A study of weather parameters for La Silla

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1 Humidty

On average, we expect to have 2.35 % more humidity downtime by lowering the closing threshold from RH=90% to RH=80%. However humidity has a clear dependence on the season, so by lowering the closing threshold, we expect 3.59 % more humidty downtime in summer, and 1.93 % more humidity downtime for the rest of the year.

2 Wind

On average, we expect to have 0.5 % more wind downtime by lowering the closing threshold from 20 m/sec to 18 m/sec, with high wind events more frequent in winter.

3 Conclusion

If high wind events and high humidity events happened in separate nights, then the expected additional weather downtime with lower closing limits would add up to 2.35+0.5 = 2.85 %. However this is an upper limit, because some of the high wind and high humidity events will happen on the same night. It is also true that high wind events are much more rare than high humidity events.

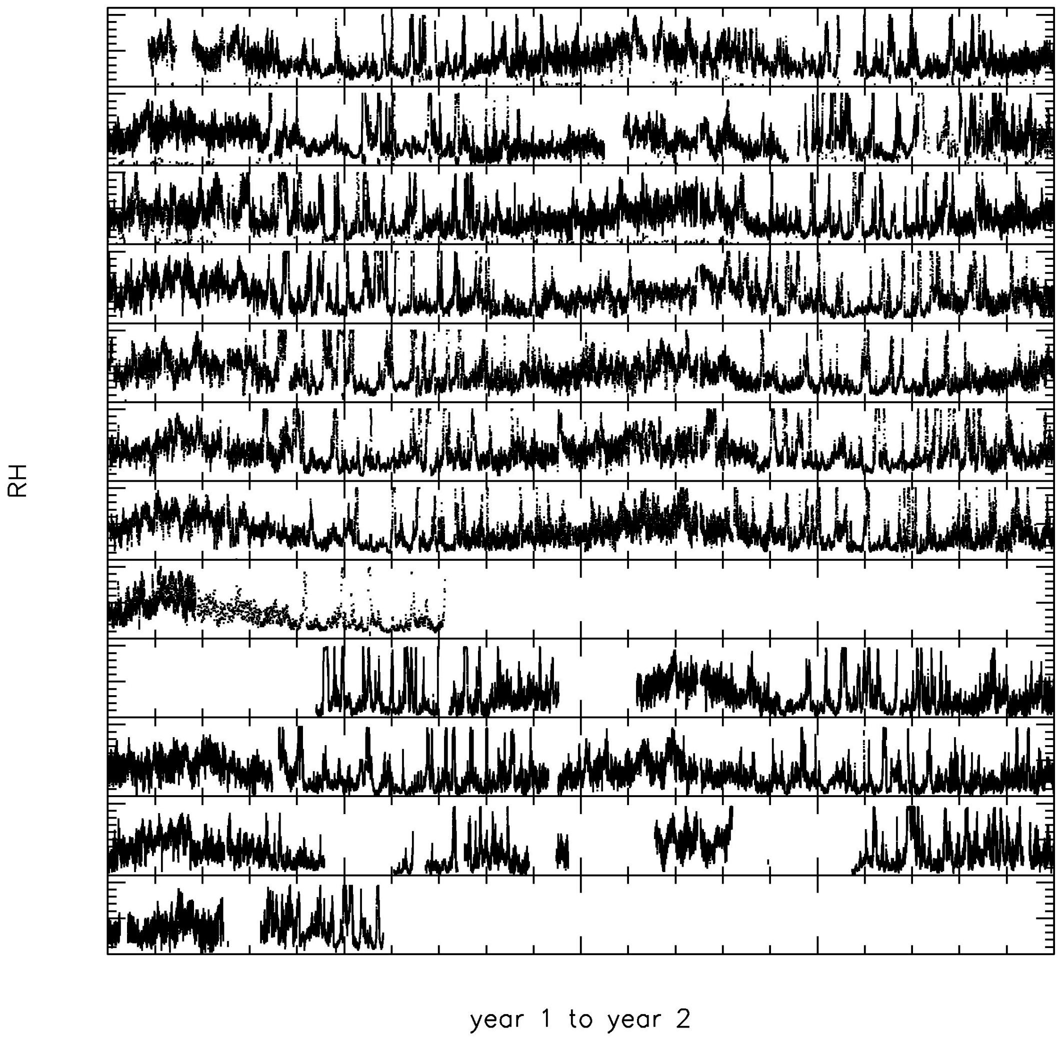

Figure 1: Evolution of relative humidity vs. time: each panel spans two years, from 1994 to 2018.

