

# On Upper Tropospheric Easterlies and the Travel of Monsoon and Post-monsoon Storms and Depressions

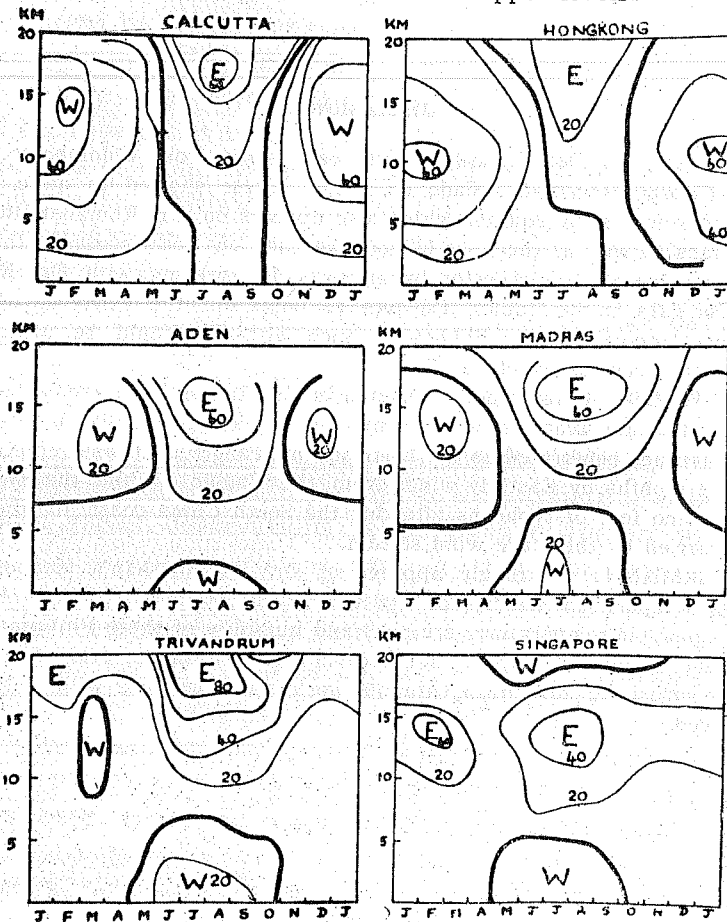
By

K. R. RAMANATHAN

*Physical Research Laboratory; Ahmedabad, India*

## Abstract

Aerological studies carried out from extensive networks of upper air stations particularly in North America and Europe have shown that the cyclones of middle latitudes are intimately connected with the undulations of the planetary westerly circulation and enabled us to trace the connection between the cyclonic vortices in the lower levels and wave-disturbances in the upper levels.



Upper winds over South Asia (wind speeds are shown in knots).

But our information regarding high level winds in the upper atmosphere over the tropics is yet too scanty. From the observation that are now available from Southeast Asia, North America, the Pacific and Australia, it is now clear that there is an easterly planetary circulation over the tropics and that waves form in this planetary stream. Indian meteorologists found in the high troposphere the easterly jet stream of the speed of nine knots in July and August over India.

Examples of tracks of cyclonic storms which crossed over from the China Seas across Indochina, Thailand and Burma from the east and re-generated in the Bay of Bengal are numerous. During the monsoon months, there occurs a succession of weather disturbances in the upper air moving one after another from the east across South Asia, and these, when they combine with an inflow of moist air from south of the Equator, develop into cyclonic storms of great extent but of feeble depth and contribute the major part of the rainfall of Burma, India and Pakistan.

It is most desirable to establish more radiosonde and radar-wind stations in the tropics.

### Discussions

R. D. FLETCHER: In 1944-45, daily flights were made from Colombo to Australia and excellent in-flight observations were made on them. These showed up quite beautifully the band of west winds across the equator which also appears on Dr. Ramanathan's illustrations of cool-season maps as well as the lines of poor weather on both edges of the band. They also show up the value of data collected by aircraft. In agreeing with Dr. Ramanathan in the great need for data in the tropics, I'd like to point out the existence of civil air craft flying over many tropical areas. Flights of such aircraft should be utilized to provide meteorologists with much needed data.

G. S. P. HEYWOOD: I was much interested in Dr. Ramanathan's remarks about the SW monsoon. This airstream reached South China from the Indian Ocean in June, July and August, and sometimes penetrated as far north as the Yangtze. It was replaced from time to time during these months by Easterly winds from the Pacific. While the SW monsoon was flowing, there was no fear of typhoons affecting the South China coast, for they always come from the east, carried by the trade wind stream.

C. E. DEPPERMAN: I strongly approve of Dr. Ramanathan's idea of strengthening our meteorological reports in the tropics. In the second week of World War II, I published a brochure on upper air temperature, pressure and humidity of these Philippine region based only on data from Singapore, Manila, and Batavia. Unfortunately, every copy was lost in the War, but it was surprising how much valuable work could be done with only four stations strategically placed.