Typhoon energy input estimation using lightning data and backtracing technique

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Price et al., 2009 analyzed the evolution of maximum winds and total lightning frequency every six hours. They found that in all of the hurricanes classified into category 4 and 5, lightning frequency and maximum sustainable wind speed are significantly correlated with a correlation coefficient of 0.82 with the lag time ~30h. Whittaker et al., 2015, enhance the Price work by increasing the number of tropical cyclones and changing the lightning collection window. Using radial lightning collection windows of < 500 km, theyfound broadly similar result to Price et al. Their work shows that lightning is good proxy to estimate the maximum wind speed of typhoon. In the present work, we are going to estimate the energy input of the typhoon by counting the number lightning swept by wind which enter into the typhoon cycle. We assume that the lightning activity is proportional to the energy input from the ocean. We use the lightning data detected by AVON supported by ULAT project of SATREPS and e-ASIA program or Blitzortung, and back-tracing of the wind. We did back-tracing using the wind data of ERA5 reanalysis at the pressure level 1000 to 400 mb with the interval 100 mb and typhoon data from the Joint Typhoon Warning Center (JTWC). First, we make symmetrical of 60 initial points in the radius of 100 km surrounding the center. Then we trace the points with the speed and opposite direction of the wind. The new position is calculated using the 30-min interval time and up to 48 hours before. Every 2 points and new locations of it in interval time 6 hours is connected and will form the polygon area as our lightning collection window. We estimate the time lag by making cross-correlation of our result to the typhoon maximum wind speed data.

Keywords: typhoon, maximum wind speed, lightning, back-tracing

