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主　論　文　の　要　旨

論文題目 Study on the Characteristics of Tropical Cyclones in the Southwest Pacific

（南太平洋西部の熱帯低気圧の特性に関する研究）

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論　文　内　容　の　要　旨

Tropical cyclones (TCs), some of the most influential weather events on the planet and can have severe impacts to people and places on the Southwest Pacific. Therefore, determination of long-term TC variability in the region is very timely and relevant. However, changes in TC activity region specific, are poorly understood and is a topic that has been relatively infrequently studied to date. This is due mainly to the discrepancies among the various datasets and the very limited instrumental records. This study explores the relative long term changes in the variability of the Southwest Pacific tropical cyclones.

The first half of the study is focused on the geographic and meteorological characteristics of 479 tropical cyclones (TCs) in the Southwest Pacific (5°–35°S, 135°E–120°W) from 1970 to 2017 by using the latest Southwest Pacific Enhanced Archive of TCs dataset. Here we show, various TC characteristics on the basis of selected metrics such as the TCs' geographic distributions, numbers, intensities, length in days (TC days), accumulated cyclone energy (ACE), and power dissipation index (PDI). Correlation analyses were conducted to determine the association of these metrics with the risen sea surface temperature in the region. An increasing behavior of TC activities has been revealed in the western, northwestern, northern, and central subdomains of the nine subdomains in the study domain. The average latitudinal location where TC genesis and maximum intensity occurred remained almost stable over time. TCs are more often than not move in the southward to southeastward direction, and most reached their maximum intensities in the western and central parts of the study domain. Annually, the number of TCs and TC days decreased while the numbers of stronger TCs slightly increased, and stronger TC days increased. Intensity metrics such as the highest annual lifetime-maximum intensity and average annual lifetime-maximum intensity also increased. The highest annual maximum intensification rates show no obvious change over the study period, nor did ACE and PDI.

The results show correlations between the highest annual lifetime-maximum intensity and average sea surface temperature (SST) variations, as well as correlations between TC days and average SST variations in the region. This suggests that SST has some influence on the lifetime-maximum intensity and TC days while status of association with other metrics is less clear.

The latter part of the study was to examine the intensifying location of TCs and the time change of their average in the area defined by 5°–35°S, 155°E–120°W from 1982 to 2017. A total of 282 TCs with 1636 intensifying events and 352 rapidly intensifying events were examined. From the analyses, it appear to be preferred latitude for TC intensification, in the confines of around 10-20°S latitude band. However, when events are grouped into5° latitude intervals, the 15-20°S band has the greatest number of events.Analyses of long-term observed trends indicated that the number of intensifying events have decreased by roughly 20% per 10 years while rapidly intensifying events has exhibit an increase of roughly 15% per 10 years. There is some evidence that the average latitude where tropical cyclones intensify has been migrated poleward. In contrast, a clear equatorward movement appears evident for rapidly intensifying events. There are clear implications that the poleward migration of intensifying latitude of all intensifying events are occurring concurrentlywith the poleward expansion of warmer SST. Isotherms of higher SST migrate southward more rapidly. This indicates that the high SST over the equatorial side have extended poleward and at the same time, region where intensifying events occur frequently is becoming warmer with time.

In summary, the research significantly enhanced and improved our understanding of the characteristics of TC activity in the Southwest Pacific; particularly with respect to the continuing warming climate; and it emphasized the necessity for determination of long-term past TC activity and may also facilitate improved future projections. In addition, this research can be served as a baseline study to aid in the ongoing researching efforts on TCs in the Southwest Pacific. And for a data sparse and understudies region like the Southwest Pacific, it is necessary to carefully consider the quality of dataset to be used, thereby enabling the provision of more robust results.