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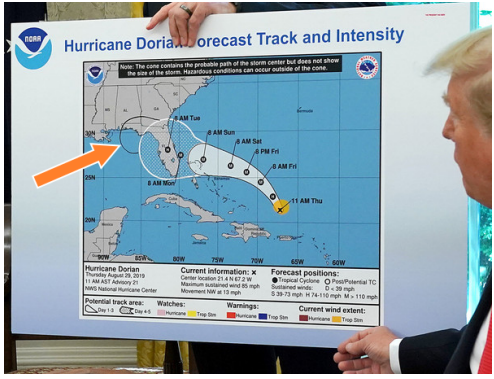
Robust Color Maps That Work for Most Audiences (Including the U.S. President)

Reto Stauffer, Achim Zeileis

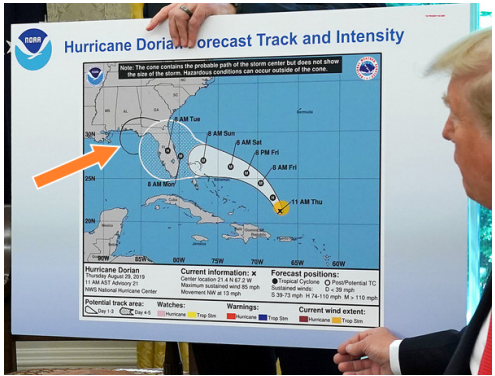
EGU2020-7173

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

Motivation

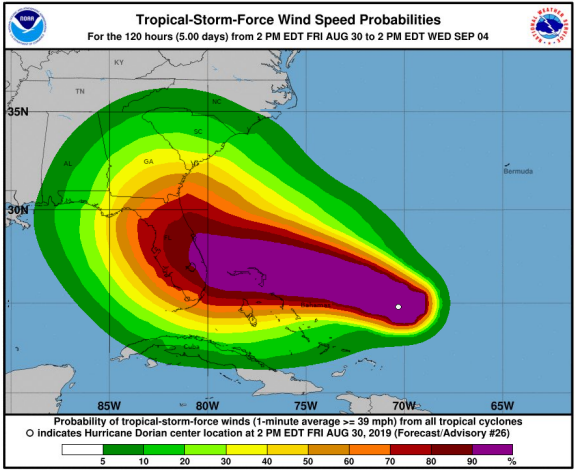

Hurricane Dorian Forecast Track and Intensity
Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.
8 AM Tue
8 AM Sun
8 AM Sat
8 PM Fri
8 AM Fri
8 AM Mon
11 AM Thu
30N
25N
20N
80W
85W
80W
75W
70W
65W
60W
Hurricane Dorian
Thursday August 29, 2019
11 AM AST Advisory 21
NHC National Hurricane Center
Current information:
Center location 21.4 N 67.2 W
Maximum sustained wind 85 mph
Movement NW at 13 mph
Forecast positions:
Tropical Cyclone
Post/Potential TC
Sustained winds:
D < 39 mph
S 39-73 mph H 74-110 mph M > 110 mph
Potential track area:
Day 1-3
Day 4-5
Watches:
Hurricane
Trop Stm
Warnings:
Hurricane
Trop Stm
Current wind extent:
Hurricane
Trop Stm

Motivation



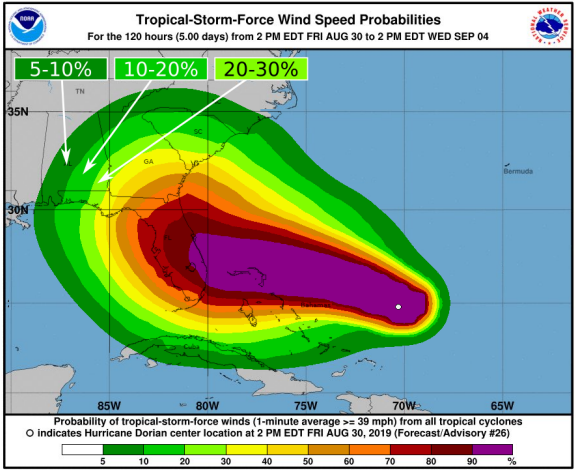
Projected track and wind speed forecast of hurricane Dorian. Screenshot of a video released by the White House (Sep. 4, 2019), tweet by the U.S. president (Sep. 5, 2019).

