POSTER 25

A Quantification Scheme for High Wind Risk in Crops at a Landscape Scale within a Watershed

Daejun Kim*, Jae-ho Shin, and Jin I. Yun

Agroclimatology Lab., Kyung Hee University, Yongin 17104, Korea

I. Introduction

According to the statistics of the Korea Meteorological Administration (KMA), three typhoons usually affect Korea per year. Most of them occur between Jul. and Sep. Typhoon occurring in this period gives a major damage to agricultural crops, in particular fruit crops in their maturity stages. The strength of typhoons, influencing Korea, tends to increase every year. Topography is an important factor influencing the intensity and direction of the wind. Korea has many mountains and complex terrain. Therefore, the distribution of heavy wind can vary even in a small region. This study evaluated a way to make an index indicating the potential of the high wind (e.g., typhoon and storm) induced damage by an orchard unit within a catchment.

II. Materials and Methods

Monthly wind speed (i.e., mean and standard deviation) was calculated from daily wind speed data collected from 27 synoptic weather observations of the KMA between 1981 and 2010. Frequency by wind speed class (i.e., 0~1, 1~2, 2~3.......m/s) was summarized. The wind speed class was transformed by a common logarithm (log10) and the distribution curve of the frequency was created. The mean (μ) and standard deviation (σ) of each observation point were calculated. The deviation of a daily wind speed (χ) from the mean was considered as the wind damage risk possibility (z).

$$Z = \frac{X - \mu}{\sigma} \qquad (1)$$

To calculate the wind damage risk possibilities of 810 catchments from the 27 observation point data, μ and σ were reanalyzed by using the area weighted mean. About the catchment at the Hadong-gun, Gyeongnam, 5 km grid resolution wind speed data (KLAPS, Korea Local Analysis and Prediction System) on 2015 Oct. 1 and Oct. 14 was refined to 270 m resolution

* Correspondence to : daejuy@khu.ac.kr

by using MUKLIMO (Micro Scale Urban Climate Model) (Shin and Kim, 2015). The refined wind speed on Oct. 1 and 14 was converted to the wind damage risk probability on the reanalyzed catchment wind speed distribution.

III. Results

3.1. Distribution of monthly wind speed

Generally, the wind speed distribution is similar with a gamma distribution, which has higher frequency near 0. This study also showed that the 0~1m/s class had the highest frequency. It was confirmed that the log transformed wind speed data roughly followed normal distribution (Fig. 1).

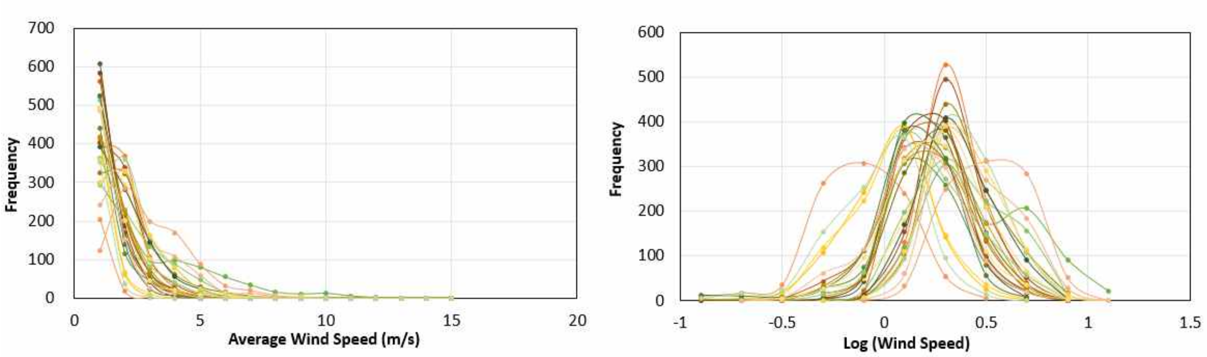

Fig. 1. Comparisons of intensity distribution of daily mean wind speed by observation point (left) and log transformed daily mean wind speed values.

When the log transformed mean wind speed was expressed as a catchment unit distribution map, it clearly showed that inland area had relatively weak wind and coastal area had strong wind. Particularly, Jeju Island showed high wind speed value all over the area. According to the wind damage risk distribution showing the relative danger compared to a normal year, a warning level wind speed for an inland area was a safe wind speed for the Jeju Island (Fig. 2).

3.2. High wind risk at a landscape scale

In the Hadong area, daily mean wind speed and maximum wind speed data was collected. Based on the data, a wind damage risk distribution map was created by comparing with a normal year catchment area data, which includes the Hadong area (Table 1).

Results showed that the whole Hadong-gun area was under wind damage risk (Fig. 3). Actually, KMA declared a gale warning on Oct. 1 for some areas of Jeonnam and Gyeongnam, the most coastal areas, and some areas of Chungbuk. Many wind damage cases (e.g., persimmon drop) were reported on news articles and blogs.

