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| NAME : Tomoki Kitashima | GROUP REF. : B2 |
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**Comparison of wind speeds provided by a weather data company with the ones measured on a conductor**

Tomoki KITASHIMA (Furukawa Electric Power Systems Co., Ltd)
Rena KUWAHATA, Severine RISO and Jonathan McGINNIS (Ampacimon S.A.)

## 1. Introduction

When introducing a DLR system to an overhead transmission line, it is essential to properly select the spans to be monitored, since they must be so-called critical spans that would determine the capacity of the circuit. The authors believe that one of the effective methods for selecting critical spans is utilizing a series of historical data given by weather service providers or other methods. They presume and provide past, present and even future weather data in a mesh with an interval of 1～5km or any points their customers designate. The most critical meteorological factor for DLR is wind velocity, which is because it has the greatest effect on ampacity. However, wind velocity is largely affected by local geography, buildings or structures surrounding the site. So, it is quite meaningful to estimate the accuracy of presumed wind velocities by comparing them to wind data measureded at a site to establish a methodology for narrowing down and determining the critical spans. Thus, the authors performed this comparison at a certain overhead line in Japan.

## 2. Overview of the measurements.

Measurements were carried out at a span of local transmission line located in an open plain in Japan in 2021, installing an Ampacimon sensor [(1)] on it. IACSR160mm$^2$ with a diameter of 18.2mm has been installed in this span, of which the length is over 600 meters crossing a river. The sensor installed is shown in Fig.1. Sag and perpendicular wind speed of the target span were estimated by analyzing the conductor vibrations detected by the sensor. The sag computed by analyzing the sensor data have been verified to be accurate enough to predict ampacity [(1)]. Perpendicular wind speeds are also estimated by applying “Strouhal equation for vortex-induced vibrations (when wind speed is less than 2m/s)” or “swing angle (when wind speed is more than 2m/s)” based on vibration analysis.

Fig.1 Ampacimon sensor installed on the target span

## 3. Reasonability of the wind speed measured by the sensor

When considering wind speeds for DLR, it is important to estimate the wind speed as the cooling effect to conductor temperature. In that sense, the Ampacimon sensor is considered quite reasonable as it estimates the perpendicular wind speed to the whole span.

Fig.2 shows the comparison between conductor temperatures of the target span in this study estimated in two different ways. The horizontal axis□ shows the temperature simply converted from the sag measured by the sensor and the vertical axis□ shows the calculated conductor temperatures obtained by substituting “perpendicular wind speeds and currents measured by the sensor” and “air temperatures and solar radiations provided by a weather service company at real time” into the heat balance equation proposed by CIGRE TB 207[(2)]. It is confirmed that both data are approximately in good agreement considering the fact that calculated sags don’t take the time lag for changing the conductor temperature into consideration, which indicates the reasonability of the wind data measured by the sensor. For your reference, the reason cond. temperatures converted from the sags tend to be a little high (approx. 3℃) is that the state change equation from sag to temperature was set conservatively for safety reason.

