Improving Sub-seasonal Precipitation and Temperature Outlooks with Deep Learning

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In this study, the Deep Learning (DL) techniques are used to improve sub-seasonal precipitation and temperature outlooks from dynamical models (e.g. the NCEP CFSv2, GEFSv12 etc.), and to explore the predictability of precipitation and temperature forecasts beyond Week 1. Benefiting from the great advance in machine learning in recent years, the more advanced DL techniques show some advantages over traditional statistical methods (e.g. the Multiple Linear Regression): such as flexible algorithm that can account for complicated linear and non-linear relationships, spatial dependency and co-variability etc. among predictors and predictands, at the same time is able to handle big data easily and also improve training efficiency.

More beneficial and advanced Neural Network (NN) architectures are designed to take the advantages offered not only from the DL algorism, but also from big data, by training different predictors and predictands over all locations simultaneously. Therefore, the techniques have the ability to extract more complicated and high level information hidden behind big data and allow the algorithm to detect what are the most important forecast input variables and where they are located for mapping the target (predictand). Those learned statistical patterns and relationships from the training processes are used to improve the original dynamical forecasts. Some encouraging results show that the Neural Network setups used here can perform more complicated forecast corrections.