to Yellow
blot
CIELab Blue to Red
jet
rainbow
erdc_rainbow_bright
erdc_rainbow_dark
nic_CubicL
nic_CubicYF
gist_earth
2hot
erdc_red2yellow_BW
erdc_marine2gold_BW
erdc_blue2gold_BW
erdc_sapphire2gold_BW
erdc_red2purple_BW
erdc_purple2pink_BW
erdc_pbj_lin
erdc_blue2green_muted
erdc_blue2green_BW
GREEN-WHITE_LINEAR
GREEN-WHITE_LINEAR erdc_green2yellow_BW
GREEN-WHITE_LINEAR

noices	••	
sets	Presets	Presets
erdc_blue2cyan_BW	Spectral_lowBlue	gray_Matlab
erdc_blue_BW	GnRP	erdc_red2yellow_BW
BLUE-WHITE	GYPi	erdc_blue2cyan_BW
erdc_purple_BW	GnYiRd	erdc_gold_BW
erdc_magenta_BW	GBBr	GREEN-WHITE_LINEAR
magenta	PuOr	Blues
RED-PURPLE	PRGn	Greens
erdc_red_BW	PiYG	Reds
RED_TEMPERATURE	OrPu	BrOrYI
erdc_orange_BW	BrBG	blue2yellow
heated_object	GyRd	erdc_cyan2orange
erdc_gold_BW	erdc_divHi_purpleGreen	coolwarm
erdc_brown_BW	erdc_divHi_purpleGreen_dim	BuRd
copper_Matlab	erdc_divLow_icePeach	GyRd
pink_Matlab	erdc_divLow_purpleGreen	GBBr
oone_Matlab	Haze_green	erdc_divLow_icePeach
gray_Matlab	Haze_lime	Haze
Purples	Haze	erdc_iceFire_L
Blues	Haze_cyan	Muted Blue-Green
3reens	nic_Edge	Green-Blue Asymmetric Div
Риви	erdc_iceFire_H	Asymmtrical Earth Tones (6
BuPu	erdc_iceFire_L	Yellow 15
BuGn	hsv	Magma (matplotlib)
SnBu	hue_L60	Inferno (matplotlib)
GnBuPu	erdc_rainbow_bright	Plasma (matplotlib)
BuGnYl	erdc_rainbow_dark	Viridis (matplotlib)
PuRd	nic_CubicL	3Wbgy5
RdPu	gray_Matlab	5 GrYe
Dranges	erdc_red2yellow_BW	yellow2 / YellowGreenLimes
Reds	erdc_blue2cyan_BW	FloatPNG
RdOr	erdc_gold_BW	Br4div
BrOrYI	GREEN-WHITE_LINEAR	GG918
NOrYI	Blues	R0918
CIELab_blue2red	Greens	Br6div
blue2yellow	Reds	62Blb
rdc_blue2gold	BrOrYI	BGdiv514
erdc_blue2yellow	blue2yellow	BG_muted_adjustedKE
erdc_cyan2orange	erdc_cyan2orange	BlueBrown3
ardc_purple2green	coolwarm	Gr4L
erdc_purple2green_dark	BuRd	GrBr17a
coolwarm	GyRd	yel15 / Yellow Orange 7 / Br
BuRd	GBBr	yel15 / Green 4 / 17f / Brown
Spectral lowBlue	erdc_divLow_icePeach	yel15 / Yellow Orange 7 / Br

which makes selection difficult.



The most powerful means of obtaining intuitive discrimination with in your data is via luminance allocation.

Luminance

the most powerful type of contrast and the key to seeing your data

There are categories of colormaps based on the luminance distribution.

do divHi pu

_Edge dc iceFire H

dc_iceFire_L v e L60

dc_rainbow_bright dc_rainbow_dark c_CubicL ay_Matlab

dc_gold_BW

dc cvan2orange

REEN-WHITE LINEAR

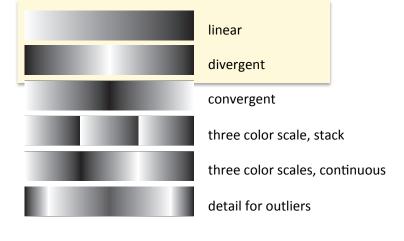
dc_divHi_purpleGreen dc_divLow_icePeach dc_divLow_purpleGree ize_green

