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

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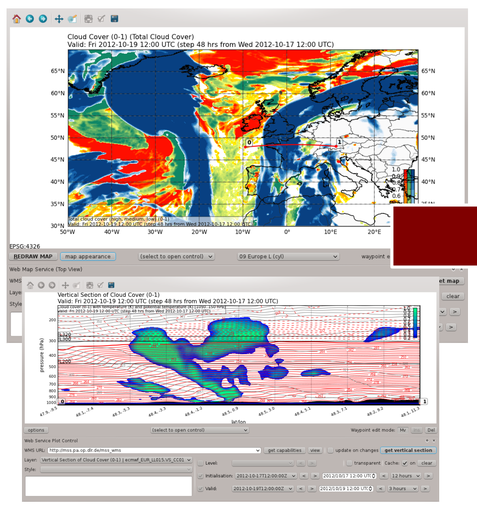
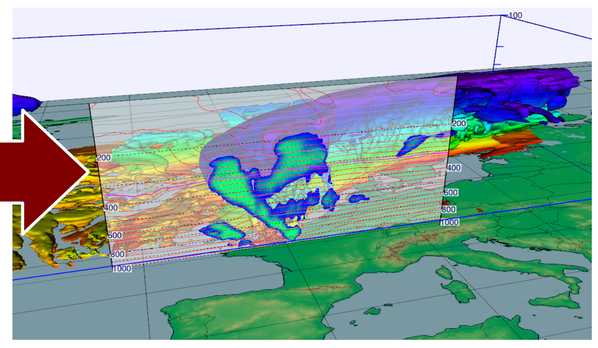
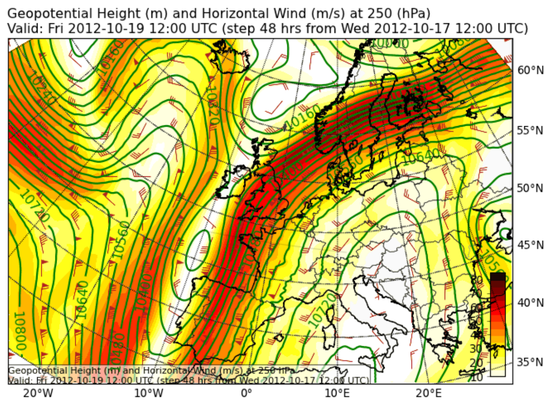
Objective: Investigate the "next step" from the current 2D system and visualize **ensemble forecast** data in **3D** to quickly identify atmospheric features of interest for a flight and to assess their **uncertainty** in the forecast.







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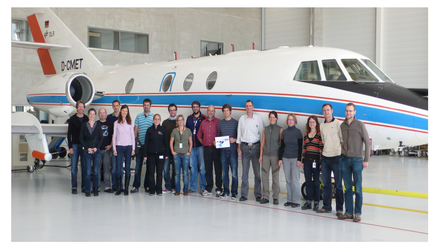
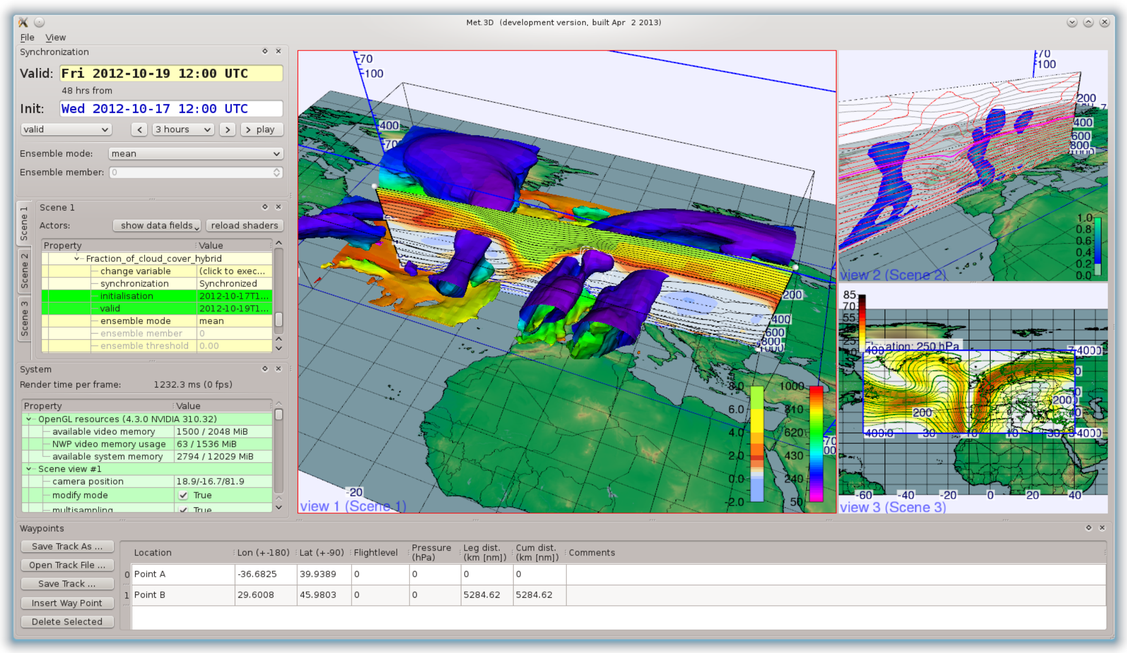


