ASPECT - Adaptation-oriented **S**eamless **P**redictions of **E**uropean **C**lima**T**e

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ASPECT is an EU Horizon Europe project aiming for the setup and demonstration of a seamless climate information (SCI) system with a time horizon up to 30yr, accompanied by underpinning research and utilisation of climate information for sectoral applications ('middle-ground level'1). The goal is to improve existing climate prediction systems and merge their outputs across timescales together with climate projections to unify a SCI as a standard for sectoral decision-making. The focus is on European climate information but also look more widely where there is a policy interest (e.g., disaster preparedness) and in regions of European interest. A strong link is maintained into an exploit learning from the WCRP lighthouse activities on explaining and predicting earth system change.

To provide a bandwidth diversity of information the SCI system is based on multi-model climate forecasts. It aligns with new activities on Digital Twins within Europe, including DestinE. The SCI combines physical science aspects with those from other disciplines to ensure the information is robust, reliable and relevant for a range of user driven decision cases. The information package incorporates baseline forecasts and projections (plus uncertainty), but also new frontiers are explored (e.g., extremes which are of socioeconomic high-level interest). To be successful the research encompasses: Understanding and attribution of various processes along the timescales (such as exploring signal-to-noise ratio) and their impact on predictability, new ways of initialisation of the prediction systems, merging predictions with projections, provision of regional SCI for Europe by downscaling (statistical methods, AI) and HighRes models (including convection-permitting models), and innovative post-processing method enhancing the skill and robustness of the climate forecasts.

In **ASPECT** baseline experiments with the latest Max-Planck Institute Earth System model ICON-Seamless will be developed. ICON-Seamless builds upon the model components of numerical weather prediction (ICON-NWP) by DWD, the ICON ocean model (ICON-O) by MPG and the aerosol tracer model ICON-ART by KIT. In addition, the configuration includes the land component ICON-L and the DWD data assimilation system, all adjusted to an Earth system model for pursuing scientific questions and operational forecasting.

In **ASPECT** large ensembles of historical simulations and initialized climate predictions are envisaged. Further large ensembles of single forcing experiments are planned to attribute the physical drivers of climate predictability. The latter is a contribution to the WCRP lighthouse activity "Explaining and Predicting Earth System Change". As a principal outcome of the large ensemble experiments we seek towards the improvement of actionable climate information including extremes for the time horizon up to 30yr.