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Development of pm2.5 Forecasting System in Seoul, South Korea Using Chemical Transport Modeling and ConvLSTM-DNN

Authors : Ji-Seok Koo, Hee-Yong Kwon, Hui-Young Yun, Kyung-Hui Wang, Youn-Seo Koo

Abstract : This paper presents a forecasting system for PM2.5 levels in Seoul, South Korea, leveraging a combination of chemical transport modeling and ConvLSTM-DNN machine learning technology. Exposure to PM2.5 has known detrimental impacts on public health, making its prediction crucial for establishing preventive measures. Existing forecasting models, like the Community Multiscale Air Quality (CMAQ) and Weather Research and Forecasting (WRF), are hindered by their reliance on uncertain input data, such as anthropogenic emissions and meteorological patterns, as well as certain intrinsic model limitations. The system we've developed specifically addresses these issues by integrating machine learning and using carefully selected input features that account for local and distant sources of PM2.5. In South Korea, the PM2.5 concentration is greatly influenced by both local emissions and long-range transport from China, and our model effectively captures these spatial and temporal dynamics. Our PM2.5 prediction system combines the strengths of advanced hybrid machine learning algorithms, convLSTM and DNN, to improve upon the limitations of the traditional CMAQ model. Data used in the system include forecasted information from CMAQ and WRF models, along with actual PM2.5 concentration and weather variable data from monitoring stations in China and South Korea. The system was implemented specifically for Seoul's PM2.5 forecasting.

Keywords : PM2.5 forecast, machine learning, convLSTM, DNN
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