

学 位 論 文 要 旨

論文題名

Climatological characteristics of tropical cyclone rainfall in Vietnam

(ベトナムにおける熱帯低気圧による降雨の気候学的特徴)

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The tropical cyclones (TCs) are one of the most destructive natural disasters, bringing dangers such as disastrously heavy rainfall and flooding. Vietnam is one of the countries strongly affected by the TCs which are originated within the South China Sea (SCS) or coming from the western North Pacific (WNP). The features of rainfall associated with TCs have not been fully understood in Vietnam, as well as its role to the climatic variation.

The main objectives of this study aims to explore:

1. The climatological characteristics of the TC rainfall in Vietnam from 1961–2008.
2. Long-term trends in TC rainfall over Vietnam region from 1961–2008.
3. An insight view of TC rainfall in central Vietnam.

First, the characteristics of the climatological seasonal TC rainfall in Vietnam, including the amount, the TC rainfall ratio, and heavy rainfall events (TC_R50) were explored. The results show the distribution of TC rainfall, TC rain ratio, and the ratio of heavy rain days varies spatially and temporally. The TC rainfall amount in the central region is higher than that in other regions, with a peak in October–November. The northern region has maximum TC rainfall from July to September, whereas the total rainfall in the south is due mainly to non-TC rainfall. The TC rain ratio varies from 0 to ~25% with a maximum value occurring from 16° to 18°N in September. The northern region receives a maximum TC_R50 ratio value up to 20% from July to October, whereas the southern region receives a low TC_R50 ratio value throughout the year. The maximum value of TC_R50 ratio occurs in September, October in the mid–central region. Distinct differences in El Niño and La Niña phases were found for both the TC rain ratio and TC_R50 ratio. During El Niño (La Niña)

years, the TC rain ratio and TC_R50 ratio significantly decrease (increase) in October–November in the central region, particularly the 15° to 17°N region. The results also emphasize that the La Niña phases more strongly affect TC rainfall than the El Niño phases, particularly in central Vietnam.

Next, the long-term trends in TC rainfall in the whole Vietnam and four sub-regions, namely REG1 (north of 20°N), REG2 (17°–20°N), REG3 (12°–17°N), and REG4 (south of 12°N) were investigated for the years from 1961 through 2008. A significant increasing trend with 90% and 95% confidence levels of TC rainfall amount (TCRA) and TC heavy rainfall (TC_R50) is observed clearly at most stations in central coastline. For regional trends, little trends are detected in REG1, REG2, and REG4, while the significant increase is found in REG3 for both of TC rainfall amount and TC heavy rainfall days. The increase of TCRA is mainly contributed from TC_R50 caused by TCs in REG3. TCs formed in the WNP contributed more than TCs inside the SCS to that trend during the study period. A larger frequency of negative anomaly of TCRA and TC_R50 indices is seen in the mid-1970s and before 1983 in REG3. On the other hand, a larger frequency of positive anomaly of those indices is seen after 1983, in particular, during the 1990s with a peak in 1990. An increasing trend of heavy rainfall in Central–south Vietnam and a decreasing trend of that index in North Vietnam in the last half of the past century were found in the previous study. These results suggest that the cause of the increasing trend of heavy rainfall in Central–south Vietnam can be explained partly by TC rainfall, while the decreasing trend in north region is due to Non-TC rainfall.

Finally, more detailed characteristics on the change in TC rainfall for the period 1990–2000 in the central part of Vietnam were explored. TC rainfall in this period has the highest value in comparison with other periods. The results show that the increase in TC rainfall in the period 1990–2000 with the contribution of rainfall accumulated from TCs formed in the WNP in October. A possible reason for the increase TC rainfall in the period 1990–2000 could be that the number of TCs affecting this region has increased. In comparison with the period 1961–1989, the result suggests that both sea surface temperature and atmospheric variables play a role in TC development in the SCS/WNP during the period 1990–2000.

The findings of this study can provide important knowledge on the spatial and temporal distribution of rain from tropical cyclones over Vietnam. This study also shows that ENSO is strongly related with TC rainfall, in particular, heavy rainfall in central part of Vietnam.

