기후 분과 [P-005]

Exploring how ENSO characteristics change over time using a low-dimensional deep learning simulator

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Currently, the Korea Meteorological Administration (KMA) is using numerical method, which calculates physical processes using the governing equation applied to the earth system. However, this method has limitations, such as uncertainty in the initial field, parametrization, and time-consuming. To overcome these issues, data-driven approaches using deep learning techniques have gained popularity in weather and climate studies, leading to significant progress in these fields. While most of AI-based studies have been conducted by focusing on the prediction or forecast, few deep learning model studies have conducted the long-term integrals like Coupled General Circulation Models (CGCMs). In our previous study, we developed the El Niño-Southern Oscillation (ENSO) simulator with deep learning technique. To explore past, present, and future changes in ENSO for climate scenarios, We applied the ENSO simulator to study. We used the Community Earth System Model 2 (CESM2) large ensemble data as training data. And, we set the 3 time periods. Moreover, to capture the ENSO information, SST, SSH, Zonal wind seasonal average data's, In the Pacific ocean region (30° S~30° N, 110° E~70° W), Empirical Orthogonal Function (EOF) PC time series 1, 2, 3 modes were used. Additionally, Indian Ocean (30° S~30° N, 40° E~110° E) SST and Tropical Atlantic Ocean (30° S~30° N, 70° W~0° W) SST were used to identify the interaction between the oceans. we trained each season model (MAM, JJA, SON, DJF) independently. these models were connected. And then, combined DNN model could integrate continuously. Through this procedure, it allows recursive integration over a long time period. We attempted to observe changes in the characteristics of ENSO over time and, in particular, see how they might change under future climate scenario compared to historical period.

Key words: ENSO, Deep learning, DNN, climate change, long-term simulation