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# WEATHER



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# WEATHER

by Philip D. Thompson, Robert O'Brien  
and the Editors of **TIME-LIFE BOOKS**

TIME-LIFE BOOKS NEW YORK



## ABOUT THIS BOOK

SCIENTISTS of all fields agree that meteorology focuses upon the biggest, toughest and probably most exciting single subject of modern scientific inquiry: the more than four billion cubic miles of atmosphere whose turbulent movements make the world's varied weather. This book traces the basic circulation of heat and winds from equator to poles, and explains the many phenomena of weather, from hailstones to hurricanes. It describes how modern meteorologists, armed with such tools as radar, laser beams and computers, may change civilization itself as they make more accurate predictions and possibly modify the weather.

Each chapter of text is followed by a supplementary picture essay, although each may be read independently. For example, Chapter 7, "The Inexact Art of Forecasting," which describes the operations of the U.S. Weather Bureau, precedes a picture essay on "The Home Weatherman."

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Published simultaneously in Canada.

Library of Congress catalogue card number 65-14589.

School and library distribution by Silver Burdett Company, Morristown, New Jersey.

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## INTRODUCTION

ANYONE WHO READS THE PAGES THAT FOLLOW can scarcely miss the air of excitement, the joy of discovery and the conviction of accomplishment that permeate the field of meteorology today. For several reasons, it is timely that the window behind which the atmospheric scientist and the professional meteorologist labor so assiduously be opened to the public view.

First, since all people suffer from the weather, benefit from the weather and support atmospheric research and weather forecasting, they have a right to know what it is all about. The meteorologist has a responsibility to tell them—as clearly and simply as it is done here.

Second, despite air-conditioned homes, automobiles and baseball stadiums, a growing population and an increasingly complex civilization are going to become more—not less—dependent on the vagaries of the ubiquitous atmosphere.

Third, advances in the pure science through which knowledge of the atmosphere is acquired, and progress in the applied science involving the use of that knowledge, are both taking place at such breathtaking speed that meteorology will be almost unrecognizable as we enter the 21st Century—when half of us can still expect to be alive. The guideposts Messrs. Thompson and O'Brien have set forth will help to make the adventuresome journey a fruitful one.

Fourth, while we are no closer to meaningful control of the weather than we were in the 1940s, the problem has subtly but perceptibly been transformed from the speculative phase to one that permits the rational and systematic exploration of possibilities and limitations. The implications of this development will require no further elaboration than that found in Chapter 8.

Finally, in a world shrunk by modern communication and transportation, beset with conflict and struggling with awesome decisions involving all mankind, there is an unparalleled opportunity to develop and perfect new patterns of international cooperation in the study and the use of an atmosphere that recognizes no national boundaries.

Weather is simply too important to be left to the meteorologists. It is a delight to invite you to share in its study, understanding and use.

—THOMAS F. MALONE  
*Committee on Atmospheric Sciences*  
*National Academy of Sciences - National Research Council*

1

# The Ingredients of Weather





TWO INESCAPABLE AND OFTEN EXASPERATING FACTS mark man's personal relations with the weather—with the state of the atmosphere as it was yesterday, as it is today, as it is likely to be tomorrow and in the near future.

One is that from his first breath to his last, it is always there. He may love it or hate it, revile it or resign himself to it; the one thing he cannot do is ignore it. Every morning there it is outside the window—raining or snowing, clear or cloudy, warm or cold. A bright, sparkling, autumn day of crisp air, blue skies, clear sunshine? He feels invigorated, stands straighter, strides more optimistically into his day. A sweltering summer morning? He feels irritable, depressed, exhausted before the day's work has fairly begun. Before he reaches the breakfast table, the weather colors and conditions man's physical well-being, the state of his emotions, his attitude toward life. Each day he takes it into account. Each day he lives by its grace, on its terms.