研 究 業 績 一 覧

*印は、本論文に直接関係するものを示す

1. 論文 (査読あり)

No.	論文名	掲載誌	巻, 号, 頁	発行年	著者名
1*	A climatological study of tropical cyclone rainfall in Vietnam	SOLA	Vol. 8, 041-044, doi:10.2151/sola.2012-011	2012	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, T. Ngo-Duc, and N. Endo
2*	Long-term trends in tropical cyclone rainfall in Vietnam	Journal of Agroforestry and Environment Bangladesh	Vol. 6 No.2 (Accepted)	2013	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, T. Ngo-Duc, and N. Endo

2. 国際会議

No.	論文名	掲載誌	巻, 号, 頁	発行年	著者名
1*	Characteristics of tropical cyclone rainfall in Vietnam	Proceedings of the Second International MAHASRI/HyARC Workshop on Asian Monsoon and Water Cycle, Nha Trang, Vietnam	201-210	2011	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, and N. Endo

3. 口頭発表

No.	論文名	掲載誌	巻, 号, 頁	発行年	著者名
1*	The contribution of tropical cyclone rainfall in Vietnam and its relation to ENSO	The 3rd International Workshop on Climate Downscaling, Ibaraki, Japan	S2-P4	2011	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, and N. Endo
2*	Climatological study on the tropical cyclone rainfall in Vietnam	The 6 th Korea-China-Japan Joint Conference on Geography, Seoul, Korea	P.60	2011	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, and N. Endo
3*	Contribution of tropical cyclones to rainfall in the Vietnam coastal region	The 7th Environment and Human Activity in South Asia – Natural Disaster and Human Activity in the North-east Indian Subcontinent and Indochina, Kyoto, Japan		2012	<u>Nguyen-Thi, H.A.</u>

4*	Variations of tropical cyclone rainfall in the Vietnam coastal region	The 30th Conference on Hurricanes and Tropical Meteorology, Florida, USA		2012	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, and N. Endo
5*	Long-term trend of extreme precipitation in Southeast Asia	Japan Geoscience Union Meeting, Chiba, Japan	HSC24-14	2012	Matsumoto, J., N. Endo, <u>H.A.Nguyen-Thi</u> , and T. Lwin
6*	Long-term trend of heavy rainfalls in Vietnam	The 32th Internatioanl Geographical Congress Conference, Cologne, Germany	C8.04-16	2012	Matsumoto, J., <u>H.A.</u> <u>Nguyen-Thi</u> , and N. Endo
7	Precipitation climatology in Vietnam by utilizing satellite and ground based observations	The 4th TRMM and GPM International Science Conference, Tokyo, Japan		2012	Matsumoto, J., H.G. Takahashi, T. Ngo-Duc, T.B. Nguyen-Thi, <u>H.A.</u> <u>Nguyen-Thi</u> , N. Endo, and V.T. Nguyen
8*	Long-term trends of tropical cyclone rainfall in Vietnam	The 8th Natural Environment and Human Activity Workshop in South Asia and Indochina – Human Activity Process Affected by Cyclone and Flood, Kyoto, Japan		2012	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, T. Ngo-Duc, and N. Endo
9*	Tropical cyclones and rainfall in Central Vietnam	The MAHASRI Workshop, Nagoya, Japan		2013	<u>Nguyen-Thi, H.A.</u> , J. Matsumoto, T. Ngo-Duc, and N. Endo

4. 研究レポート等

No.	論文名	掲載誌	巻,号,頁	発行年	著者名
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上記のとおり相違ありません。

平成 25 年 7 月 9 日

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※講演も記載すること。著者名は全員記載し、ご本人に下線を引いてください。
ご本人のローマ字入力のお名前も下線をお願いいたします。
主要論文に*など印をつけてください。

【英文の表記について】

英語タイトルの大文字と小文字を研究業績一覧の中で統一すること。

1つの単語が2行にわたる場合は、必ず音節（シラブル）で区切りハイフン（-）を入れて、次の行に送ること。

履 歴 書

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修了見込み

受賞歴

なし

上記のとおり相違ありません。

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