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ENABLING SPACE WEATHER EVENTS INVESTIGATION USING VIRTUAL REALITY

Abstract

Within the European Space Operations Centre (ESOC) large amounts of data are produced daily. Their proper visualization is the bridge between the quantitative information in the data and the human intuition and understanding. The Space Weather (SWE) System in the Space Safety Programme (S2P) produces huge amounts of data products of spatiotemporal nature from hundreds of sensors on ground and in space. Based on this data, the Space Weather forecasters make qualitative and quantitative nowcasts and forecasts. Despite the constantly advancing numerical simulation techniques and advanced analysis of the data, human interpretation of the outputs is still crucial in providing and sharing high quality forecasts. However, the current main means of visualization are $2D$ graphs projecting the propagation of heliospheric plasma velocity, density and other quantities on two orthogonal planes. This is an artificial view rather far from how humans intuitively understand the world. Hence, intuitive data visualisation is one of the key techniques to improve the forecasts' accuracy in the near future.

In this paper, we present a proof-of-concept application where historic data of Coronal Mass Ejections (CMEs) and other SWE events come to life in an interactive tool based on a Virtual Reality (VR) game engine. The technology has been touted for several years as one likely to have a profoundly transformative effect to the way we live and work. With this VR tool, the users are immersed and are able to interact with the SWE phenomena in a $3D$ world, navigate forward and backwards in time, contextualize their results and get new key insights. The aim is to visualise the propagation of the plasma from a solar event as well as its interaction with background solar wind in a $3D$ environment, increasing knowledge about the propagation and unfolding of CMEs which pose a threat to human activities both on Earth and in space. The tool can be used as a means of a visual comparison among different model parameters or among different models. The tool will offer support to educational and promotion activities on the SWE segment and is an innovative application of novel technologies, linking SWE forecasting to mission operations at ESOC.