Problem



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

Problem



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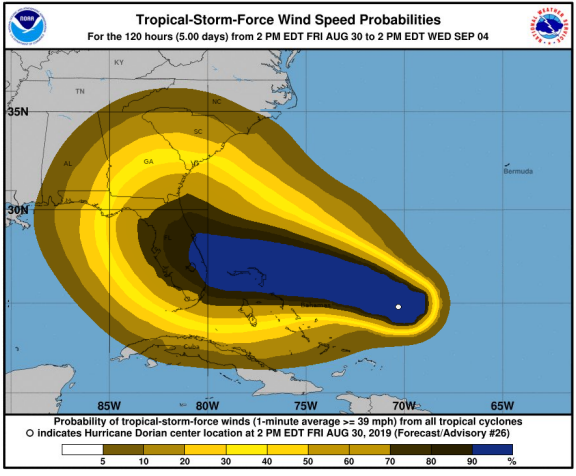

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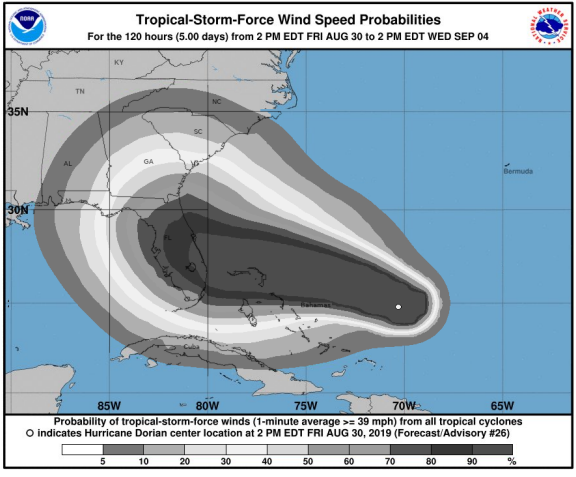

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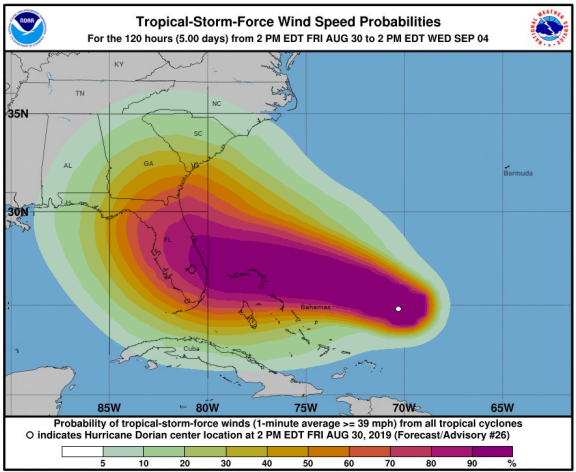
Solution



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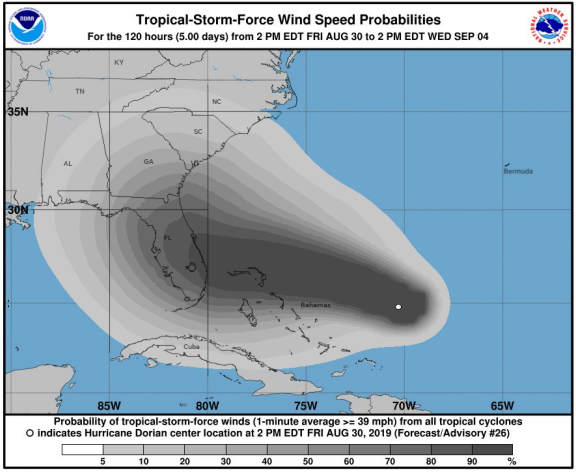