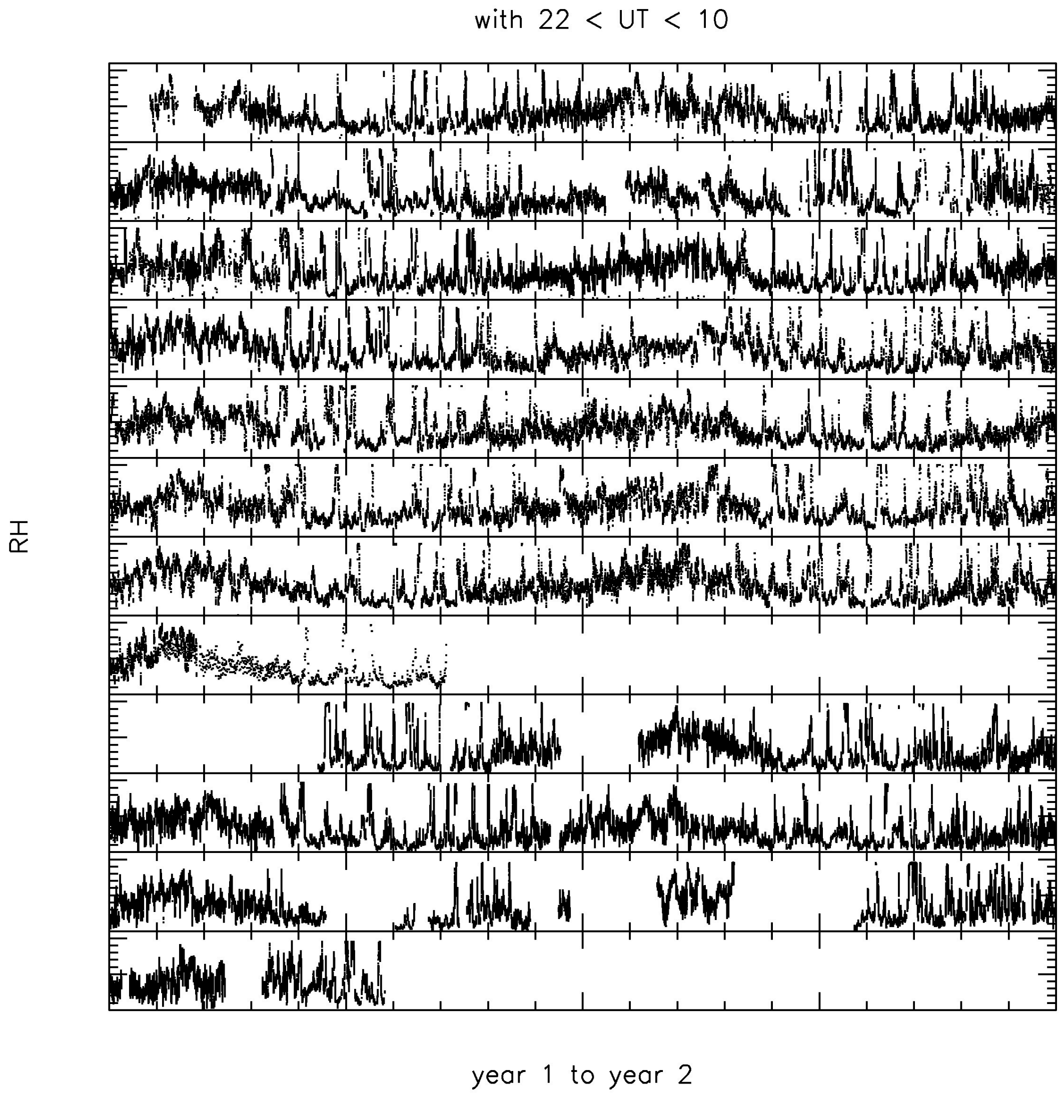

Figure 2: Same as Fig. 1 but only for night time (22 < UT < 10)

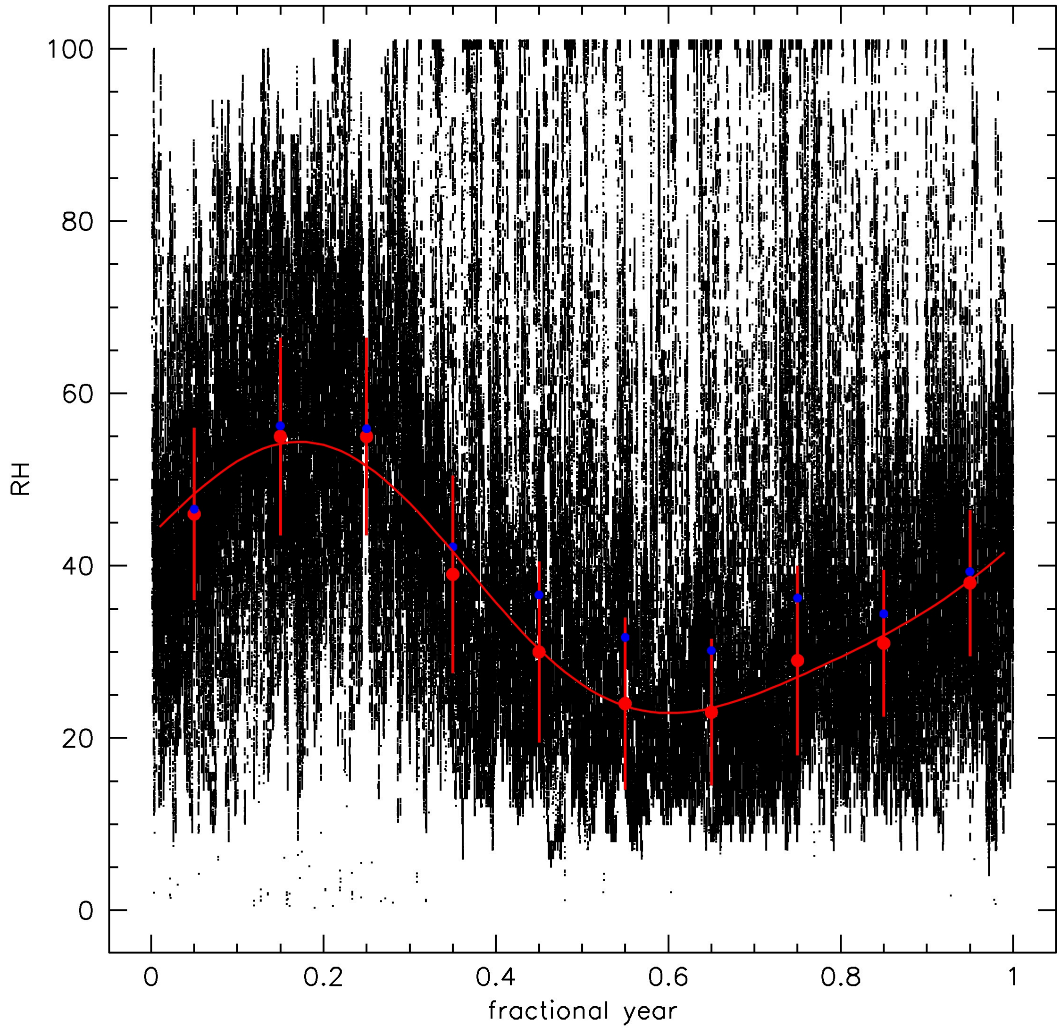

Figure 3: RH vs. fraction of year, for the reference period. The red dots represent median values in bins of 0.1 years, and the curve is a polynomial fit to those points. Error bars represent the semi-quartile range, and blue dots represent average values within the same bins. To enhance the appearance of the plot, a random value between 0 and 1 has been added to each RH point, in order to remove the quantization. The polynomial fit of degree 19 has been performed on a time span which is three times the one shown here.

