

## Immersive Space Weather Analytics

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We explore embodied data interaction with empirical space weather datasets in a mixed reality (MR) environment using extended reality (XR) technologies.

Three empirical variables related to the study of solar storms over an 18-year period are shown: SYM-H index data, sunspot number, and ground-based total electron content from the northwest sector of the continental United States.

Our goal is to showcase correlations among these variables in a novel MR environment and to use audio and visual analytics to explore using the XR capabilities to detect correlations.

We provide sonification (the use of non-speech audio to convey information) and visual analytics techniques in an MR tool deployed on an MR headset.

A user study involving 54 participants tested the usability and efficacy of the newly developed MR tool on users with no space-science expertise or prior knowledge of the datasets.

The results show that even with minimal knowledge of space weather and limited experience with MR environments, the participants were able to identify correlations and begin to understand the scientific context of space weather phenomena. At the CEDAR 2023 Workshop, we broadened the demographics of the study by studying the responses of space-weather experts in order to more rigorously quantify and assess the potential impact of XR technologies on educational and analysis tools and techniques.

Forty-three space science experts gave their feedback about the usability and the potential of this emerging technology as an open science methodology.

At the 4th Eddy Cross-Disciplinary Symposium, we intend to present the results collected from the space weather experts, discuss the next steps, and highlight the strengths and challenges of this novel approach to data analysis.

Presentation file

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