2014 Low Wind Patterns in Turkey

Wind speed anomalies (I)

RATIONALE

Significant extremely low wind speed conditions have been detected across Turkey throughout 2014, according to feedbacks and questions received from several VORTEX clients, and based on measurements from different wind mast sites. This observational evidence raises the following questions:

1. Is the observed low wind speed regime visible in our modeled data?

2. What is the actual impact of current year conditions on long-term assessment based in Vortex data?

The aim of this technical note is to provide a preliminary response to these questions and guidance for wind industry usage of modeled data for long-term wind condition. We aknowledge that an in-depth analysis is needed to explain the full climatic context.

Q1: Is the observed low wind speed regime visible in our modeled data?

Vortex mesoscale modeling technology has been validated against certified wind mast data in Turkey in previous studies. Results were consistent and a climate quality assessment confirmed the usability of the Vortex mesoscale model for long--term wind assessment applications.

In this study, long--term Vortex 9-km resolution data were employed to assess the countrywide spatial distribution for 2014 wind speed departures from long-term estimates (30-year period). Figure 1 shows the spatial distribution of wind speed anomalies for 2014. From the analysis, a clear country-wide extremely low wind speed pattern has been identified, which is consistent with observational feedback received from different wind industry Vortex users in Turkey. In several areas of the country, the mean speed wind values have been 30% lower in 2014 than in the last 30 years.

Wind speed anomalies (II)

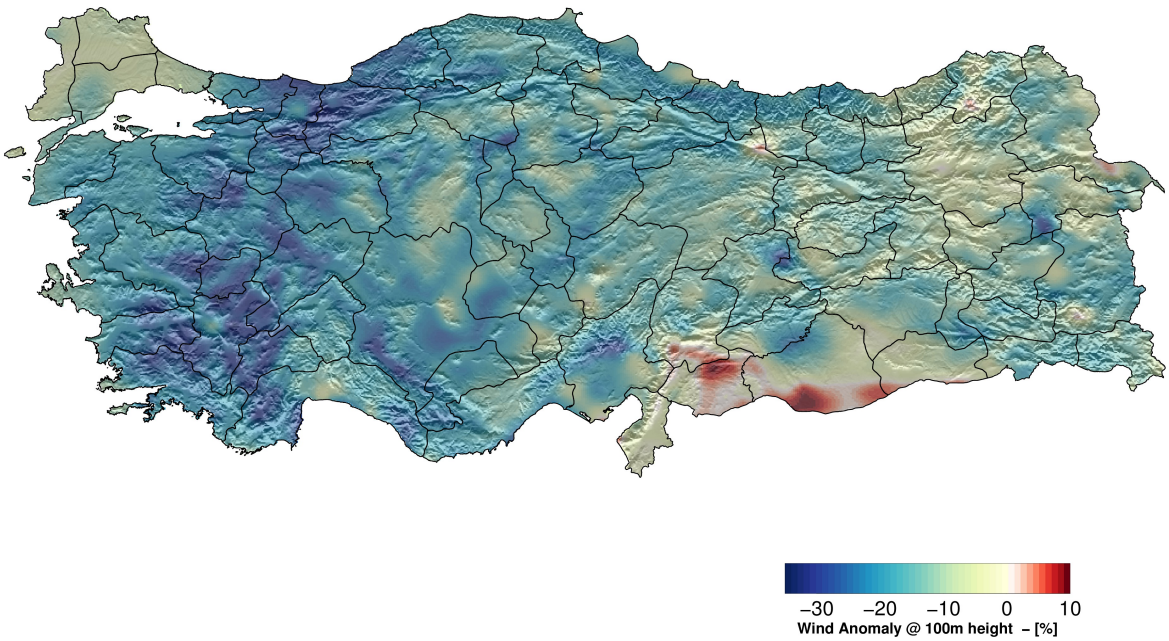

Figure 1: Jan--Aug wind speed departure [%] for 2014 vs. long-term trend (1985--2014)
Source: Vortex 9-km mesoscale model data, height above ground 100m

Q2: What is the actual impact of the current year on long-term assessment based in Vortex data?

Wind speed deficit assessment for 2014 were performed for 13 selected sites, representing areas with high wind energy potential and penetration in Turkey. These sites were therefore selected to quantify wind regime variability for and from a wind industry perspective.

Times series from sites located in the following provinces were analyzed: Balikesir, Canakkale, Tekirdag, Kirikkale, Sivas, Mersin, Antalya, Bursa, Adana, Erzincan, Amasya, Samsun and Konya.

Data was obtained using the Vortex 9-km mesoscale model. Additionally, NASA MERRA Reanalysis project (50 km) data was also included in the analysis to provide a coarse resolution alternative for the climate variability site assessments.