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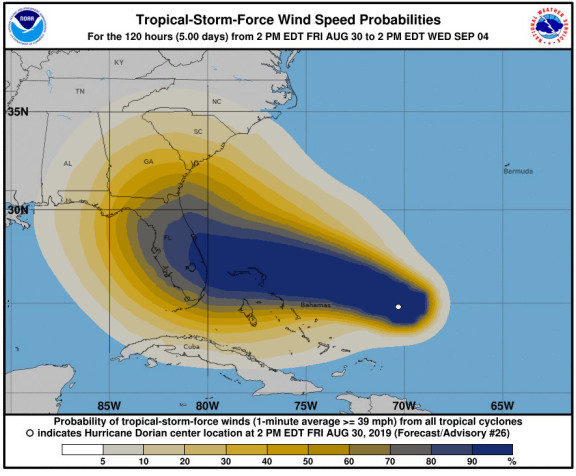

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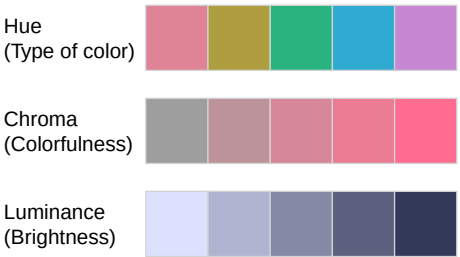
HCL vs. RGB

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



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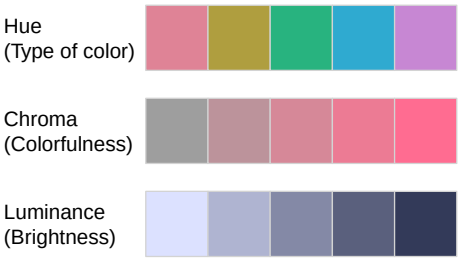
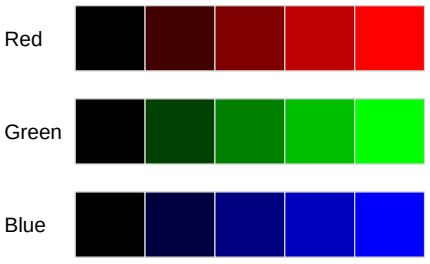
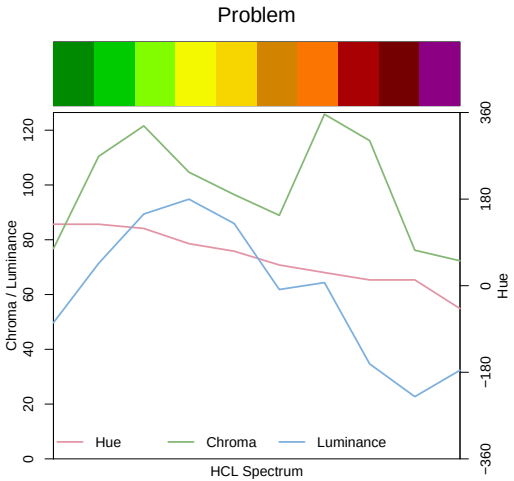
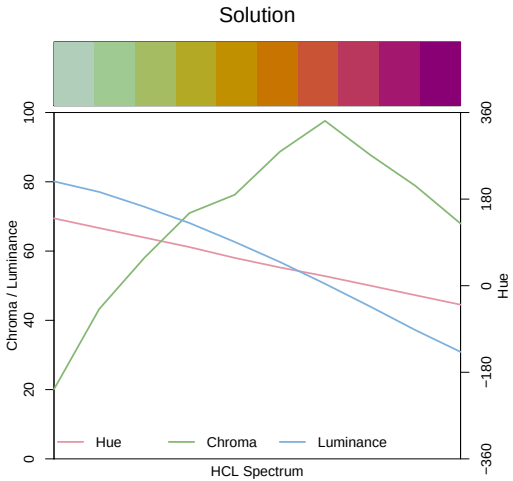


RGB: Motivated by how computers/TVs used to generate and still represent color.



HCL vs. RGB


Problem
Chroma / Luminance
Hue
HCL Spectrum
Hue
Chroma
Luminance


Solution
Chroma / Luminance
Hue
HCL Spectrum
Hue
Chroma
Luminance

Color palettes: Somewhere over the Rainbow

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`