

# Why weather forecasters still don't always get it right

By Jeffrey B. Halverson

It was March 2017, and a winter storm named Stella promised to deliver up to a foot and a half of snow to New York City and parts of New Jersey. Officials pushed out blizzard warnings, suggesting the city was under imminent snowy siege.

But only 7 inches fell. Then-Gov. Chris Christie blasted forecasters. "I don't know how much we should be paying these weather guys," he said. "I've had my fill of the National Weather Service after seven and a half years."

For anyone following the weather, forecasts for big storms are sometimes still roller coaster rides – with sudden shifts in track or intensity. As a meteorologist who forecasts for a large urban market, I can attest to the frustration. Why can't we get it right every time, given this era of 24/7 weather data, dozens of satellite and sophisticated computer models? The answer lies in the quirks between the most popular forecasting models.

## **Battle of the models**

Computer forecast models have become the mainstay of weather prediction across North America and many other parts of the world. Run on fast supercomputers, these sophisticated mathematical models of the atmosphere have gotten better over the past couple decades.

Human forecast skill has improved by approximately one day per decade. In other words, today's four-day forecast is as accurate as a three-day forecast was a decade ago.

Forecasters in the U.S. routinely examine several models, but

the two most discussed ones are the American and the European. When the models disagree on the track of a big storm, forecasters must often choose which they believe is most correct. This decision can make or break a critical forecast.

Most meteorologists agree that the European model is the most skillful. This was cemented in March 1993, when it correctly forecast the track and intensity of a historical Nor'easter. Called the "Storm of the Century," the storm dropped a blanket of heavy snow from the Gulf Coast to the northern tip of Maine.

The storm was a milestone for what is termed medium-range forecasting, or forecasts made three to seven days out. The European model nailed the prediction five days in advance. That meant officials could declare states of emergency before the first flakes ever flew.

Fast forward to 2012, and the Euro was still making correct calls on big, dramatic storms. But this time, the lead time went beyond eight days. The storm was Hurricane Sandy, a massive Atlantic storm. More than a week in advance, the European model predicted an oddball westward jog in Sandy's track, whereas the American model arced it eastward and harmlessly away from the East Coast. Score: another major victory for the European.

### **European versus American**

Why does the European do so well, compared to its American counterpart?

For one, it's run on a more powerful supercomputer. Two, it has a more sophisticated mathematical system to handle the "initial conditions" of the atmosphere. And three, it's been developed and refined at an institute whose singular focus is on medium-range weather prediction.

In the U.S., the medium-range American model is part of a

suite of several models, including several short-range prediction systems that run as frequently as every hour. The time, intellectual focus and costs are shared among as many as four or five different types of models.

The public has heard about the European model's victories. But forecasters also know that the American model is quite skillful; it's had its share of wins, albeit less high-profile. One of these was Winter Storm Juno, a 2015 Nor'easter that severely impacted the New England coast. Forecasters put out a dire warning for 24 to 36 inches of snow across all of New York City. In an unprecedented move, Gov. Andrew Cuomo shut down the subway system in advance, a move never done for an impending snowstorm.

This doomsday snow forecast was based on the European model. The American model predicted that the storm would be displaced about 50 miles farther eastward – shifting the big thump of snow away from the city proper. In reality, Juno took this eastward track and Central Park ended up with “only” 10 inches – a significant amount of snow, but not a crippling 2 to 3 feet. The unnecessary economic losses from the city's shutdown were huge, putting meteorologists on the defensive.

In the case of winter storm Stella, the American model massively overpredicted snowfall. But a short-range model called the North American Model correctly predicted a storm track 50 to 100 miles farther east.

## **Predicting the weather**

It all comes down to this: Weather forecasters have many choices for predictive models. The art of forecasting is based on years of experience spent with each model, learning the unique biases and strengths of each. The National Weather Service and other forecasting outfits have made strides in better communicating forecast uncertainty, given the inherent spread in the models. But it still often comes down to that

gut feeling: European or American?

Researchers are taking steps to improve U.S. medium-range weather prediction by doubling the computer speed and tweaking the way the model ingests data. Companies like Panasonic and IBM have entered the arena with their own novel weather prediction models.

In the meantime, while we wait for the American model to “catch up” to the skill of the European, there are a few ways people can learn to decipher the forecast message. Individual model runs are less skillful beyond about five days; what you’re looking for is run-to-run consistency. Also, seek out forecasts that frame the predictive uncertainty. For instance, a forecast may suggest alternate scenarios for an upcoming snowstorm: a 20 percent chance of up to 15 inches, or a 20 percent chance that only 4 to 6 inches will fall.

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