



# colorspace

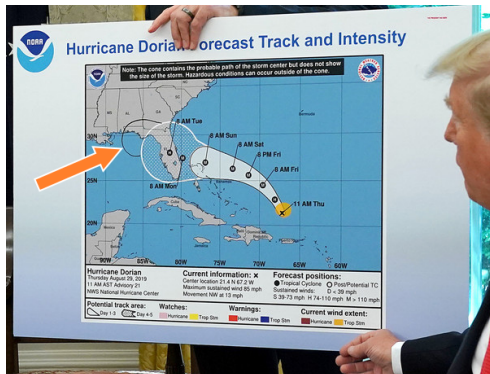
## Robust Color Maps That Work for Most Audiences (Including the U.S. President)

Reto Stauffer, Achim Zeileis

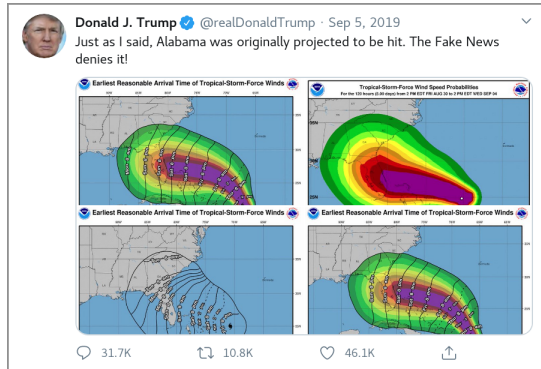
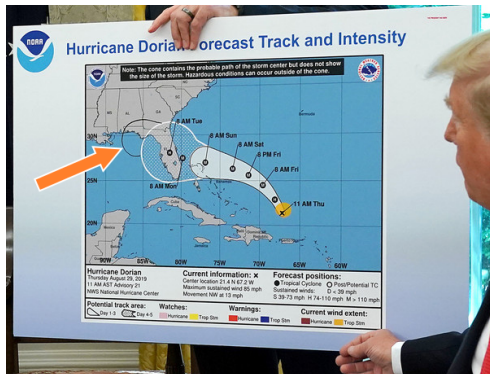
EGU2020-7173

<http://colorspace.R-Forge.R-project.org/>

# Motivation

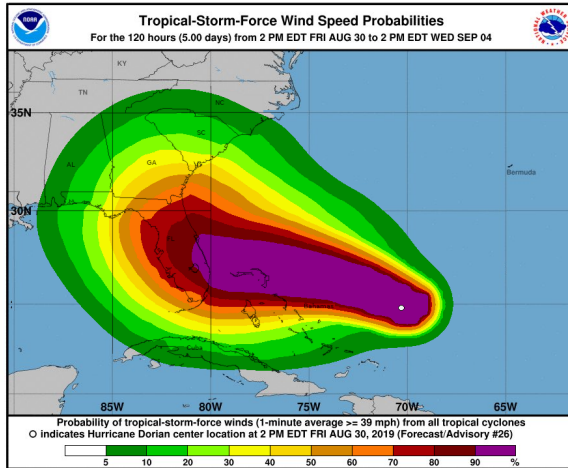


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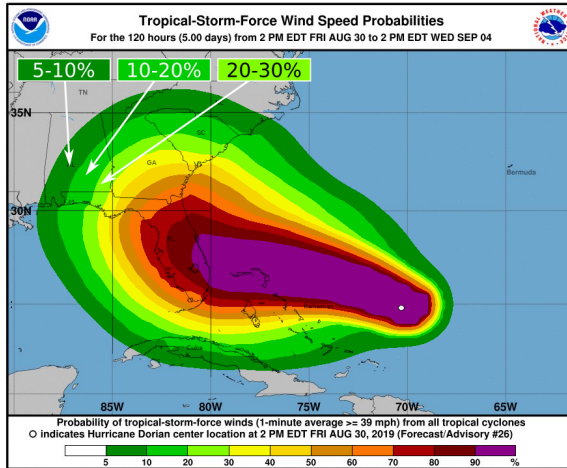
Projected track and wind speed forecast of hurricane Dorian. Screenshot of a video released by the White House (Sep. 4, 2019), tweet by the U.S. president (Sep. 5, 2019).