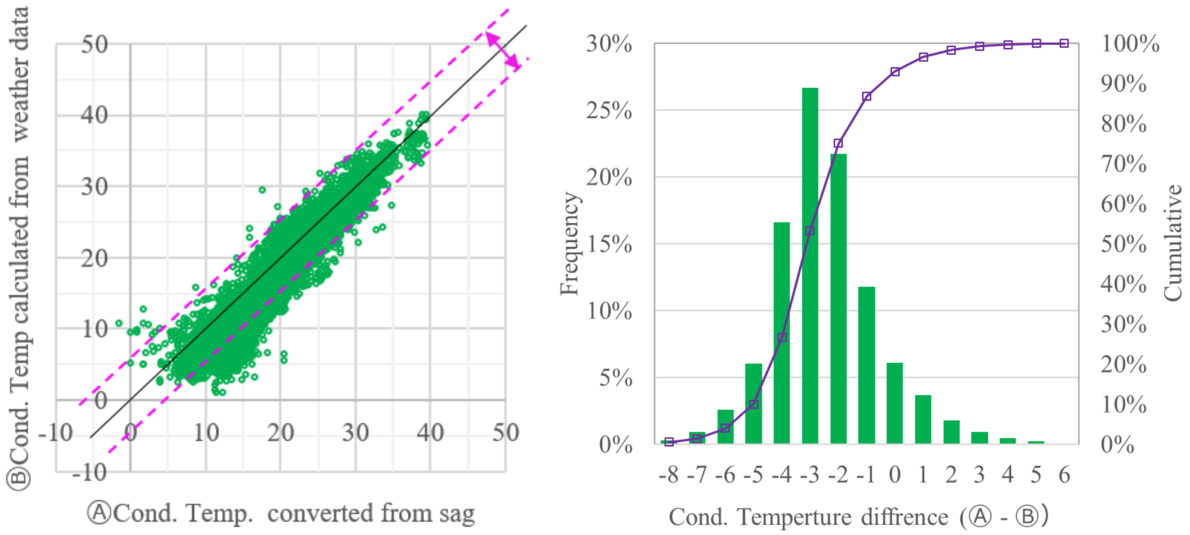


Fig.2 Comparison of conductor temperatures obtained by two different ways

**4. Comparison of measured and provided wind speeds**

Fig.3 compares perpendicular wind speeds measured at the target span to the ones provided by the same weather service company mentioned above for the same location (in the mid-point of the span) in real time. Although the provided ones tend to be higher than the measured , over 60% of the data have less than 1 m/s difference. This fact suggests that the wind speeds provided by the weather data company are reasonable for narrowing down the critical span of an overhead line in a plain area.

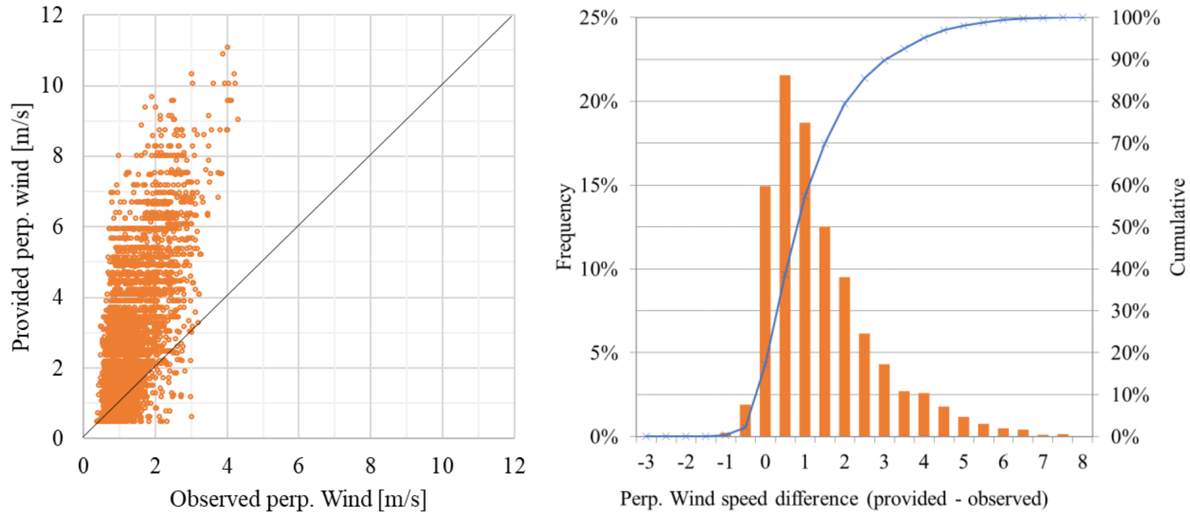


Fig.3 Comparison of wind speeds perpendicular to conductor between measured by Ampacimon sensor and provided by a weather data company

**5. Comparison of provided and interpolated wind speeds**

Most of the weather companies do not disclose the estimation method of weather data at a given location and their accuracy. Thus, the authors performed estiamations of wind velocity of the target span on our own employing the wind velocity data of the grid points with 5km intervals provided by the Japan Meteorological Agency and compared them to the ones provided by the weather company we employed in this study. The estimation method applied by the authors is a simple bilinear interpolation method.

