OUR NATIONAL PASSION

by KEAY DAVIDSON, Illustrations by Dusan Petricic

Preoccupation with weather reflects both our hunger for constant change and our need to recover a lost sense of awe toward the natural world

A generation ago adolescent meteorologists monitored local weather by turning milk cartons into barometers and Ping-Pong balls into anemometers. But nowadays, simply by tapping a keyboard, their successors can track weather as it happens all over the globe. The World Wide Web offers a jungle of "weather weenie" sites. Its users can stare until stupefied at weather-radar imagery from St. Louis, St. Paul or St. Cloud, satellite pictures of fog hugging the California coast or the Appalachian foothills, charts that depict dry lines and tropical maps that show a long, sinister red band. That band is the thermal signature of El Niño, now mercifully slumbering in Pacific Ocean waters (until it strikes again!). "And Hurricane Floyd probably sucked more people onto the Internet than it did palm trees and street signs into its swirling maw," joked the *Los Angeles Times*.

The modern fascination with weather is also epitomized by tornado chasers on the Plains, politically charged conferences on climate change and the Weather Channel on cable television. In the age of CNN and MSNBC, weather disasters receive the breathless, moment-by-moment, you-are-there coverage once reserved for wars. In the comfort of our living rooms in New York City and San Diego and Dubuque, we watch live TV images from the southeastern U.S. as Hurricane Floyd pounds beach mansions into pulp. Pundits, meanwhile, exploit every atmospheric disaster—a Chicago heat wave, a California monsoon, a Northeastern blizzard—as material for debate: Is the weather changing? Are we to blame?

The weather craze has a historical parallel. More than a century ago geology was the preeminent popular science in Victorian Britain; weekend rockhounds sketched geologic layers exposed on cliffsides and scrutinized granite outcroppings with magnifying glasses. The Victorians' obsession reflected, at least in part, the 19th century's larger fixation with Time—with grand hypotheses of social evolution over thousands of years and biological and planetary evolution over millions and billions of years.

Likewise, I suspect that today's weather craze is no mere craze; rather it reflects the larger cultural mood circa the Millennium. Whereas Half Dome and the Grand Canyon just sit there, mute marvels of geologic change a millimeter at a time, and whereas astronomical objects typically creep at an imperceptible pace across the evening sky, the weather is ever changing—the perfect natural entertainment for the "MTV generation," accustomed to films and videos with high-speed plots and millisecond editing. But the craze also reflects a deeper sentiment akin to the feelings poured into the environmental movement: a desire to escape from our increasingly artificial lives—surrounded as we are, from cradle to grave, by the chrome-and-concrete, claustrophobic womb of Civilization. Our nomadic and agricultural forebears hauled carcasses of woolly mammoths or bags of berries home in the face of blinding rainstorms and shuddered in awe at every flash of lightning. The spirits were angry! True, few moderns would wish to return to prehistory, with its short, brutish lives. But many people today, huddled around "entertainment centers" in their air-conditioned homes, suffering through unhappy marriages and disappointing careers, wish nothing more than to recapture our ancestors' sense of awe—the sense that they were part of something greater.

To devoted weenies, myself included, nothing is more enthralling and educational than the nonstop melodrama of the atmosphere—the skyrocketing growth of thunderstorms, the writhings of the jet stream, the balletic choreography of fronts

and air masses. In textbooks, Newtonian equations and Avogadro's law and fluid mechanics look dry and inscrutable, but in the heavens they come to vivid, sometimes violent, life. Nothing dramatizes the physical process of moist adiabatic cooling better than the formation of a cumulonimbus; nothing epitomizes angular momentum more shockingly than a tornado's buzz-saw mayhem. Weenies old enough to have obtained driver's licenses may spend every spring and summer in the Midwest chasing ominous-looking convective clouds that, they pray, will soon sprout twisters. "I have only one purpose in life—to chase and photograph severe storms," one chaser declares on his personal Web site. "I am glad when I can contribute to scientific research and education about storms, but the driving force behind my lifelong passion is the incredible power and beauty of the storms themselves."

Weather fanaticism has spawned its own commercial culture. In *Weatherwise* magazine and in colorful brochures for weather-oriented mail-order boutique stores such as Wind & Weather, one sees advertisements for a "solar-powered weather station" ($990) and a "WeatherPager" that beeps you with weather alerts ("NWS issued severe t-storm watch until 6:00 P.M."). You can even learn how to construct a home "tornado simulator" (which uses fans to generate realistic-looking "tornado" funnels). There are also the usual classified ads for, say, "Tornado-Chasing Safaris" that "will take you on an experience you won't forget as we travel through the Midwest in the spring and summer of 2000."

