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Producing realistic climate data with GANs

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Abstract. This paper investigates the potential of a Wasserstein Generative Adversarial Networks to produce realistic weather situations when trained from the climate of a general circulation model (GCM). To do so, a convolutional neural network architecture is proposed for the generator and trained on a synthetic climate database, computed using a simple 3 dimensional climate model: PLASIM.

The generator transforms a “latent space”, defined by a 64 dimensional Gaussian distribution, into spatially defined anomalies on the same output grid as PLASIM. The analysis of the statistics in the leading empirical orthogonal functions shows that the generator is able to reproduce many aspects of the multivariate distribution of the synthetic climate. Moreover, generated states reproduce the leading geostrophic balance present in the atmosphere.

The ability to represent the climate state in a compact, dense and potentially nonlinear latent space opens new perspectives in the analysis and the handling of the climate. This contribution discusses the exploration of the extremes close to a given state and how to connect two realistic weather situations with this approach.

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