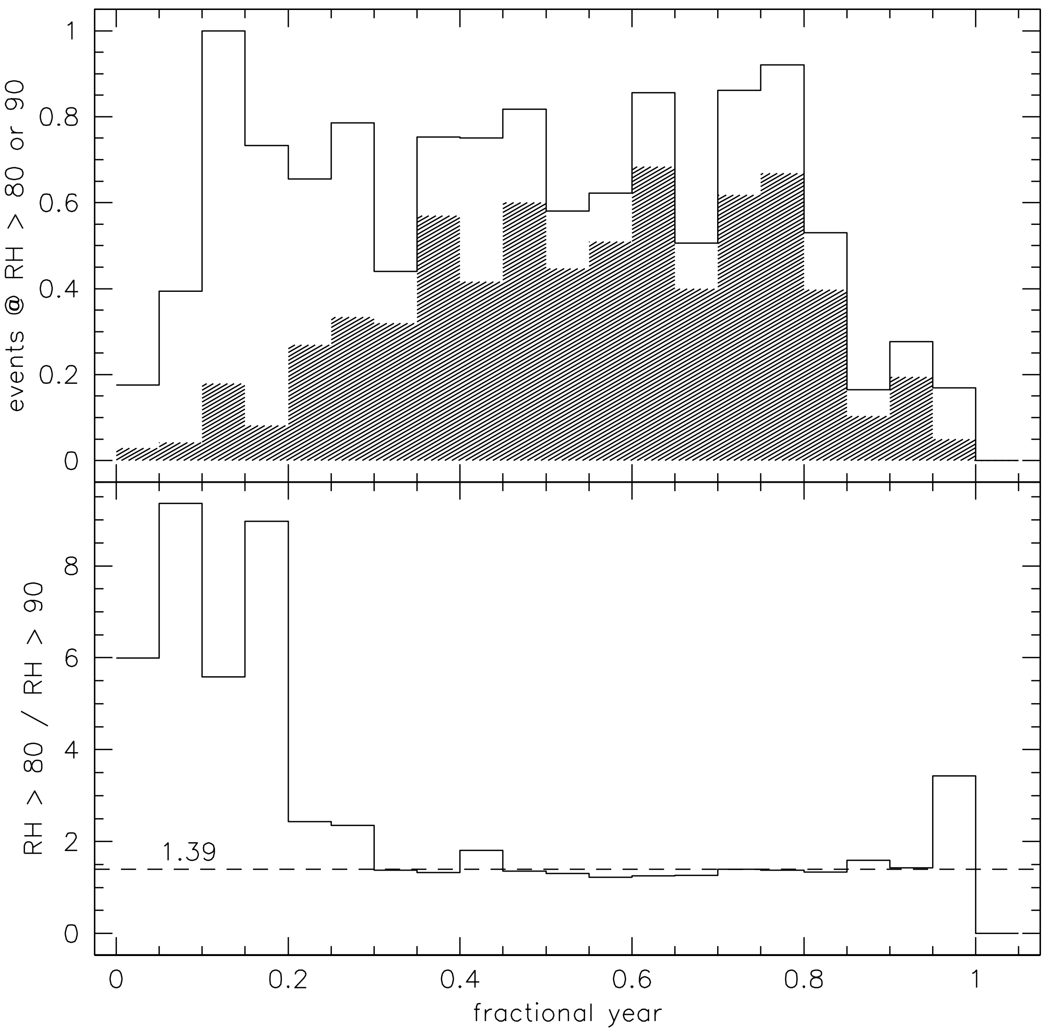

Figure 4: The upper panel shows the distribution over the year of time when RH > 80% or RH > 90% (shaded histogram). Events with RH > 90% are more frequent in winter, while events at RH > 80% are more uniformly distributed. The lower panel shows the ratio of the two distributions. Taking the median value, events at RH > 80% are ∼ 40 % more frequent than those at RH > 90%, but they become six to eight time more frequent in summer.

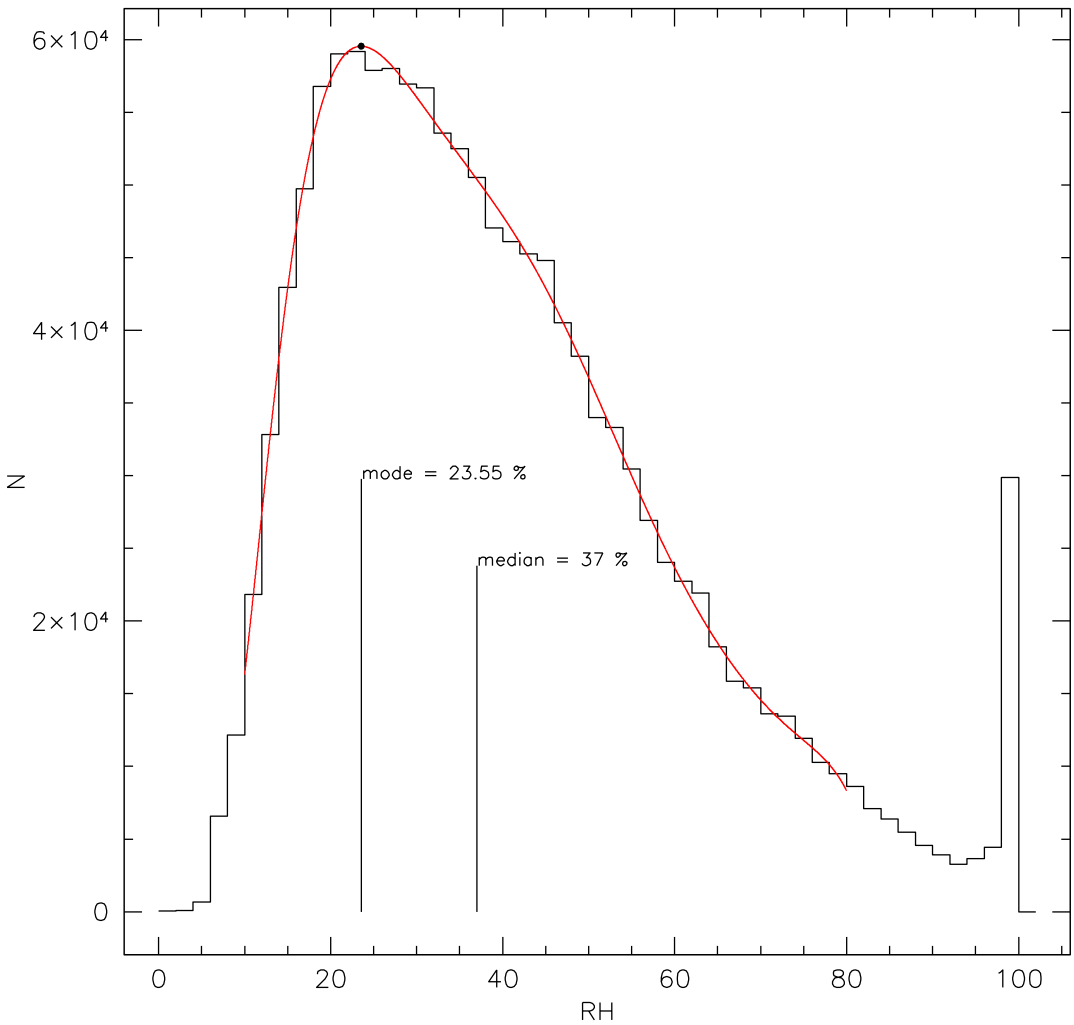

Figure 5: Distribution of events over relative humidity, which shows that the typical humidity is 23.55 %, and that half of the time the humidity is below 37%. The red curve is a polynomial fit of degree 9.

