m3odel
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# Uncertainty Quantification by means of Generative Networks

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Models in natural sciences have typically vast number of uncertain parameters or input data. In order to find solution dependence on these parameters the so-called uncertainty quantification methods can be used. Performing uncertainty quantification (UQ) tasks with Monte Carlo methods could be infeasible due to its slow convergence and correspondingly the need to perform millions of forward model evaluations in order to obtain convergent statistics. This yields the cure of dimensionality.

The aim of this PhD project is to develop new efficient methods based on the generative networks techniques to find a lower dimensional solution-parameter nonlinear map. The generative network is a generative modeling using deep learning methods. Given a training data set, this technique learns to generate new data with the same statistics as the training set.

In the proposed project we aim to build on our expertise with UQ of cloud models that have been successfully carried out by Lukácová and Spichtinger. However, till now we were only able to track one uncertain parameter. The challenge is to generalize this random model for the case of large number of uncertain parameters, which is a typical case not only in atmospheric flows, but also, e.g., in geophysical flows. Here we want to profit from the synergy of expertise of all three PIs: atmoshperic physics (Spichtinger), numerical modelling (Lukacova) and machine learning (Wand).

The techniques developed in this project can be latter applied also to other models studied within M3ODEL.