Project title:	**Machine learning-based parametrisations and analysis for the ICON model (ICON-ML)**
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Abstract. Earth system models are fundamental to understanding and projecting climate change. Although they have improved significantly over the last decades, considerable biases and uncertainties in their projections remain. A large contribution to this uncertainty stems from differences in the representation of clouds and convection occurring at scales smaller than the model grid resolution, as well as from biologically mediated land surface processes. We will take a new approach by harvesting output from high-resolution simulations with the ICOsahedral Non-hydrostatic (ICON) model in combination with observations to develop a machine learning (ML) based hybrid model for ICON (ICON-ML). ICON-ML will include new ML-based approaches for parametrisations of small-scale atmospheric processes (e.g. clouds) and for the representation of spatial and temporally variable land-surface fluxes, states and parameters. The new ML-based ICON will have the potential to eliminate some of the long-standing systematic errors and to provide robust climate projections. Newly developed ML-based observational products will support a comprehensive evaluation of ICON-ML. This project provides computational support to the European Research Council (ERC) Synergy Grant “Understanding and Modelling the Earth System with Machine Learning (USMILE)” project (https://www.usmile-erc.eu/).