

Book review

Precipitation - process and analysis
by Graham Sumner (John Wiley & Sons, 1988). ISBN 0 471 90534 8.
Pp xv + 455, Stg 45.00.

This volume is aimed at a diverse audience including environmental science, geography and engineering hydrology students. It is written by a university geographer whose personal research has concentrated on precipitation climatology.

The first two-thirds of the book (six chapters) cover the traditional meteorological subjects related to precipitation formation. Chapter 1 discusses the amount of water vapour in the atmosphere, the general circulation which transports vapour globally, and the changes of state of water substance which may occur and their relation to latent heat. There is a special section on evaporation and evapotranspiration and techniques of their measurement. Chapter 2 is concerned with cloud formation. It begins with a discussion of cloud condensation nuclei and ice nuclei and their relation to cloud droplet and ice particle formation. This is followed by a discussion of the main mechanism of cloud formation, namely, the cooling of air by ascent until saturation is reached. The stability of the atmosphere is then treated and the thermodynamic diagram is presented with examples. The chapter ends with a traditional discussion of the ten main cloud genera centred on cloud morphology. Chapter 3 is concerned with precipitation formation. The water-droplet coalescence process and the Bergeron-Findeisen or ice process are discussed. The major forms of precipitation including drizzle, rain, snow and hail are then described.

The next three chapters are concerned with the organisation of precipitation in the atmosphere. Chapter 4 covers the full range of convective rainstorms. This includes air-mass showers, isolated severe storms, the larger multicell and supercell storms, squall lines and mesoscale convective complexes. There is an interesting section on rainstorms due to local wind regimes and topographic effects. Chapter 5 is concerned with precipitation in temperate latitude synoptic-scale weather systems. Consideration is given to frontal systems and to systems in which a

depression is the main feature. The smaller-scale rainbands often associated with the variability of frontal precipitation are discussed. Chapter 6 treats the main tropical precipitation systems including the intertropical convergence zone, cyclones and monsoons.

Although a significant amount of information on the meteorological aspects of precipitation development is included in these first six chapters the presentation of material is difficult to follow. This is due to the frequent introduction of undefined, technical terms which the intended reader could not be expected to understand (e.g. 'mean geostrophic flow' on p.94). Although the author has consciously de-emphasised the use of equations and mathematical treatment and has emphasised verbal descriptions these often consist of overly long sentences with numerous, qualifying phrases. A subsequent edition of this book should be heavily edited for economical expression and clear definition of terminology.

The last one-third of the book (three chapters) is concerned with precipitation measurement at the ground and its spatial and temporal distributions. These distributions are viewed as the surface manifestation of the 'character and organisation' of precipitation in the cloudy atmosphere. This part of the book includes the author's personal area of research, and he clearly is more comfortable with these chapters.

Chapter 7 treats precipitation measurement including rain gauge design and siting and design of networks of gauges. There is useful information on snow and dew measurement and material on precipitation estimation with radar and satellites. The last two chapters cover the temporal and spatial distributions of precipitation and should be of particular interest to the engineering hydrology student. In Chapter 8 there are sections on (a) the annual, seasonal, day-to-day and diurnal variations of precipitation that can occur at a site, (b) the temporal variations of precipitation rate that apparently are characteristic of various kinds of individual precipitation events and (c) intensity-duration-area kinds of information commonly used in hydrological planning. Chapter 9 begins by showing how precipitation over an area is mapped using isohyetal analysis,

then discusses several methods of estimating the total precipitation over an area, and finally describes the spatial correlation of precipitation that can occur amongst a group of points in a geographic region subject to a particular rainfall regime. The last topic comes from the author's personal research and is illustrated with data from northern Queensland. It will be of interest to Australian precipitation climatologists.

A valuable feature of this book is its extensive list of references (about 1000 in total). About

one-third of these are less than ten years old and can provide the reader with up-to-date elaboration on the material in the text. The references in the last three chapters should prove particularly useful to the meteorologist interested in learning more about precipitation at the ground.

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