Geophysical Research Abstracts
Vol. 19, EGU2017-11681, 2017
EGU General Assembly 2017

Mining key elements for severe convection prediction based on CNN

Ming Liu (1), Ning Pan (1), Changan Zhang (1), Hongzhou Sha (2), Bolei Zhang (2), Liang Liu (2), and Meng Zhang (2)

(1) Fujian Meteorological Center, Fuzhou, China, (2) IBM Research - China, Beijing, China

Severe convective weather is a kind of weather disasters accompanied by heavy rainfall, gust wind, hail, etc. Along with recent developments on remote sensing and numerical modeling, there are high-volume and long-term observational and modeling data accumulated to capture massive severe convective events over particular areas and time periods. With those high-volume and high-variety weather data, most of the existing studies and methods carry out the dynamical laws, cause analysis, potential rule study, and prediction enhancement by utilizing the governing equations from fluid dynamics and thermodynamics. In this study, a key-element mining method is proposed for severe convection prediction based on convolution neural network (CNN). It aims to identify the key areas and key elements from huge amounts of historical weather data including conventional measurements, weather radar, satellite, so as numerical modeling and/or reanalysis data. Under this manner, the machine-learning based method could help the human forecasters on their decision-making on operational weather forecasts on severe convective weathers by extracting key information from the real-time and historical weather big data. In this paper, it first utilizes computer vision technology to complete the data preprocessing work of the meteorological variables. Then, it utilizes the information such as radar map and expert knowledge to annotate all images automatically. And finally, by using CNN model, it cloud analyze and evaluate each weather elements (e.g., particular variables, patterns, features, etc.), and identify key areas of those critical weather elements, then help forecasters quickly screen out the key elements from huge amounts of observation data by current weather conditions.

Based on the rich weather measurement and model data (up to 10 years) over Fujian province in China, where the severe convective weathers are very active during the summer months, experimental tests are conducted with the new machine-learning method via CNN models. Based on the analysis of those experimental results and case studies, the proposed new method have below benefits for the severe convection prediction: (1) helping forecasters to narrow down the scope of analysis and saves lead-time for those high-impact severe convection; (2) performing huge amount of weather big data by machine learning methods rather relying on traditional theory and knowledge, which provide new method to explore and quantify the severe convective weathers; (3) providing machine learning based end-to-end analysis and processing ability with considerable scalability on data volumes, and accomplishing the analysis work without human intervention.