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2nd Edition

Weather

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Explore how weather is forecast

Get a close-up look at clouds, storms, and seasons

Understand how climate affects weather

John D. Cox

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2nd Edition

by John D. Cox

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Weather For Dummies®, 2nd Edition

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Weather For Dummies®

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Introduction

Weather is a big part of life. It is part of life in the sense that weather is something that everyone experiences more or less directly every day. And weather's extremes of storm and heat are something that most people have to put up with at one time or another.

But weather is part of life in another, bigger sense. It is part of life in the same way the air that you and I breathe is part of it. Often weather gets talked about as something that interferes with travel plans or interrupts a picnic, but that is not the point. Without weather, *there is no picnic.* No food, no forest, no flowing fresh water.

What's going on up there when the wind blows, when the clouds roll in, when the rain falls and the lightning flashes? To wonder about these things is to share some thoughts with the first people who poked their heads out of a cave and looked up into the dark sky of a violent storm. It is part of being human. This wondering about the weather came long before there was reading and writing and science, and long before there were reasonable explanations for these things. Some of the old explanations, you wouldn't believe. The wind, the clouds, the rain, and the lightning make a lot more sense to the likes of you and me than they used to, but when all is said and done, you have to admit, still they are wonderful!

About This Book

The reasonable weather explanations that separate you and me from the folks poking out of the cave are part of the modern knowledge specialty of *meteorology,* which is

the five-dollar word for the science of weather and climate. That's what this book is all about. Weather scientists know the answers now to the basic questions about the changes that take place in the sky and plenty more.

Already you know more than you probably think you do about the weather. Phrases like "low-pressure system" and "high-pressure ridge" have become familiar, even if not so well understood. And images from space satellites of enormous arms and blotches of cloudiness slowly swirling over the surface of Earth appear on television screens and on our smartphones as familiar as the faces of friends. Already you are ahead of people who wondered about the weather some 60 years ago before the satellites went into orbit and made the great size of storms so obvious.

So even before you tackle the details of the comings and goings in the air over your head, some congratulations are in order. In most times past, when people wondered about the weather, they were scared to death. They were frightened by the storms, and when they asked questions about them, they were frightened by the answers they got. If I told you it was the magic of the witch doctor, or the fact that the gods are angry, now you would laugh at me. You and I have come a long way, baby.

There is no right way to read this book, and no wrong way to read it either. You can read it straight through from the first page to the last, but you don't need to. You don't need to read Chapter 1, for example, to get a grip on the subjects covered in Chapter 2. Browse through it or start anywhere you like. If there's something about how weather happens that's been bugging you, just jump in and check it out. (Why the sky is blue is explained in

Chapter 15, for example.) *Weather For Dummies* is your ready reference on the subject.

Foolish Assumptions

To write this book, I had to make some assumptions about you. I think you are somebody who enjoys watching the changes that take place in the sky from day to day, or month to month. You take some satisfaction in knowing what's behind these changes. You like to know the meaning of the words you hear or read in the daily weather reports simply because you like to know the meaning of the words you hear. And from time to time, you have some questions about how the weather works.

You are a consumer of weather information. You are not a mathematician. You are not a weather scientist or forecaster. You have a natural curiosity about the weather, and a healthy respect for it. But you are not crazy-in-love-with-it like a storm chaser who runs out the door with a video camera at the first word of severe thunderstorms nearby. You are not a "weather geek," someone who really wonders about the weather *a lot* and who devours every bit of information they can find on the subject. Although maybe you are a weather geek and you just don't want to admit it yet. If this is the case, your secret is safe with me!

Icons Used in This Book

In the pages of *Weather For Dummies* are a set of symbols that alert you to certain kinds of information. They help you sort through the wide variety of facts and details and put them in your own order. Here's what these symbols mean.

BIG IDEA This icon lets you know about a concept, or big idea, that is not just a detail about the weather, but is a whole train of thought on a subject. Big ideas are not complicated. In fact, they are simple. They're important, or big, and worth checking out, because they help explain a lot of details.

WEATHER JARGON Some words are just weather words. There are a whole lot of special weather words that scientists use all the time when talking to each other, and this book avoids most of them. The ones you find at this symbol are included because they are helpful or interesting.

