ROYAL METEOROLOGICAL SOCIETY: AUSTRALIAN BRANCH MEETING

24 May 1978

Tropical Cyclones

W. Gray

Professor Gray, Colorado State University, summarised the results of many years of research into the basic structure of tropical cyclones and their environment. The research undertaken by Prof. Gray and his group is based upon the detailed diagrams of many years of data obtained in the western Pacific Ocean from conventional networks and special cyclone investigatory aircraft flights. To overcome the often restrictive data dearth in the tropical oceans, Prof. Gray adopted the method of 'system compositing' in which each disturbance is arranged relative to a common geometric origin. Such a procedure emphasises common features that may exist in all disturbances, increases the effective number of observations, and allows a classification of subsets of disturbances. Armed with this formidable data set, Prof. Gray proceeded to discuss properties of tropical disturbances with particular reference to tropical cyclogenesis, basic studies, cyclone motion, and the physical maintenance of the mature tropical disturbance.

Professor Gray listed the necessary environmental conditions for the transformation of a cloud cluster into an established tropical cyclone. The prerequisites for disturbance growth were determined by comparing the meteorological environments of cloud clusters that grew into tropical cyclones with those that dissipated. It was found, for example, that for disturbances to grow, the environment had to exhibit sharp horizontal shear but a minimum vertical shear (i.e. deep easterlies). Similar environmental classifications for cyclone motion were developed and the importance of radiation effects underlined by noting the distinct diurnal variation of the cloud clusters. The strong message that emerged from the seminar was the importance and dominance of the large-scale circulation of the tropics, which, possessing a time scale significantly longer than the formation time scale of the tropical cyclone itself, tended to produce long periods (weeks) of successive cyclone formation or suppression.

Professor Gray alluded to future research in which he and his group will be involved. It is hoped to enlarge the data set by considering composites from other regions and thus establish that the properties already discovered are not merely local effects. Initial work with Caribbean Sea data indicate the properties to be general. He further emphasised the need for the basic properties of tropical cyclones determined empirically in the manner described above to be explained physically. He noted that at this stage no one had successfully modelled the transition from a cloud cluster to a tropical cyclone and all cyclone models depended upon the supply of an initial vortex.

Replying to questions, Prof. Gray emphasised the need for the Bureau of Meteorology to follow the lead of the USA in issuing projections of tropical cyclone paths to at least 72 hours ahead. He noted that whereas skill obviously diminished with the increase in forecast period, the educational value of the exercise was important. He further suggested that fruitful observational and diagnostic research could be undertaken in Australia even with limited resources.

Professor Gray's seminar was a unique experience. It is rare for one to encounter a seminar that lays down an expansive observational platform upon which theoretical research may grow and that (and possibly more importantly) establishes an immediate and systematic approach to operational forecasting of tropical cyclones. Perhaps we should not be surprised. Professor Gray is one of the very few dedicated researchers whose basic product is immediately digestible for operational purposes.

P.J.W.