



Interactive 3D visualisation of ECMWF ensemble weather forecasts

Marc Rautenhaus (1), Christian M. Grams (2), Andreas Schäfler (3), and Rüdiger Westermann (1)

(1) Computer Graphics and Visualisation Group, Technische Universität München, Garching, Germany
(marc.rautenhaus@tum.de), (2) Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland, (3) Deutsches Zentrum für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

We investigate the feasibility of interactive 3D visualisation of ensemble weather predictions in a way suited for weather forecasting during aircraft-based atmospheric field campaigns. The study builds upon our previous work on web-based, 2D visualisation of numerical weather prediction data for the purpose of research flight planning (Rautenhaus et al., *Geosci. Model Dev.*, 5, 55-71, 2012). Now we explore how interactive 3D visualisation of ensemble forecasts can be used to quickly identify atmospheric features relevant to a flight and to assess their uncertainty.

We use data from the European Centre for Medium Range Weather Forecasts (ECMWF) Ensemble Prediction System (EPS) and present techniques to interactively visualise the forecasts on a commodity desktop PC with a state-of-the-art graphics card. Major objectives of this study are: (1) help the user transition from the “familiar” 2D views (horizontal maps and vertical cross-sections) to 3D visualisation by putting interactive 2D views into a 3D context and enriching them with 3D elements, at the same time (2) maintain a high degree of quantitiveness in the visualisation to facilitate easy interpretation; (3) exploitation of the Graphics Processing Unit (GPU) for maximum interactivity; (4) investigation of how visualisation can be performed directly from datasets on ECMWF hybrid model levels; (5) development of a basic forecasting tool that provides synchronized navigation through forecast base and lead times, as well as through the ensemble dimension and (6) interactive computation and visualisation of ensemble-based quantities.

A prototype of our tool was used for weather forecasting during the aircraft-based T-NAWDEx-Falcon field campaign, which took place in October 2012 at the German Aerospace Centre’s (DLR) Oberpfaffenhofen base. We reconstruct the forecast of a warm conveyor belt situation that occurred during the campaign and discuss challenges and opportunities posed by employing three-dimensional visualisation of ensemble forecasts for atmospheric research flight planning.