Geographic Belts for Hurricane Landfall Location Prediction

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When predicting a hurricane's landfall location, small improvements in accuracy result in large savings of lives, property, and money. The project's purpose was to apply a breakthrough method that can predict the geographic location of a hurricane's landfall with high accuracy. Researchers have known for a long time that there are strong correlations between a hurricane's landfall location and the geographic regions its track passes through. However, no methods have been developed to mathematically and explicitly describe these correlations. Consequently, the correlations can only serve to meteorologists as vague guidelines for their guestimates and are not usable in making practical forecasts. By studying the correlations and performing numerical optimization on historical hurricane data, this research discovered a set of geographic belt regions in the Gulf of Mexico that can be used as landfall location predictors. When a hurricane passes through any one of these belt lines, a prediction can be made by extending the hurricane's moving direction vector towards land–the intersection point of this extension line with the coastline is the predicted landfall location. This prediction method is simple and straightforward. It only uses basic measurements from meteorological satellites: the hurricane's real-time locations and moving directions. In conclusion, when compared to existing methods, the predictive belt method (PBM) created in this research provides a landfall location forecast with higher accuracy. Verification with historical hurricane data demonstrated that the PBM's average error is less than 50% of the National Hurricane Center models' error.

Awards Won:

Third Award of $1,000