Pn	esets Cool to Warm
	Cool to Warm (Extended)
	Warm to Cool
	Warm to Cool (Extended)
	Rainbow Desaturated
	Cold and Hot
	Black-Body Radiation
	X Ray
	Grayscale
	Black, Blue and White
	Black, Orange and White
	Linear YGB 1211g
	Linear Green (Gr4L)
	Linear Blue (8_31f)
	Blue to Red Rainbow
	Red to Blue Rainbow
	Rainbow Blended White
	Rainbow Blended Grey
	Rainbow Blended Black
	Blue to Yellow
	blot
	CIELab Blue to Red
	jet
	rainbow
	erdc_rainbow_bright
	erdc_rainbow_dark
	nic_CubicL
	nic_CubicYF
	gist_earth
	2hot
	erdc_red2yellow_BW
	erdc_marine2gold_BW
	erdc_blue2gold_BW
	erdc_sapphire2gold_BW
	erdc_red2purple_BW
	erdc_purple2pink_BW
	erdc_pbj_lin
	erdc_blue2green_muted
	erdc_blue2green_BW
	GREEN-WHITE_LINEAR
	erdc_green2yellow_BW
	blue2cyan
	biuezcyan

		•
Presets		Prese
erdc_blue2cy	/an_BW	S
erdc_blue_B)	N	G
BLUE-WHITE		G
erdc_purple_	BW	G
erdc_magent	a_BW	G
magenta		Pi
RED-PURPLE		P
erdc_red_BW	1	Pi
RED_TEMPE	RATURE	0
erdc_orange	_BW	B
heated_object	:t	G
erdc_gold_B)	N	er
erdc_brown_	BW	er
copper_Matla	ab	er
pink_Matlab		er
bone_Matlab		н
gray_Matlab		н
Purples		н
Blues		н
Greens		ni
PuBu		er
BuPu		er
BuGn		h
GnBu		h
GnBuPu		er
BuGnYI		er
PuRd		ni
RdPu		91
Oranges		er
Reds		er
RdOr		er
BrOrYl		G
RdOrYl		B
CIELab_blue	2red	G
blue2yellow		R
erdc_blue2g	old	Br
erdc_blue2ye	ellow	bi
erdc_cyan2o	range	er
erdc_purple2	lgreen	c
erdc_purple2		B
coolwarm		G
BuRd		G
Spectral low	Plue	

The key to revealing data is the allocation of contrast, primarily luminance, rather then the selection of a specific hue or color.

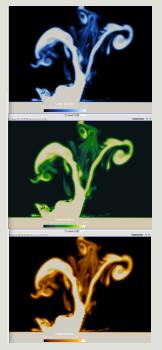
luminance distributions



Linear colormaps differ in hue but convey similar information.

Pre	cool to Warm
	Cool to Warm (Extended)
	Warm to Cool
	Warm to Cool (Extended)
_	Rainbow Desaturated
_	Cold and Hot
_	Black-Body Radiation
	X Ray
	Grayscale
	Black, Blue and White
	Black, Orange and White
	Linear YGB 1211g
	Linear Green (Gr4L)
	Linear Blue (8_31f)
	Blue to Red Rainbow Red to Blue Rainbow
_	Rainbow Blended White
_	Rainbow Blended Grey
	Rainbow Blended Black
	Blue to Yellow
	blot
	CIELab Blue to Red
	jet
	rainbow
	erdc_rainbow_bright
	erdc_rainbow_dark
	nic_CubicL
	nic_CubicYF
	gist_earth
	2hot
	erdc_red2yellow_BW
	erdc_marine2gold_BW
	erdc_blue2gold_BW
	erdc_sapphire2gold_BW
	erdc_red2purple_BW
	erdc_purple2pink_BW
	erdc_pbj_lin
	erdc_blue2green_muted
	erdc_blue2green_BW
	GREEN-WHITE_LINEAR
	erdc_green2yellow_BW
	blue2cyan
	erdc_blue2cyan_BW

Linear	r colorm
Pi	resets
	erdc_blue2cyan_BW
	erdc_blue_BW
	BLUE-WHITE
	erdc_purple_BW
	erdc_magenta_BW
	magenta
	RED-PURPLE
	erdc_red_BW
	RED_TEMPERATURE
	erdc_orange_BW
	heated_object
	erdc_gold_BW
	erdc_brown_BW
	copper_Matlab
	pink_Matlab
	bone_Matlab
	gray_Matlab
	Purples
	Blues
	Greens
	PuBu
	BuPu
	BuGn
	GnBu
	GnBuPu
	BuGnYl
	PuRd
	RdPu
	Oranges
	Reds
	RdOr
	BrOrYI
	RdOrYI

