

Interactive comment on “3-D visualization of ensemble weather forecasts – Part 1: The visualization tool Met.3D (version 1.0)” by M. Rautenhaus et al.

Anonymous Referee #1

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General Comments

This manuscript is well written, of high quality and, and from my point of view publication ready except for some minor revisions.

The paper describes the new open-source visualization tool Met.3D, which was developed to support 3D visualization of ensemble numerical weather predictions in a specific field campaign. By taking into account many domain specific challenges it bridges the gap between the visualization community and the meteorological domain.

Due to the application centric concept of the software Met.3D developed, the paper will be a very useful contribution to the literature and especially help introducing po-

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tential users to this new open source tool. The paper and the accompanying movie contained in the supplement nicely demonstrate the interactive use of the new tool for the visualization of ensemble weather prediction data.

I appreciate very much the efforts of the authors to facilitate interactive 3d visualization in the context of weather forecasting and (uncertain) meteorological ensemble data. To my knowledge, no other 3D visualization solution is available at all which allows for 3D visualization of meteorological simulation data given on terrain following model grids (sigma-pressure levels). Furthermore, the extensive utilization of the GPU applied for the implementation of the desired visualization algorithms is promising, since most existing 3D solutions used in the domain have performance limitations. The availability of innovative features like the use of shadows for perception enhancement, normal curves inside of isosurfaces and the integration of ensemble statistics further contribute to the potential of the system developed.

The manuscript generally gives enough details on the algorithms used for the different processing steps and the visualization methods applied.

Specific comments

The introduction section is quite long. Due to occasional redundancy within the overall manuscript I feel that it could be shortened a bit. Generally, please reduce repeating statements.

As stated in Section 4, P.2118 L.4 ff., response times are crucial to the user acceptance of interactive visualization tools. Therefore I wonder why the “standard” ensemble statistics such as mean, median, minimum, maximum or standard deviation are computed on demand - instead of deriving them prior to the interactive visualization session in a standardized way. The values given in Table 1 indicate that file based ensemble statistics is computationally quite expensive. To wait 34s for displaying the next time step is not really acceptable in the context of interactive visualization. Although it is nice to have the option to do the statistics within the visualization tool, I would

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rather recommend to precomputing the quantities and statistics needed. Both data complexity and size are increasing, and the interactive part of the analysis and visualization workflow should guide the user by hiding complexity and reducing unnecessary information. With respect to this, I personally don't think, for example, that the direct visualization of all single ensemble members is very useful. With respect to response time it might be sufficient to mainly concentrate on (precomputed) statistical means.

The abstract states that the tool can operate directly on sigma-pressure level grids. This is true, but the statement might be misleading, though. To my understanding, horizontal slices through data defined on sigma-pressure levels are rendered as straight planes on pressure levels. The values on these pressure levels are interpolated linearly in $\ln(p)$ between the original data points of the level above and the level below the plane. What about a visualization *directly* on the model levels? A terrain-following slice through the data?

On P.2124 L.15 a factor of about 4 is given for the computational cost of sampling data on model levels compared with pressure levels. How is the impact on the overall rendering time for new time steps? It would be great if Table 1 could include both setups: model level data and pressure level data.

Minor details

P.1 L. 14/15: I suggest "... European Centre for Medium Range Weather Forecasts (ECMWF) and can operate directly on hybrid sigma-pressure level grids."

Section 2.1 3-D visualization in meteorology: There are also some commercial 3D visualization tools used in the meteorological domain (e.g. IDL, Avizo Green).

Figures: Some figures are quite small, and the annotations are then hard to read. Specifically the GUI shown in Fig. 2 should be enlarged.

Interactive comment on Geosci. Model Dev. Discuss., 8, 2101, 2015.