SNOWSTRADAMUS

JOEL GRATZ IS A COLORADO SKIER WHO PUTS OUT WINTER STORM ALERTS THAT TRACK THE ESSENTIALS: WHERE EXACTLY THE SNOW WILL FALL, HOW MUCH, AND WHEN. AS FELLOW WEATHER NERD MICHAEL BEHAR FINDS OUT, IT'S WONDERFUL WHEN IT WORKS.

PHOTOGRAPHS BY
BENJAMIN RASMUSSEN

JOEL GRATZ IS MAKING

me nervous. It's midmorning on a snowy Colorado day in March, and we're riding the Sun Up triple chair in Vail's Back Bowls. Gratz has scooched his butt to the very edge of the seat, and now he's thrashing his right arm to and fro, determined to capture a few flakes with his mittened fist. Whenever Gratz talks about the weather—snow especially—the 31-year-old meteorologist can forget where he is, speaking in a nonstop stream. "I usually just tune it out," says his girlfriend, Lauren Alweis, who is skiing with us.

"These flakes are pretty sweet!" Gratz shouts. "And look at the way they're falling—from northwest to southeast. That's good! But the moisture layer is thin."

Gratz, a lifelong skier who lives in Boulder, loves nailing a forecast, and today he did just that, having predicted that Vail would get nearly a foot of new snow. To prove it to the tens of thousands of people who follow his powder forecasts—posted daily on his website, OpenSnow.com—he whips out his iPhone and snaps pictures of freshly covered glades that he'll upload later. Gratz also has a ruler affixed to a ski pole; ten minutes earlier, he jammed it into the snowpack and photographed that, too. "A week ago I said today would be a very good day," he says. "It turned out that it was. That's pretty cool from a weather standpoint."

Gratz is what weather buffs like me call a microscale forecaster, which means he focuses on a particular kind of weather event (in his case, snowfall) for an audience that is particularly interested (skiers and snowboarders). He got started five years ago, frustrated by his inability to find the tailored forecasts he craved. "I was livid whenever I missed a powder day," he tells me. "Nobody could forecast them, so I started doing it myself."

What eventually became OpenSnow started with an e-mail to 38 friends, sent on December 17, 2007, which said: "You're on this list because you know there's nothing better than the feeling of skiing in deep, untracked powder!" Gratz's first advisory predicted dumps at various Colorado resorts, including Vail, Aspen, and Steamboat. "Friday could be a great day to play hooky," he wrote. A buddy pinged back, "You are a great man! People will sing songs about you."

Today, OpenSnow, which went live in 2010, attracts a million unique visitors a year, including 1,600 members who pay up to $45 annually to receive customized powder alerts by e-mail and time-lapse video feeds from the slopes at 24 Colorado resorts. OpenSnow has also expanded to cover Lake Tahoe, New England, Utah, and portions of the mid-Atlantic. Each region gets its own forecaster, handpicked by Gratz for both weather knowledge and powder addiction.

OpenSnow is one of several newfangled websites offering such fine-tuned information, on everything from surf conditions to wind speeds for kiteboarders to the likelihood that thunderstorms will drench your mountain-bike ride. (See "Precision Forecasting," page 100.) These sites exist because they meet a demand that government weather agencies aren't filling.

"Government forecasts don't focus on the recreational side of weather—the fun side," Gratz points out. The sole mission of the National Weather Service (NWS) is to protect lives and property. For this reason, its winter forecasts often cover hundreds of square miles and are intended mainly to scare drivers off the roads during snowstorms. OpenSnow targets people who *want* to put themselves in the crosshairs of a blizzard.

Prior to one snowstorm last March, Gratz projected different snow totals for Copper Mountain and Vail, even though the two resorts are only 12 miles apart. The NWS, part of the National Oceanic and Atmospheric Administration (NOAA), would never bother with such a distinction. After the front rolled through, Copper had amassed only two inches, while Vail got nine—a difference Gratz saw coming. A spread like that is momentous to a skier or boarder.

"It's fun to forecast in Colorado, but holy shit, is it hard," Gratz says. It helps, he says, that "I've got a little bit of OCD in me. But without wanting that powder day myself, I would never have the motivation to do all this work."