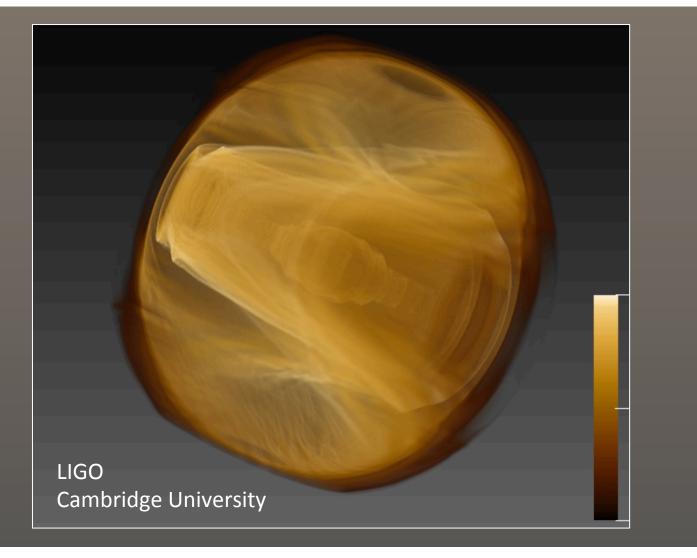


The above are different hues but similar information.

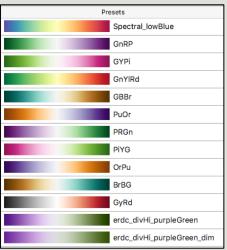
Pr	esets
	Spectral_lowBlue
	GnRP
	GYPi
	GnYIRd
	GBBr
	PuOr
	PRGn
	PiYG
	OrPu
	BrBG
	GyRd
	erdc_divHi_purpleGreen
	erdc_divHi_purpleGreen_dim
	erdc_divLow_icePeach
	erdc_divLow_purpleGreen
	Haze_green
	Haze_lime
	Haze
	Haze_cyan
	nic_Edge
	erdc_iceFire_H
	erdc_iceFire_L
	hsv
	hue_L60
	erdc_rainbow_bright
	erdc_rainbow_dark
	nic_CubicL
	gray_Matlab
	erdc_red2yellow_BW
	erdc_blue2cyan_BW
	erdc_gold_BW
	GREEN-WHITE_LINEAR
	Blues
	Greens
	Reds
	BrOrYl
	blue2yellow
	erdc_cyan2orange
	coolwarm
	BuRd
	GyRd GBBr

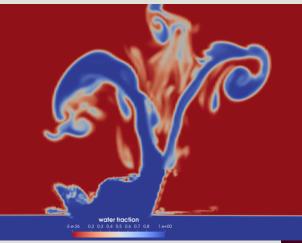


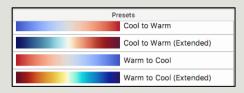
Simply Luminance Contrast



Divergent colormaps



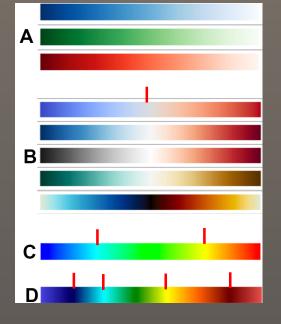




The most commonly used divergent colormaps.

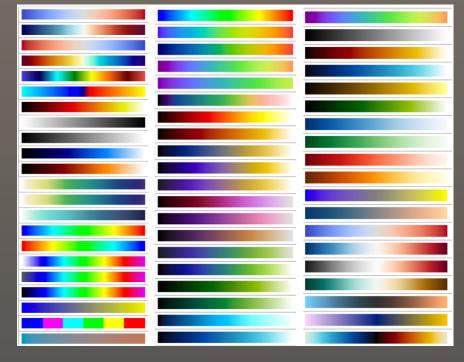
Divergent colormaps contain two hues ranges moving from dark to light and the first and light to dark in the second. The detail of the visualization will depend on the range of contrast across the two color scales, some divergent colormaps revealing more detail than others but the structure of the presentation is similar.