Wind speed anomalies (III)

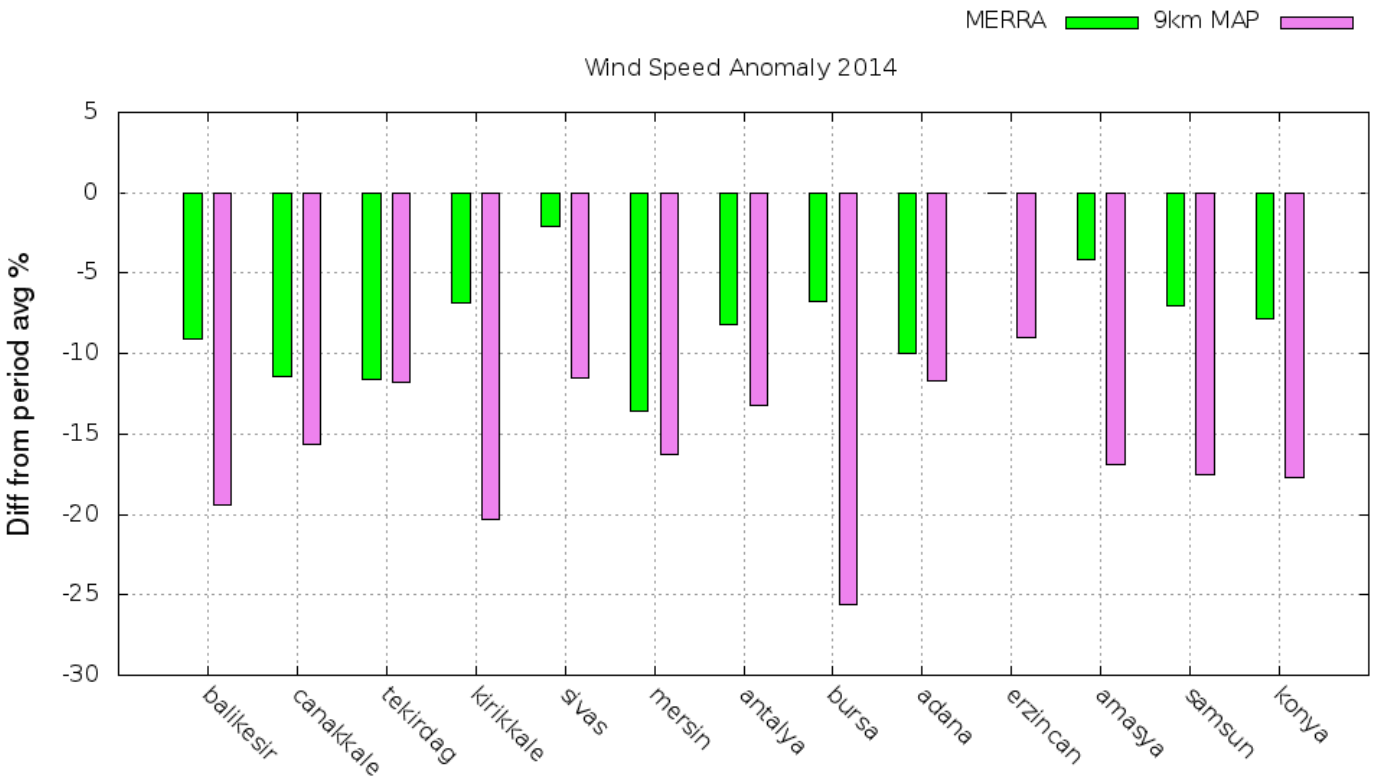

Figure 2: Site wind speed deficit [%] for Jan--Aug 2014 vs long--term period (1985-2014)
Sources: VORTEX 9-km mesoscale, NASA MERRA 60-km resolution time series

Results from the sites assessment show a coherent wind speed deficit, which is variable in intensity for each individual site, as shown in figure 2. The intensity of the 2014 wind speed deficit fluctuates from -8% to -25%. The impact derived from MERRA also shows the same general negative pattern for 2014 but with a lower intensity.

Differences in negative wind speed deficit values between VORTEX and MERRA are expected as:

1. MERRA is a coarser resolution and offers smoother wind regime changes

2. MERRA wind regime extremes are constrained by a coarser resolution

3. VORTEX resolution can more effectively detect topography-induced change in the wind regime

Conclusions

In conclusion, the negative wind speed patterns for 2014 are clearly visible in VORTEX modeled data. Moreover, the wind speed deficit intensity derived from VORTEX data shows a strong anomalous conditions which justifies the feedback and concern of users regarding current year measurements.

Site impact assessments show different levels of variability, ranging from -8 to -25%. Results are qualitatively confirmed with an alternative source, MERRA Reanalysis. From the analysis, January to August 2014 wind conditions highlight the need for long-term analysis using technology able to consistently represent different weather regimes affected by current conditions.

REFERENCES:

[1] Vortex Modeled Data Validation for Turkey:
http://www.vortexfdc.com/assets/docs/turkey_validation.pdf

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