My First Forecast

How times change. At age 11, every day after school in southern Ontario, I rummaged through my parents' mail for the latest edition of The Map. Ah, there it was: a thin publication, approximately six by nine inches when folded, with a return address that mentioned the U.S. Weather Bureau and Government Printing Office. I ran to my room, leaped on the bed and happily unfolded it. Before my eyes lay a green-and-white depiction of the U.S. and southern Canada, littered with hundreds of hieroglyphlike symbols. Each town had its own hieroglyph, which sported a little feather and was surrounded by numbers. The Map also featured big grayish blobs and long, bold black lines—some lined with jagged edges, others with little domes—arcing across several states. The blobs marked regions of precipitation. The jagged lines were cold fronts; the domed ones, warm fronts.

Blessed with this wealth of meteorological data, I set to work with a ruler and a pencil. My favorite maps showed major storms over the central plains or Rocky Mountains or American Southwest or Midwest. Western storms often moved toward the northeastern sector of the country and southeastern Canada, sometimes passing over my home in southern Ontario. After a few days of tracking a storm's progress, monitoring its speed and direction, I'd forecast whether it would pass overhead—and if so, when. Unfortunately, thanks to the sluggishness of mail delivery, the maps typically depicted weather that was a few days old; I was frequently upset to discover that the storm had already come and gone. I was too ignorant to take account of other factors such as the jet stream, which refuels and guides storms.

But I've never forgotten my first successful storm forecast: I calculated that a major disturbance would arrive within a few hours, that very evening. I ran to the barometer that hung on my bedroom wall and tapped the glass case: the needle plunged. That night I awoke in the bedroom darkness to hear the faint growl of an approaching thunderstorm. A successful forecast! At a time when most other kids' horizons were defined by the distance to school, the softball diamond and the candy store, I was monitoring humidity in Santa Cruz, rainfall in Madison and wind directions in Orlando. A year or two later the U.S. Weather Bureau (now the National Weather Service) canceled circulation of the daily weather map. Saddest day of my childhood.

We weather buffs descend from a great tradition: Thomas Jef-

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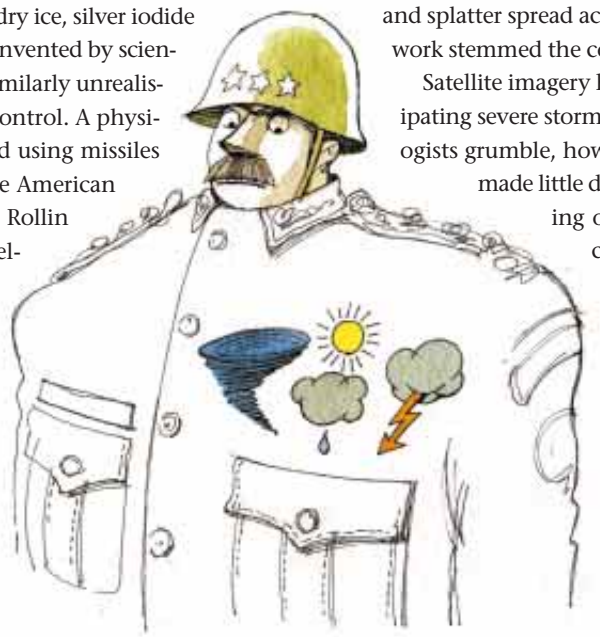
ferson and Benjamin Franklin were serious amateur meteorologists. As every bright schoolchild knows, the latter risked his life by using a kite to figure out the mystery of lightning; he also helped to pioneer the crucial notion that weather systems move over long distances (rather than forming and dying in pretty much the same area). And ol' Ben was also America's first recorded "storm chaser," of a sort. In 1755, while on horseback, he pursued a strong dust devil for almost a mile; he later recalled it as "forty or fifty feet high... [and] twenty or thirty feet in diameter.... I tried to break this little whirlwind by striking my whip frequently through it, but without any effect."

