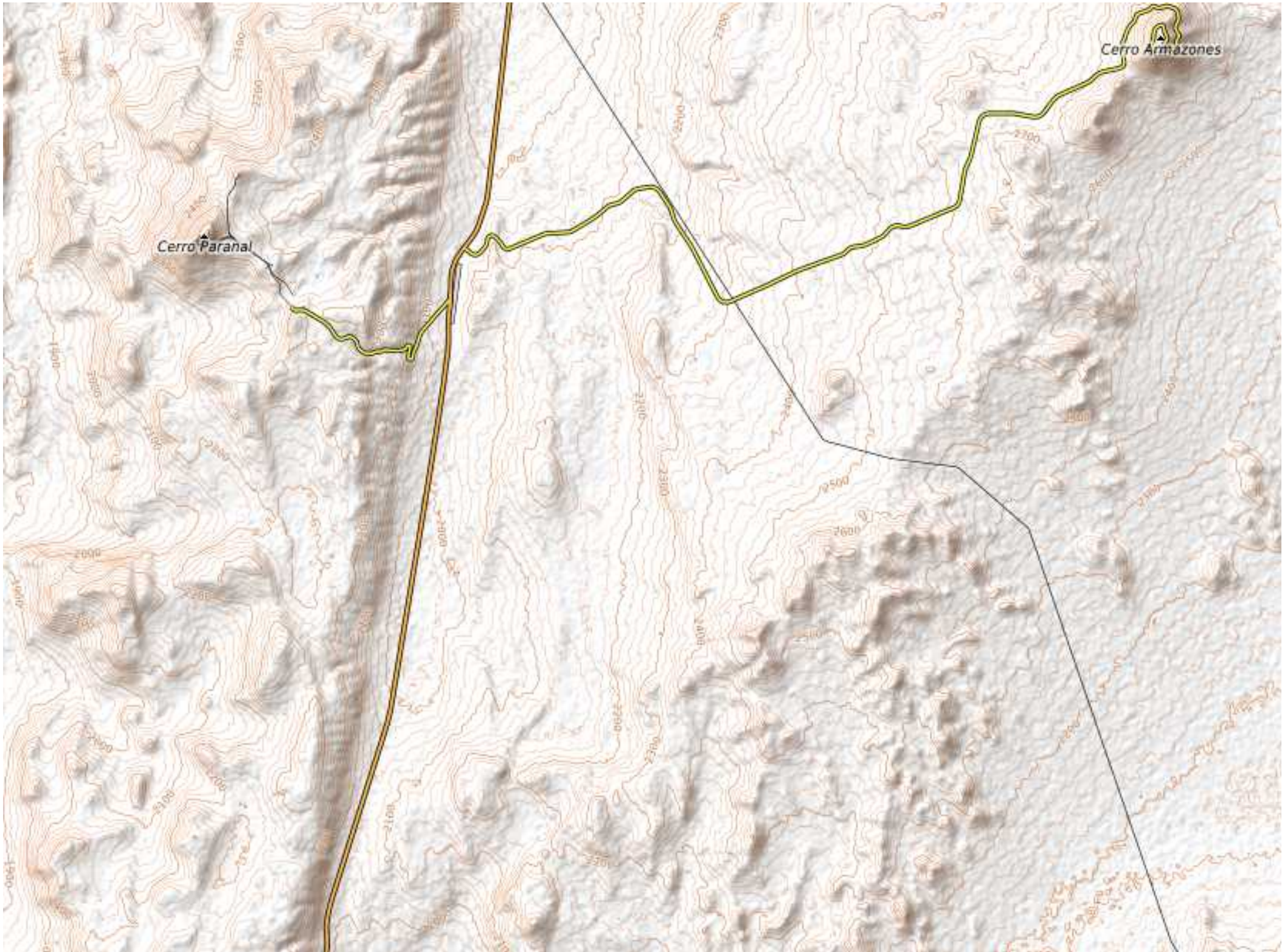
Armazones 2k climatology

Tomek Bulik


Cerro Armazones
