Advanced Earth System Modelling Capacity (ESM): Solving Grand Challenges by improving the representation of the components of the Earth system and their coupling

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With climate change and the conjoint challenges of food availability, clean water and geo-energy resources, our society is facing major challenges in the near future. These challenges are hard to address, because projections of Earth system change involve uncertainties that require quantification. Therefore, the Earth system science community tries to develop tools that provide decision-makers with the information required to effectively manage these issues.

The Advanced Earth System Modelling Capacity project (ESM) aims to enable such tools, investigating problems by looking at interactions between different Earth system components and improve their representation in numerical models. The project was funded by the German Helmholtz Association in April 2017 and involves eight research centers across Germany. The ultimate goal of the project is to represent the Earth system and how it changes with a world-leading modelling infrastructure that will support the process of developing solutions for the grand challenges we are facing.

The five different work packages of the project are working on topics such as enhancing the representation of Earth system model compartments, develop a flexible framework for coupling of Earth system model components, advance the Earth system data assimilation capacity, diagnose Earth system models, further develop cutting-edge frontier simulations, cross-scale modelling, and contribute to the shaping of a national strategy for Earth system modelling. The project also engages in training activities to educate and transfer knowledge to the next generation of scientists.

Since its initiation the project contributed with important results to several key model systems and platforms. In this presentation, we will highlight some current results and discuss advances in our Earth system modelling community and the way forward.