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Real-time Interactive Exploration of Large Atmospheric Datasets in Virtual Reality

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While technological advances in high performance computing allow for an ever-increasing accuracy in climate and weather simulations, they also lead to grand challenges regarding the data visualization and analytics process. We present a visualization framework, which allows for interactive exploration and real-time visualization of such large scale datasets in virtual reality. It combines parallel and distributed feature extraction using high-performance computing resources with octree-based level-of-detail rendering methods to assure high frame rates during the complete analysis process. When parameters such as an iso-value or the current time-step are modified, the visualization is updated progressively in a view-dependent manner.
In addition, the data is shown in relation to the geographical, planetary and celestial context: the data is shown as part of our solar system. Planets are rendered with a sophisticated level-of-detail system based on the HEALPix tessellation of spheres. HEALPix tiles have equal areas and do not suffer from singularities at poles which are a common issue with other tessellations. Geographical datasets (e.g. Satellite images, digital elevation data or vector maps) are loaded from Web-Map-Services (WMS). Example datasets for Earth include, but are not limited to, Sentinel images, Open Street Map, TanDEM-X or SRTM30. NASA's SPICE library is used to compute the position of sun, planets, moons and stars.
In this PICO presentation we will provide technical insight in the technologies used for realizing this framework and show some exemplary use-cases to illustrate the usefulness of such a system.