ONLY RECENTLY has weather forecasting become a high-tech business. Back in the 1950s, the NWS refused to issue tornado warnings because the science was notoriously inaccurate. Mike Smith, a senior vice president for AccuWeather, a Pennsylvania company that produces made-to-order forecasts for some 175,000 industry and government clients, recalls that even in 1971, when he got his first job at a TV station in Oklahoma City, they still relied on radars that used World War II technology. "It was considered taboo for meteorologists to issue tornado warnings more than a day out," he says.

Nowadays, thanks to an explosion in satellite data gathering and supercomputer power, it's possible to forecast more than two weeks in advance. We can also zoom in on areas of a few square miles and make up-to-the-minute spot forecasts. Smith's team is beta testing a new system called SkyGuard Mobile, an app that continually monitors your location using the GPS in your smartphone and then alerts you when something nasty is coming. "If you're a trucker, it can warn you if you're about to drive into an unexpected ice storm," Smith says. The app would be indispensable to a mountaineer, he says, or a "fisherman out in a boat as a thunderstorm approaches."

Generally, meteorologists base their forecasts on three major models. Two of them, the Global Forecasting System and the North American Mesoscale Model, are produced in the United States by the NWS. The third, the European Centre for Medium-Range Weather Forecasts, is run by an intergovernmental agency in Britain. There's ongoing debate among weather nerds about which is best and why, but most agree that the Europeans are kicking our butt, chiefly because they've invested more in computers.

To feed these models, data is gathered from dozens of sources. There are remote-sensing satellites that can detect minute atmospheric changes—even "seeing" through clouds to measure subtle temperature shifts on the ground. There are also pulse Doppler radars, which visualize storms in four dimensions (spatially and chronologically). Weather balloons and backyard hobbyists all contribute to the data trove, while the Internet and wireless networks facilitate a grand information exchange.

What's more, thanks to NOAA and a handful of other taxpayer-funded agencies, virtually everything is available for free, online, with just a few mouse clicks. "There's a huge potential business for people who want to predict recreational weather," Smith says.

And that's exactly what Gratz is doing, working full-time as CEO and overseeing a growing operation that started turning a profit during its second season, with nearly 10 percent of its 18,000 registered users signing up for paid extras in the first two months they were offered. In a recent public message to OpenSnow readers, Gratz confided, "I pay about $200 a year for two websites that provide data, but 98 percent of the data I use to make forecasts is freely available … and OpenSnow wouldn't exist without it."

ON VALENTINE'S DAY, a week before I skied with Gratz, we met for lunch at a trendy bistro in downtown Boulder called the Kitchen Next Door. The previous month had been dismal for Colorado snow, but that day it was dumping. Our waiter immediately recognized Gratz—he's been featured in the *Denver Post* and on local TV—and wanted to know when to expect the next powder day.

"You should take Thursday off," Gratz told him.

"Gotta work," the waiter groaned.

"Switch with someone," Gratz said, sounding quite serious. "Something big is going to happen. Trust me." Gratz then launched into a discussion of weather-model behavior that went on until the waiter's eyes glazed over, as did mine. Gratz didn't notice: he was already busy checking an iPhone app that displayed animated radar images of the day's blizzard. "Look at this incoming band of snow!" he said, shoving the screen in my face. "The wind direction!" Eventually, he snapped out of it and started telling me how he got into all this.

Gratz was an only child raised in Doylestown, Pennsylvania, and he loved snow as far back as he can remember. He started skiing at four, and when he was ten he began tracking and charting the weather as a hobby. "In high school, I'd check radar on the Internet in the library to see if it was going to snow enough for us to get out of school," he told me. "Whenever there was snow, I wanted to know how long it would last, was it heavy or light. I was obsessive."

Gratz went to Penn State—graduating in 2003 with a bachelor's in meteorology—and then got a summer internship at the NBC TV affiliate in Philadelphia. "I worked with Glenn 'Hurricane' Schwartz," he said. "I did all the background stuff for the forecasts. But when the cameras shut down, I never knew if anyone was listening or making decisions based on what we just did."

"FRIDAY COULD BE A **GREAT DAY TO PLAY HOOKY,**" GRATZ WROTE IN HIS FIRST SNOW-ADVISORY E-MAIL, IN 2007. A BUDDY **PINGED** BACK, **"YOU ARE A GREAT MAN! PEOPLE WILL SING SONGS ABOUT YOU."**

He nixed the idea of pursuing a career as an on-air weatherman, in part because he didn't want to end up with a starter job in "bumblefuck nowhere." During his junior year at Penn State, he got involved in an on-the-ground research project with scientists at the University of Oklahoma who were investigating thunderstorm formation. "That was my first chance to actually see the weather developing," he said. "We drove all over the plains with radar trucks. But I ruled out research, because you'd get all this data and then have to spend years trying to get grants to write code that would forecast the weather."