# Problem



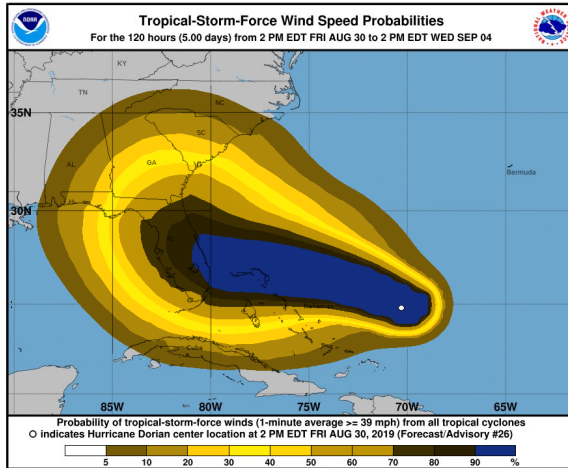
Probability of exceeding wind speeds of 39 mph ( $63 \text{ km h}^{-1}$ ), Aug 30 – Sep 04, 2019 (noaa.gov).

# Problem



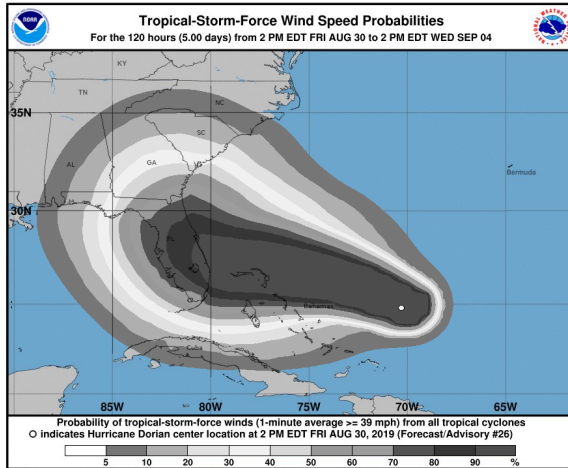
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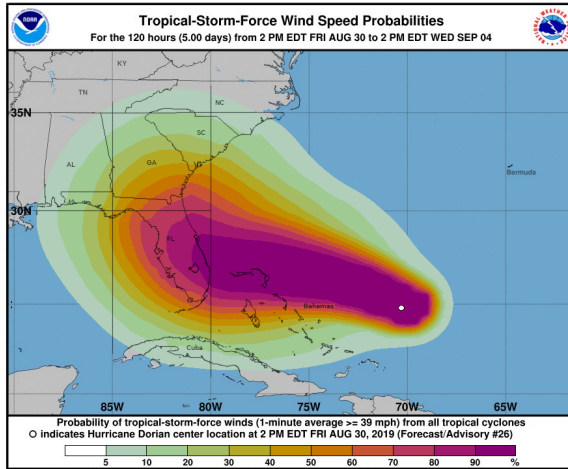
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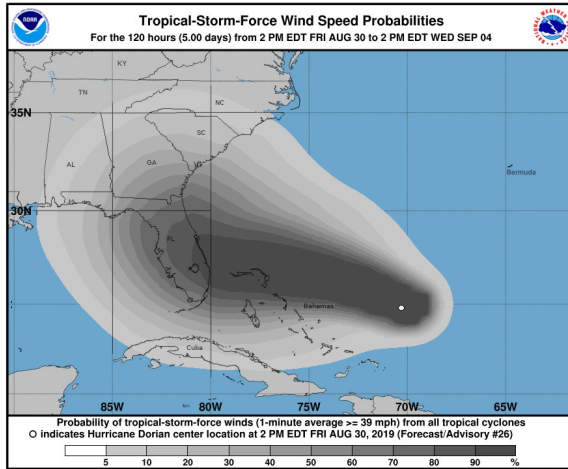
# Solution



Probability of exceeding wind speeds of 39 mph ( $63 \text{ km h}^{-1}$ ), Aug 30 – Sep 04, 2019 (noaa.gov).

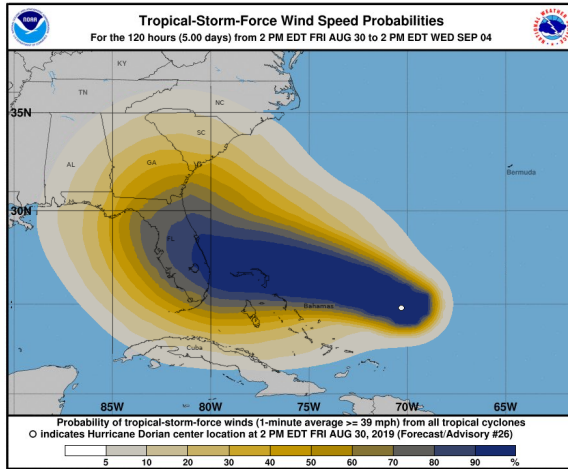


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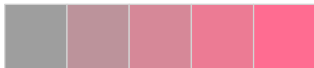
# HCL vs. RGB

**HCL:** Polar coordinates in CIELUV.  
Captures perceptual dimensions of  
the human visual system very well.

Hue  
(Type of color)



Chroma  
(Colorfulness)



Luminance  
(Brightness)



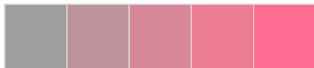
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**RGB:** Motivated by how computers/TVs used to generate and still represent color.

