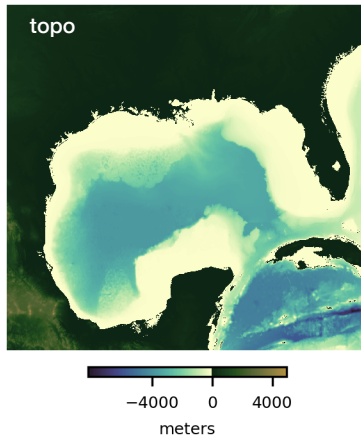
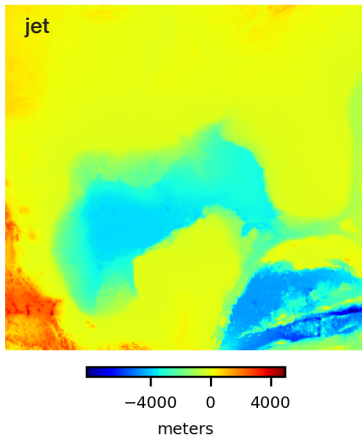


Why Are Colormaps Important?

Mapping data values to colors for visual representation should honestly and clearly represent the data. The colors chosen for mapping (a *colormap*) control how we interpret relationships in data.



After Rogowitz and Treinish¹

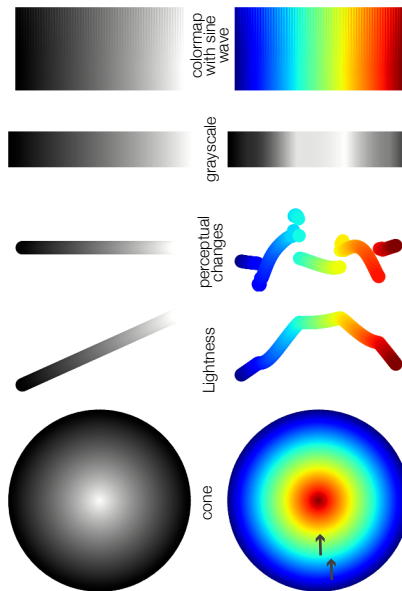
Jet (left) is inscrutable but **topo** (right) is instantly recognizable as water and land (Gulf of Mexico) based on the colormap and critical value.

Who Should Care?

- You have quantitative data and want to display its structure and form across a two dimensional plane
- You want to be able to see small, high frequency details in your data
- You want to see the data as accurately as possible
- You want other viewers to understand the data as easily as possible

Why Not Jet?

- Experts accustomed to **jet** made more mistakes interpreting a heart scan plotted with **jet** compared to another colormap²
- Conversion to grayscale loses ordering from hue, leaving only underordered lightness
- Perceptual jumps in colormap are arbitrarily located
- Jumps add fake gradients while obscuring details
- Information added by the colormap makes data look artificially banded
- **jet**-encoded data *are* easier for reading off numbers⁴
- Note that some plotting packages have replaced their default colormaps away from **jet**, recognizing that it is not a good default choice. Python plotting package Matplotlib's default is **viridis**, and MATLAB's is **parula**.

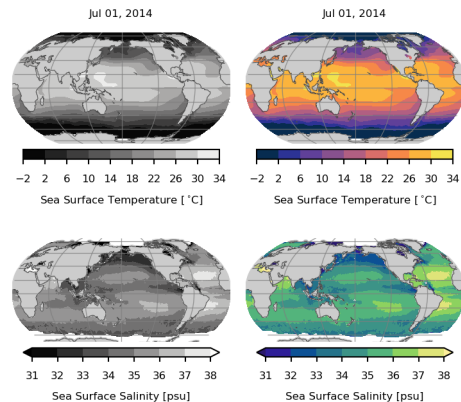


After Thyng, et al, 2016³.

Why Not Grayscale For Everything?

When in doubt, perceptually uniform grayscale is an excellent option. However, using color allows tailoring colormap to data:

- Sequential vs diverging data
- Match intuition with variable
- Have one colormap per variable to build recognition



¹ Rogowitz and Treinish, 1998. Why Should Engineers and Scientists Be Worried About Color.

² Borkin, M., K. Gajos, A. Peters, D. Mitsouras, S. Melchionna, F. Rybicki, C. Feldman, and H. Pfister. 2011. Evaluation of artery visualizations for heart disease diagnosis. IEEE Transactions on Visualization and Computer Graphics. 17(12):2479–2488, <http://dx.doi.org/10.1109/TVCG.2011.192>.

³ Thyng, K.M., C.A. Greene, R.D. Hetland, H.M. Zimmerle, and S.F. DiMarco. 2016. True colors of oceanography: Guidelines for effective and accurate colormap selection. Oceanography. 29(3):9–13, <http://dx.doi.org/10.5670/oceanog.2016.66>.

⁴ Spence, I., Kutlesa, N., & Rose, D. L. (1999). Using color to code quantity in spatial displays. Journal of Experimental Psychology: Applied, 5(4), 393–412. <http://doi.org/10.1037/1076-898X.5.4.393>