

Agency Objective. Assess and improve the understandability of graphical indicators of climate change by reducing complexity and displaying descriptions of key indicator messages.

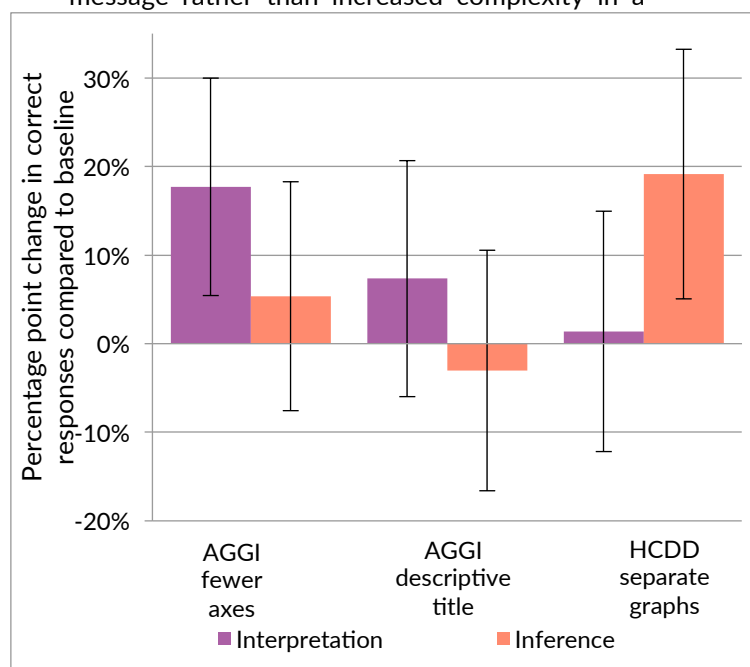
Background. The U.S. Global Change Research Program (USGCRP) makes available figures of climate data, including a set of indicators. Developed by climate impact experts and stakeholders, the indicators are intended to communicate scientific facts, inform decision making, and illustrate progress and change. The effectiveness of indicators for informing the public and decision makers depends in part on their understandability: their abstractness, complexity of patterns portrayed, and graphical techniques. The research team gauged the understandability of 14 existing USGCRP indicators using an online survey of a sample of the U.S. population. For each indicator, approximately 100 respondents were asked between three and six questions designed to gauge (1) how successfully indicator information was interpreted, and (2) whether this information was used correctly in making inferences about their meaning. The two indicators that had the lowest understandability were selected for redesign.

Methods. Two versions of the Annual Greenhouse Gas Index indicator were created: the first eliminated one of the y-axes, and the second changed the title to reflect the key message of the indicator. The Annual Heating and Cooling Degree Days indicator was redesigned by depicting two related trends as separate graphs instead of a single paired bar graph. A second online survey asked new samples of 75–100 respondents the same questions to test whether the design changes had an effect on understandability.

Results. For the Annual Greenhouse Gas Index, eliminating one of the y-axes increased successful interpretation of the indicator by 18

percentage points, from 57 to 75 percent ($p < 0.01$, 95% CI [5.43, 29.96]) but did not improve correct inferences ($p = 0.42$, 95% CI [-7.56, 18.26]). Using a more descriptive title did not lead to a significant improvement in interpretation or inference. For Annual Heating and Cooling Degree Days, separating paired bar graphs did not improve interpretation but did increase correct inferences by 19 percentage points, from 47 to 66 percent ($p < 0.01$, 95% CI [5.04, 33.26]).

Conclusions. Indicator effectiveness is best achieved through clarity of the visual key message rather than increased complexity in a



single graphic. Similar tests and improvements may help improve understandability of indicators. However, not all changes aimed at indicator simplicity or clarity result in significant improvements in understandability.⁵¹

⁵¹ In collaboration with I. Feygina, the research conducted by M.A. Kenney, M.D. Gerst, and J.F. Wolfinger was supported by National Oceanic and Atmospheric Administration grant NA09NES4400006 and NA14NES4320003 (Cooperative Climate and Satellites-CICS) at the University of Maryland/ESSIC.