

A. H. Weber¹, S. R. Chiswell¹, J. B. Blackmon²
¹ Savannah River National Laboratory, SC. ² University of Alabama in Huntsville
 * weber.allen@gmail.com

The Savannah River National Laboratory (SRNL) working with the University of Alabama in Huntsville has performed a statistical analyses on extreme winds, gusts and turbulence intensities collected at SRNL's onsite Central Climatology Tower (CLM on Figure 1 site map). Wind instruments at 61, 32, 18, and 4 meter heights and a temperature sensor at 2 meters have been collecting 15-minute averaged data during an extended period including the calendar years 2001-2010 (over 1,250,000 records for the wind variables). These data are used to support research and operational activities at the Savannah River Site in accordance with Department of Energy regulations. Extreme winds and gusts are used to estimate the potential for damage to existing onsite structures, operational safety considerations, and future risks for onsite construction over extended periods.

Extreme winds, gusts and turbulence intensities are also used to help determine the vibrational wind effects on heliostats, both in operational and stowed orientations near the ground. Of interest is the fractional time at or above various threshold values. The frequencies induced by gusts and turbulence are sufficiently close to heliostat drive unit natural frequencies so that dynamic coupling could occur. Since typical heliostats have relatively low damping ratios, the resulting dynamically coupled loads can be significantly higher than the static loads. This effect can reduce service life and impact reliability through both the low cycle failures for excessively high dynamically coupled loads and the additional load cycles that could contribute to cumulative fatigue damage.

