Interactive 3D visualization of ECMWF ensemble forecasts for research flight planning

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**Objective:** Investigate the "next step" from the current 2D system and visualize ensemble forecast data in 3D to quickly identify atmospheric features of interest for a flight and to assess their uncertainty in the forecast.

**T-NAWDEX-Falcon campaign:**
DLR Oberpfaffenhofen, October 2012, in-situ measurements in Warm Conveyor Belts (Schäfler et al., 2013, submitted to Weather). Here we show the case of 19 October 2012. Tasks were to compute ensemble trajectories to detect WCBs and to visualize a derived probability of WCB occurrence in the context of the ensemble forecast.

**How to use ensemble in 3D:** Animate members? Explore statistical metrics? Explore detected features? Explore probabilities of features? Met.3D: Prototype of a 3D forecasting tool – navigation through 5D data (space + time + ensemble); bridge from 2D to 3D.

**WCB probability via trajectories:**
Compute 48h trajectories from low-level grid points for every member, starting every six hours (C. Grams, ETH Zürich, using the LAGRANTO model, Wernli & Davis, 1997, Q.J.R. Meteorol. Soc.).

**Interactive filter according to ascent:** e.g. 500 hPa/48h.

**Extract trajectory positions at specific valid time and grid these positions:** Probability of WCB occurrence = how many members have a trajectory in a given grid box?

**GPU based visualization:**
2D sections: Map model grid to vertices, perform model level searches & interpolation on GPU.

Raycaster: Level searches and trilinear interpolation all along the viewing ray is expensive.