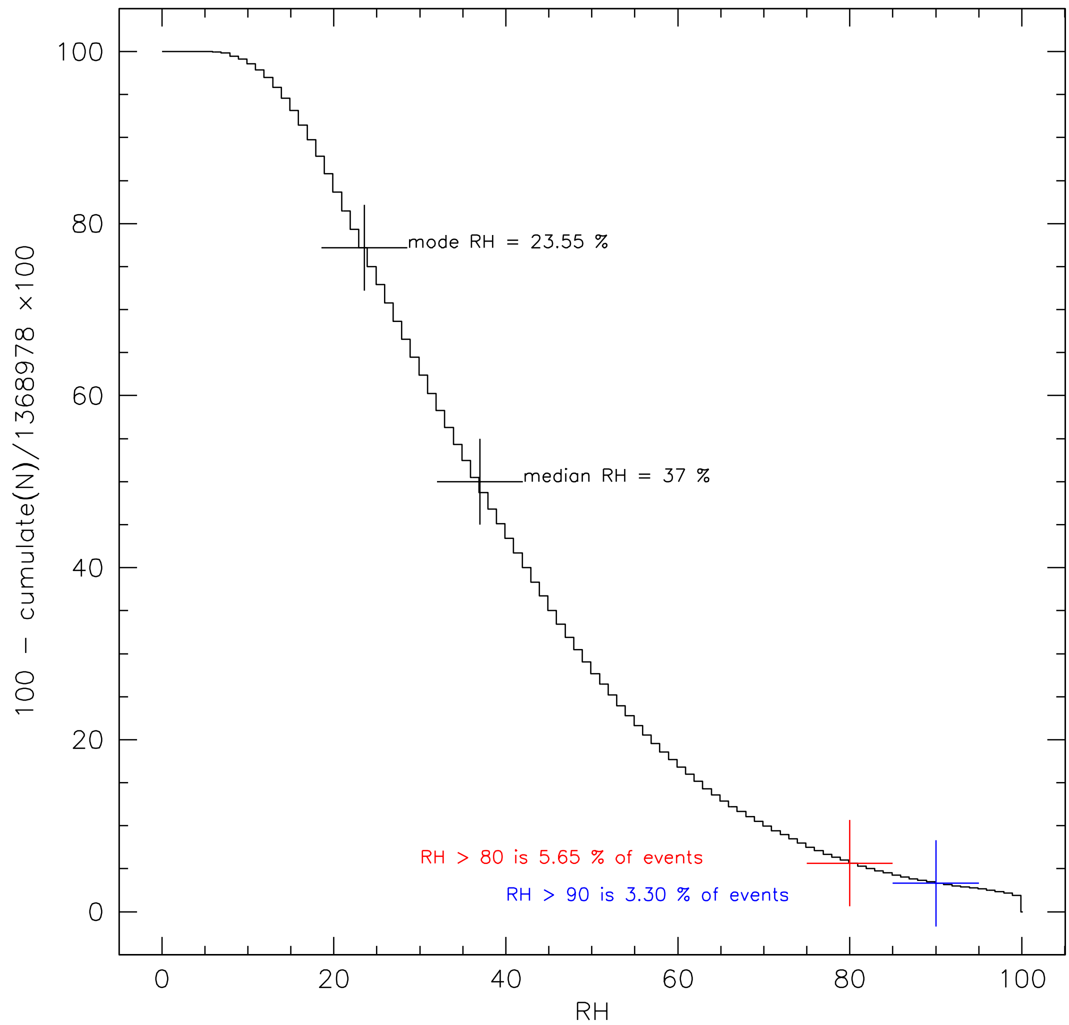

Figure 6: Cumulative distribution of events over relative humidity. It shows that we expect to have 2.35 % more humidity downtime by lowering the closing threshold from RH=90% to RH=80%.

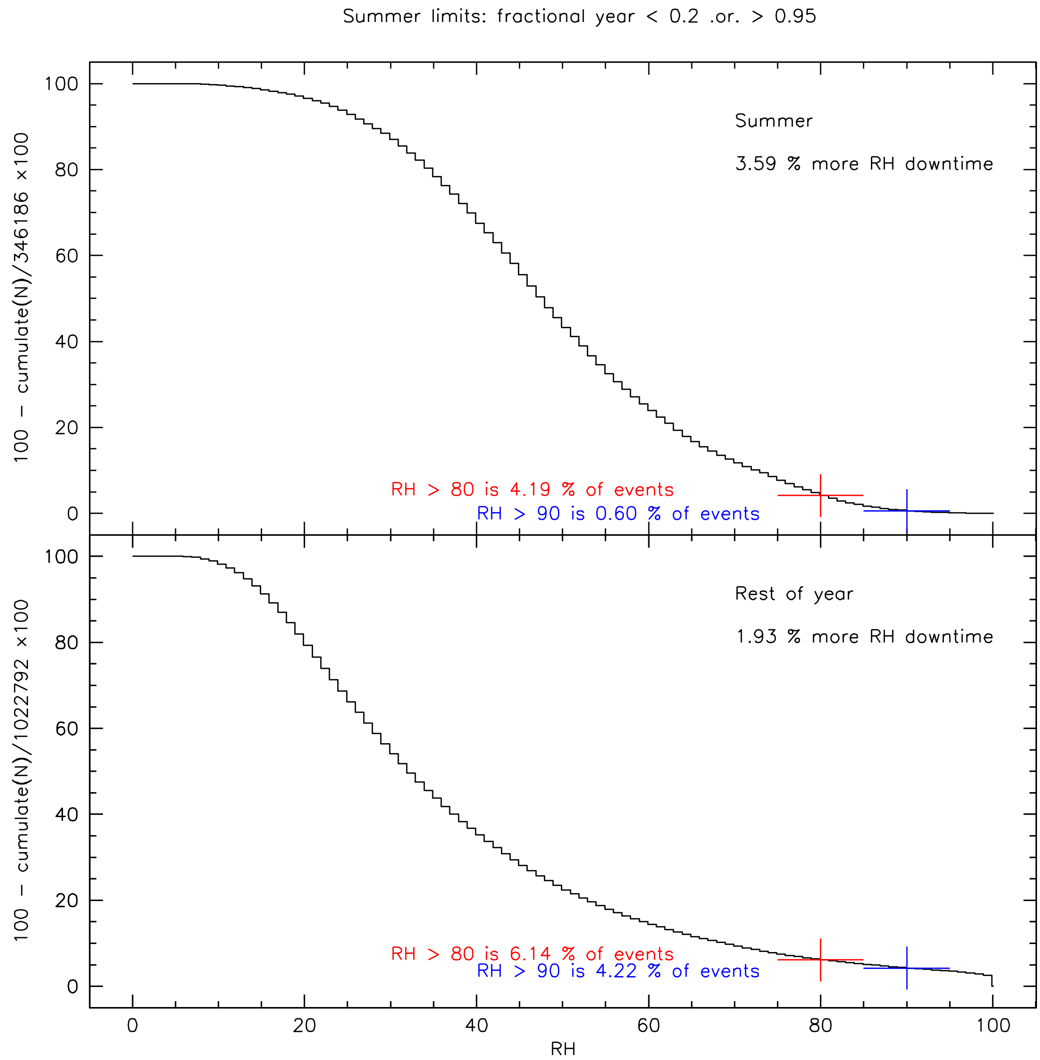

Figure 7: Same as Fig. 6, but distinguishing summer and rest of year. By lowering the closing threshold, we expect 3.59 % more downtime in summer, and 1.93 % more downtime for the rest of the year.

