

Introduction

The terrain in Japan is remarkably different from that of Europe and America, and thus it is extremely important to consider Japan's unique topographic effect on the wind, such as a local speed-up, separation, reattachment. In wind farm More recently, was built in the complex terrain on the operation rate is less than originally anticipated, that is, or remarkably bad wind turbine, failure of a wind turbine inside and outside (for example, failure of yaw gear and yaw motors, power generation output wind turbine blade problem, etc.) of crack is obvious. The main cause, slight change in topographical relief of a wind turbine is the most recent origin, I considered disturbance of the wind generated from and there is a (terrain turbulence). In response to this situation, in our group, carried out a precise numerical wind conditions diagnosis with actual terrain version RIAM-COMPACT® software (Wind risk assessment), you are performing a wind turbine placement examination efficient. In this paper, in cooperation Kyudenko New Energy Co., Ltd., since conducted a numerical wind conditions diagnostic of (start operation from December 2012) Kushikino REIMEI wind farm, we report on the results.

Airflow characterization of the nacelle anemometer wind direction and an overview of the wind power plant

In cooperation Kyudenko New Energy Co., Ltd., we performed LES turbulence simulation of high resolution target (start operation from December 2012) Kushikino REIMEI wind farm. (See Figure 1) is located in Kagoshima Prefecture Ichikikushikino Hashima district this power plant. I will show an overview of the wind farm in Table 1. Results as a target 10 Units and No. 9, it was confirmed monthly average wind speed of January to September 2013, has been confirmed (10 Unit is low) is the difference of a clear wind speed in September and June. In addition, a comparison of the wind direction by the frequency of occurrence of September and June, it was found to be a month incidence of easterly winds high in both points. This (see Figure 2 and Table 2), which is estimated to affect Mount Benzaiten which is located about 300m 10 east of Unit (altitude 519m). Since the response to this result, it is investigated in details by Mount Benzaiten (altitude 519m), and using real terrain Version RIAM-COMPACT® software was performed numerical wind diagnostics.