Cerro Paranal

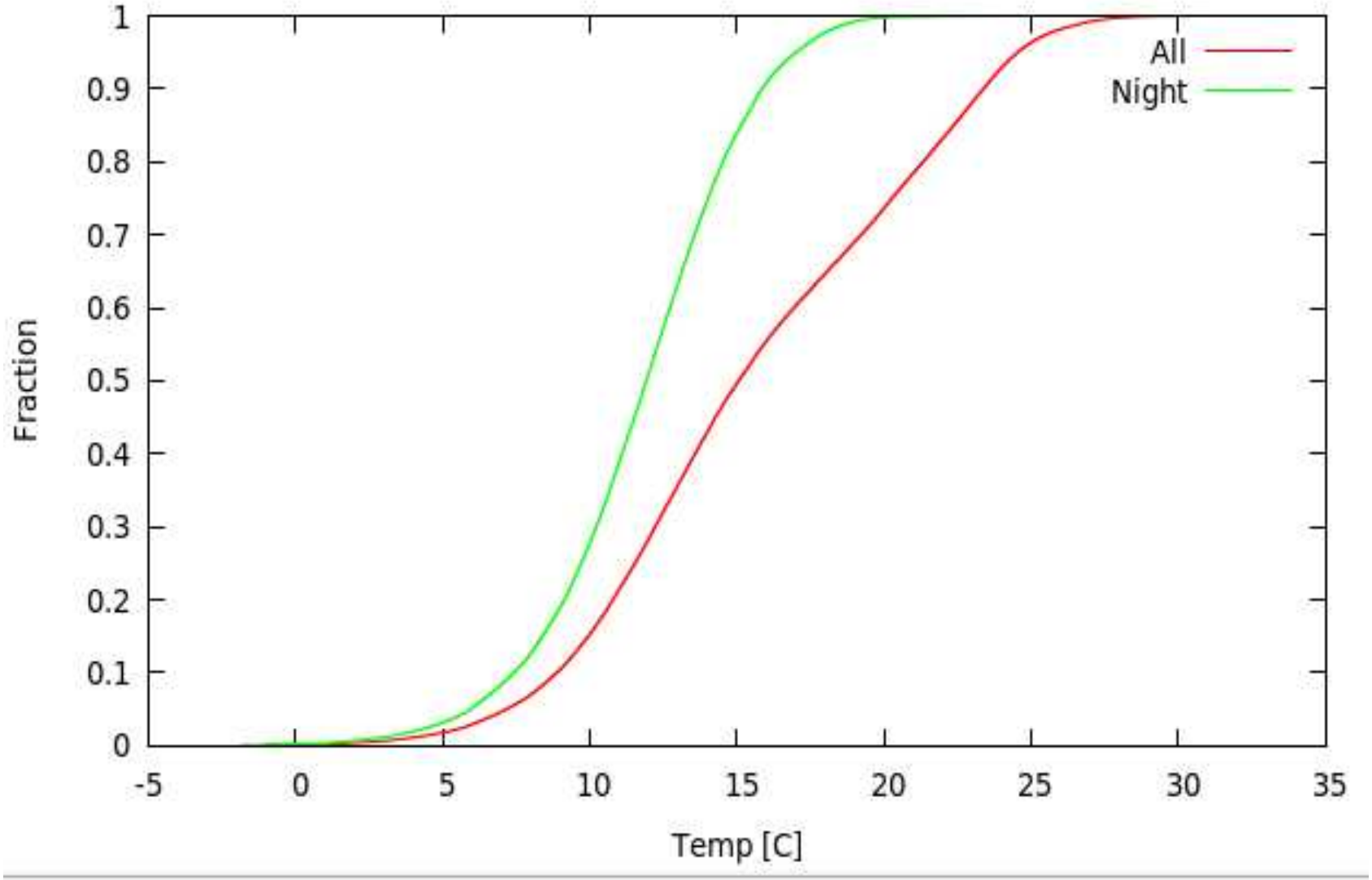
What do we know

- Armazones: Atmoscope