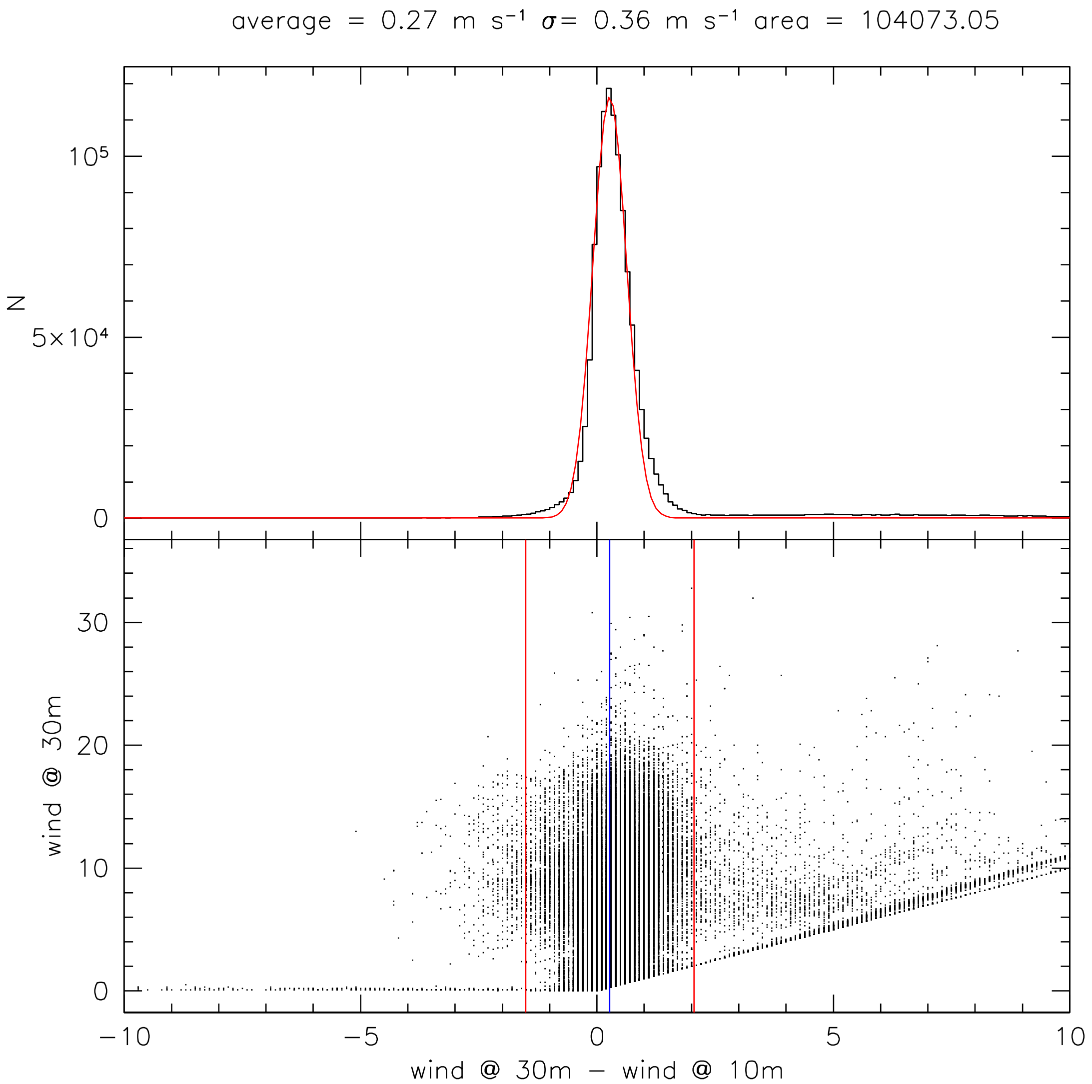

Figure 8: The bottom panel shows the wind speed at 30m vs. the difference in wind speed at 30m and 10m. The top panel shows an histogram of the speed difference, and a Gaussian fit to the histogram (red curve). The average difference is 0.27 m/sec (blue vertical line in the bottom panel), with a one-sigma dispersion of 0.36 m/sec, so the wind speeds at the two heights are very similar. Eighty percent of the data are comprised within 5-sigma of the average, i.e. between differences of -1.53 m/sec and 2.07 m/sec (red vertical lines).