ParaView has 97 colormaps, ...of limited impact.



luminance distributions

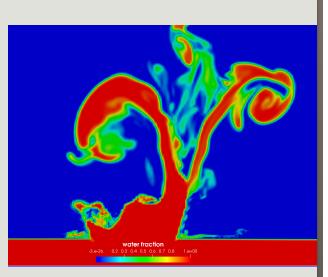
ParaView's colormap selections





Rainbow colormaps are popular because of the assumption that we can see more of our data.

However testing has shown that this is not the case.



The problematic ubiquitous rainbow.

<u>Colormaps</u> <u>spanning **hue** and **value**</u>

Presets Cool to Warm

nol to Warm

Cold and Hot

Grayscale Black, Blue and White Black, Orange and White Linear YGB 1211g Linear Green (Gr4L) Linear Blue (8_311) Blue to Red Rainbow Red to Blue Rainbow

rm to Cool (E)

how Blended Whit

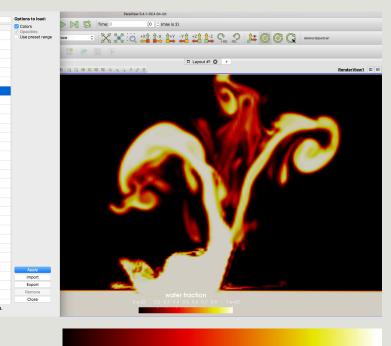
ainbow Blended Gre

blot CIELab Blue to Red jet rainbow erdc_rainbow_bright erdc_rainbow_dark nic_CubicL