Gratz moved to Colorado in 2003 to work under Roger Pielke Jr., a professor of environmental studies at the University of Colorado at Boulder. He earned a master's and tacked on an MBA. In 2006, just out of grad school, he was hired by Boulder-based ICAT, a provider of catastrophic property insurance, to do risk-modeling analysis.

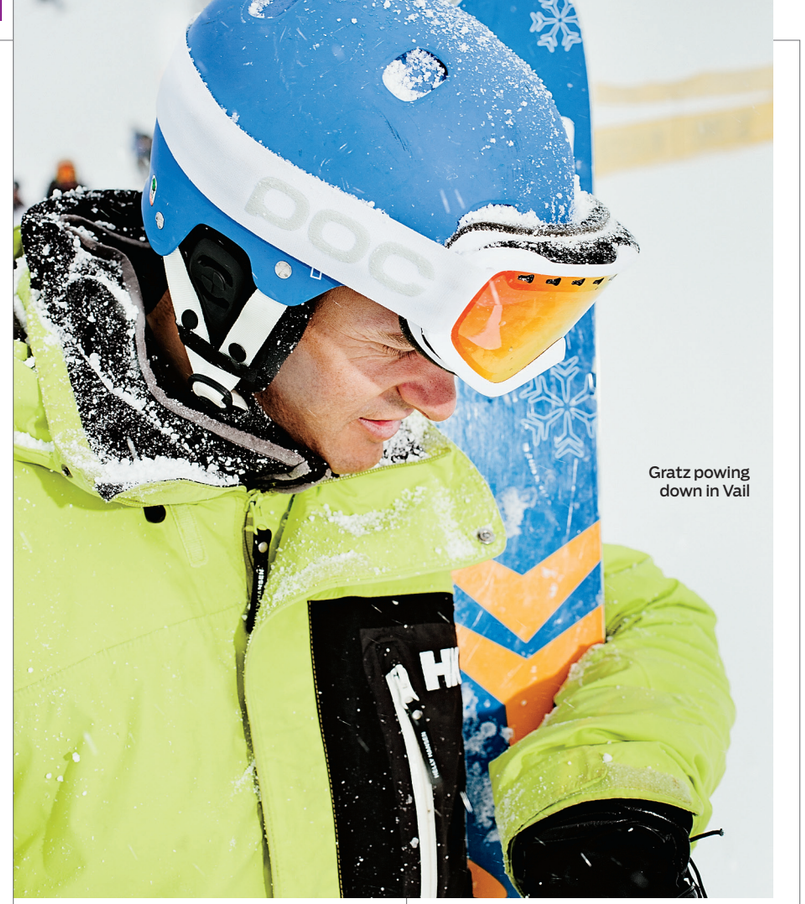
It was a high-paying job, but he hated cubicle life. He would leave work and immediately head home to geek out on local weather at his computer. "Every night, I would look at some stuff, make notes, and after a storm moved through I would check the snow amounts," he said. "I was looking at the weather for hours a day."

He got better at identifying potential snowmakers, which he would deconstruct in weekend forecasts that he e-mailed to friends. His list grew to 500 and included professional big-mountain skier and Aspen resident Chris Davenport, who met Gratz at an event in Boulder and asked to be added. "Once he saw it, he realized it was legit and passed it on," Gratz told me.

After that things ballooned. Gratz started blogging in late 2008, quit his job, and launched OpenSnow (originally called Colorado Powder Forecast) on a shoestring in 2010. He was joined by meteorologist Andrew Murray, who came from the National Center for Atmospheric Research, where he'd been designing and coding weather-themed websites. Gratz also recruited Bryan Allegretto, who was writing a popular blog featuring powdercasts for the Lake Tahoe area.

"I had no kids, no wife, and a mortgage half covered by a roommate, so I decided to do it, even though I had no business plan and no clue what I was going to do the rest of the year," Gratz said. But making money and building a company were never his principal goals. "I wanted to feel useful, really useful," he said.

