

Mastermind: Dr. Jeff Masters

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Concentrate magazine, 3/23/2011

We predict it with varying degrees of success, feel under it, put the blame on it, sing odes to it – even survive it. The only thing that's for sure is, wherever you are on the planet, the weather is its own master.

After digging out from the sixth snowiest winter since 1880 (67.5" at DTW airport), Ann Arbor's got to be ready for spring. But today Tree Town's smacked by a 36-degree high temp and a shower of ice pellets. The good news is there's almost three more minutes of daylight today – and no recent earthquake activity. Or so says Weather Underground, the internet weather service firm that operates the Wunderground.com website.

Dr. Jeff Masters, co-founder and director of meteorology at Weather Underground, has built a site that wraps his mind around the tragicomedy of whatever the atmosphere throws at us. Masters co-founded the internet's first weather site back in 1995, and today Wunderground.com is visited by 17 million people worldwide (13 million in the U.S.) each month, ranking second only to Weather.com in U.S. web traffic. It's the 77th-most visited site in the U.S., according to Quantcast, and depending on turns of the weather, has been ranked as high as 52nd, Masters says.

"It was a long fascination that began when I was a boy," he recalls. In elementary school, Masters kept exhaustive weather records and planted a weather station with a little swinging vane in his Birmingham, Michigan backyard. He received bachelors and masters degrees in meteorology from the University of Michigan, where he later returned for his Ph.D. in air pollution meteorology. During the seven-year break between graduate programs, he worked as a Miami-based flight meteorologist for the National Oceanic and Atmospheric Administration's (NOAA) Aircraft Operations Center. It was there, as a member of NOAA's Hurricane Hunters team, that the weather nearly whipped him for good.

Thick dark clouds suddenly envelop the aircraft. A titanic fist of wind, three times the force of gravity, smashes us. I am thrown into the computer console, bounce off, and for one terrifying instant find myself looking DOWN at a precipitous angle at Sean across the aisle from me...

Masters writes in "Hunting Hugo," his account of the team's near-disastrous 1989 flight into the eye of Hurricane Hugo on a mission to study the mechanisms responsible for hurricane intensification. Their radar system failed on approach, the storm turned out to be a category 5 tempest – and that was just the eye-opener. The plane withstood 196-mph wind gusts, an engine fire, and a 200-pound life raft torpedoing into the ceiling. It's still in service today, Masters says.

After that death-defying experience, Masters bid adieu to the Hurricane Hunters. Even so, he still calls flying into the eye of a hurricane at low altitude one of the most incredible spectacles on earth, like being in a "stadium" of rotating, bulging clouds.

Gazing down from the plane, he describes: "You can't even see the ocean surface because it's been foamed up into this kind of spray froth mixture that makes the ocean surface kind of this eerie translucent bluish greenish white..."

"It's hard to beat that experience for the most dramatic," he laughs wryly, "because that was the worst turbulence any Hurricane Hunter has experienced and survived, at least for the NOAA Hurricane Hunters."

"Don't knock the weather; nine-tenths of the people couldn't start a conversation if it didn't change once in a while."

-Kin Hubbard

Upon returning to Ann Arbor for his doctoral program at U-M in 1991, he concentrated on the more applied science of air pollution meteorology because, "I had a lot of concerns back then about how human activities were harming the environment and people who rely on the environment for jobs or for a strong economy..." In particular, he studied smog. Climate change was emerging as an issue back then, a matter with which he soon became preoccupied. At the same time, the internet was just getting off the ground. As part of his advisor Perry Samson's class: "Interactive Weather Computing," he wrote a text-based program that made weather information available online to anyone on campus. Then Ann Arbor-based Merit Network, which ran the internet backbone at the time, took notice.

"They wrote a couple subroutines for my program, I plugged them in, and then – presto! We had weather info available for any place in the world on the internet," Masters recounts. Within nine months of launch, in 1992, the program was the most popular service of any kind on the worldwide net.

"It was much more fun to work on this internet-based stuff and that's where I tended to focus a lot of my energy and time," Masters says.

He and Samson received a National Science Foundation (NSF) grant to further their educational internet weather project. After further successive grants, the NSF suggested they become self-sufficient, take their project off-campus and make a go of it as a for-profit operation. So in 1995, with the launch of the worldwide web, the pair launched their own webpage. The Weather.com domain name was snapped up by The Weather Channel just weeks before, so the pair took the moniker of Weather Underground.com, after their educational project at U-M.

Masters and Samson then worked with five other co-founders, including Chris Schwerzler and Alan Sterenberg, former students of Samson's who'd moved to the Bay Area. They developed the web pages and wrote the software. Another partner, Jeff Ferguson, was and still is the CFO.

It took a couple of years building custom weather pages for clients before they could land their first advertiser. Today, 70 percent of the firm's income comes from advertising, Masters says. Another 20 percent is derived from custom feeds for the likes of Google, American Express, The Associated Press, and over 1,000 newspapers. Another five percent comes from print newspapers

including the *Detroit Free Press*, *San Francisco Chronicle*, and dozens of others nationwide. The odd remainder comes from site members who pay \$10 annually for an ad-free site and extra-long radar animations.

The dot-com crash in 2000, when revenues dropped by a factor of two, was a cloudy time for the company, but since then it's been on a steady uptick. During the recession of 2009-2010, wunderground.com maintained 10 percent to 20 percent growth each year, Masters says. Employee headcount is now at 38, and includes six U-M grads. Thirty-three staff members are based in San Francisco, while Masters, Ferguson, and three other part-timers are in downtown Ann Arbor.