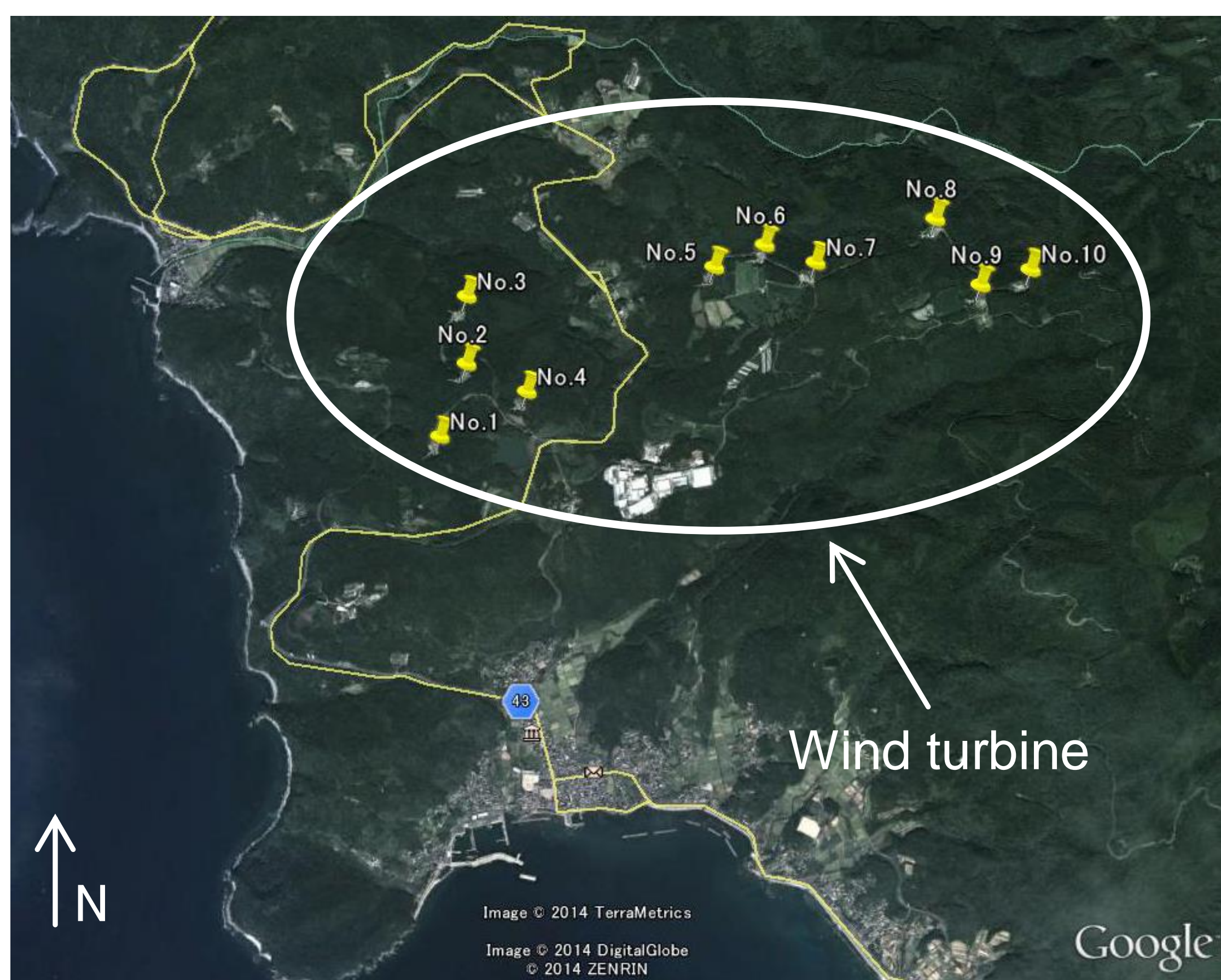


Figure 1 Terrain of Kushikino REIMEI wind farm near (I According to Google Earth)

Results and Discussion of the numerical wind conditions diagnosis

Figure 3 shows the results of the numerical wind diagnostics. If from this figure, the easterly wind blew, that it is strongly influenced by peeling flow formed from Mount Benzaiten of (terrain turbulence) is clearly observed 10 unit. At the same time, you look at the vertical distribution diagram of the air flow in the wind turbine location points in the same time, wind speed at 10 unit compared to No. 9, and is slowing greatly windmill swept plane. In general, without assumptions presence of the wind turbine, the power curve of the wind turbine (catalog value) is specified in wind velocity value that flows into the wind turbine hub center under the flat ground. In addition, the distribution is in accordance with the power law assumption of 5-7 also about velocity shear. Thus, under the shear rate that deviates significantly from the power law, a significant reduction in power production is expected. At the same time, I believed that this large velocity shear insane manner will become more and more important now in connection with or vibration problem, the wind turbine tower, and problems such as fatigue strength of yaw gear.

Table 1 Overview of Kushikino REIMEI wind farm

	No.1~No.10
Wind turbine manufacturer, Output	Hitachi, Ltd. HTW2.0-80
Height of the wind turbine (Ground~Hub center)	60m
Diameter of the wing (blade)	80m

Conclusions

Using real terrain version RIAM-COMPACT® software to target (start operation from December 2012) Kushikino REIMEI wind farm Kyudenko new energy which is located in Kagoshima Prefecture Ichikikushikino Hashima district Co., Ltd. I was carried out LES turbulence simulation of high resolution. As a result, in the case of the east wind, Mount Benzaiten which is located on the wind turbine upstream of the 10 Unit (altitude 519m) is the origin, (terrain turbulence) is generated turbulence of the wind from there, 10 Unit strongly the influence it is has been shown. In the future, we conducted a number wind conditions diagnosis that takes into account the situation of the land reclamation of the wind turbine around, to carry out a detailed investigation of the east wind. In addition, it is planned to clarify the situation in wind farm and other wind direction other as well. Since the effect of terrain local turbulence caused by the slight relief of the terrain and small terrain that dot the wind turbine around, is often overlooked and reproduction, difficult in RANS turbulence model of time-averaged type, RIAM-COMPACT® approach (LES) is valid unsteady turbulent flow models such as.