- Armazones 2k:
  - Atmoscope like stations since May2015
  - November 2015:
    - 30 meter weather tower
    - ASC
    - Sun Moon photometer
    - Seismometer

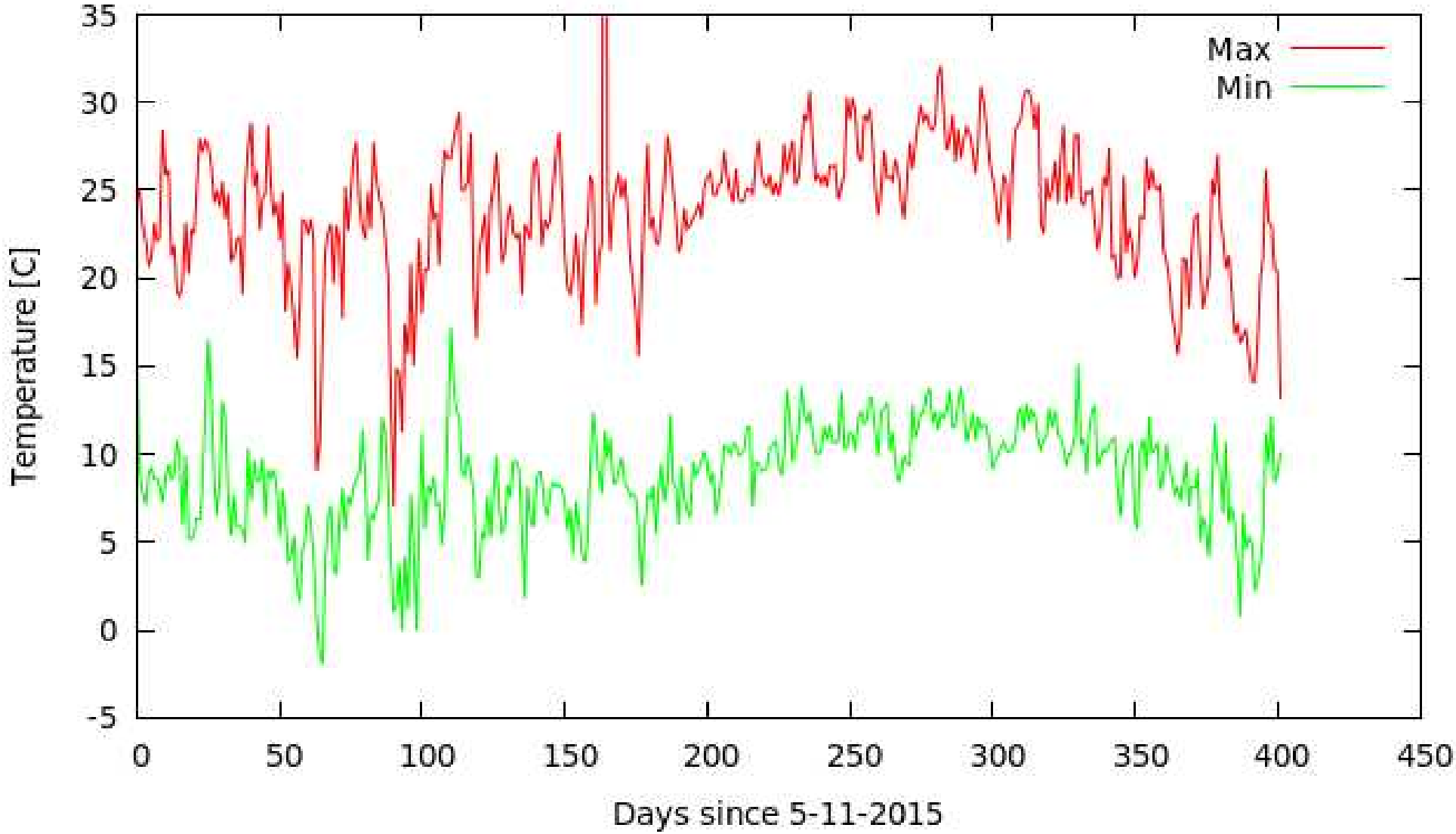