TIP Some kinds of information are valuable because they make complicated easy or they help cut through a lot of detail to a useful idea. That's the kind of thing this symbol points out, an idea that makes things a little quicker or easier.

REMEMBER A lot of details are useful only to a specific subject, but some things are valuable to keep in mind because they help explain a variety of things. That kind of good-to-remember information is what this symbol identifies.

WARNING Some weather situations are so dangerous that they should be avoided always. Most of the dangers are pretty obvious, but not all of them. This symbol alerts you to extreme weather conditions where dangers are clear and present. It also points you to tips about what to do if you are hurt by the weather.

TECHNICAL STUFF Don’t be alarmed by this nerdy-looking guy. The technical stuff included in this book is not really the heavy-duty number-crunching kind of thing that weather scientists do once in a while. This symbol alerts you to stuff that’s just a little more technical than the rest.

A Note about Measurements

Because this book is published in the United States, I have adhered fairly closely to the use of imperial measures of temperature and length (degrees Fahrenheit and inches) rather than their metric counterparts (degrees Celsius and centimeters), which are used more commonly by the rest of the world. Chapter 2 has a Fahrenheit to Celsius conversion chart that may be helpful, and Chapter 4, which discusses the amounts of rainfall and other precipitation, includes a chart that converts inches to centimeters and millimeters.

Beyond the Book

In addition to the abundance of information and guidance related to weather that I provide in this book, you get access to even more help and information online at Dummies.com. Check out this book's online Cheat Sheet. Just go to www.dummies.com and search for "Weather For Dummies Cheat Sheet."

Where to Go from Here

Go outside. I mean it. You've been spending too much time indoors, anyway, so close this book temporarily, tuck it under your arm, and head out the door. Go outside and give your sky a good looking-over. It's your sky, and it's your weather, because nobody else sees it or feels it exactly like you do. Are there clouds up there? Do you know how they form or what their names are? Do you know how much fun it is to start practicing identifying the clouds in your sky? If you don't, it's time to come back inside and open *Weather For Dummies* again. Chapter 6 is a good place to start.

Part 1

What’s Going On Up There?

IN THIS PART ...

Discover weather science's most popular finished product: the daily weather forecast. See what goes into making state-of-the-art accurate forecasts and understanding how to interpret them.

Wrap your mind around weather words — precipitation, temperature, humidity, highs and low, wind chill, among others — and what they mean in your local forecast.

Find out about the things that make the atmosphere and its weather the way it is — so changeable — here today, gone tomorrow, as the saying goes.

Find the answer to the question, "What is fog, exactly?" as well as how the oceans and the land masses affect your weather.

Chapter 1

What in the World Is Weather?

IN THIS CHAPTER

- **Looking at our imperfect planet**
- **Exploring the weather forecast**
- **Hanging with the weather celebrities**

Earth is not a perfect planet. (It may well be that none of them are, but, you know, who are we to say?) It is not perfectly round, for one thing. One half of it has a lot of land with mountains and valleys, the other half, not so much. It circulates (once a year) around the Sun, its energy-supplying star, but the path it takes is not perfectly circular either. It is not perfectly upright, for another thing, the way you might expect a perfect planet to be. In relation to the Sun, it is seriously akilter, spinning (once a day) on a 23-degree tilt, as if it has been knocked over by something. On top of everything is the atmosphere, this brew of nitrogen and oxygen and other gases that make up the air we breathe. This ocean of air swirls along like the planet itself — but not perfectly.

All these imperfections create imbalances of heat and cold, wet and dry that keep the atmosphere in motion, like a soft body squirming in a hard seat. These motions of an uncomfortable atmosphere always looking for balanced perfection — this squirming, that's what we call *weather.* It doesn't just make life interesting, by the

way; it supplies our fresh air and our fresh water. It makes life possible.

In this chapter, I give you a quick survey of the subject of meteorology — weather science — and where in *Weather For Dummies* you can find more information about each topic. Beginning with the product we encounter every day and moving on to explore how the atmosphere's changing chemical composition is hitting the ground, let's take a look at what's in store.

