INTERNATIONAL GEOPHYSICS SERIES . VOLUME 15

Monsoon Meteorology

C. S. Ramage

UNIVERSITY OF HAWAII HONOLULU, HAWAII



1971

ACADEMIC PRESS · New York and London

Contents

PR	PREFACE			
AC	KNOWLED	OGMENTS	xi	
1.	Definition	on of the Monsoons and Their Extent		
	1.1	Monsoon Index	2	
	1.2	Circulation Persistence	4	
	1.3	Monsoon Definition	6	
	1.4	Weather and Climate	6	
	1.5	Subsequent Chapters	6	
2.	Regiona	al Climatology of the Surface Monsoon Circulations		
	2.1	Data	8	
	2.2	Large-Scale Coastal Influences	9	
	2.3	Annual Variation of Surface Circulations	11	
	2.4	Heat Balance at the Ocean Surface during the Monsoons	17	
		Rainfall Distribution	20	
3.	Synoptic	c Components of Monsoons		
	3.1	Polar Anticyclones	27	
	3.2	Heat Lows	33	
	3.3	Tropical Cyclones	38	
	3.4	Monsoon Depressions	43	
	3.5	Subtropical Cyclones	47	
	3.6	Weak Low-Pressure Circulations	73	
	3.7	Troughs in the Upper-Tropospheric Westerlies	73	
	3.8	Near-Equatorial and Monsoon Troughs	74	
	3.9	Quasi-Stationary Noncirculating Disturbances	78	
	3.10	Transequatorial Flow	85	
	3.11	Squall Lines	91	

4.	Precipi	tation and Mesoscale Features			
	4.1	The Character of Precipitation in the Monsoons	101		
	4.2	Mesoscale Features	111		
5.	March of the Seasons				
	5.1	Role of the Himalayan-Tibetan Massif in the Monsoons	117		
	5.2	Procedure Selection	121		
	5.3	The Deserts	123		
	5.4	Equatorial Africa	129		
	5.5	Indonesia and Malaysia	135		
	5.6	Indian Ocean	141		
	5.7	North Africa	143		
	5.8	Asia	150		
	5.9	Southern Hemisphere	205		
6.	Synopti	c Analysis and Short-Period Forecasting			
	6.1	Synoptic Analysis	210		
	6.2	Short-Period Forecasting	220		
7.	Monsoo and Tre	ons and the Atmospheric Circulation; Floods, Droughts, ands			
	7.1	Transequatorial Effects of the South Asian Summer			
		Monsoon	230		
	7.2	The East Asian Winter and Australian Summer			
		Monsoons	231		
	7.3	Variability of July Rain in Central China	238		
	7.4	Long-Range Forecasting	239		
0	Canalud	Suc Develo	2.42		
8.		ling Remarks	243		
Pla	tes I–IV	Mean Conditions during January, April, July, and October	246		
Lis	List of Symbols				
Bib	Bibliography				
AU.	AUTHOR INDEX				
SUB	UBJECT INDEX				