Machine Learning for Model Parameterizations and Post-processing

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This talk will review how AI/ML has been advancing our capabilities to model the weather and climate faster and with more accuracy by looking at three approaches. First, ML postprocessing has allows us to merge model output with historical observations to improve real-time forecasts. This widely applied method has been a boon to forecast improvement for a variety of applications. We'll review the Dynamic Integrated Forecast System (DICast) and its use for renewable energy applications among others. Secondly, ML replacements and emulations of model physical parameterizations has the potential to not only greatly speed computations, but when built with observational data, to also provide more accurate solutions. Work on multiple parameterizations have shown major potential to advance modeling capabilities, including one for surface layer parameterizations that has proven to provide advances beyond standard methods, even at sites where it was not trained. Finally, using AI/ML to actually produce model output is beginning to show real potential. One example is using deep learning to provide high-resolution features conditioned on a coarser simulation. After being trained on high-resolution model output, this approach can provide plausible high-resolution images even on regions where it was not originally trained. These applications suggest a potential for future fully learned AI/ML modeling capability. These types of advances are in the midst of revolutionizing how we model the atmosphere.