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Approximating simple general circulation models with deep learning

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It is an appealing idea to use neural networks for both weather and climate forecasting. We use a bottom-up approach for assessing whether it should in principle be possible to do this. We use the relatively simple general circulation models PUMA and PLASIM as a simplified reality on which we train deep neural networks, which we then use for predicting the model weather at lead times of a few days. We specifically assess how the complexity of the climate model affects the neural networks' forecast skill, and how dependent the skill is on the length of the provided training period. Additionally, we show that a neural network trained on a simple general circulation model without seasonal cycle can be used to generate a stable "climate" dataset, comparable to that of the model itself. On the other hand, using the neural networks to reproduce the climate of general circulation models including a seasonal cycle remains challenging.