Title

Detecting climate patterns: Bayesian neural network approach

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Abstract

Machine learning is becoming an increasingly important tool for climate scientists, but hampered by lacking uncertainty quantification. Here, a machine learning approach for detecting patterns indicating a changing climate is combined with probabilistic modelling to retrieve uncertainty values. We train neural networks on climate model simulations of temperature and precipitation under historical and future scenarios. We find that the resulting so-called Bayesian neural network (BNN) has similar predictive strength to an Artificial neural network (ANN), with a post-year 2000 mean absolute error of 9.00 years for temperature, but over-fits less. The BNN is able to recognise temperature change starting in 1994, which is 14 years later than the ANN. Our analysis shows that uncertainties in found climate patterns are much higher than the patterns themselves, reducing their value for further use. This work demonstrates that BNNs are a suitable tool for quantifying uncertainties of patterns indicating a changing climate.