

Book Review

FROM WEATHER VANES TO SATELLITES; AN INTRODUCTION TO METEOROLOGY

by
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Spiegel's and Gruber's book, From Weather Vanes to Satellites, presents a satisfactory solution to the problem of an introductory text for non-science majors at colleges or universities. This introduction to meteorology, which covers the basic principles of the science, contains numerous photographs, illustrations, graphs, and charts, enabling the student to comprehend significant facts and concepts.

Each aspect of meteorology is developed in a unique chapter. An overview of the science, a brief history, and the evolution of the atmosphere are discussed in the first three chapters. The following subjects are treated in chapters four through eleven: temperature, moisture, pressure, winds, air masses, and large and small scale weather systems. Solar influences and exploration of the upper and lower regions of the atmosphere are touched upon as well in these first series of chapters. Weather analysis and forecasting along with climatology are reviewed in the two concluding units.

A minimum of mathematics is required; however, those who wish to explore the mathematical concepts involved with meteorology may refer to the appendices. Laboratory exercises will give the student experience in meteorological and climatological analyses; a glossary and index are available but there is no bibliography. Additional sources may be accessible by using footnotes which are found throughout the text.

In chapter one, the authors discuss several disciplines of meteorology and the history of the science. The disciplines range from synoptic, aviation, agricultural, and industrial meteorology, to weather modification techniques. The history of atmospheric science begins with the caveman's impressions of weather in which he believed that the gods were angry with him during spells of violent weather. Meteorology had one of its most important origins during the days of classical Greece. Aristotle's Meteorologica was the leading authority on the subject for many years. Following this period, insignificant advances were made until the times of Galilee; following Galilee until now, rapid progress was made. This fruitful period led to the development of

the polar front theory, radiosonde, radar, sophisticated instrumentation, computer applications, and meteorological satellites. A brief summarization of the history of the National Weather Service concludes this section.

The composition contaminants (man-made, primarily) and the structure of the atmosphere are treated in the second chapter. An error occurs when the authors confuse carbon dioxide with carbon monoxide as the chief pollutant emitted by automobiles. Other pollutants are described satisfactorily. The exploration of the upper regions of the atmosphere along with the appropriate investigative tools are discussed. Details of solar radiation, heat and energy balances, the greenhouse effect, and albedo are examined in chapter three. The measurement of temperature, an important aspect of meteorology, is examined in the fourth chapter. The subjects of scale, instrumentation, conversions, seasonal variations, lapse rates, vertical differences are thoroughly reviewed. Water vapor, the most important constituent of the atmosphere, is discussed under such topics as vapor pressure, saturation point, relative humidity, dewpoint, specific and absolute humidity. These subjects along with a section concerning the hydrologic cycle are illustrated and explained in the fifth chapter.

Manifestations of water vapor, such as fog, dew, clouds, and precipitation are explained in chapter six; this chapter could have been considered a section to the previous one due to its similarity of subject matter. Each hydrometeor is reviewed including how the phenomenon forms and dissipates or, in certain cases, evaporates. The subject of clouds is particularly fascinating since they are the one aspect of meteorology which is seen daily. There is a cloud chart in the appendix which will aid the student in the identification of clouds and their unique characteristics. Other important hydrometeors, such as dew, frost, and fog are reviewed as well, indicating their importance for agriculture and transportation. The precipitation processes along with their measuring devices including different types

of rain gauges are studied. Weather modification techniques, which are becoming more common today than in the past, are discussed in the concluding part of this chapter.

The seventh and eighth chapters deal with atmospheric pressure and winds respectively. Topics which are illustrated and explained in these units are as follows: altimetry principles, pressure measurement instruments, global distribution of pressure and winds; also Coriolis, centrifugal, centripetal, and frictional forces. The concepts of gradient and geostrophic winds, which every meteorologist should know, are explained and diagrammed. Particular wind systems which exist at one time or another depending upon differential heating are discussed; such systems are the land-sea breezes, mountain-valley winds, chinooks, monsoon patterns, and the upper atmosphere's jet stream system.

Air masses, fronts, and storm systems are reviewed in the ninth and tenth chapters. Source regions and classifications of air masses in various parts of the globe are considered. The student is made aware of the types and structures of cold, warm, occluded and stationary fronts. Tropical weather vagaries are treated in chapter ten. The formation, life cycle, dissipation, and destructiveness of tropical storms, hurricanes, and typhoons are well-detailed. The authors stress these storms in view of the fact that their occurrence over various parts of the world cause a great amount of economic and human hardship.

Local severe weather phenomena such as tornadoes, waterspouts, and thunderstorms are portrayed in the eleventh chapter. Even though these systems are on a relatively small scale, their potential for destructiveness makes them quite important. The life cycle of thunderstorms is analyzed and the formation of hail is described quite well. Particularly enlightening are the photographs of tornadoes in this unit.

Weather maps, observations and elementary analyses are examined and well-illustrated in the twelfth chapter. This unit is quite educational since it gives an opportunity for the student to become acquainted with the duties of an operational meteorologist. The construction and analysis of a weather map is stressed; however, the authors describe the most modern techniques of map analyses. Today machines have taken over the making of such charts -- thus eliminating most if not all the hand-work which goes into map-making. The facsimile and computer have been the tools responsible for this advancement in synoptic meteorology. Finally, the thirteenth chapter examines the topic of climatology. Various principles and facts are explained and illustrated in the form of pictures and charts. Climate classifications, however, are omitted. These

classifications, such as Koeppen's and Thornthwaite's may be studied using other sources recommended by the author. Topics which are included deal with climatic controls, distribution of elements, variability or change, and general effects upon society, especially agriculture. In conclusion, man's advertent or inadvertent effects upon climate are briefly summarized. The student will be able to take advantage of the thirteen laboratory exercises contained at the end of the text. These will enable him/her to think through some of the more common meteorological problems. He/she will plot various types of maps, construct a sounding, and do some climate mapping.

Each book has a few faults and this one is no exception. There is confusion with several descriptions of instrumentation in the fourth chapter. For instance: the action of the mercury column in a maximum thermometer is impeded only in the downward direction. Several minor mathematical errors were noted occasionally. The most glaring error occurs in the drawings or sketches of cumuloform clouds. The bases of this type of cloud are generally flat and do not have downward bulging protuberances as suggested by these sketches. Besides this, the drawings illustrate a fictitious constriction of the diameter of the clouds at the freezing level. This simply does not occur in nature. If a second edition of this book is published, these errors should be rectified. Some definitions in the glossary are vague but not entirely incorrect. A few more words would have made a significant improvement. For example, clouds are composed not only of water droplets but also ice crystals.

Even though there are errors, this book is a satisfactory basic text for introductory meteorology. An alert instructor may smooth the rough spots throughout the book. He may add information which will complete some omissions as well. This book is an asset to non-science majors who want to learn more concerning the intriguing science of meteorology.

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