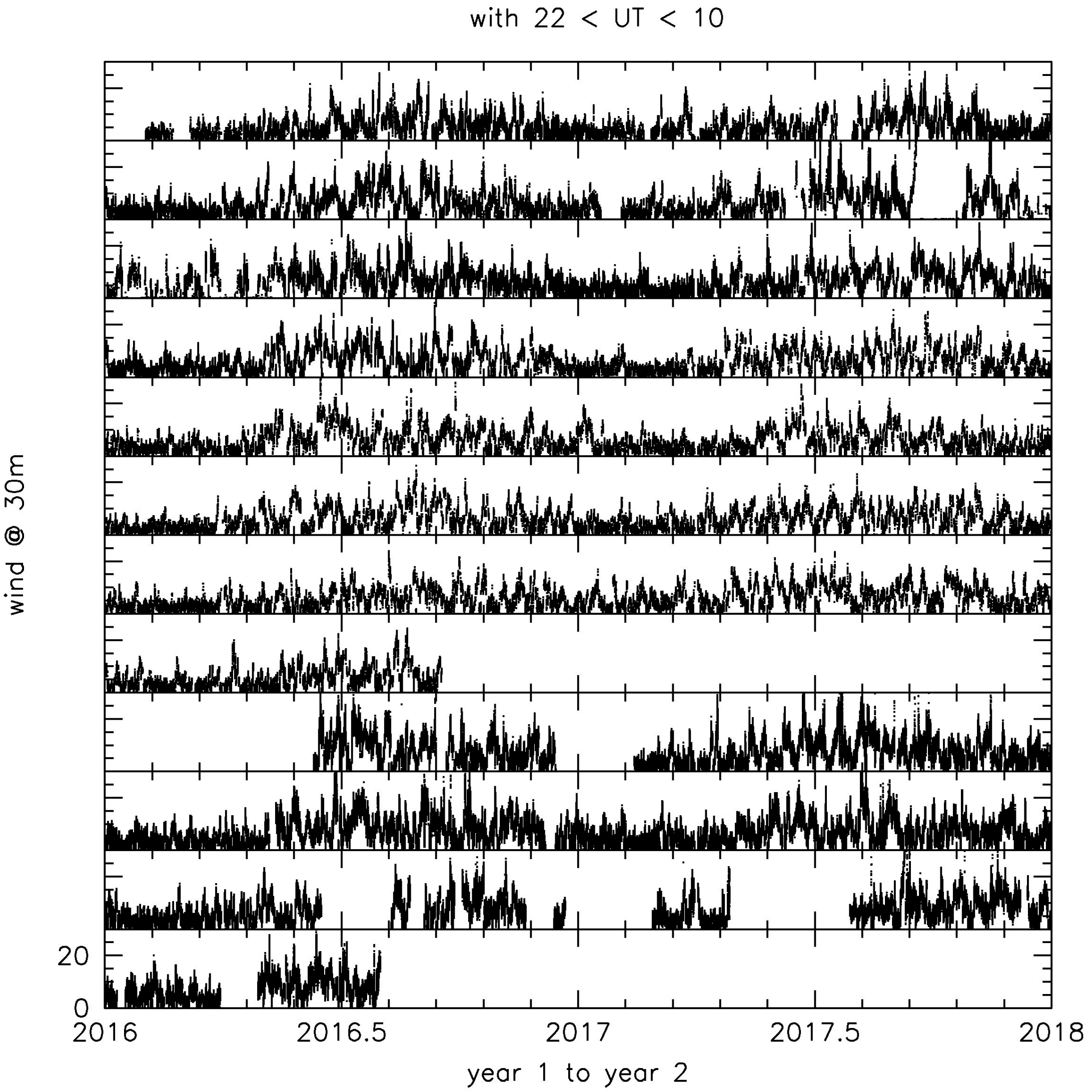

Figure 9: Evolution vs. time of wind speed at 30m height: each panel spans two years, from 1994 to 2018, and only night time is considered (22 < UT < 10).

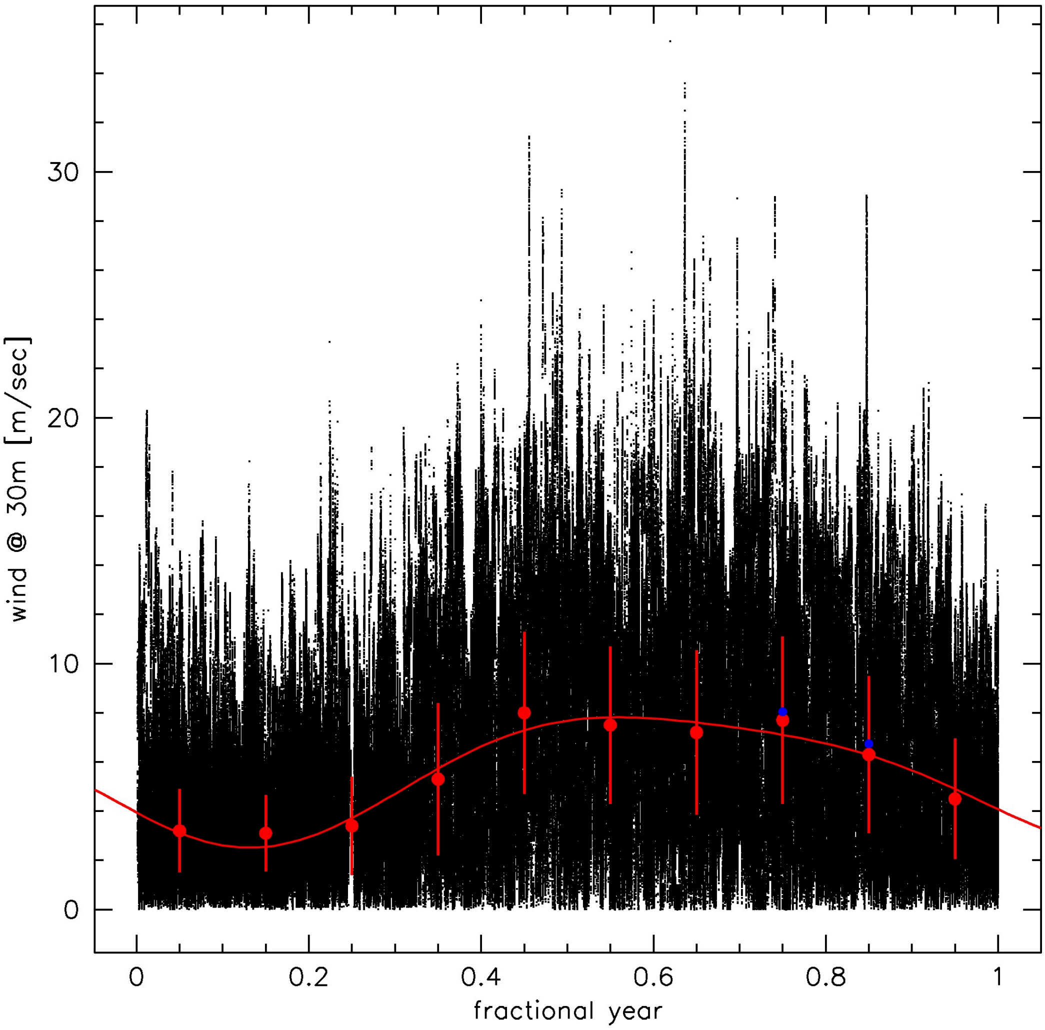

Figure 10: Wind speed at 30m, vs. fraction of year, for the reference period. The red dots represent median values in bins of 0.1 years, and the curve is a polynomial fit to those points. Error bars represent the semi-quartile range, and blue dots represent average values within the same bins. To enhance the appearance of the plot, a random value between 0 and 1 has been added to each point, in order to remove the quantization. The polynomial fit of degree 19 has been performed on a time span which is three times the one shown here.