POWDER FIENDS aren't the only ones seeking out—and paying for—microscale technology. At his home in Redmond, Washington, Michael Fagin, founder of a forecasting operation called Washington Online Weather, is able to monitor conditions on Mount Everest—comparing six different models—and advise climbing teams who hire him for the service. "I e-mail detailed forecasts directly to the Base Camp manager," says Fagin. He'll also speak to climbers by satellite phone if a



Gratz powing down in Vail

PRECISION FORECASTING

The best websites for targeted weather info —M.B.

OpenSnow
Tracks snowstorms for skiers and boarders. Cost: Basic membership is free. Pro accounts, $20 or $45 a year, get you add-ons like access to meteorologists and powder alerts for resorts you pick. *opensnow.com*

Chance of Weather
Select an activity—from biking to barbecuing—and plug in a zip code for hourly forecasts, along with rankings that grade the potential enjoyment of your chosen pursuit based on conditions. Cost: Free. *chanceofweather.com*

WindAlert
Gives kiteboarders, sailors, and windsurfers minute-by-minute wind reports and hourly forecasts at more than 50,000 locations worldwide. Cost: Free to view forecasts. Pro memberships—$3 to $10 monthly—feature real-time wind observations, daily meteorologist briefings, and unlimited e-mail or SMS alerts. *windalert.com*

Washington Online Weather
Offers high-altitude mountain forecasts for the Himalayas, the Alps, Denali, the Caucasus, the Karakoram, and the Andes. Reports are customized to match intended climbing routes. Cost: From $45. Price varies depending on location and quantity of forecasts. *wowweather.com*

SkyGuard Mobile
Select conditions—tornadoes, lightning, flash flooding, heavy snow, hail, high wind—and get notified if severe weather is in the vicinity. Ignore an alert for more than two minutes and a meteorologist texts you to ensure you're safe. Cost: Up to $20 a month per device. *enterprisesolutions.accuweather.com/skyguard-mobile*

Stealth Travel Club
Get e-mailed when it's about to go off at one of numerous world-class surf breaks. Book and pay to join a prearranged "surfari" and within 48 hours you'll be charging bombers. Cost: Free for forecasts; trip costs vary depending on destination. *worldsurfaris.com/stealth/index.html*

barometric pressure and ripples in the jet stream. Sometimes he'll call or text ski patrollers he knows: firsthand eyes on the hill. The effort can take as much as three hours, at which point he'll post his prognosis to OpenSnow, usually by nine. On snow days he often files updates.

The process will get faster for Gratz as emerging technologies mature. One such innovation is the High-Resolution Rapid Refresh model, in development at NOAA's Earth System Research Laboratory in Boulder. Alexander MacDonald, who directs the lab, is compiling data from at least 30 sources, some never before used to build weather models. "We pioneered having commercial aircraft send us temperatures and wind

GRATZ PREDICTED A BIG APRIL STORM THAT FELL APART. THAT AFTERNOON, OPENSNOW PROVIDED A DETAILED POSTMORTEM, COMPLETE WITH ANIMATED SATELLITE IMAGERY, ON WHAT WENT WRONG.

fast-moving front could put lives at risk.

AccuWeather and WeatherFlow (which tracks wind speeds for kiteboarders, windsurfers, and sailors) refine their services with proprietary models designed to run on off-the-shelf computers. Both companies collect data from several thousand networked weather stations that dispatch regular reports to their central servers. From this data, meteorologists can run simulations in-house and then compare the outcomes to the conventional models.

Gratz has something similar in mind for OpenSnow. He's developing a model to compute the impact of wind direction and topography on snow totals at various winter resorts in Colorado. "It should be able to tell us that, when Vail gets a northwest flow, they'll get twice the amount of snow that other models forecast," he says.

Gratz plans to test-drive his homegrown model in the fall, when forecast season begins. At the first sign of snow, he'll make it part of a daily ritual that has gone unchanged since OpenSnow went live in 2010. Every morning before dawn, working in bed in his underwear, Gratz will check the latest global models, view infrared feeds from satellites, examine Doppler images, and peek at the resort and highway webcams. He'll note variations in speeds every hour," says MacDonald.

Unlike conventional models, which encompass large regions of the country and take hours and even days to generate, the High Resolution Rapid Refresh model is fast and focused. It carves the U.S. into parcels measuring nine square kilometers. Click on a parcel and you get a "nowcast" for what's going to occur every 15 minutes forward, out to 24 hours.

