The Impact of Cold Surge for Convection of Maritime Continent

*yuta matsuzaki[1], Jun Matsumoto[1]

1. Tokyo Metropolitan University

1. Introduction

Cumulus convection widely occurs in the tropical region. Latent heat which is generated by cumulus convection affects global climate through generation of global circulation. Especially the domain 10˚S-20˚N and 90˚E-150˚E is called the Maritime Continent where unique environment exists by complex distribution of large islands with high elevation mountains and warmest ocean (Neal and Slingo 2003). In northern winter time, sometimes northeasterly wind, so called cold surge brows originated from the outbreak of cold air mass from Siberia. The cold surge has large impact on the climate of the Maritime Continent. For example, it gives wet and cool weather in east side of the Annan Mountains (110˚E,20˚N-113˚E,12.5˚N) and dry condition in the western side, furthermore it activates convective activity in the northern region of Borneo Island (Houze et al. 1981). Sometimes it also causes tropical cyclones (Chang et al. 2003, Takahashi et al. 2011).

Previous studies revealed the convection in the Maritime Continent influenced by cold surges, but they mainly focused on relationship between cold surges and synoptic conditions, so it has not been studied enough on relationship with convective activities. Studies on the relationship between cold surges and convection has focused on the surges in the South China Sea and influence of that to the surround area, it was rarely studied about the relationship between the Philippine Sea surges and convective activities. In this study we defined cold surges in both the South China Sea and the Philippine Sea, and revealed the impact of respective surges on convective activities in the Maritime Continent.

2. Data and Method

Japanese 55-year Reanalysis data (JRA55; Kobayashi et al. 2015) for the 10 boreal winters (November 2000 - March 2010) was used to analyze the climate conditions and extract the cold surge events. To investigate the relation of development of cold surge and convective activity, National Oceanic and Atmospheric Administration (NOAA) Outgoing Longwave Radiation-Daily Climate Data Record (OLR daily-CDR) was used for index of convective activity.

Target area was 10˚S-20˚N and 90˚E-150˚E, so called the Maritime Continent.

In this study definition area was set for the South China Sea (SC: 110˚E-115˚E, 15˚N) and the Philippine Sea (PH: 125˚E-130E, 17.5˚N), and calculated the average and standard deviation (σ) of meridional wind at 925hPa in 30 winters. When meridional wind speed at 925hPa was below -1 σ (SC: -9.23m/s, PH:-7.17m/s) and continued that condition over 24-hours, it was extracted as a cold surge event.

3. Result

Cold surge event was extracted 89 events in the South China Sea and 94 events in the Philippine Sea. When SC surges occur, negative OLR anomaly around the central part of the South China Sea becomes stronger. It tended to enhance convection of windward coast such as the eastern coast of the Malay Peninsula in SC surges or the southeastern coast of Philippine and the northeastern coast of Borneo, except the eastern Indochina Peninsular.

In PH surges, negative OLR anomaly was distribute mainly south eastern Philippine or north eastern coast of Borneo. Divergence over the Maritime Continent is not developed during the enhancement of cold surge in velocity potential at 200hPa. Maritime Continent has remarkable diurnal cycle. So, these convective activities might be formed by convergence of land breeze and coastward wind.

References

Chang, C.-P., C.-H. Liu, and H.-C. Kuo, 2003: *Res. Lett.*, 30, 1150. doi:10.1029/2002GL016365.
Houze R. A., S. G. Geotis, F. D. Marks, and A. K. West, 1981: *Mon. Wea. Rev.*, 109, 1595-1614.
Neal R. and Slingo J., 2003: *J. Climate*, 16, 834-848.
Takahashi H. G., Fukutomi Y. and Matsumoto J., 2011: *J. M eteor. Soc. Japan*, 89A, 181-200, doi:10.2151/jmsj.2011-A12

Keywords: winter East Asian monsoon, cold surge, maritime continent, tropical convection