Red



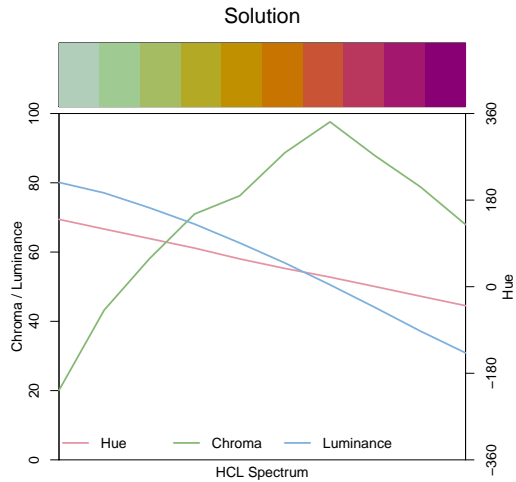
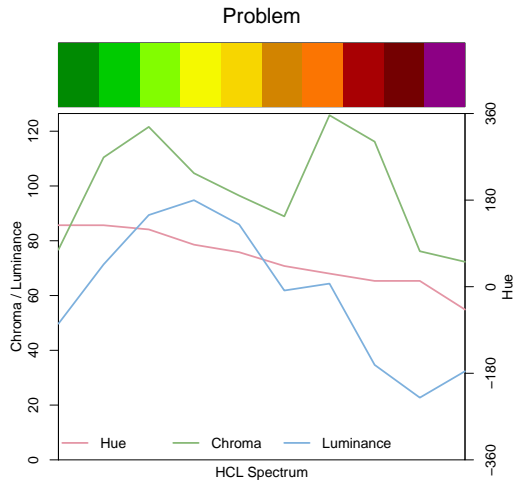
Green



Blue



# HCL vs. RGB



# Color palettes: Somewhere over the Rainbow

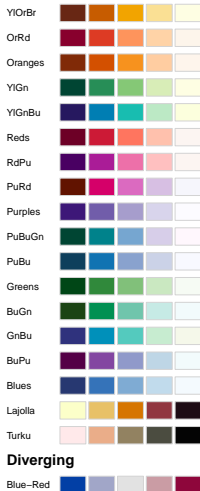
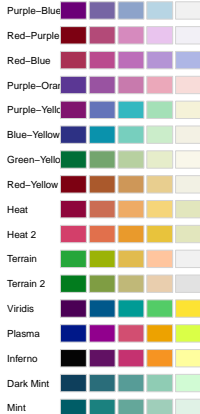
## Qualitative



## Sequential (single-hue)



## Sequential (multi-hue)



# Do it yourself

**Software:** *colorspace*.

- R (mature): <http://colorspace.R-Forge.R-project.org/>.
- Python (beta): <https://github.com/retostauffer/python-colorspace>.
- Web (interactive): <http://www.hclwizard.org/>.

## **Take-home messages:**

- Choose colors carefully.
- Make areas of interest stand out from background.
- Check robustness.
- Software helps you.

# References

- Zeileis A, Fisher JC, Hornik K, Ihaka R, McWhite CD, Murrell P, Stauffer R, Wilke CO (2020). “colorspace: A Toolbox for Manipulating and Assessing Colors and Palettes.” Forthcoming in *Journal of Statistical Software*, preprint available from <http://arxiv.org/abs/1903.06490>.
- Zeileis A, Hornik K, Murrell P (2009). “Escaping RGBland: Selecting Colors for Statistical Graphics.” *Computational Statistics & Data Analysis*, **53**, 3259–3270. doi:10.1016/j.csda.2008.11.033.
- Stauffer R, Mayr GJ, Dabernig M, Zeileis A (2015). “Somewhere over the Rainbow: How to Make Effective Use of Colors in Meteorological Visualizations.” *Bulletin of the American Meteorological Society*, **96**(2), 203–216. doi:10.1175/BAMS-D-13-00155.1