Deep learning-based future drought prediction for the US drought monitor

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Drought is a disaster that can cause enormous agricultural and water resource losses and result in socio-economic damage over the world. To reduce damage from droughts, prediction of future drought conditions is crucial as an early warning system. This study used deep learning techniques to predict seasonal (in this case, a 12-week forecast lead time) droughts for the US Drought Monitor (USDM). UNet architecture, one of the image-to-image translation techniques, was adopted as a deep learning model to consider spatial characteristics (such as the extent) of drought by itself. The four different types of hydro-meteorological variables including precipitation from both Phase 2 of the North American Land Data Assimilation System and Climate Forecast System Version 2 were used as input variables to take into account each past and future meteorological environment. The time series of USDM were also used as inputs in the model. The predicted results from UNet fell into an additional correction process and then compared to the existing seasonal drought outlooks provided by the National Oceanic and Atmospheric Administration Climate Prediction Center. The final predicted results for its non-training period indicated about 65% in terms of overall accuracy and showed about 6% improvement in terms of overall accuracy for changing drought conditions when compared to the seasonal outlooks. Future studies will further discuss the proposed models' ability to predict outcomes using other comparable references.

Key words: Drought prediction, USDM, Deep learning