Deep learning for tropical cyclone intensity change prediction

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Here we develop a deep learning-based tropical cyclone (TC) intensity change prediction system (DeepTC). To consider the environmental and structural conditions, we used zero, one, two, and three-dimensional variables as input; to improve the prediction skill of rapid intensification (RI), we used focal loss as a loss function. Prediction performance for TC intensity change of the DeepTC model is higher than operational forecast of China Meteorological Administration (CMA) or persistence forecast (PER), especially the Heidke skill score for RI of the DeepTC model is 0.4, and that of the CMA and PER are 0.02 and 0.11, respectively. We employed a deep learning interpretability method called occlusion sensitivity to identify the source of the RI prediction skill of the DeepTC model; this method quantifies the relative importance of the input. As a result, latitude, maximum sustained wind speed, intensity change, vertical wind shear (0D), and relative humidity (3D) were the most important in improving RI prediction performance.

Key words: Deep learning, Tropical cyclone, Intensity change, Prediction, Rapid intensification