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Met.3D: Interactive 3D ensemble visualization for rapid exploration of atmospheric simulation data

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Visualization is an important and ubiquitous tool in the daily work of atmospheric researchers and weather forecasters to analyse data from simulations and observations. Visualization research has made much progress in recent years, in particular with respect to techniques for ensemble data, interactivity, 3D depiction, and feature-detection. Transfer of new techniques into the atmospheric sciences, however, is slow.

Met.3D (https://met3d.wavestoweather.de) is an open-source research software aiming at making novel interactive 3D and ensemble visualization techniques accessible to the atmospheric community. Since its first public release in 2015, Met.3D has been used in multiple visualization research projects targeted at atmospheric science applications, and also has evolved into a feature-rich visual analysis tool facilitating rapid exploration of atmospheric simulation data. The software is based on the concept of "building a bridge" between "traditional" 2D visual analysis techniques and interactive 3D techniques and allows users to analyse their data using combinations of 2D maps and cross-sections, meteorological diagrams and 3D techniques including direct volume rendering, isosurfaces and trajectories, all combined in an interactive 3D context.

This PICO will provide an overview of the Met.3D project and highlight recent additions and improvements to the software. We will show several examples of how the combination of 2D and 3D visualization elements in an interactive context can be used to explore atmospheric simulation data, including the analysis of forecast errors, analysis of synoptic-scale features including jet-streams and fronts, and analysis of forecast uncertainty in ensemble forecasts.