Table 2 Positional relationship of No.10 and No.9 Mount Benzaiten and (altitude 519m)

Wind turbine No.	Elevation	Advanced blade tip	Offset distance
No.9	418m	518m	300m
No.10	414m	514m	550m

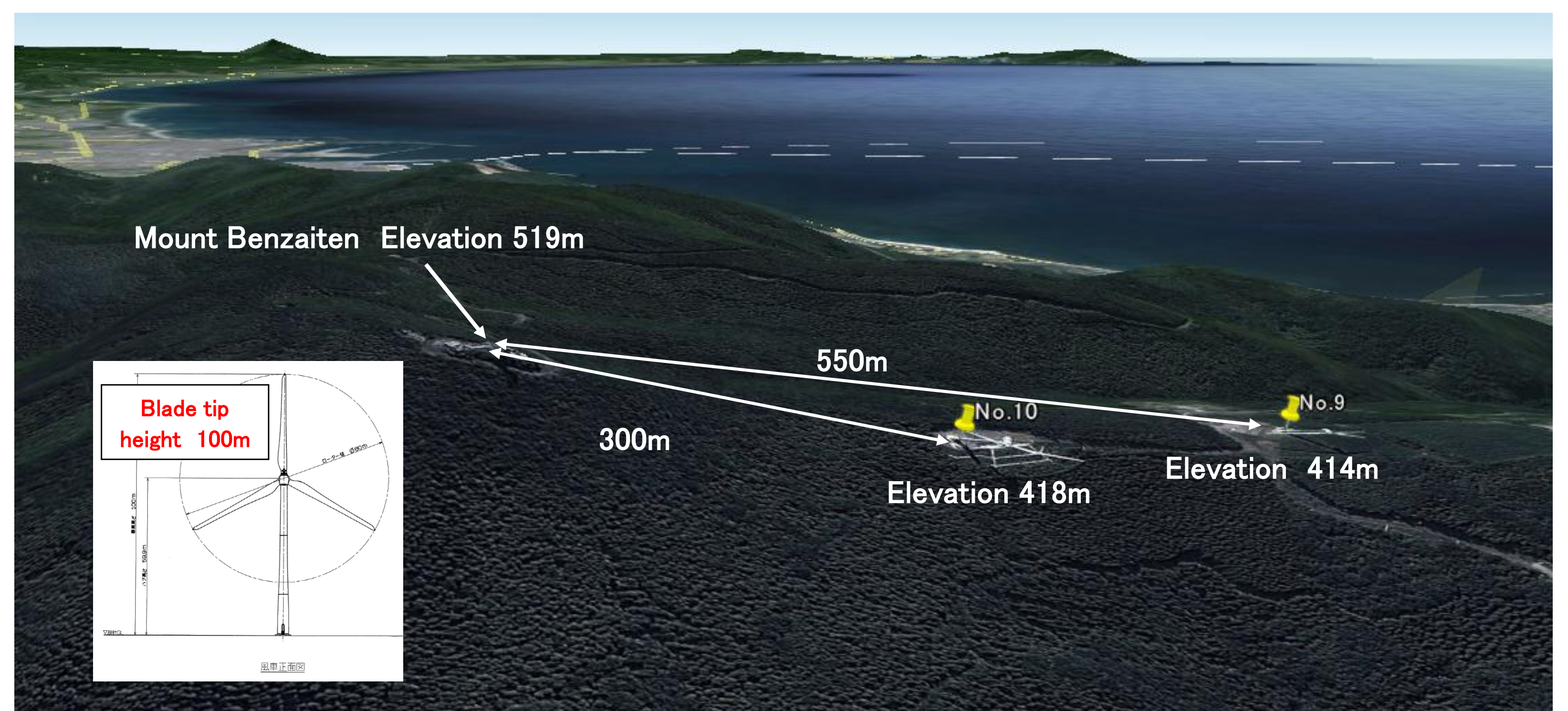


Figure 2 Positional relationship of No.10 and No.9 Mount Benzaiten and (altitude 519m)

