A Scalable Convective Severe Weather Forecasting Solution

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Introduction

Across many industries, convective severe weather can wreak havoc on many fronts of daily operations.

In the electric utility industry for example, convective severe weather can pose a wide variety of hazards from the transmission of the electricity through the power lines to the line crew deployment and safety. To help mitigate the costs and increase the safety around these weather hazards, we have created a mutable, spatial forecasting product. This product delivers key severe weather information that can quantify the potential impact and format the information in an operationally convenient way for the end user.

The Convective Severe Weather Forecast Engine

The severe weather forecasting engine is actually a module on top of a general precipitation forecasting engine.

This allows for a consistent forecast for any module spun off of the general precipitation forecast and also saves the severe weather forecaster time as the distribution of precipitation and its convective potential is inherent as a first guess. The severe weather forecaster's role is to add detail to convective events forecasted that cannot be resolved by the first guess.

Quantifying Convective Severe Weather Forecast Parameters

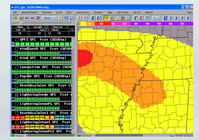
The convective severe weather parameters that the end users are most concerned with are:

- Hail Size
- Storm Wind Gusts
- Lightning Intensity

The next step is quantifying the severity into categories which can be general or custom rules sensitive to a specific end user.

Use of the Graphical Forecast Editor (GFE) as the Tool to edit Severe Convective Parameters

The Graphical Forecast Editor (GFE) was employed to handle the spatial editing necessary to create an efficient scalable solution for forecasting both the general precipitation forecast as well as the convective severe weather forecast on a high-resolution (5km) grid. GFE which was originally developed by NOAA's Earth System Research Laboratory, has been in use by the National Weather Service since 2001 and has been operational for short and medium range forecasts at Telvent since 2004. The strength of GFE is more than its ability to interactively forecast weather spatially but also has the flexibility to configure first guess input that continuously evolve as inputs become increasingly of higher quality.



Run Forecasts over specified Zones or Districts

The forecasts run over specified zones or districts where each zone is made up of various numbers of 5km grids. Once all forecasts for all grids are complete for a zone, functions such as averages and max functions can be run to obtain peaks, zone averages, etc… For example, lightning intensity can be calculated for average strokes in the zone and peak intensity in the zone.

One example of zones that can be used in the convective severe weather forecast system are the NWS Zones.

End User Specified Severity Categories of Convective Severe Weather

The severe weather forecasts are assigned a level of severity per grid depending on the end user's criteria of number of levels and what thresholds those levels are defined. The average level and max level in the zone can be calculated after all grids forecasts are produced based on the defined thresholds.

Storm Scale	Type	Wind Gusts	Lightning	Hail Size	Comments
1	Shower	None	None	None	Just Rain
2	Light T-storm	<30MPH	1-75	Pea	Minor Problems
3	Mod T-Storm	30-45MPH	76-150	Pea	Moderate Problems
4	Strong T-storm	45-60MPH	151-300	Nickel	Significant Problems
5	Severe T-storm	60-70MPH	301-450	Quarter	Major Problems
6	Extreme T-storm	70+ MPH	451+	Golf Ball +	Destructive

Forecast Output

The forecast is compiled hourly over the span of 7 days and can be delivered in various file types such as comma delimited files(CSV) HTM, XML, etc. The output can be formatted in a variety of ways depending on the requirements of the end user. Below is an example of the output formatted according to probability of occurrence with more detail quantifying forecast lightning intensity.

SS1-3 represent storm intensity levels, Lightning activity is the average lightning strikes forecasted per hour for the zone and the lightning intensity is the maximum strokes per hour. The coverage shows the forecasted coverage of the storm intensity levels and lightning.

The output can be simplified further into a higher level product by taking max functions over the course of a 24 hour period to pinpoint specific zones or districts for the day that potentially will need special attention.

ValidDateTime	StationID	PoP	QPF	SS1Cov	SS1Prob	SS2Cov	SS2Prob	SS3Cov	SS3Prob	LightningActivity	LightningActivityP	LightningInten	ModelRunDateTim
1/11/12 14:00	FL_022	55	0.07	100	55	41	39	14	14	55	39	58	1/9/12 19:00

Summary

The forecasts generated by the convective severe weather forecast engine delivers high resolution complex meteorological data specific to convective severe weather into a product that a non-meteorologist can efficiently decipher to obtain key information about the weather forecast.