Eye of the Storm

Introducing the pinpoint-precise local microcasts of IBM's Deep Thunder.

By Marc Spiegler

For more than 40 years, weather forecasting in the US has relied on supercomputers to crunch through reams of climatic data and make predictions based on elaborate mathematical models. Yet despite decades of advances in computer hardware and meteorological methodology, we still view our local forecasts with a deep skepticism.

Most of today's national forecasts are based on a grid system (imagine superimposing a colossal piece of graph paper over North America). The grid used by the National Weather Service divides the continent into 100,000 distinct regions, or cells. Readings are collected from each cell and then fed into a supercomputer that weaves together all the disparate data to produce a forecast. But herein lies the problem: While scientists understand the physics of weather, they're stuck with a grid system that's too widely spaced for supercomputers to deliver accurate local forecasts in good time.

The National Weather Service concerns itself with producing weather models that span the continent; regional and local forecasts are then shaped from the national models. But each grid cell contains so much data that by the time supercomputers can digest it all, some real-world factor will change - a storm stalls over the Pacific, for instance - and throw off the forecast before it's ever completed. So you would either have to start all over, in which case you could face the same problem, or stick with an erroneous forecast that may mean rain instead of sun, or snow instead of rain.

A team of researchers at the National Oceanic and Atmospheric Administration (NOAA), which oversees the National Weather Service, and IBM have been working to solve this problem by outfitting beefed-up RS/6000 SP supercomputers - a unit of the

same make and speed that trounced chess champ Garry Kasparov - with advanced 3-D modeling and visualization applications. Nicknamed Deep Thunder, this is the first joint project between IBM and NOAA. The results are impressive. From raw numerical data generated by a software program called the Regional Atmospheric Modeling System (RAMS), Deep Thunder's visualization software generates dazzling 3-D full-color views of local weather - forecasters can look inside a storm with the meteorological equivalent of an X ray. On a good day, RAMS, supported by the parallel processing power of the RS/6000 SP, can make calculations every 24 hours for an area down to a few city blocks.

"The National Weather Service produces an enormous amount of data from satellites in orbit, radar, ground stations, and weather balloons," explains Deep Thunder researcher Lloyd Treinish, who joined IBM after a 12-year stint at NASA as a senior computer scientist. "But their forecasts cover 29-kilometer grids ... and you can't always wait for the big models to run. We use the same available data to make predictions for areas only a few kilometers in size - at finer resolution if the infrastructure is there to support it."

Deep Thunder débuted at the 1996 Atlanta Olympics, where organizers needed to pinpoint forecasts for each event site. ("The Olympic committee asked for precise forecasts," recalls Treinish, "but the local weather service office said they couldn't do it.") Its most dramatic test came with the closing ceremony. The IBM team (in collaboration with the National Weather Service and others) predicted no thunderstorms would soak the celebrants, while other forecasts called for a fête-flattening downpour. Trusting Big Blue, the organizers went ahead. A storm did arrive, but it never got closer than 10 to 15 miles from the stadium.

Since Deep Thunder concentrates on what's happening locally only hours before the weather action happens, it isn't good at making long-range forecasts. For that, meteorologists use more sophisticated atmospheric models - or, like Piers Corbyn at Weather Action, sunspots - to foretell weather seasons ahead. But for short-term local forecasts, says Treinish, the elaborate 3-D RAMS models provide "a greater level of precision and accuracy, compared with what's available for a simulation of the entire country. Important features could easily be missed using traditional methods, which simply take too long. In localized forecasts, phenomena are short-lived, but we can refresh with new data every few hours."

Since the Atlanta trial, Treinish and company have ramped up the system by adding flyover animation and panoramic displays. In May 1997, his team traveled to Beijing to help install the only Deep Thunder system currently running. It monitors the eastern half of China - 2.3 million square miles broken into cells of 38.6 square miles. IBM is now discussing similar projects with several Southeast Asian governments, which seek shelter from economy-wracking typhoons. "Several nations there rely on other countries' weather services for simulation forecasts," Treinish says. "But that means they're stuck with other people's data - and with forecasts that don't

focus on their needs."

The Deep Thunder setup costs roughly $750,000 - too much for your average yachting enthusiast, but a pittance by corporate standards. Potential clients in the US include aviation-related firms and insurance companies, who hope to give agents a jump on settling claims by predicting where natural disasters will strike. And the biggest potential customer, of course, is the US government - federal emergency teams, for example, could save both lives and money with early planning on the deployment of paramedics and material resources, such as blood and medicine.

Considering the hardware investment, Treinish says, it's unlikely the National Weather Service will employ Deep Thunder across the country. But IBM has been talking with state and local agencies, for whom the investment makes more sense. If you're lucky enough to be living in a city that buys one of these systems, your local weather forecast might soon sound something like this: "Unless you're going downtown today between 10:20 and noon, leave the umbrella at home. On the South Side, make sure to slap on the sun-screen; North Siders, swallow some extra Zoloft - it's gonna be gray all day. And you West Side gardeners, cover your tulips: There's hail coming in at 1:45 this afternoon."

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