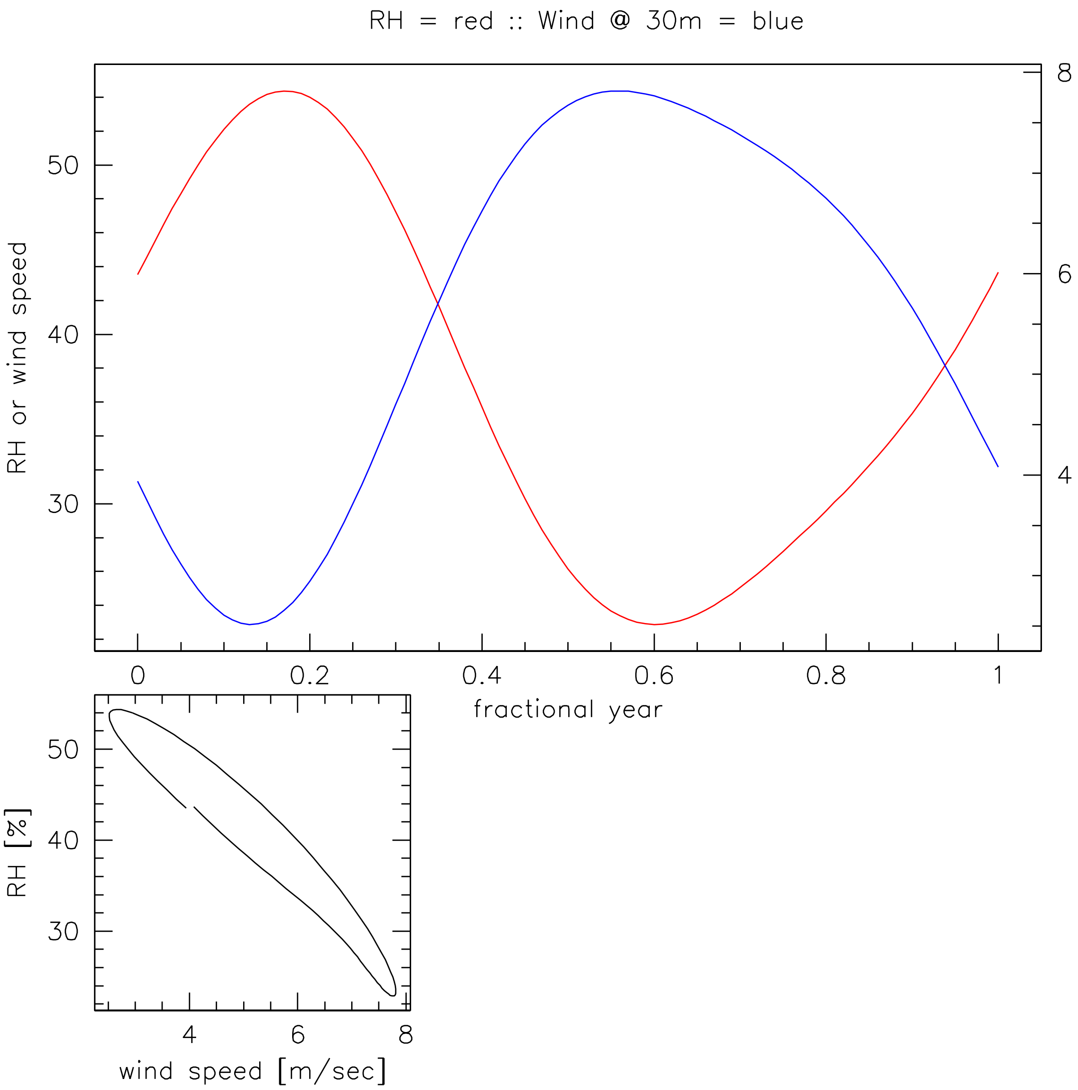

Figure 11: The top panel shows the average wind speed at 30m, and average relative humidity, vs. fraction of year, for the reference period. Summer is characterized by high humidity and low wind, while the opposite is true in winter. The curves are the polynomial fits shown in the previous figures. The bottom panel shows that on average, with higher wind speed there is lower humidity.

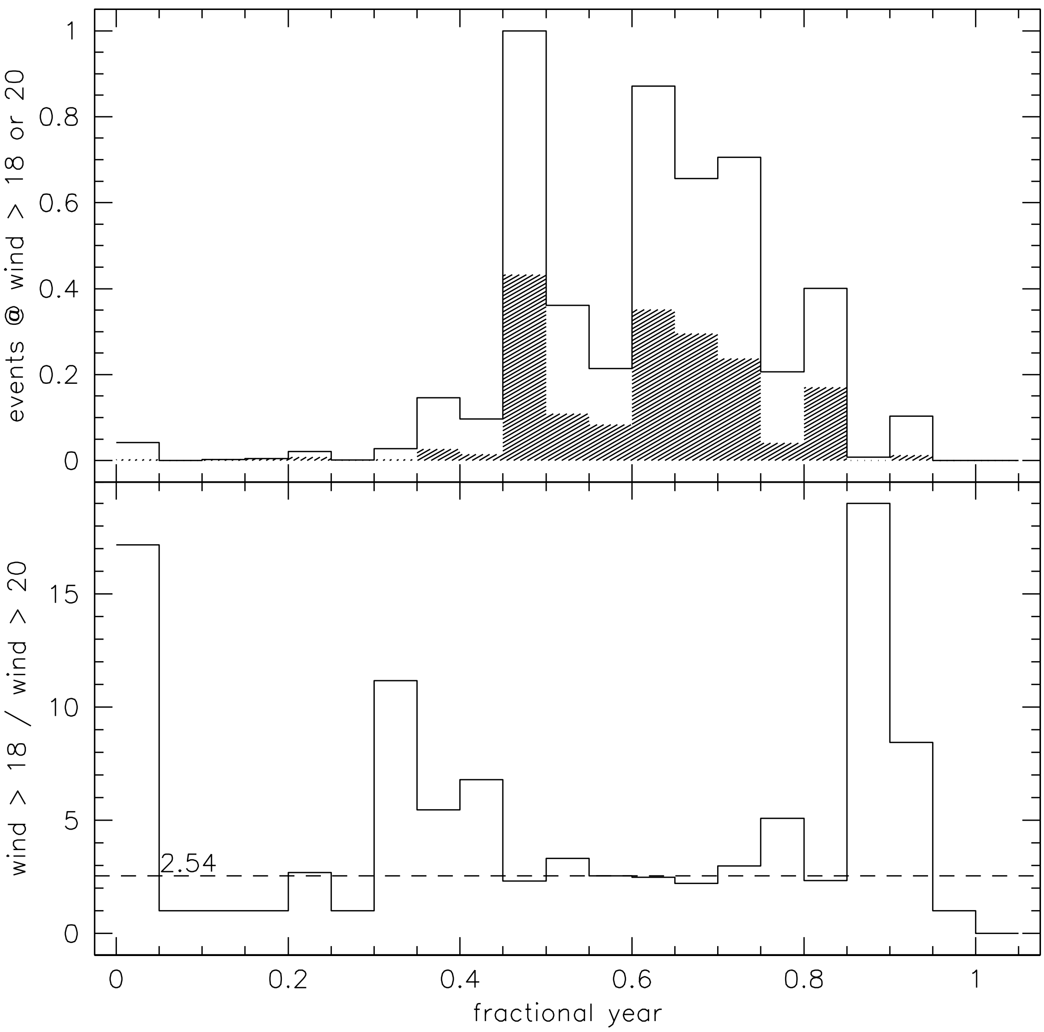

Figure 12: The upper panel shows the distribution over the year of time when wind speed at 30m > 18 m/sec or > 20 m/sec (shaded histogram). Events with high wind speed are more frequent in winter. The lower panel shows the ratio of the two distributions. Taking the median value, events at wind speed > 18 m/sec are ~2.5 times more frequent than those at speed > 20 m/sec, but they become even more frequent in particular months.