Not every inch of the U.S. is modeled (yet), but MacDonald was able to walk me through the process of determining air temperature six feet above the ground, at a precise location near Chicago O'Hare International Airport, 12 hours into the future. Eventually, with added computing power, he intends to shrink the parcel size—or "resolution"—to one kilometer. "By January 2015, all you'll have to do is download an app to your phone," MacDonald says. "It will always know where you are and what the weather's going to be like at your location for the next 12 or 18 hours."

"Nowcasting is likely the future," Gratz agrees. "Right now I'd classify it as pretty good much of the time, but not great all of the time. When something fails occasionally, it's hard to trust it." So for the moment, Gratz is sticking to the tools that have worked for him—and made him **continued on page 112**

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something of a celebrity. While we're at Vail, admirers intercept him in the lift line. "Thank you, Joel!" a woman gushes, confessing that she'd called in sick to the office because of his forecast. "I love you," another declares.

OF COURSE, GRATZ sometimes fails, a fact he discusses frankly on a part of his site called Keep Me Honest. For several consecutive days in early April, he assured his readers that a monster powder maker was brewing. "Nearly all resorts will see about 5-10 inches from the storm, with about 10-18 inches for areas east of the [Continental] Divide," he wrote just 48 hours before the impending storm. He added: "The best days to ski deep snow will be Tuesday … it could be very good."

On Tuesday, April 9—the day of reckoning—the system fell apart, and only a couple of areas saw flakes. That afternoon, Gratz posted a mea culpa to OpenSnow: "This storm has certainly turned into a pain in the you know what." Then he provided an exhaustively detailed postmortem, complete with animated satellite imagery, on what went wrong.

"In retrospect, I'm not sure I would have done anything differently," Gratz told me later. "Colorado is one of the more difficult places to forecast, because it's got big topography, chaotic topography. You have all these mountain ranges going every direction with no rhyme or reason."

Occasionally, Gratz gets surly comments from readers. When a storm didn't materialize in February, an OpenSnow user lashed out in the site's comments section: "Two days before the storm, he was calling for significant accumulations over the next two days. That didn't happen. He was wrong about the overall snowfall in the high country over the last five days by a LONGSHOT." But in the same thread, many defended Gratz. "Since discovering Joel, I've found he's spot on or in the range 95 percent of the time," one user wrote. "If chasing pow was the equivalent of the Range Game on *The Price Is Right,* I'd want Joel sitting in the audience telling me what to do."

Gratz offers this: "I may not be perfect all the time, but my audience realizes that they are better off overall because of what I do for them." Some clearly more than others. Shortly before Christmas, an admirer, presumably female, submitted a private message to OpenSnow. "There's nothing better than reading your forecast for pow every morning while I'm laying in bed," she wrote. "You look pretty cute in your picture. Are you single?"

When I ask if anything still stumps him, Gratz doesn't hesitate. "Steamboat Springs," he says. "It's the last unexplained thing for me in Colorado. I call it the Steamboat Surprise. Every year they'll get a foot or two overnight when they should have got a few inches and nobody else gets anything close. It has frustrated me for the better part of eight years, and you can't explain it due to orographics."

I sense a dissertation coming, so I interrupt. "I know a tree run that rarely gets skied," I say. "It'll be untouched." Suddenly, the other Gratz reappears. "I'm game," he says. "Show me the way." *O*

MICHAEL BEHAR (@MICHAELBEHAR) WROTE ABOUT GENE-BASED ENDURANCE RESEARCH IN FEBRUARY 2011.

Volume XXXVIII, Number 7. OUTSIDE (ISSN 0278-1433) is published monthly by Mariah Media Network LLC, 400 Market St., Santa Fe, NM 87501. Periodical postage paid at Santa Fe, NM, and additional mailing offices. Canadian Goods and Services Tax Registration No. R126291723. Canada Post International Publications Mail Sales Agreement No. 40015979. Subscription rates: U.S. and possessions, $24; Canada, $35 (includes GST); foreign, $45. Washington residents add sales tax. POSTMASTER: Send U.S. and international address changes to OUTSIDE, P.O. Box 6228, Harlan, IA 51593-1728. Send Canadian address changes to OUTSIDE, P.O. Box 877 Stn Main, Markham, ON L3P-9Z9.