10 meter station results

- Temperature
- Humidity
- Wind

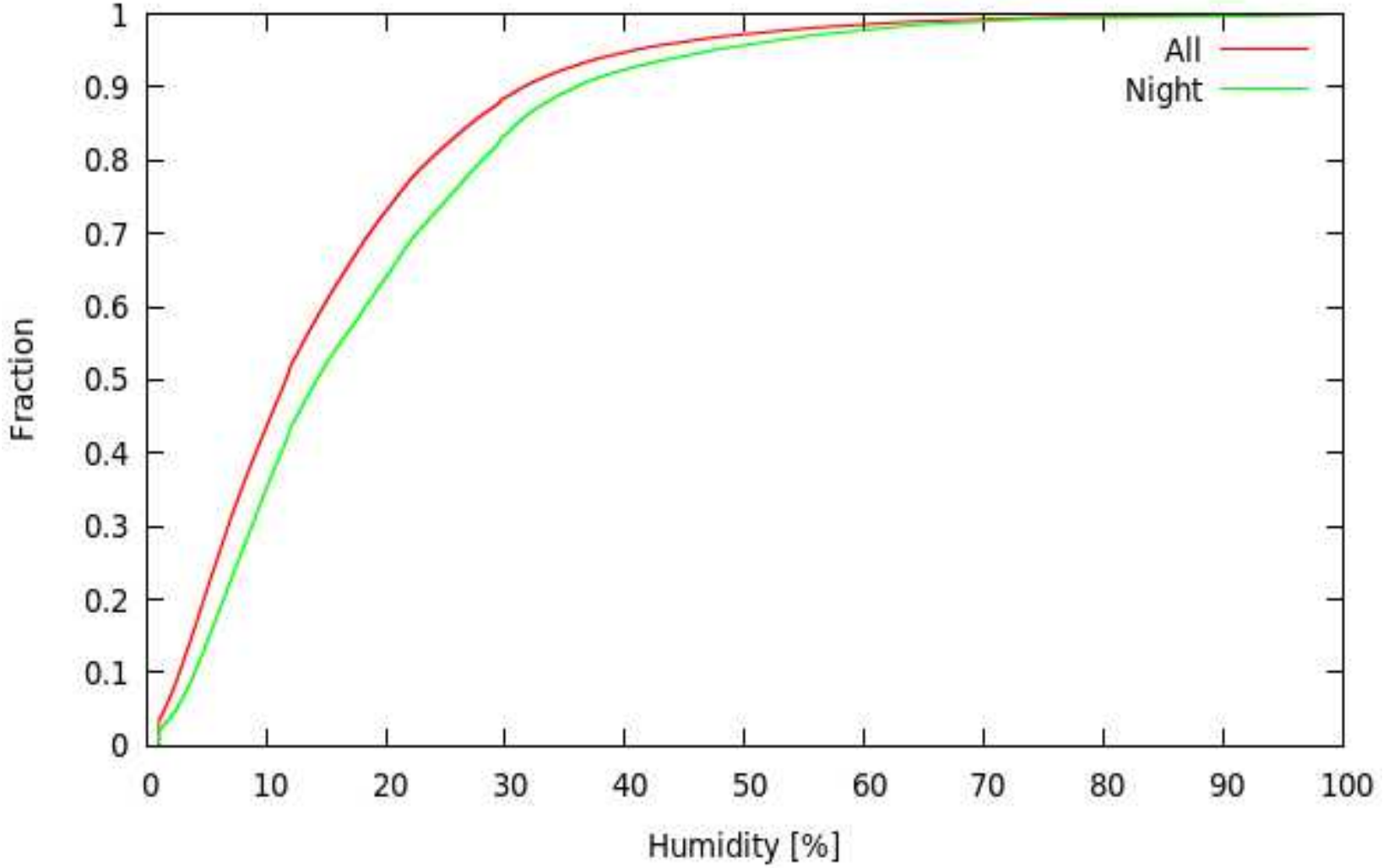