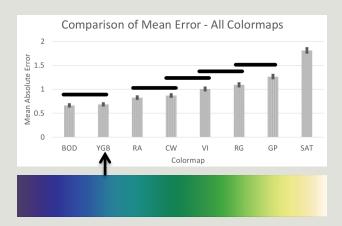
nic_CubicYI

2hot e-click> to apply a pre

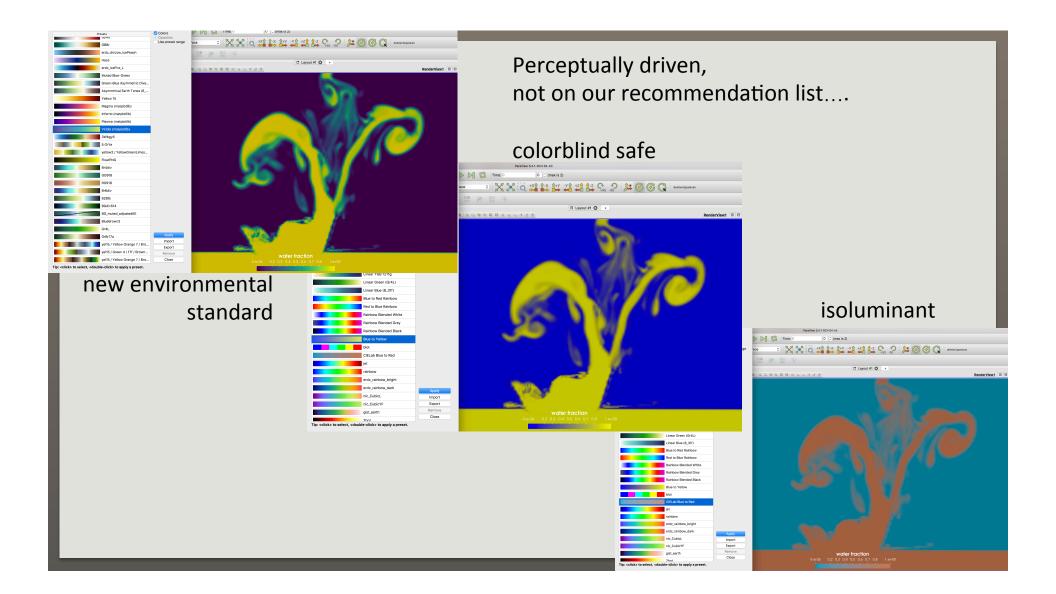
gist_earth

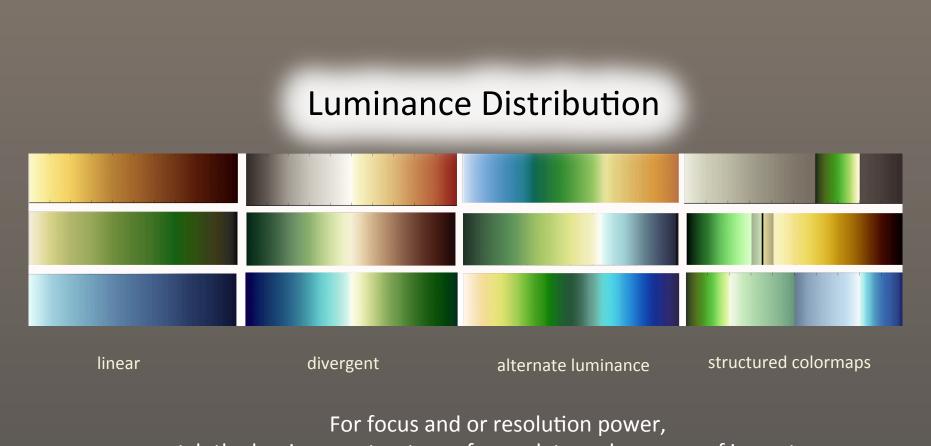


Black-body radiation a good default.



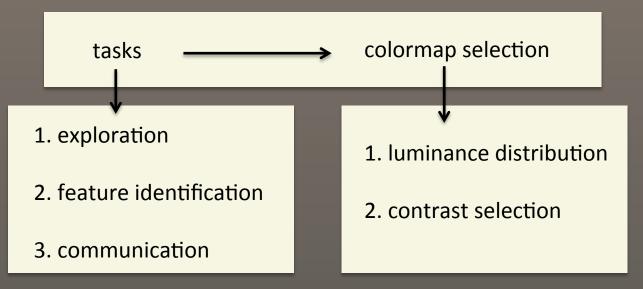
blue-green-yellow, spanning hue and value range

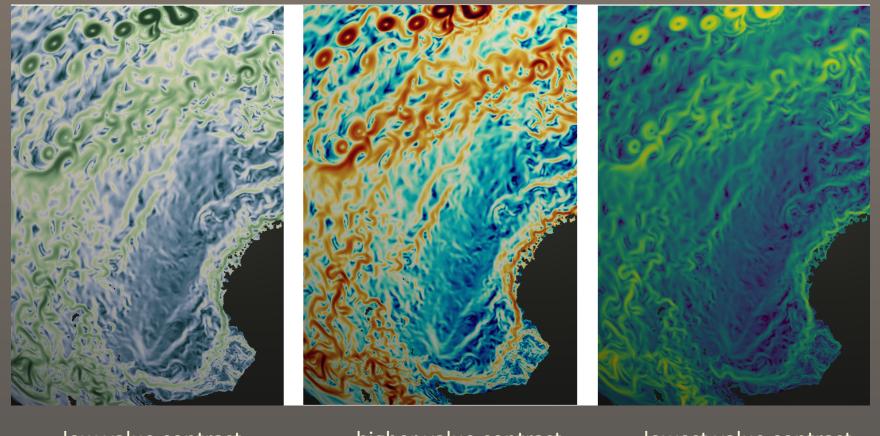




match the luminance structure of your data and or areas of importance.

Follow the task.....