Weather Underground's pioneer status as the internet's first weather site enabled it to build on an initial following that eventually snowballed via word of mouth, Masters explains. He also points to the viral nature of the tens of thousands of weather stickers the company has given away. The graphic takes two lines of HTML code to install and displays the current time and temperature for your city.

"A lot of people put them on their websites," he claims. "They got very popular and that drives a lot of traffic to our website when people would click on these weather stickers."

Weather Underground is privately held and has never taken venture capital funds. All employees get stock options.

"We've had several offers to buy the company that we've turned down because we enjoy what we do. The one offer we got right before the dot-com crash we're really glad we didn't take," Masters laughs. "Because that was all in stock which immediately went to zero within a few months!"

With the company remaining in the original founders' hands, Masters sees expansion potential in a push overseas to provide radar and satellite data and severe weather warnings in markets where the internet hasn't yet reached a saturation point. Employees are also building apps for the mobile device market.

The current forecast and colorful, fast radar images are the most popular features on the site. The site is also fed by data from the world's largest network of 17,000 individual weather stations, installed by small government agencies, airports, and backyard weather hounds.

"That's another big draw for people, too, they can get very local weather from just down the street if somebody happens to have a weather station on their block."

Personal weather stations are 12X12 cylinders with rain gauges and topped by cups that rotate with the wind. They run about \$200 to \$700. Masters has a wireless installation in his Highland backyard. From it he gets minute-by-minute uploads of the temperature, dew point, wind direction and speed, UV light levels, and pressure. It's a big step up from his boyhood pre-web days, when he had to go outside to take manual observations from his weather station.

"Bad weather always looks worse through a window."

-Tom Lehrer

The site has become a weather Wiki of sorts, where in addition to feeding weather station data, users can upload their own digital weather photos (over 1.3 million and counting). And anyone who wants to can contribute a pertinent blog.

Masters has a large following as Weather Underground's chief blogger; his posts sometimes draw thousands of comments a day. This time of year, he posts every other day, usually on weather and climate matters, but he's right there when upheavals occur. On the morning of our interview, he's just covered the air trajectories of radioactive plumes coming from a nuclear reactor affected in Japan's earthquake.

Hurricanes, however, remain his forte. During peak season from August through October, Masters will blog daily, even multiple times, if a big storm is churning.

He's also written extensively on climate change, with focused concern on drought, flooding, and the rise of world-wide sea levels. Climate change theory is a highly politicized field, he says, and it's up against "probably the best-funded PR effort in history against science – done by some of the same people who brought us the tobacco industry's campaign against the science showing that tobacco was harmful."

Needless to say, after posting his conclusions, bundles of hate mail get dropped into his lap. But the evidence, Masters believes, is unmistakable.

"The planet is warming. Pretty much nobody disputes that. Even the skeptics," he argues. "And it is warming in ways that can only be the case if human caused emissions of heat-trapping gases are responsible. Warming is greater at the poles than on the rest of the planet. There's cooling in the stratosphere going on which you wouldn't expect to see if it were some other cause. The spring is coming earlier each year, species are moving northwards in response to the warming, and the nighttime and wintertime warming is more than the daytime and summertime warming. All these factors are consistent with what you'd expect to see from a warming planet that's due to human effect."

On a lighter note, can weather strike that balance between theory and amusement? The ideal movie, he says, hasn't been made yet. "*Twister* was certainly entertaining, but pretty lousy science in there. *Day After Tomorrow* [was] pretty lousy science on climate change, though it was entertaining."

Masters is currently working on a fiction project about a flood on the Mississippi River. He plans to post short chapters on his blog and measure the reaction. The working title is *Mississippi Rising*, and it's set in the little-known Old River Control Structure, a floodgate system built by the Army Corps of Engineers at the convergence of the Mississippi and Atchafalaya Rivers in Louisiana.

"So the Mississippi very badly wants to carve a new path down to the Gulf of Mexico," he begins. The story promises a what-if scenario where Old Man River changes course in a flood.

"[*Mississippi Rising* is] going to try and talk a little about how climate change has changed the equation because now with a warmer world you have more moisture in the atmosphere, which can potentially cause heavier rains and bigger floods," he warns. "And the current flood control system has been designed with the previous climate in mind. Now that we're moving towards a new climate we are going to see heavier rains and bigger floods and the system isn't designed to handle that and will need to be overhauled, or it *will* fail in coming decades."

Movie material? He'll keep us posted.

Masters' fictional eagle may land this June, yet... he just hasn't been able to escape the weather siren events of 2010 and 2011. He tried to get to the story last spring, "...but, *no*, we had the [BP] oil spill and I had to write about that every day – where the oil might go. Then we had a really busy hurricane season – not necessarily in the U.S."

This year has brought a howling winter to the U.S.; flooding in Australia, South Africa, and Sri Lanka; and Japan's 9.0 Richter Scale earthquake and the tsunami and radioactive fallout. "Particularly this past year, it's been ridiculous," he says.

Where in the world does he get away from the weather?

"I don't think you can beat the Big Island of Hawaii," he laughs. "It's pretty ideal." His favorite place of refuge is Arizona's mountains and Grand Canyon. "They have pretty good weather there too."

Other than vacation, work sometimes takes him away from satellite and radar screens. He spent a week at the National Hurricane Center last year as a visiting scientist. And once a term you can catch him delivering guest lectures for Dr. Perry Samson's class at U-M. The course title: "Extreme Weather."