Florida Department of Transportation Research

Evaluation of Fog Predictions and Detection, Phase 2

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Current Situation

Nationally, heavy fog contributes to over 20,000 fog-related crashes every year, with the highest percentage occurring in the Southeast. However, fog levels are difficult to both predict and detect, making timely driver notification difficult. The Florida Department of Transportation (FDOT) is working on this problem through deployment of detection and warning systems and through an ongoing program of research to detect areas where fog is likely to form and to create more accurate detection and warning technologies.

Research Objectives

Florida State University researchers investigated the possibilities of using readily available data sources for forecasting fog.

The low visibility conditions created by fog creates a serious driving hazard.

Project Activities

The researchers focused on soil moisture as an important predictor, along with temperature and humidity, of fog formation. It would be impractical to try to monitor every few hundred yards of highway for the presence of fog, but rainfall data, to which soil moisture is closely related, is maintained on a rather fine scale state-wide by the National Weather Service.

First, to determine whether rainfall could be used to predict soil moisture, the researchers needed sufficient sources of data for rainfall, soil type, and soil moisture. Rainfall and soil type data were readily available. Rainfall data with general coverage of the surface was available from radar and satellite imaging. However, the researchers found that Florida has very few stations that actually measure soil moisture, so Oklahoma, which has over 80 such sites, was used as a test case for this part of the project.

Soil moisture and rainfall data from the Oklahoma stations were collected for a year, allowing correlations between rainfall and soil moisture in dry and wet periods. Measurements from rain gauges and daily rainfall values derived from radar by the National Weather Service were collected. The relationship between rain gauge and radar rainfall data was reliable. The researchers demonstrated that radar-derived accumulated rainfall accurately predicts soil moisture, as accurately as the rain gauge but on a spatial resolution two orders of magnitude greater than the rain gauge network in Oklahoma and even better for Florida, and at a fraction of the cost. This allowed the researchers to use rainfall data from existing NWS radars to create soil moisture maps at the same resolution needed by high resolution numerical fog models and also as the fog dimension itself.

The researchers compared the method of deriving soil moisture from radar rainfall measurements with the daily measurements of soil moisture taken by earth-orbiting satellites. They found that the satellite date required significantly greater processing than the radar-based method, with no improvement in soil moisture prediction.

Project Benefits

The ability to predict fog formation based on readily available information provides another tool for protecting drivers on Florida highways.

For more information, please see www.fdot.gov/research/.