Contribution of Tropical Cyclone to Rainfall in the Vietnam Coastal Region

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Contribution of Tropical Cyclone to Rainfall in the Vietnam Coastal Region

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- Vietnam’s area is: 329560km².
- Northern Vietnam: four seasons.
- Southern Vietnam: dry and rainy seasons.
- Vietnam is prone to natural disasters such as storms, floods and droughts.
Fig. Big Inundation in Hanoi caused by very heavy rainfall (during only 2 hours)

Left : Nui Truc Street
at 19UTC 14 July 2006

Right : Nguyen Khuyen Street
at 00UTC 17 Aug 2006
Typhoon name: Xangsane
Time: 9/30/2006, 0613Z
Rainfall:
- Hue: 49.7 mm/day
- Da Nang: 22.2 mm/day
- Quang Ngai: 31.1 mm/day
Introduction (cont.)

- Vietnam is located in the typhoon center of the South China Sea, and on average, it is hit by 4-6 typhoons per year (Garcia, 2002).

But little has been known about the total rainfall contribution of TCs in Vietnam.

Fig. Best track all TCs in the South China Sea (1961-2008)

Kubota and Wang (2009) examined that in the Western North Pacific (WNP) region.

Jiang et al. (2010) estimated the contribution of TCs to the global precipitation by using TRMM data.

Hattori et al. (2010) showed the contribution of TCs to the seasonal change patterns of precipitation in the WNP based on JRA-25/JCDAS.

Etc.,.
Fig. Climatological-mean (a),(d): TC frequency, (b), (e): TC rain ratio (Kubota & Wang, 2009: JC)
Introduction (cont.)

This talk focuses on the characteristics of rainfall amount, rain ratio, and heavy rainfall days caused by TCs in the coastal region of Vietnam.
Data and Methods

Data:
- The South China Sea is defined to be the ocean body within 0°N and 25°N, and 100°E and 120°E.
- The TC best-track data are downloaded from: http://weather.unisys.com
- Daily rainfall of 15 weather stations in Vietnam
- The period: 1961 - 2008

Fig. Map of 15 weather stations (red dots) and the South China Sea
Data used and Methods (cont.)

- Englehart and Douglas (2001): 550 km from the center.
- Gleason (2006): 600 km from the center. His definition considered the 600 km distance is believed to satisfactorily account for the majority of all rainfall associated with TC.
- Kubota and Wang (2009) assumed that the influential radius is 1000km from the station to center.
- Jiang and Zipser (2010) and Hattori et al. (2010) used 500 km of the center of the TC.
- Non_TC rainfall = Total rainfall – TC rainfall.
- TC rain ratio = TC rainfall/Total rainfall.
- Heavy rainfall days caused by TC is defined as day in which the daily rainfall amount exceeded to 50mm (TC_R50).
- All factors are calculated when a TC is within 600km distance from the station.
Blue: Total rainfall
Red: TC rainfall
Green: Non-TC rainfall
- TC rain ratio contributes between 0% and 25%.
- From 18°N to northward, maximum TC rain ratio shifts to July.
- Highest TC rain ratio is located in the region 16°N-18°N, up to 25% in September.
- TC_R50 starts in June and become more frequent during July-November.
- Region15°-17°N receives maximum TC_R50 in October and November.
Annual (June – December) distribution of TC rain ratio and heavy rainfall days

(a) TC frequency
(b) TC rain ratio
(c) TC_R50
Fig. Annual trend of TC frequency (left) and TC rainfall (right). An increase trend is shown by a triangle, while a decrease trend is shown by an inverted triangle. Closed symbols indicate significant trends at the 5% level and black circles display no trend.
Fig. Annual trend of TC rain ratio (left) and TC_R50 (right)
**Fig.** Annual (June-December) trend of TC rain ratio (left) and TC_R50 (right) (average of 15 stations)
Conclusions

• The maximum TC rainfall occurs from July to September in the northern region, whereas the total rainfall at stations south of 12°N is mainly composed of non-TC rainfall.
• The TC rainfall amount is concentrated in the central region, with a peak in October-November.
• The TC rain ratio varies from 0 to 25%, showing a maximum value in the region of 16°–18°N in September.
• The 15°–17°N region receives a maximum TC_R50 in October and also has the highest TC frequency in the same period.
Conclusions (cont.)

- TC rainfall and TC rain ratio have an increasing trend in all regions (except one station).
- A significant increasing trend is found in the central region, but no significant trend is detected in the south region.
- Annual average TC rainfall over 15 selected stations has a significant increasing trend during the 48-year period.
Thank you very much for your attention!