The Cold-Front War

Franklin's behavior was very American: he wished not only to understand the vortex but to control it. The 19th century also brought a swarm of schemes for "controlling" weather, such as meteorology pioneer James Pollard Espy's proposal to fight droughts by starting forest fires, which (he reasoned) would initiate atmospheric convection, triggering rain-bearing thunderstorms. Rainmakers were highly visible hucksters in the farm belt.

In the 1940s, when the modern science of "cloud seeding" to make rain fall (by sprinkling dry ice, silver iodide or other chemicals into clouds) was invented by scientists at General Electric, it inspired similarly unrealistic hopes for the future of weather control. A physicist and an air force officer proposed using missiles to destroy tornadoes. Addressing the American Meteorological Society in 1953, Col. Rollin H. Mayer said the nation could develop "a fleet of airplanes loaded with missiles waiting to attack tornadoes." Nobel laureate Irving Langmuir claimed that cloud seeding could bring about "important changes in the whole weather map," including the diversion of hurricane paths. There were also speculations about warming the Arctic by diverting warmer ocean waters toward polar regions or by sprinkling dark-colored substances (which would absorb sunlight) on the ice to warm it and about washing pollution from Los Angeles skies by finding a way to generate thunderstorms near the city. The military was keeping an eye on weather control, too: Gen. George C. Kenney, former head of the Strategic Air Command, said, "The nation which first learns to plot the paths of air masses accurately and learns to control the time and place of precipitation will dominate the globe."



Before controlling weather, scientists had to understand how it worked. But early meteorologists seriously underestimated the difficulties ahead. In 1895 Mark Walrod Harrington, the director of the U.S. Weather Bureau, expected that "three competent physicists, left to pursue their investigations for ten years without disquiet and given proper encouragement and assistance, would probably be able to so improve our art of weather forecasting as to satisfy all ordinary requirements. The cost would perhaps be $10,000 per year, but the resulting benefit would be a thousand or ten thousand times that annually." Clearly, this was overoptimistic, as can be attested by anyone who has had a picnic ruined by a "20 percent chance" shower.

This is not to deny that meteorology has made progress. Two historic anniversaries are coming up this April: the 40th anniversary of the first weather satellite and the 50th anniversary of the first computerized weather forecast. On April 1, 1960, the first TIROS weather satellite transmitted to the earth blurry but enthralling images of cloud patterns. These images dramatized better than any amount of meteorological data what the "Bergen school" of meteorologists in Norway had argued in the early 20th century: that weather obeys certain geometries, with masses of cold air and warm air engaged in intricate dances, sliding over and under each other, generating specific types and distributions of clouds that had previously seemed like so much confusion and anarchy, so much meaningless fuzz and splatter spread across the blue heavens. (From their work stemmed the concept of cold and warm fronts.)

Satellite imagery has made a big difference in anticipating severe storms such as Floyd. Veteran meteorologists grumble, however, that weather satellites have made little difference, so far, in the understanding of "routine" weather such as precipitation. We lack adequate three-dimensional atmospheric data, both from space-based sensors and from ground-based devices like wind profilers, which can map wind speeds and directions at different heights.

A half-century after the first computerized "weathercast" was made, computers are essential tools of weather forecasting, di-

gesting Niagaras of data that no one human mind could juggle. Unfortunately, the dream of high-precision, long-term (say, many weeks ahead) forecasting has largely soured, thanks to the discovery in the 1960s of "chaos." (Nowadays every schoolchild has heard of the "butterfly effect," in which a minor weather phenomenon—as trivial as a butterfly flapping its wings—can unleash a far grander phenomenon, extremely disproportionate in energy to the input, perhaps a typhoon half a world away.)

Also, even if chaos did not exist, the computers' crunching is of little value if the assumptions and data fed into them are ambiguous or erroneous—the old GIGO (garbage in, garbage out) problem. In that regard, it is disturbing that so much remains unknown about basic processes in our atmosphere. It startles people when I tell them that we still do not have a fully worked out and generally accepted explanation for why rain falls or why thunderstorms become electrified and spark with lightning. (Popular explanations in schoolbooks are invariably oversimplified and ignore experts' disagreements.) In recent years, some atmospheric scientists have begun to argue that our understanding of fronts is badly flawed. And the recent recognition of upper atmospheric phenomena called sprites and blue jets—massive electrical events of some kind occurring high in the atmosphere above thunderstorms, some of them many miles across and, incredibly, not scientifically acknowledged until 1989 despite anecdotal reports by airline pilots of their existence—reminds one of 19th-century astronomers' long resistance to accepting the reality of meteorites. In short, there is a great deal yet to learn about our atmosphere.

