EGU2020-7173
https://doi.org/10.5194/egusphere-egu2020-7173
EGU General Assembly 2020

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

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Color is an integral element in many visualizations in (geo-)sciences, specifically in maps but also bar plots, scatter plots, or time series displays. Well-chosen colors can make graphics more appealing and, more importantly, help to clearly communicate the underlying information. Conversely, poorly-chosen colors can obscure information or confuse the readers. One example for the latter gained prominence in the controversy over Hurricane Dorian: Using an official weather forecast map, U.S. President Donald Trump repeatedly claimed that early forecasts showed a high probability of Alabama being hit. We demonstrate that a potentially confusing rainbow color map may have attributed to an overestimation of the risk (among other factors that stirred the discussion).

To avoid such problems, we introduce general strategies for selecting robust color maps that are intuitive for many audiences, including readers with color vision deficiencies. The construction of sequential, diverging, or qualitative palettes is based on on appropriate light-dark "luminance" contrasts while suitably controlling the "hue" and the colorfulness ("chroma"). The strategies are also easy to put into practice using computations based on the so-called Hue-Chroma-Luminance (HCL) color model, e.g., as provided in our "colorspace" software package (http://hclwizard.org), available for both the R and Python programming languages. In addition to the HCL-based color maps the package provides interactive apps for exploring and modifying palettes along with further tools for manipulation and customization, demonstration plots, and emulation of visual constraints.