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Visual Analysis of time-dependent 2D Uncertainties in Decadal Climate Predictions

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Climate prediction systems used today for investigating the climate predictability on a decadal time scale are based on coupled global climate models. First, ensembles of hindcast experiments are carried out in order to derive the predictive skill of the prediction system. Then, in a second step, the prediction system is initialized with observations and actual future predictions are computed.
The ensemble simulation techniques applied enable issuing of probabilistic information along with the quantities predicted. Different aspects of the uncertainty can be derived: The ensemble standard deviation (or ensemble spread) is a measure for the internal variability of the simulation, while the predictive skill is an inverse measure for the uncertainty in the prediction.

In this work, we focus on the concurrent visualization of three related time-dependent 2D fields: the forecast variable itself, here the 2m temperature anomaly, along with the corresponding predictive skill and the ensemble spread which is given through the ensemble standard deviation. On the basis of temporally filtered data, animations are used to visualize the mean spatio-temporal development of the three quantities. Furthermore, seasonal analyses are similarly visualized in order to identify seasonal patterns.

We show exemplary solutions produced with three different visualization systems: NCL, Avizo Green and ParaView. As example data set, we have used a decadal climate prediction carried out within the German research project "MiKlip - Decadal Predictions" using the MPI-M Earth System Model (MPI-ESM) from the Max Planck Institute for Meteorology in Hamburg.