The Daily Forecast: A Scientific Marvel

Weather For Dummies begins with weather science's most popular finished product: the daily forecast. Without all the numbers and equations, the first part of the book describes what goes into making a forecast and understanding what it means. It lays out the terms that apply and the circumstances that make up weather emergencies.

Before we get into the details of the weather science behind it in Chapter 2, though, take a closer look at the next televised weather forecast you see. You will probably see a sharp, full-color image of half the Earth, captured in real time by a satellite that is constantly hovering 22,300 miles above the planet. You will see great arms and swirls of clouds crawling across the landscape, the signatures of storms. Even without explanation, you can see where the storms have been and surmise where they are going.

This is a uniquely modern experience. Nobody before us has ever witnessed a more helpful or accurate prediction of the future behavior of the atmosphere. This short,

precise presentation is an honest-to-goodness scientific marvel, the result of many years of demanding research and incredible expense.

They make it look slick and easy on TV, of course — the smoothly moving images, the colorful animations driven by extremely high-powered computer models — but before that forecast got to the television studio, a lot of hard-knuckle science went into creating it. And hard-knuckle life. In 19th-century England, the first man to issue a *weather forecast,* Vice-Admiral Robert FitzRoy, an English officer in the Royal Navy, was pleading the case for so many sailors lost at sea. He didn't succeed, but he died trying, and he left behind the popular idea that weather services are a government obligation.

The scientific knowledge that made modern forecasting possible did not come easily over the years. Earth does not very willingly give up her big secrets. During World War I, the young Englishman Louis Fry Richardson, a brilliant mathematician, described his impossible dream of a "forecast factory" — a multi-layered, gridded theoretical "atmosphere" tended by hundreds of individuals sharing data with others attending adjacent blocks of air. During World War II, a stable of brilliant scientists built the first electronic computer that was actually capable of such an ingenious, enormously complex undertaking. So, in the 1950s, began the new computer-driven era of "numerical weather prediction" and it changed everything.

The advent of weather satellites in the 1960s made visually obvious to everyone what research meteorologists had been grappling with all along: weather's natural enormity — the truly planetary scale of the problems they were trying to solve. (Chapter 16

delves into the forecasting work of satellites and other tools in the weather forecaster's toolbox.)

What Causes Weather?

So why is there weather? What basic forms does it take? Chapter 3 is where you find the answers to these questions. Sometimes it helps to think of the atmosphere as a blanket that has been thrown over the planet. The blanket's surface is not entirely smooth. There are ridges and folds and bumps and dips here and there. This is where storms are, in these imperfections. Chapter 3 explains why there are storms and Chapter 4 describes precipitation in all its shapes and sizes. Here you get the idea of different air masses meeting along fronts like opposing armies.

The Weather Celebrities

Weather is a very popular subject when there are big storms brewing or when things like summer temperatures are getting to be extreme. These are the weather celebrities that get all the media attention: tornadoes, heatwaves, ice storms. In Part 2, you find a chapter devoted to hurricanes, perhaps the biggest weather celebrity of all.

But behind every storm and every heatwave and every cold snap is a cast of characters that are responsible for the whole production. They make the winds blow. They form the clouds. Chapter 5 answers the question, "why all this wind?" and explains how air pressure is the cause. In Chapter 6, you pick up a little Latin: *cirrus, stratus, cumulus, nimbus.* Can you tell one type of cloud from another? This chapter also gives you the lowdown on all forms of clouds and how you can tell if there's rain

on the way or something a bit more sinister brewing. And there are two pages of color photographs in this book devoted to the basic cloud types that are spelled out in this part.

It's Seasonal

If you live in the same part of the world very long, eventually you get fairly set in your ways about what to expect of the different seasons through the year. Winter, spring, summer, and fall have certain personalities, certain kinds of storms, certain ranges of temperature. And fair weather has a different feel to it from one season to the next.

Part 3 is organized around this general idea about different seasons coming in different varieties of weather. It begins with the big storms of winter, focuses on the tornadoes of spring and the thunderstorms and temperature extremes of summer, and it takes a good look at hurricanes that reach their seasonal peak in autumn. It is helpful as far as it goes, this way of organizing our thoughts, but it's worth remembering that every region of the globe has its own variety of seasons.