# 2024 Workshop: Advanced Scientific Visualizations and Virtual Reality

Long title
3D Tools and Advanced Visualization Techniques in Geospace Science
Conveners
Kristina Collins
Jaime Aguilar Guerrero
kvcollins@spacescience.org
Description

Geospace phenomena are inherently multi-scale and multidimensional processes, whether measured or simulated. We traditionally use 2D analysis techniques for the characterization and visualization of such data. However, virtual reality, augmented reality, mixed reality and spatial computing tools in general have become sufficiently robust and widely available, and now present a novel and opportune research paradigm for the CEDAR community to meaningfully pursue. Currently, these advanced visualization tools, along with novel data expressions and formats, are most commonly used to showcase the conclusions reached by traditional 2D means. However, they should also be considered for their potential to analyze data directly and intuitively, with fidelity to both temporal and spatial scales. We seek abstract contributions related to the use of ≥3-dimensional data in geospace science, such as eclipse paths, ionospheric pseudosurfaces, satellite tracking, vertical coupling, TIDs and atmospheric gravity waves, etc. Projects which already make use of advanced volumetric (or auditory) data expressions, including virtual, mixed/augmented reality or sonification, are particularly welcome. In recognition of the early adoption of these tools in the geosciences, we also seek submissions from authors who have not previously used ≥3D tools. These contributions may be submitted to the conveners in the form of 3D files (.stl, .obj, .glb, .gltf) or pointclouds (.ply, .laz, or .csv with columns for X, Y, Z and colormap). These files will be presented in virtual reality during the session using a Valve Index VR headset, an Apple Vision Pro, and smartphone/tablet-based mixed reality tools. Prospective contributors are encouraged to contact the conveners directly to coordinate their data presentations.

Justification

As frontier questions in geospace increasingly demand the integration of multi-instrument observations, it is imperative to develop best practices for data presentations which accurately reflect the scale of the geospace system and the locations of instruments within it. The Sun/Earth system is vast and in constant motion, and nearly every line of inquiry within it requires grappling with its counterintuitive scale, from tracing the flow of energy between the poles and equator to tracking satellites relative to ground instruments and daily variations. Achieving flexible and unified workflows to explore this system of systems in virtual space (VR/AR/MR) will enable the intuitive presentation and manipulation of geospace data. This in turn will help researchers of every career level to better comprehend and more succinctly express their findings, as well as encourage scientific discovery through natural user interaction. This session will offer an opportunity to showcase what the community has achieved, as well as to promote dialogue on how these tools may be harnessed to support scientific discovery. Furthermore, the community stands to define what these tools may best look like, and be part of the development of it.

Recent AGU Fall Meeting sessions organized by the conveners (IN42A, IN43B at AGU23) demonstrated that VR tools are in use across multiple domains in the AGU community, and included the successful deployment of VR headsets for a selection of demonstrations in the AGU poster hall. This session will support and extend the discussion of VR tools in geospace science, while providing a timely introduction for new users and a space to discuss the use of spatial computing tools in the context of research, education and outreach.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Fuse the knowledge base across disciplines in the geosciences
Manage, mine, and manipulate geoscience/geospace data and models
Workshop format
Short Presentations
Round Table Discussion
Hands On Training
Keywords
Virtual reality, visualization, sonification, spatial computing
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