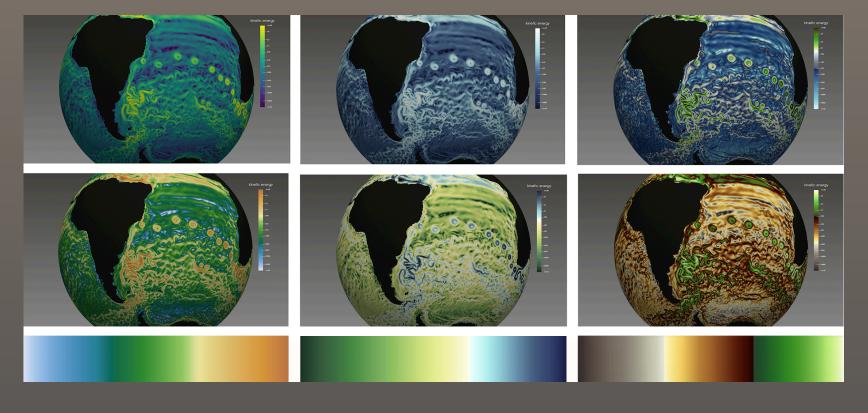


low value contrast

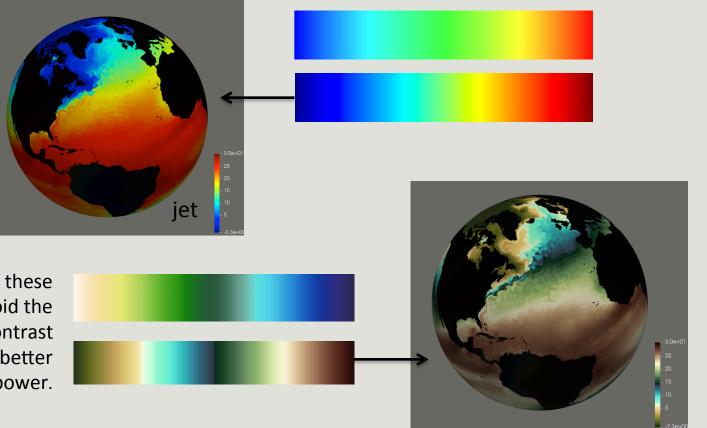
higher value contrast

lowest value contrast

Domain intuitive Alternate luminance distributions

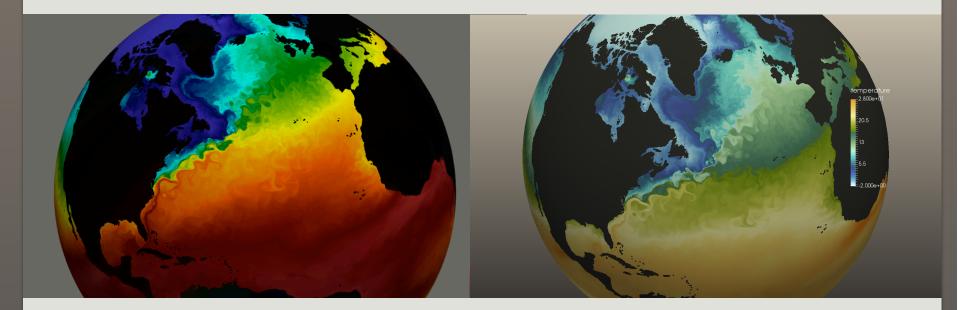


The upper set shows the ocean temperature in the rainbow and jet colormaps.



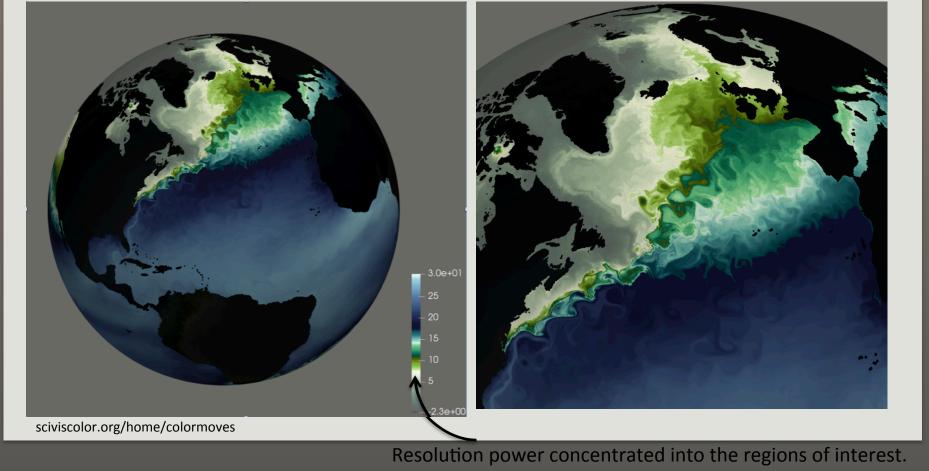
http://sciviscolor.org/home/colormaps/rainbow-alternatives/

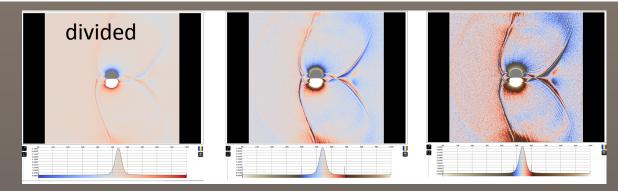
Both of these colormaps avoid the simultaneity contrast tension and prove better discriminatory power. The de-saturated rainbow is often used by scientists desiring detailed renderings. The saturated palette produces a subtle vibration and not optimal in many situations.



Alternatives include "wave" colormaps (I) or custom maps are available on SciVisColor.org.

