Knowledge about the development of the climate over the coming decades and centuries is important for taking appropriate mitigation and adaptation measures. As it is not only physical laws that influence the climate trend, but also human social and economic behaviour, a range of plausible climate scenarios are being developed resulting in an estimate of greenhouse gases and other forcings on the basis of possible future anthropogenic activities. Climate projections are then performed with Earth system models and simulate the effects of these greenhouse gases and other forcings on the climate system. These simulations are internationally coordinated as part of the World Climate Research Programme's (WCRP) Coupled Model Intercomparison Project which is now in its Phase 7 (CMIP7).

The aim of CAP7 is to make a highly visible national contribution to CMIP7 with the Earth system models developed and applied in Germany. To this end, the ICON model, which was developed into a climate prediction model in the ICON-Seamless project, is now being further developed for the simulation of climate projections. The climate configuration of ICON is named ICON-XPP (eXtended Prediction and Projection). In addition, the two Earth system models AWI-CM and AWI-ESM are also being further developed to meet the requirements of CMIP7. These models will be used to run the required DECK (Diagnostic, Evaluation and Characterization of Klima) simulations and to simulate various scenarios. CAP7 will also make a significant contribution to the evaluation of the project models and the CMIP7 ensemble by further developing and applying the Earth System Model Evaluation Tool (ESMValTool). As a result of CAP7, we will receive efficient and high-quality Earth system models as well as global climate projections as a German contribution to the international CMIP7 project alongside a strong contribution to the analysis of CMIP7 which will further enhance understanding of climate change. In addition, in ICON-XPP the nitrogen cycle and the interactive carbon cycle are also implemented, so that emission-driven climate projections, which are recommended as preferred in CMIP7, can be carried out for the first time. A first prototype of a hybrid (physics + machine learning (ML)) ICON-XPP-ML model is also developed to demonstrate the potential of this new approach to climate modelling.