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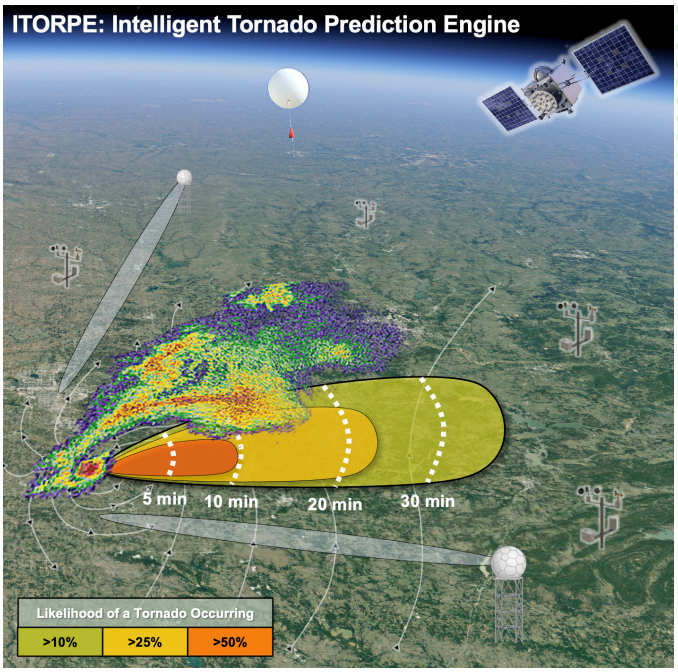
Intelligent Tornado Prediction Engine

Technology Office | Lincoln Laboratory

Tornadoes in the southeastern United States pose a unique threat to life and property due to their rapid development, transient nature, and the density of manufactured homes and other vulnerable residential structures. As the climate changes, tornadoes in this region are becoming stronger and more frequent, leading some to declare that Tornado Alley is shifting towards the Southeast. The most common type of tornado in this region, known as a quasi-linear convective system tornado, is historically difficult to warn for, with lead times hovering under 7 minutes and a false alarm rate of over 75 percent. With a plethora of remote and in situ observations available to National Weather Service (NWS) meteorologists, as well as the advent of extremely high-resolution numerical models, "data overload" can prevent forecasters from being able to accurately fuse all of the available information mentally in times of high stress.

Jointly funded through the Climate Initiative and Humanitarian Assistance and Disaster Relief Technical Investment Portfolios, the Intelligent Tornado Prediction Engine (ITORPE) combines meteorological and machine learning expertise from Group 43 and the Lincoln Laboratory Supercomputing Center to perform extremely large-scale data fusion spanning several years' worth of radar, satellite, model, and in situ observation platforms. These historical datasets are combined with a finely curated "truth" database that utilizes NWS damage surveys and warning polygons to learn trends and features in the data that lead to the formation of a tornado. A deep-learning approach is used to look for combined precursors across the datasets that can aid in predicting tornadoes, leading to the goal of not only increasing lead times but, perhaps more importantly, decreasing the false alarm rate in order to build better trust with the public regarding tornado warning performance. ITORPE seeks to provide enhanced situational awareness to forecasters in this fashion using a graphical interface to focus forecasters' attention on the storms of highest importance.



ITORPE will provide predictions for the formation of tornadoes using a catalog of historical events and an extremely large database that spans several observing modalities.

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