Temperature distribution



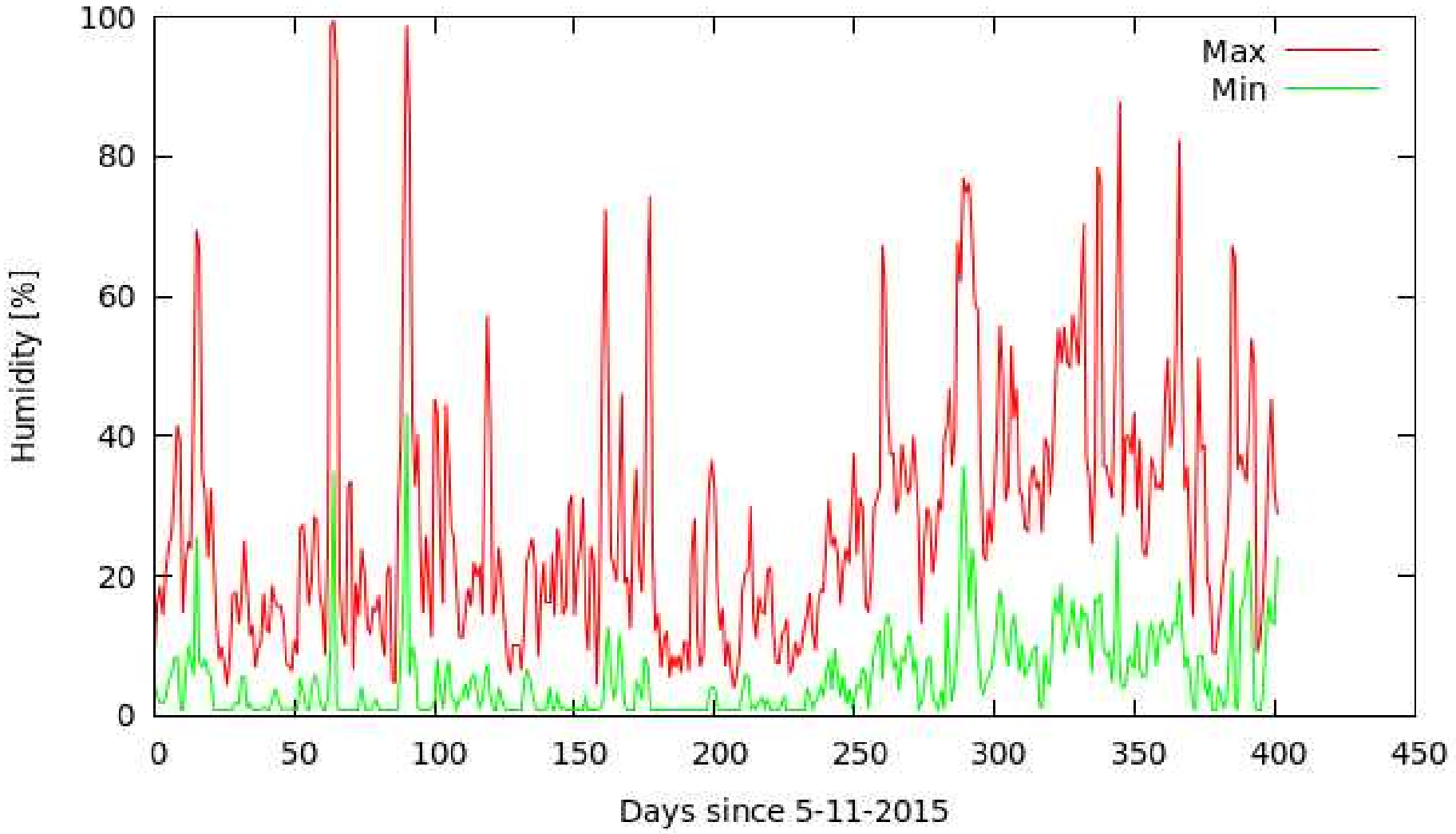
Temperature extremes