T-NAWDEX-Falcon campaign:

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.**



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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**.

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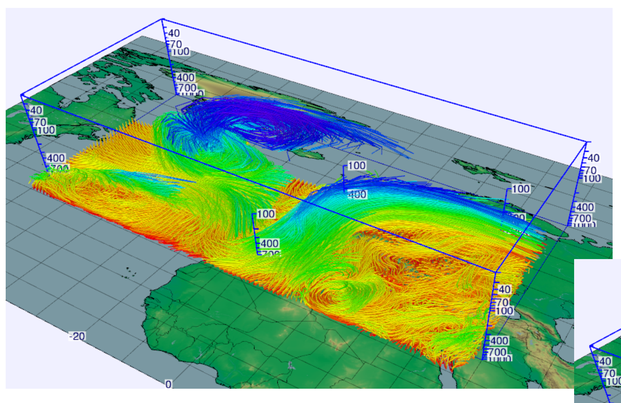
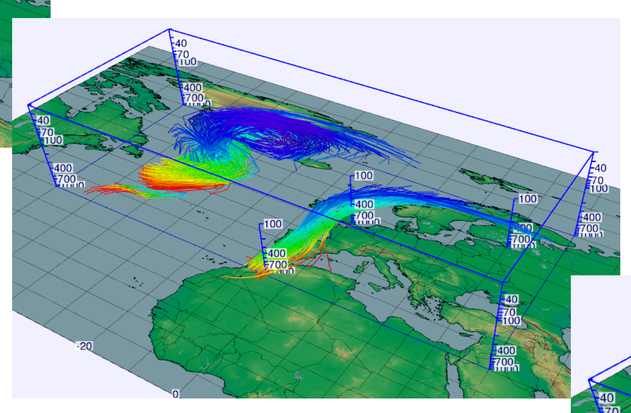
WCB probability via trajectories:

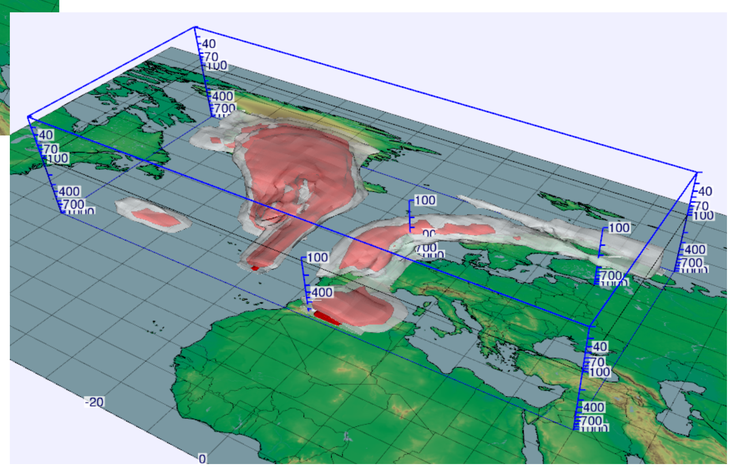
IAC ETH



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.).



Interactively 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?

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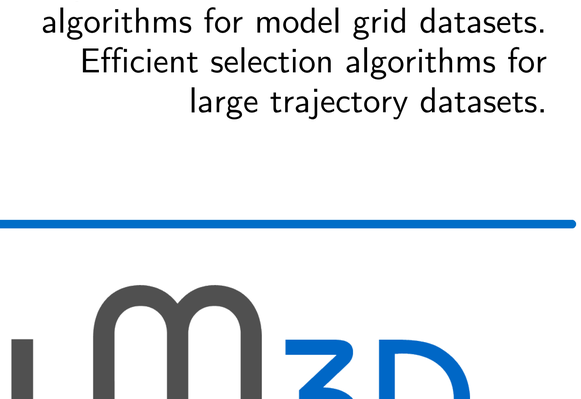
GPU based visualization:

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.

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Ongoing work:

Uncertainty visualization. Label placement. Efficient visualization algorithms for model grid datasets. Efficient selection algorithms for large trajectory datasets.

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