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CLIM Program Transition Workshop
May 14-16, 2018

Talk 1 Lecture: *The Climate Informatics Working Group: An Overview*

Speaker: David Gagne

Abstract:
The climate informatics working group investigated many different avenues in which machine learning and other data science tools can be applied to climate science. The centerpiece of the group's work is a review paper on deep learning for the geosciences that highlights how deep learning has been applied to climate science problems in recent years and some potential applications and challenges going forward. The talk will also discuss some of the other joint work between the Climate Informatics Working Group and other subgroups.

Talk 2 Lecture: *A Generative Adversarial Network Stochastic Parameterization of the Lorenz '96 Model*
Presented jointly with Aneessh Subramanian

Generative adversarial networks (GANs) are a form of deep learning designed to generate realistic samples from any multidimensional data distribution through the process of training two neural networks to optimize against each other. GANs have been used successfully to generate realistic synthetic images of faces and scenes and have also shown promise for generating spatial fields. In this project we developed a GAN that can generate stochastic realizations of the subgrid state of the Lorenz '96 dynamical model and compared the GAN with other stochastic statistical parameterizations on weather and climate timescales. Stochastic parameterizations combine a model of the mean state of a process with a noise-generating model to account for process variability and to sample from a wider portion of the feature space. The GAN combined external random processes with internal stochasticity in the form of dropout to generate a full set of subgrid values that closely approximated the true feature space. A Lorenz '96 ensemble successfully ran with a GAN parameterization in both short "weather" runs and longer "climate" runs. We examine the spread-skill relationship of the GAN parameterizations at weather timescales and how well the GAN approximates the true model's climatological distributions overall and within certain regimes. We also examine the sensitivity of GAN performance to certain parameter choices.