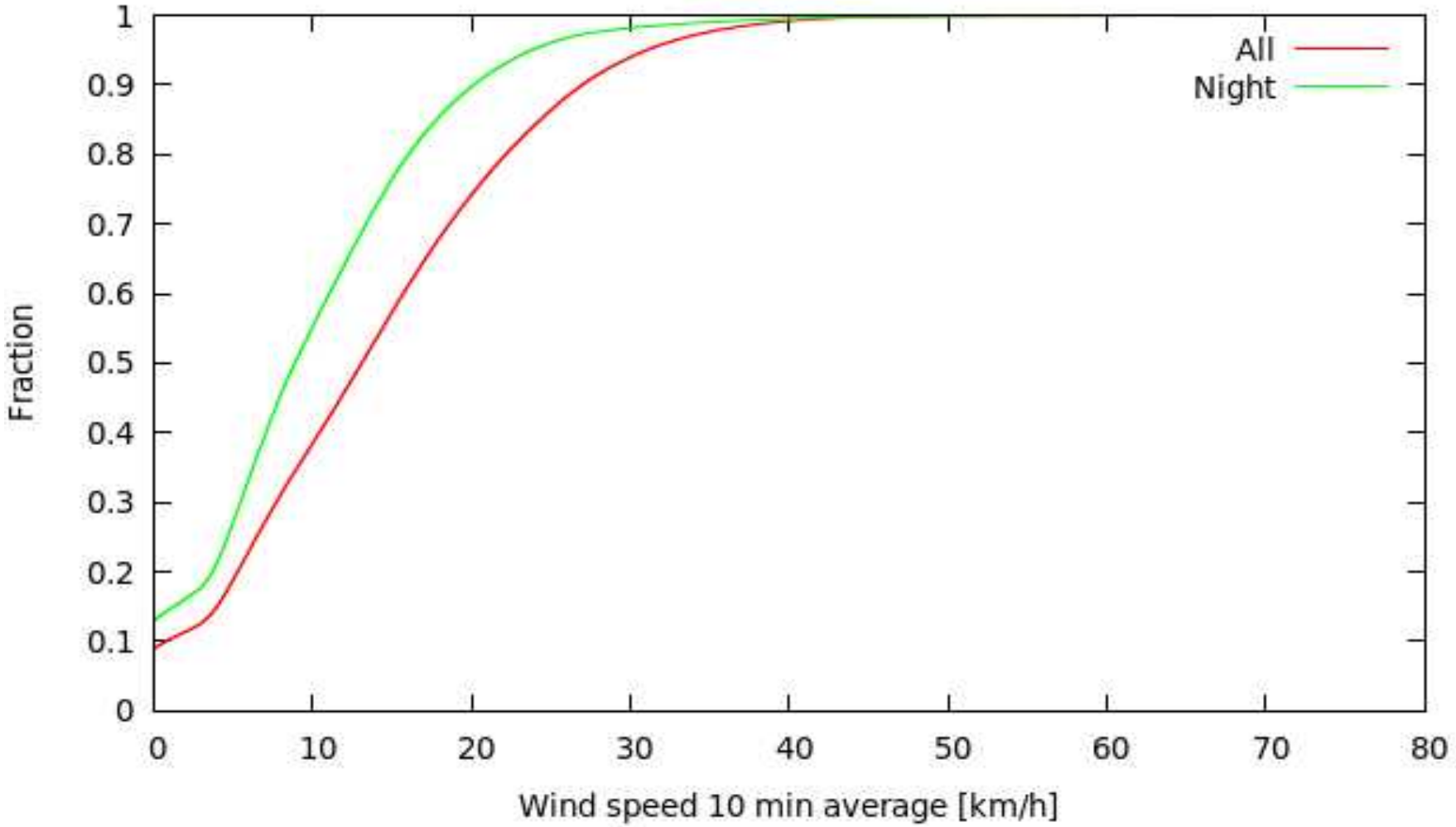
Humidity distribution



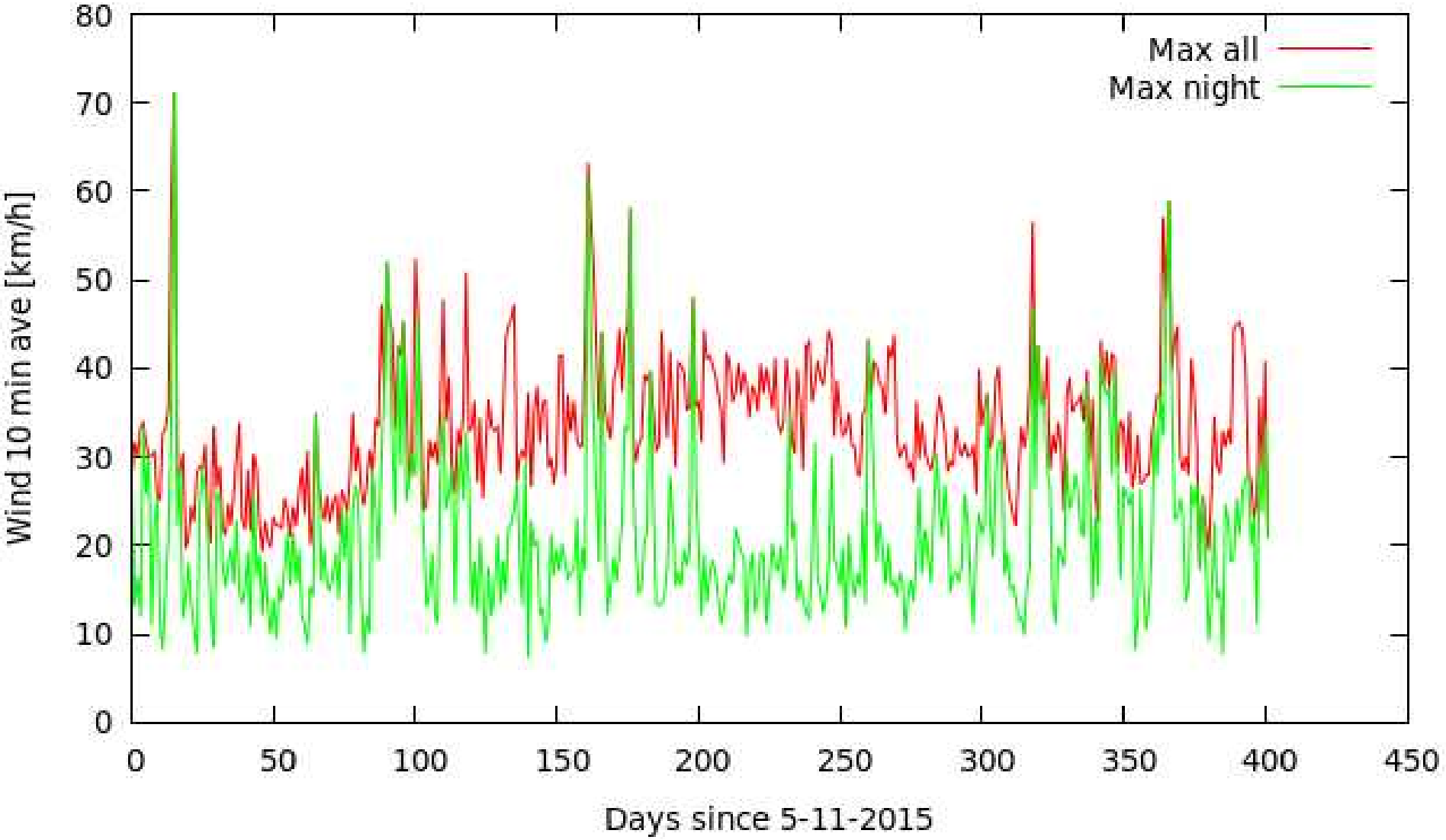