1. Data collected from the Climatology Tower (CLM) at the Savannah River Site (SRS).

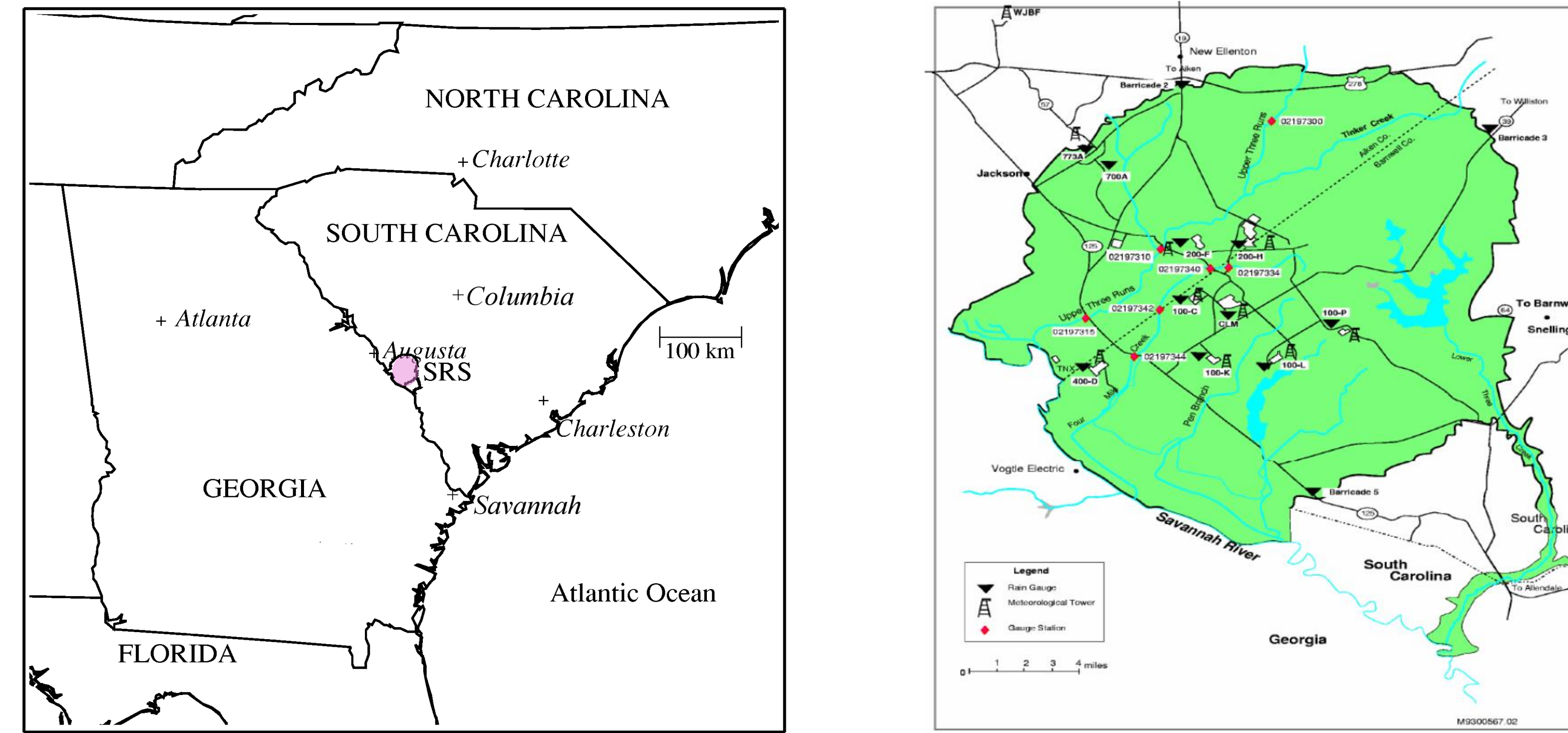


Figure 1 Map of a) SC and SRS b) SRS towers showing CLM where the data was collected.