Table 1. Mean and standard deviation of wind speed for a normal year of the catchment including Hadong-gun, Gyeongnam

Watershed	**Avg.(log(ws))**	**Std.ev**
400105	-0.02	0.19
400106	-0.02	0.19
400107	-0.02	0.17

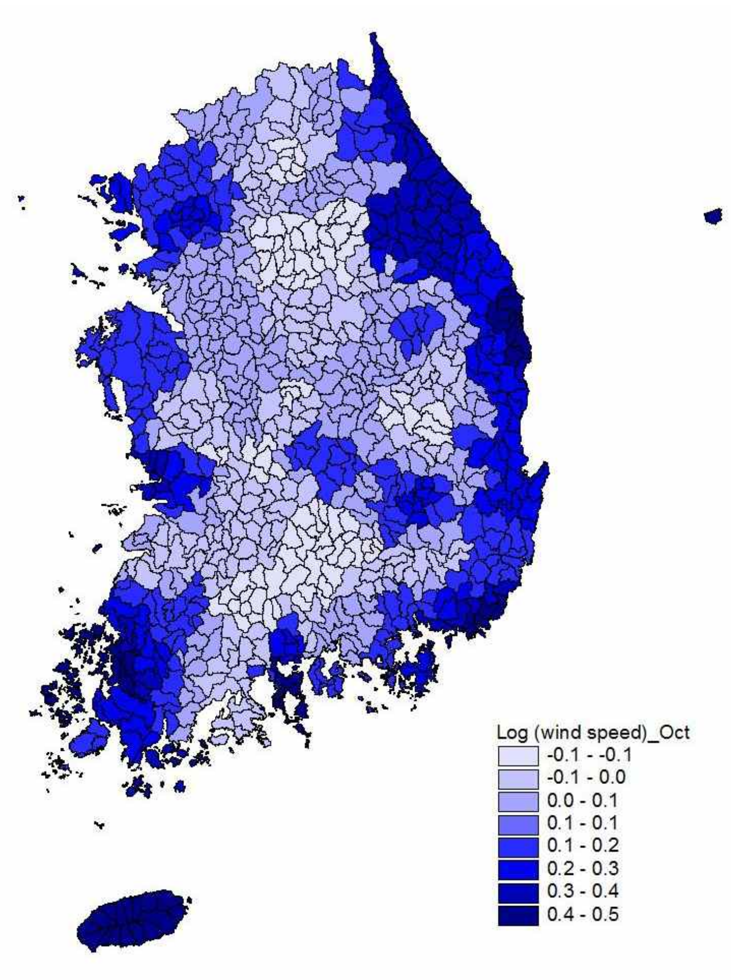

Fig. 2. The distribution of log transformed mean wind speed by catchment unit (October).

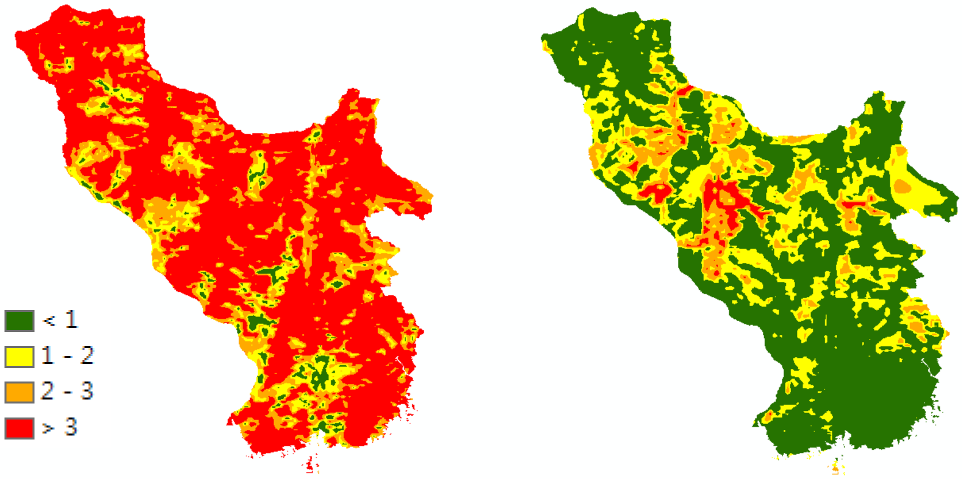

Fig. 3. An example of Hadong-gun wind damage risk map (October 1, 2015 (left), October 14, 2015 (right)).

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References

Kim, D. J., E. Yun, D. Lee, and M. Kim, 2014: Mapping reference risk of crop weather hazards in South Korea. *Proceeding 15th Conference on Agricultural and Forest Meteorology*. Korean Society of Agricultural and Forest Meteorology. Jeonju, Korea, 194-197.

Shin, J. H., and S. O. Kim, 2015: Performance of MUKLIMO in Simulating Surface Wind Field over a Complex Terrain. *Proceeding of 16th Conference on Agricultural and Forest Meteorology*. Korean Society of Agricultural and Forest Meteorology, Jeonju, Korea, 161-165.