Jehovah's Wrath

That weather remains so mysterious, so hard to predict, surely accounts for much of its present—and past—popular allure. Early settlers viewed American weather as almost transcendentally majestic, like the national topography: grandiose canyons, a 1,000-mile river, vast mountain ranges, the surreal wind-carved natural monuments that adorn the landscape of the Southwest. Also, American weather was quite unlike anything the ancestors of Native Americans or their European successors had seen in their lands of origin. This is especially true of tornadoes, which are almost uniquely American in their frequency and ferocity: it is hard to think of a weather phenomenon, save lightning, that is quicker to inspire thoughts of the wrath of Jehovah.

A few years after the presidency of Andrew Jackson, Father Pierre Jean de Smet accompanied settlers from Indiana to California and witnessed a tornado a mile high, a sight surely as baffling to them as Moses' encounter with the burning bush: "In the twinkling of an eye the trees were torn and uprooted, and their boughs scattered in every direction. But what is violent does not last. After a few minutes, the frightful visitation ceased.... All was calm and we pursued our journey." Another twister awed naturalist John James Audubon: "The whole forest before me was in fearful motion. I saw, to my great astonishment, that the noblest trees of the forest bent their lofty heads for a while, and, unable to stand against the blast, were falling into pieces.... The horrible noise resembled that of the great cataracts of Niagara, and it howled along in the track of the desolating tempest." To some, such ethereal visitations embodied God's wrath. A St. Louis tornado in 1927 was "a visitation from a merciful and loving Providence," a preacher assured his flock. "Whom the Lord loveth he chastiseth. Chastisement here is better than chastisement hereafter."

Despite their scientific leanings, I believe that weather fanat-

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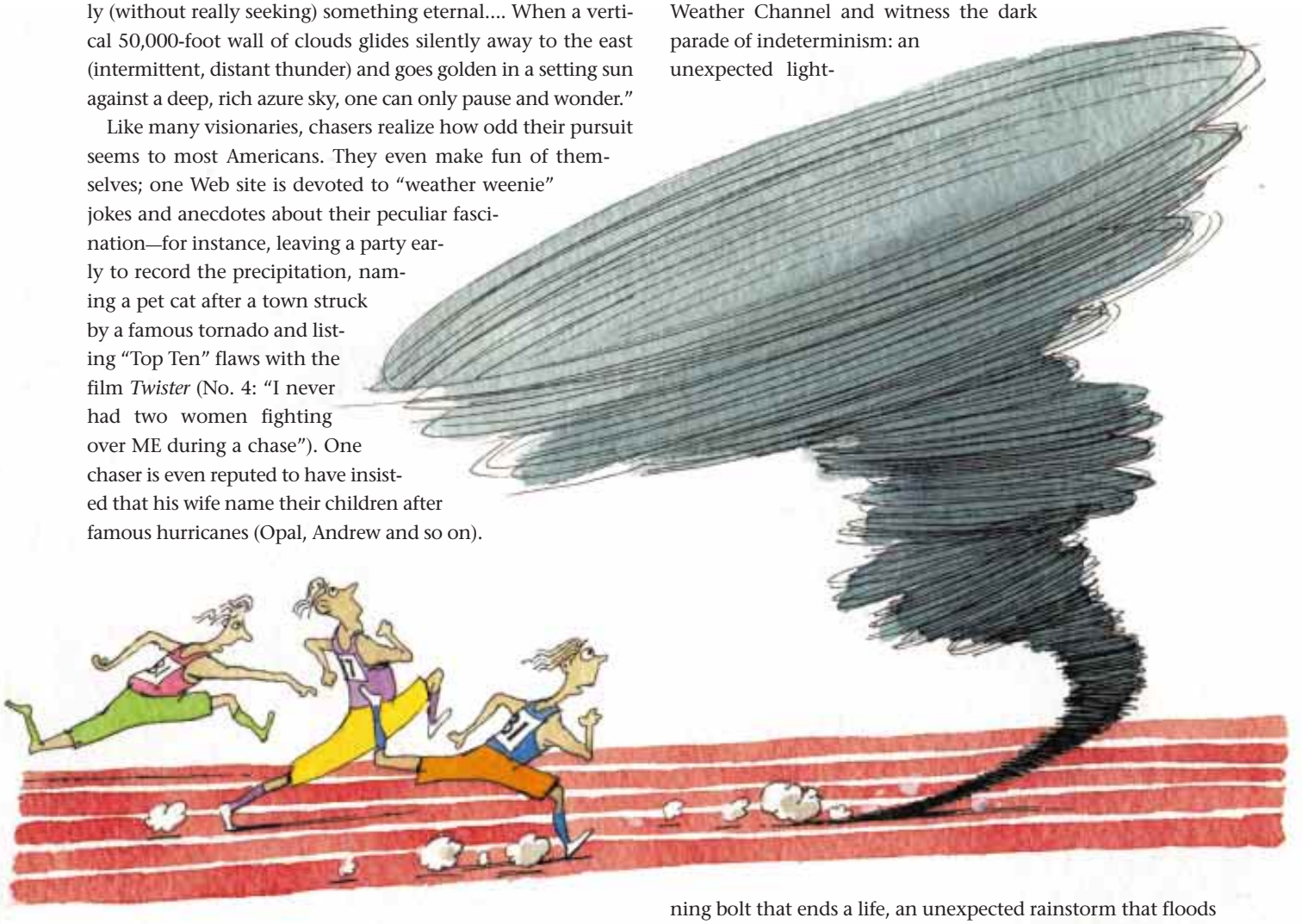
ics—especially storm chasers—have far more in common with Father Pierre and Audubon than with Gen. Kenney. Ponder the words of pioneering storm chaser David Hoadley, who wrote in *Storm Track* magazine in 1982 that he chased partly for "the sheer, raw experience of confronting an elemental force of nature—uncontrolled and unpredictable.... Few life experiences can compare with the anticipation of a chaser while standing in the path of a big storm, in the gusty inflow of warm moist gulf winds sweeping up into a lowering, darkening cloud base, grumbling with thunder as a great engine begins to turn." His reaction is far more explicitly religious than Father Pierre's: "an experience of something infinite," Hoadley remarks, "a sense of powers at work and scales of movement that so transcend a single man and overwhelms the senses that one feels intuitively (without really seeking) something eternal.... When a vertical 50,000-foot wall of clouds glides silently away to the east (intermittent, distant thunder) and goes golden in a setting sun against a deep, rich azure sky, one can only pause and wonder."