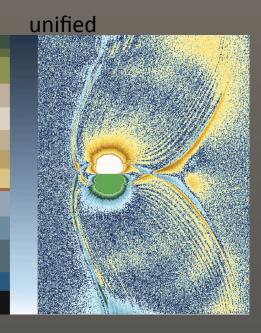
Contrast is the means by which color delivers information. If there is a specific area of interest, condense the contrast to those areas.

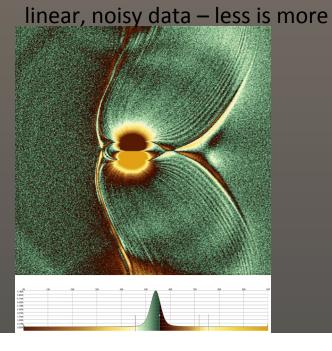




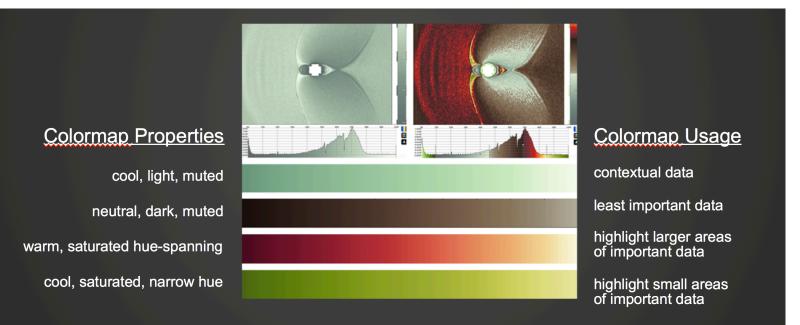
standard cool warm colormap -

Aligning type of data to type of contrast





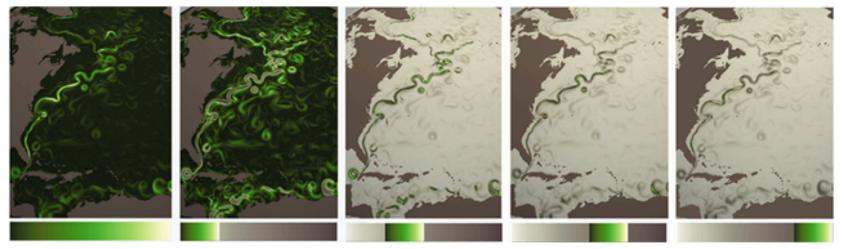
Constructing color palettes based on contrast theory



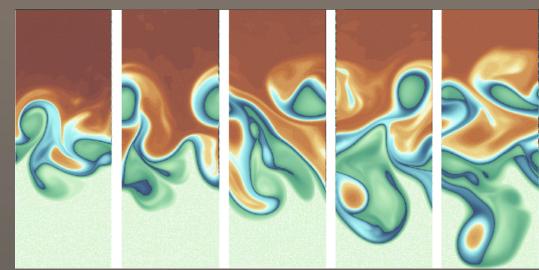
focusing contrast

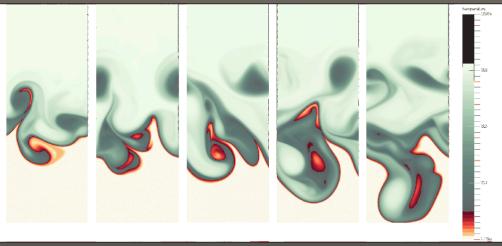
The Colormap Microscope

Stepped Insets



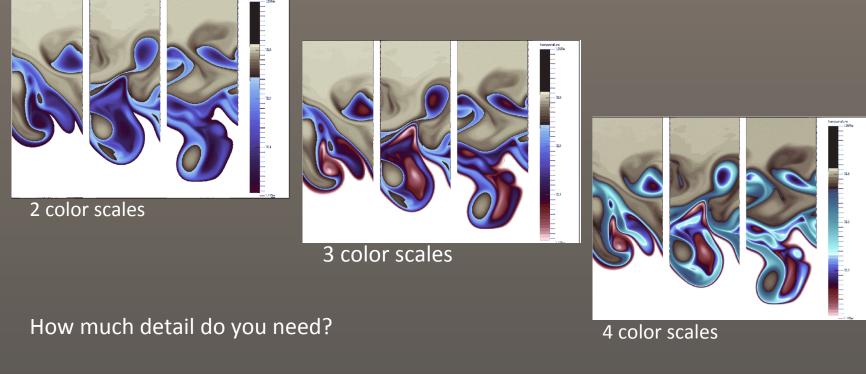
http://sciviscolor.org/home/colormaps/765-2/