2. Histograms of the wind speeds and gusts with simple statistics for the speeds, gusts, bivane angles and temperatures.

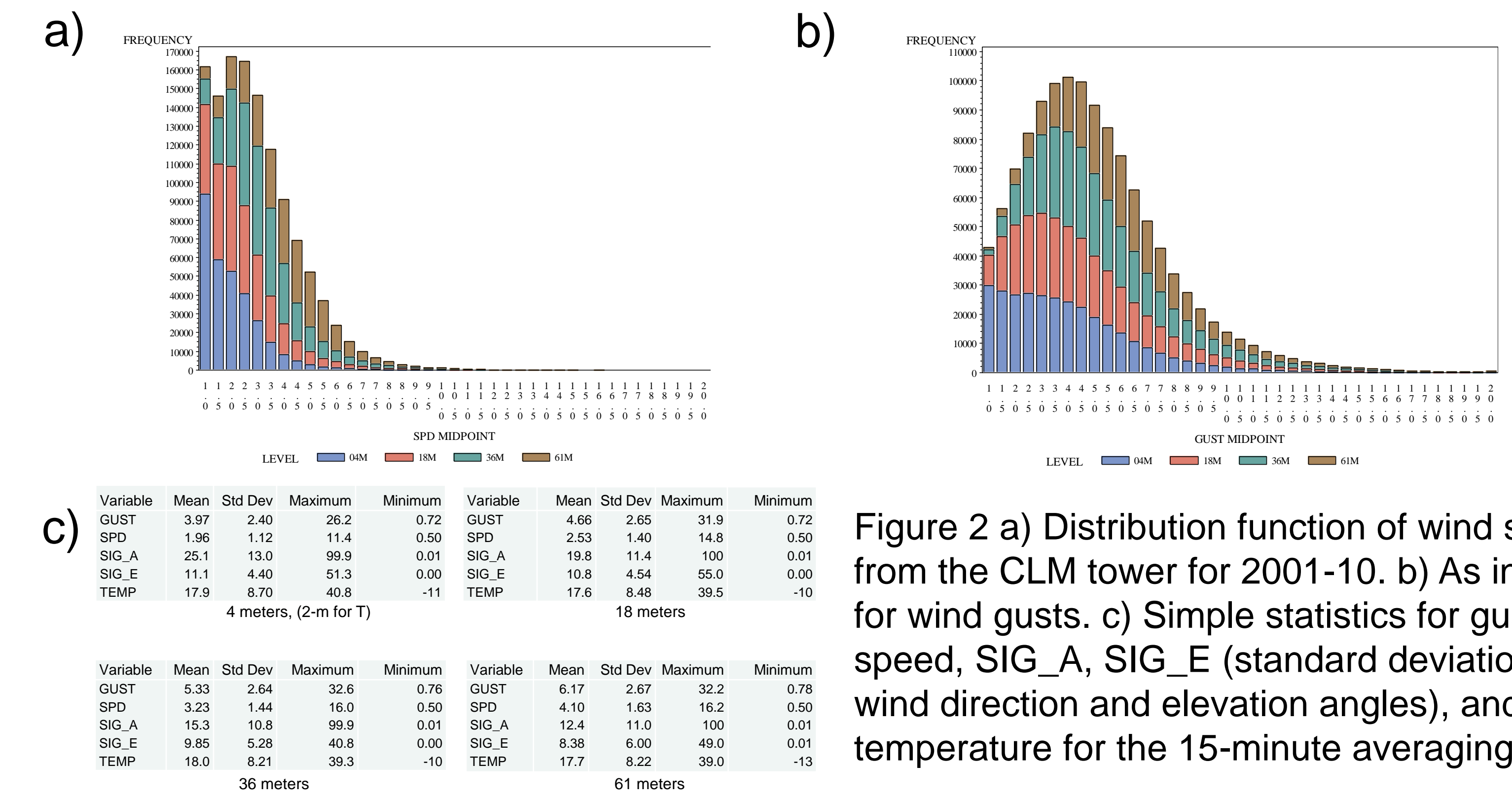


Figure 2 a) Distribution function of wind speeds from the CLM tower for 2001-10. b) As in a) but for wind gusts. c) Simple statistics for gusts, speed, SIG_A, SIG_E (standard deviations of the wind direction and elevation angles), and temperature for the 15-minute averaging periods.

3. Height dependence and trends in the variables over 2001-10.

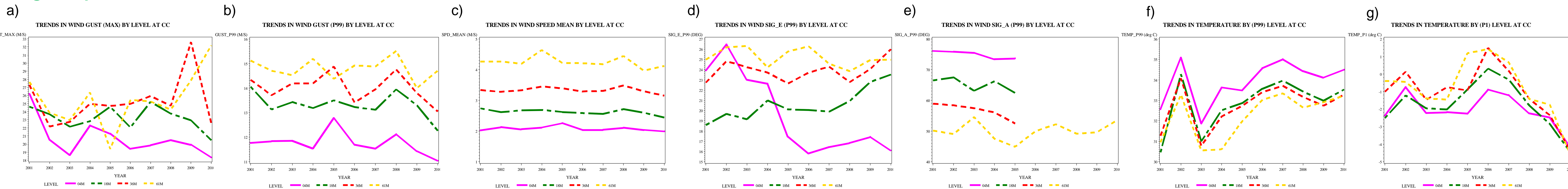


Figure 3 a) Height dependence and trends in max wind gusts for 4, 18, 36, & 61-m during 2001-10. b) As in a), but for P99 values (99th percentile wind gusts). c) As in b) except for mean wind speeds. d) As in b) except for SIG_E's (standard deviation of the elevation angle of wind). e) As in d) except for SIG_A's (standard deviation of the azimuth angle of wind). f) As in e) except for temperatures (high temperatures) (warm temperatures). g) As in f) except for P1 values (1st percentile temperatures) (cool temperatures).

4. Height dependence and trends in the variables during daylight hours.

5. Height dependence and trends in the variables after sunset and before sunrise.

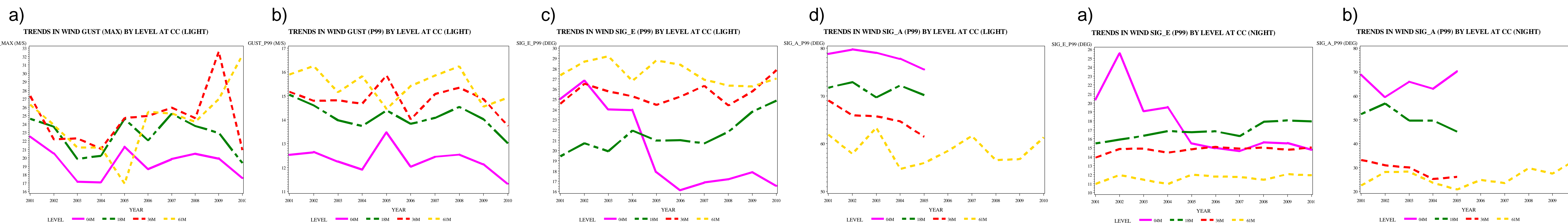


Figure 4 a) Height dependence and trends in max wind gusts for 4, 18, 36, & 61-m during 2001-10 for daylight. b) As in a), but for P99 values (99th percentile wind gusts). c) As in b) except for SIG_E's. d) As in b) except for SIG_A's.

Figure 5 a) Height dependence and trends in P99 values of SIG_E for 4, 18, 36, & 61-m during 2001-10 for nighttime. b) As in a), but for P99 values of SIG_A.

Summary

- Overall gust maxima show no trends with time, but gusts at the 99th percentile level are trending downward. Mean wind speeds also show a slight downward trend.
- The standard deviations sigma-E at the 99th percentile are trending upward, except for the 4-m height which is trending downward. The 61-m height of sigma-A is trending upward. There is insufficient data for trends of sigma-A at lower levels.
- Temperatures at the 99th percentile level are trending upward, while temperatures at the 1st percentile are trending downward.

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