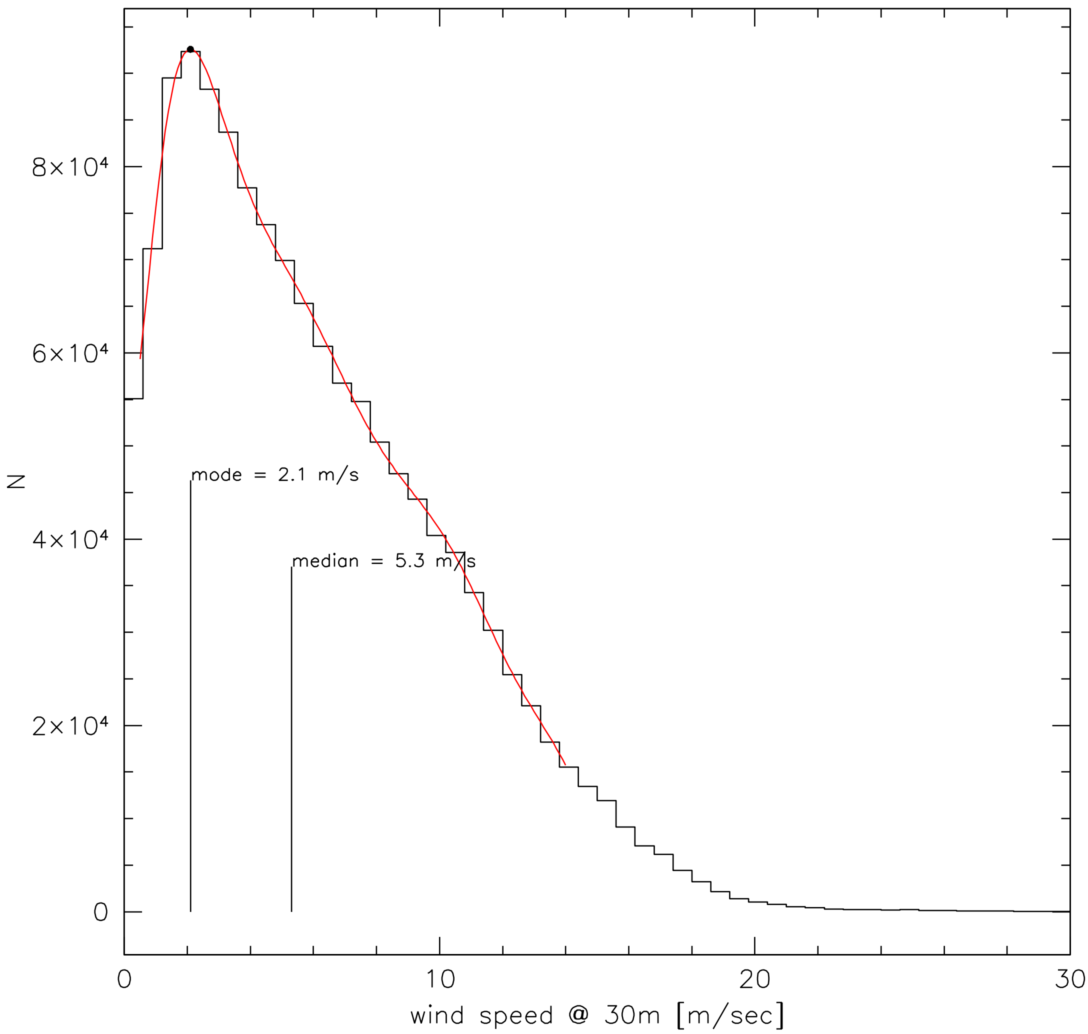

Figure 13: Distribution of events over wind speed, which shows that the typical wind is 2.1 m/sec, and that half of the time the wind is below 5.3 m/sec. The red curve is a polynomial fit of degree 10.

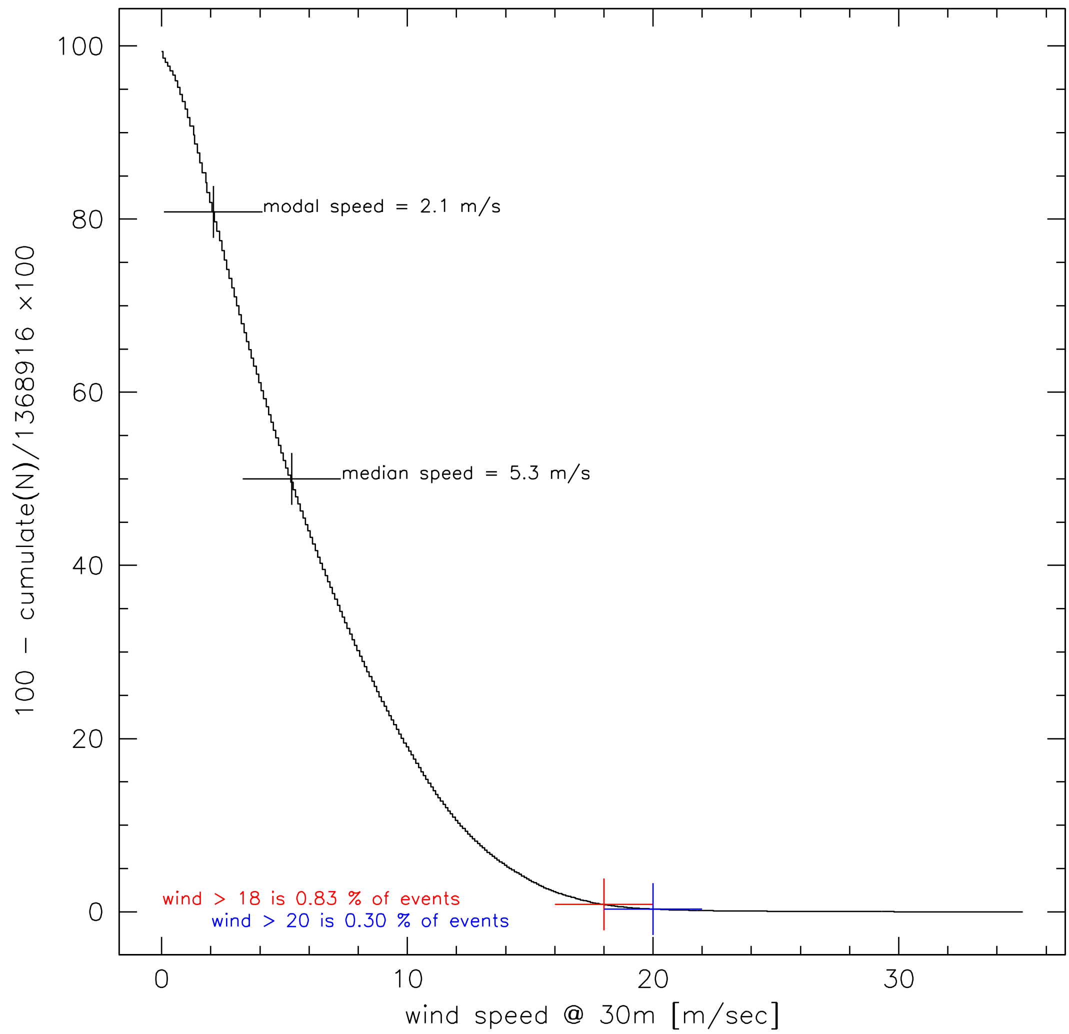

Figure 14: Cumulative distribution of events over wind speed at 30m height. It shows that we expect to have 0.5 % more wind downtime by lowering the closing threshold from 20 m/sec to 18 m/sec.