The other absolute is change. Whatever the state of the weather here and now, the one certainty is that it will not remain that way. Moreover, when it changes it will do so without even token reference to the needs or wishes of the humans in its path. As a heedless elephant scatters an ant hill, so a developing storm destined to paralyze Northern Europe next week will, en route, totally disrupt the lives of millions of Americans, playing havoc with their picnics and outings, their voyages and vacations, their arrivals and departures, their harvestings and homecomings. But, just as impersonally and with the same tantalizing caprice, it may come like a blessing, bringing unseasonable warmth amid the cold, refreshing sea breezes during the steaming days of summer, providing rain for thirsty lawns and crops, snow to ski on, fair winds for sailing, blue skies for flying.

The impact of weather strikes deeper than this.

A night fog drifts down over a busy turnpike, and a cautious driver slows down. A big truck roaring through the mist hits him from the rear; other vehicles, unable to stop, pile into the wreckage. Toll: many dead, more injured. A freak March storm forms off Cape Hatteras, travels up the Atlantic Coast, veers toward Newfoundland, stalls, sweeps its gale-force winds back across the Eastern Seaboard, then moves on once more to decay somewhere in the North Atlantic. Stunned residents count their losses: scores dead, thousands of homes and buildings destroyed, miles of beaches washed out to sea—damage estimated in the millions. A typhoon forms near Guam, spins across the Pacific, strikes first the Philippines, then Japan, and blows away to the northeast, leaving in its wake incalculable destruction and thousands dead. A sudden cold spell hits Florida—and half the state's citrus crop, mainstay of its agricultural economy, is frostbitten and rendered worthless. West of the Appala-

#### THE DAILY GENESIS OF WEATHER

This sunrise over Sleeping Bear Dunes in Michigan marks the beginning of the daily cycle of weather. While heat from the sun evaporates dew from gardens and lawns in Michigan, its energy is also driving the machinery of weather all over the world, soaking the tropics with rain, blanketing the Alps with snow—and perhaps generating a 200-mph storm off Cape Horn.

chians, it rains too hard and too long, and the Ohio River goes on a rampage; east of the Appalachians, it does not rain enough, and some 11 million people living in the New York metropolitan area have their water supplies rationed.

But all this may bring its own benefits. To cope with the vagaries of the weather, millions of Americans manufacture snow tires and bikinis, furnaces and raincoats, sunsuits and air conditioners: they fabricate golf clubs and patio furniture, run summer resorts in the Catskills and ski resorts in Colorado. Weather in its more benign form is the reason why one tenth of the nation lives in California, why the Southwest desert country is booming, why the multibillion-dollar space industry is burgeoning along the balmy Gulf Coast crescent.

### The folk art of forecasting

Outdoorsmen have always had a special stake in tomorrow's weather. As a result, for thousands of years forecasting was a folk art practiced primarily by sailors, farmers, hunters, fishermen. They studied the clouds, felt the air's dampness on their cheek, noted a shift in the wind, added a certain tingling in their shoulder, an ache in the left femur, checked it with the behavior of cattle or birds, remembered pertinent sayings of their grandfathers, referred finally to their own experience and personal weather lore—and came up with an educated guess.

Though these methods were often amazingly accurate, weather has long since ceased to be a matter for chimney-corner experts. Today forecasting is a science called meteorology (from the Greek *meteoros*, high in the air, and *logos*, discourse). Federal spending on atmospheric research in the United States reached \$170 million in 1963, and climbs higher every year.

Thanks to electronics and the space age, meteorologists now command the instruments and machines of an exciting technology that has discovered more about weather in the last 20 years than in all previous history.

Today a satellite with a television eye spies on hurricane clouds from above, and tells meteorologists how fast and in which direction they are moving. Balloons, tracked from the ground, reconnoiter the swift-flowing wind streams of the upper atmosphere. Rockets bore through the airless reaches of outer space with radiation-measuring devices that send their data streaming earthward in telemetered radio signals. On earth itself, electronic computers that can perform a million calculations a second assimilate information from hundreds of observation points all over the globe, sorting it, sifting it, following the instructions contained in intricate equations—and printing out, finally, the probable pattern of the upper atmosphere of the entire Northern Hemisphere for a complete 24-