利用深度學習演算法發展颱風快速增強預報技術
The Development of Typhoon Rapid Intensification Forecas Technique Using Deep Learning

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摘　要

本研究利用深度學習演算法，發展颱風快速增強（rapid intensification, RI）之預報技術。此技術之目的在同時整合、應用不同類型之衛星觀測資料，並利用深度學習發展颱風強度估計及預報技術，在節省人力的同時提供客觀、穩定的颱風強度變化資訊。本研究根據前人研究之模式架構，撰寫了颱風快速增強機率預報模式之程式。此模式結合了卷積神經網路、循環神經網路演算法以及跨衛星頻道注意力機制。除此之外，本研究亦提出具體增進預報能力之方案：如包含增加及改進資料之使用策略、將預報目標由RI機率改為未來24小時之強度變化分布、及持續改進深度學習演算模組等。初步校驗結果顯示，所發展之模式確實具有應用於颱風快速增強預報之潛力。

關鍵字：颱風、快速增強、深度學習

Abstract

This research develops forecast techniques of tropical cyclone (TC) rapid intensification (RI) by using deep learning model, and these techniques aim to simultaneously utilize various types of satellite datasets to develop TC intensity forecasts. The goal of these techniques is to provide stable and objective information on TC development with less human power. Based on the model framework proposed by previous studies, the TC RI forecast model combines convolutional neural network (CNN), recurrent neural network (RNN) and cross-channel attention (CCA) algorithms, and is compatible with the database delivered to CWB so that the model is convenient to be further improved and deployed in CWB for operations. In addition, several specific improvement plans are proposed: (i) increasing the data feature and improving the using strategies, (ii) changing the forecast target from RI probability to the distribution of 24-hour TC intensity change, and (iii) continuously improving the deep learning modules. Preliminary verification results show that the deep learning model does have the potential to be applied to RI forecasting.

Key words: Tropical cyclone, Rapid intensification, Deep learning