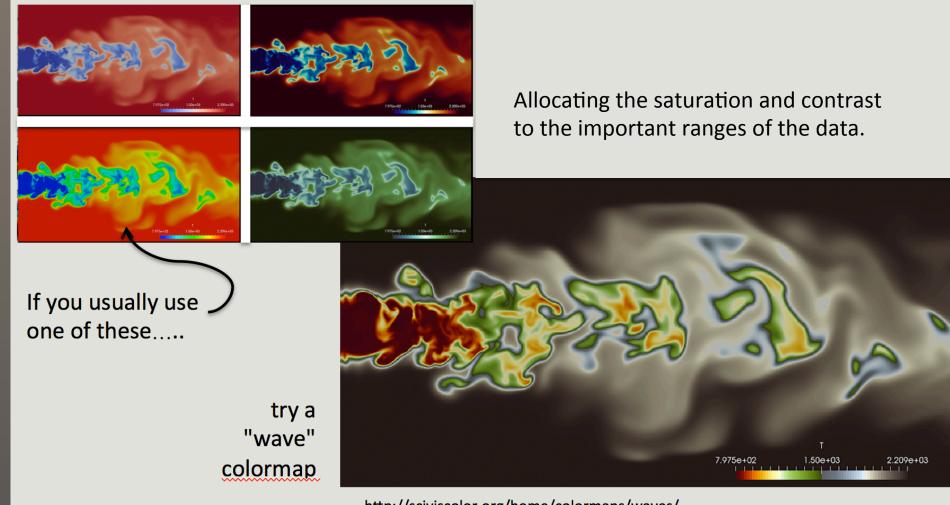


Focus contrast on a specific data range and track it over time.

Cropped data range, with 2, 3 and 4 color scales



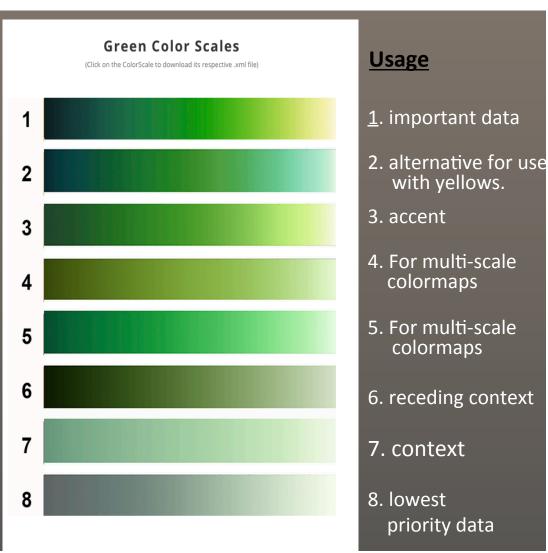
At what point does it stop adding value?



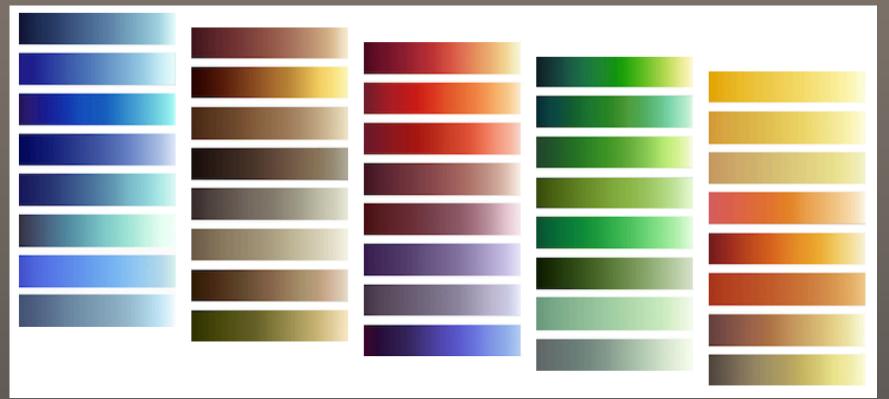
http://sciviscolor.org/home/colormaps/waves/

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



Color Scales



ColorMoves enables alignment of luminance with statistical distribution