Fig.4 indicates the comparison of perpendicular wind speeds between two methods. Although the scattered plot on the left shows that they have large variations, it is confirmed that wind speeds interpolated by us are in fair agreement with those provided by the weather data company with most of the differences being within ±1m/s, as seen in the right histogram. This fact may suggest that the bilinear interpolation method is also reasonable for estimating wind velocities in a plain area.

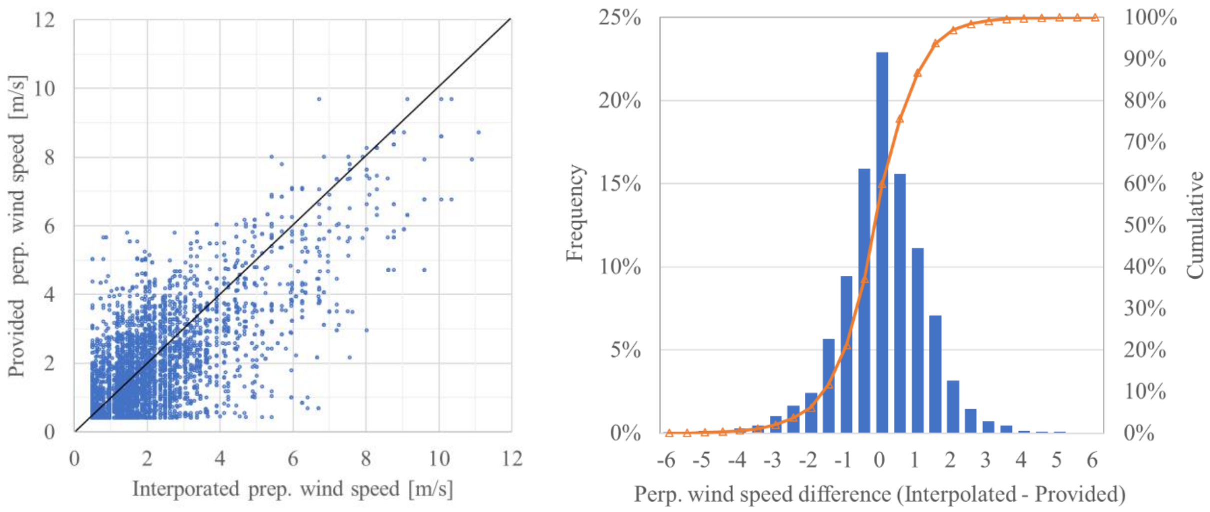


Fig.4 Comparison of wind speeds between provided by a weather service company and interpolated from the JMA data

**6. Conclusion**

This study compared wind speeds between “measured by an Ampacimon sensor on a conductor”, “provided by a weather data company” and “estimated by a bilinear interpolation from the grid points data from the JMA”, indicating their good agreement.

This fact suggests the reasonable quality of wind data not only provided by a weather data company but also estimated by the bilinear interpolation from reliable grid data for narrowing down the critical span of an overhead line for introducing DLR.

However, it should be kept in mind that this study picked up a span located in an open plain where wind velocities are relatively easy to estimate due to few obstacles. Therefore, further consideration and real measurements seem necessary when adopting estiamated wind speed for narrowing down critical spans for overhead lines in the area with complex topography.

**References**

(1) E. CLOET and J-L. LILIEN, “Uprating Transmission Lines through the use of an innovative real-time monitoring system”, IEEE, 2011

(2) CIGRE, “Thermal behaviour of overhead conductors”, CIGRE Technical Brochure, No.207, SC22 WG12.22, 2002