Like many visionaries, chasers realize how odd their pursuit seems to most Americans. They even make fun of themselves; one Web site is devoted to "weather weenie" jokes and anecdotes about their peculiar fascination—for instance, leaving a party early to record the precipitation, naming a pet cat after a town struck by a famous tornado and listing "Top Ten" flaws with the film *Twister* (No. 4: "I never had two women fighting over ME during a chase"). One chaser is even reputed to have insisted that his wife name their children after famous hurricanes (Opal, Andrew and so on).



Storm chaser Web sites publish their poetry and songs (a tune called "Inflow," by Taz Fujita: "You see it coming like a nightmare/Darker than your fears/You scream as the gust front overtakes you/But no one hears"). The storm chasers' accounts are not all poetry, yet they are today's folk poets of the nation's heartland, struggling to express in words the same feelings of startled wonderment that welled up within the early pioneers as they confronted the surreal gigantism of both America's landscape and weather.

Weather's unpredictability makes it easier to anthropomorphize; hence much of its fascination. Part of the thrill of watching a hurricane is wondering: "Where will it strike?" We give hurricanes human names and attribute to tornadoes the traits of living creatures—willfulness, cunning, evil. In a sense, our attitude toward nature is psychologically atavistic, a relic of an epoch when we were all animists and believed all of nature was alive, when we imagined gods and spirits hiding atop the thunderclouds and within the raindrops. Nowadays, when faith in gods is far weaker, weather's indeterminism seems to satisfy something in our souls. In an era when science purports to be explaining so much—heredity via DNA, feelings via neurochemistry—it is satisfying to ponder sciences that yield less readily to the determinists' agenda. Turn to the Internet or the Weather Channel and witness the dark parade of indeterminism: an unexpected lightning bolt that ends a life, an unexpected rainstorm that floods a state, an unexpected tornado that devastates a town. Although some observers foresee "the end of science," this purported end—should it ever come—remains very far off for meteorology, the branch of the physical sciences that touches our lives most intimately.

KEAY DAVIDSON is a science reporter for the *San Francisco Examiner*. His books include *Carl Sagan: A Life* and *Twister: The Science of Tornadoes and the Making of an Adventure Movie*.