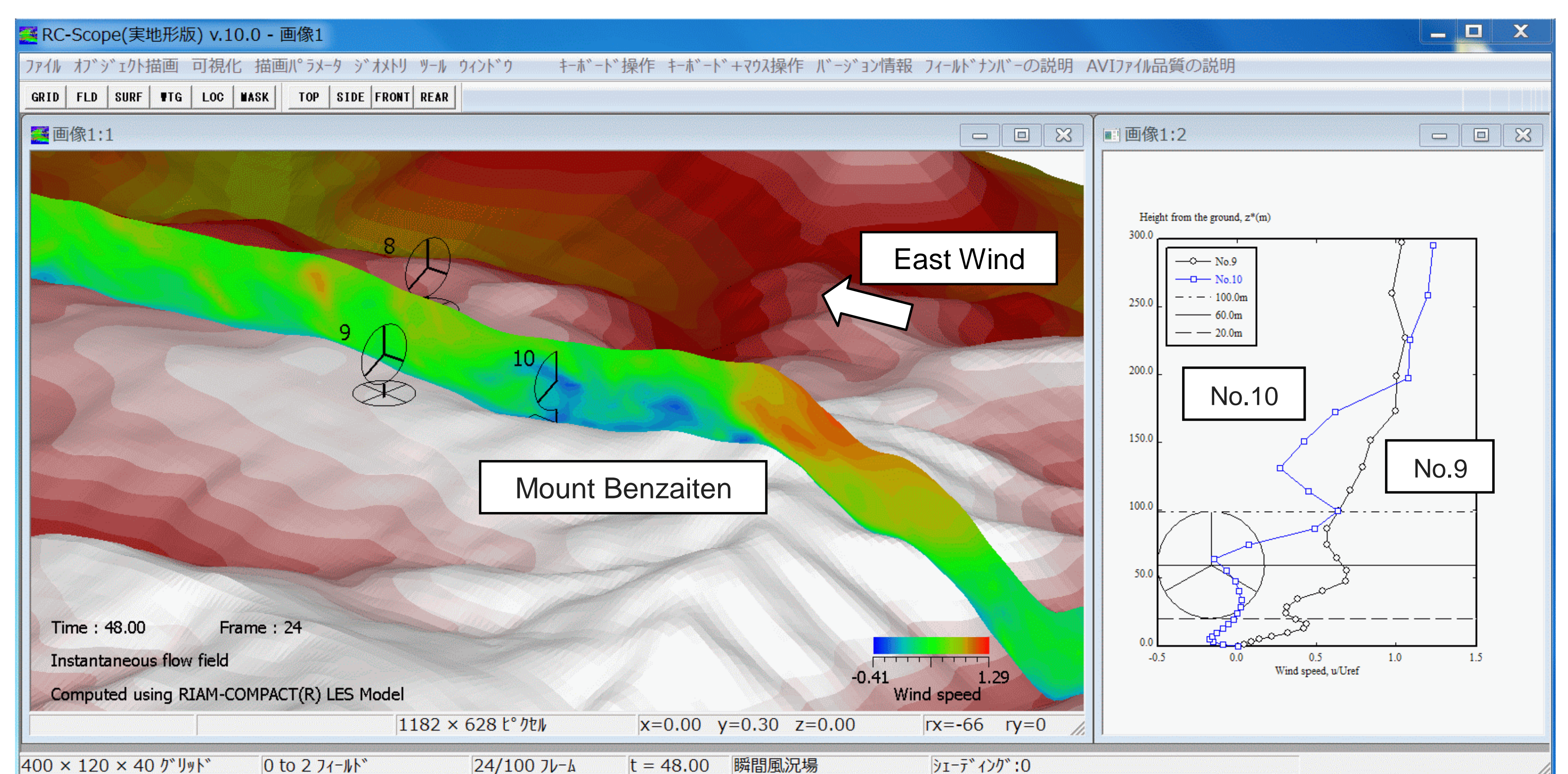


Figure 3 Numerical diagnosis, Wind direction: East, Vertical distribution map of wind speed at the wind turbine location point (which means that the wind speed, the larger red) distribution diagram of the main flow direction wind speed