NASA Visualization of Global Carbon Dioxide

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ABSTRACT

NASA's unique combination of observed and modeled data plays a critical role in helping scientists to better understand how our climate is changing by tracking increases in global carbon dioxide as they happen. Creating data visualizations to share new scientific insights has a direct impact in visual climate science communication, especially when such visualizations become the focal point during presentations to policy makers and international forums.

Keywords: Science communication, climate visualization, scientific visualization, climate science, public, trust, high impact

Index Terms: Human-centered computing: Visualization: Visualization application domains: Scientific visualization, Information visualization, Geographic visualization, Visual analytics; Computing methodologies: Modeling and simulation: Simulation types and techniques: Scientific Visualization

1 INTRODUCTION

NASA's Goddard Earth Observing System (GEOS) [1], produced by the Global Modeling and Assimilation Office (GMAO) is a complex modeling and data assimilation system used for studying the Earth's weather and climate. GEOS assimilates data from NASA's Orbiting Carbon Observatory, 2 (OCO-2) and is also informed by satellite observations along with about 1 million weather observations collected every hour. Together, OCO-2 and GEOS create one of the most complete pictures of atmospheric carbon dioxide (CO_2). Team members at the Scientific Visualization Studio (SVS) [2] worked alongside NASA scientists to visualize volumetric global carbon dioxide data extracted from the GEOS model for a one-year period (June 1, 2020-July 31, 2021). The visualization [3][4] shows the atmosphere in three dimensions, highlights the accumulation of CO_2 in one year and demonstrates how interconnected the world's greenhouse gas problem is.

2 DATA AS A VISUAL MESSAGE

The data visualization was created to support a series of presentations from NASA for the 2021 United Nations Climate Change Conference [5] (Figure 1). NASA scientists and leadership presented at the conference using the following model: i) data driven visualizations were displayed on a hyperwall system (3x3 tiled display system), ii) in-person NASA presenters delivered their address in front of the hyperwall system showing the climate visualizations, iii) remote NASA presenters (due to the pandemic) accompanied the visualization with a pre-recorded video on a side

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screen. In this model the role of data visualization is elevated to an impactful visual message for the delivery of key scientific insights from a trusted source (NASA).
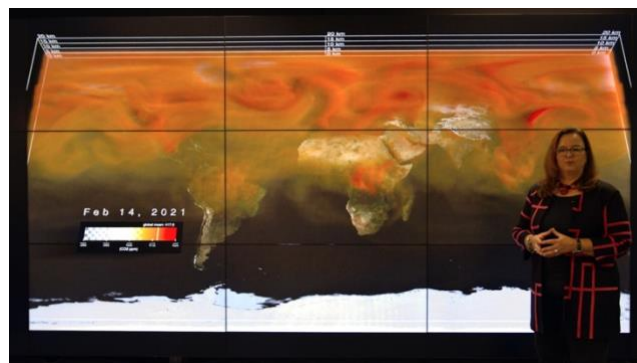

Figure 1: Karen St. Germain, NASA's Director of Earth Science addresses the 2021 United Nations Climate Change Conference (COP26). Source: NASA/GSFC

3 THE PRACTICE

Data-driven visualizations from the SVS are created in multiple resolutions and formats, in close collaboration with NASA's scientific body. Upon approval for scientific integrity and data accuracy the visualizations are released to the public from the SVS website [2]. Following this practice, the Global Carbon Dioxide 2020-2021 visualization was released publicly [3], along with frames and movies in various resolutions and formats [4]. The release [3][4] includes a high-level overview of the science, along with a description of the visualization and the techniques utilized, links to related works and a listing of the data sources used to create the visualization to support openness, transparency, and reproducibility.

REFERENCES

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