Humidity extreme



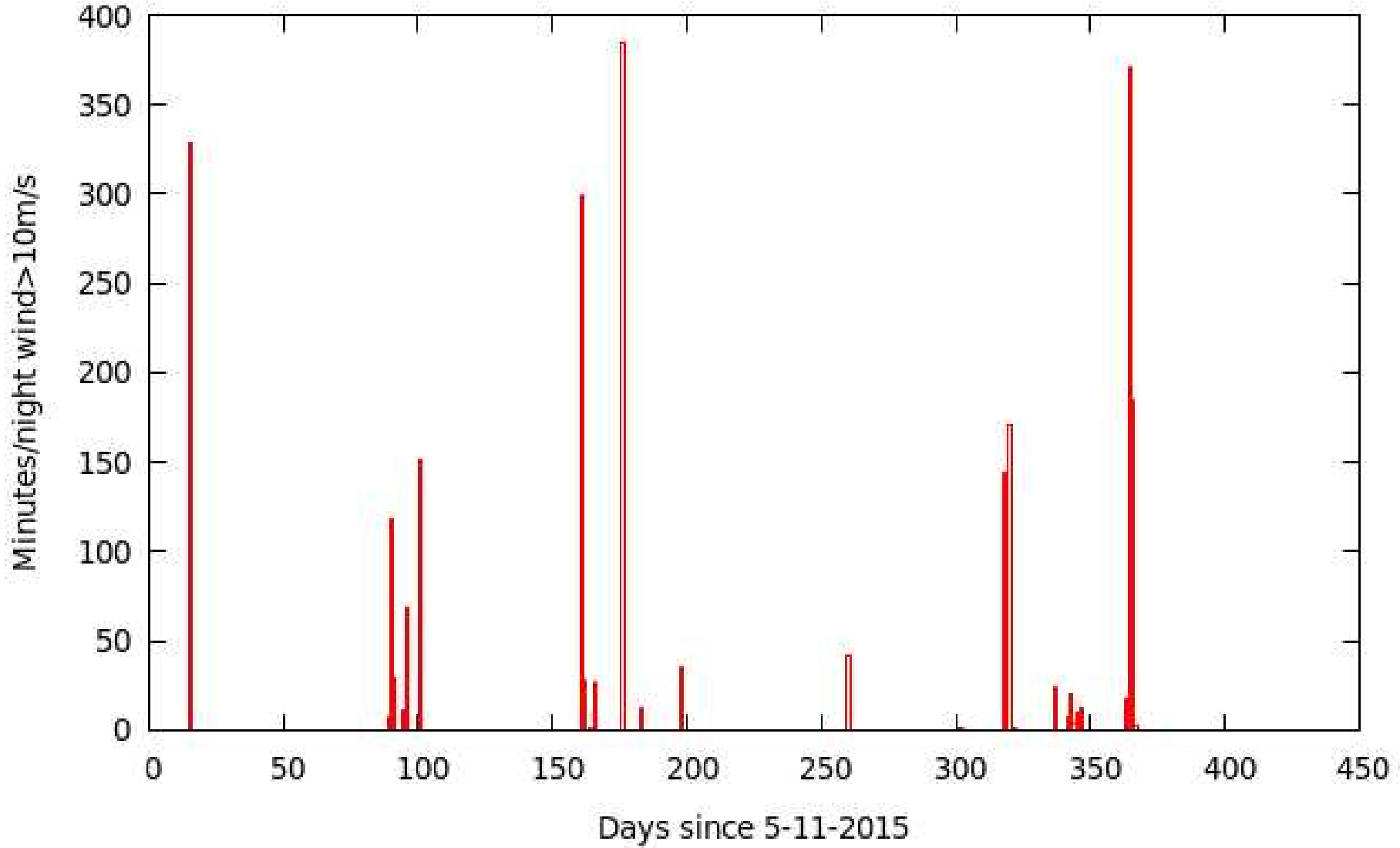
Wind distribution



Wind extremes

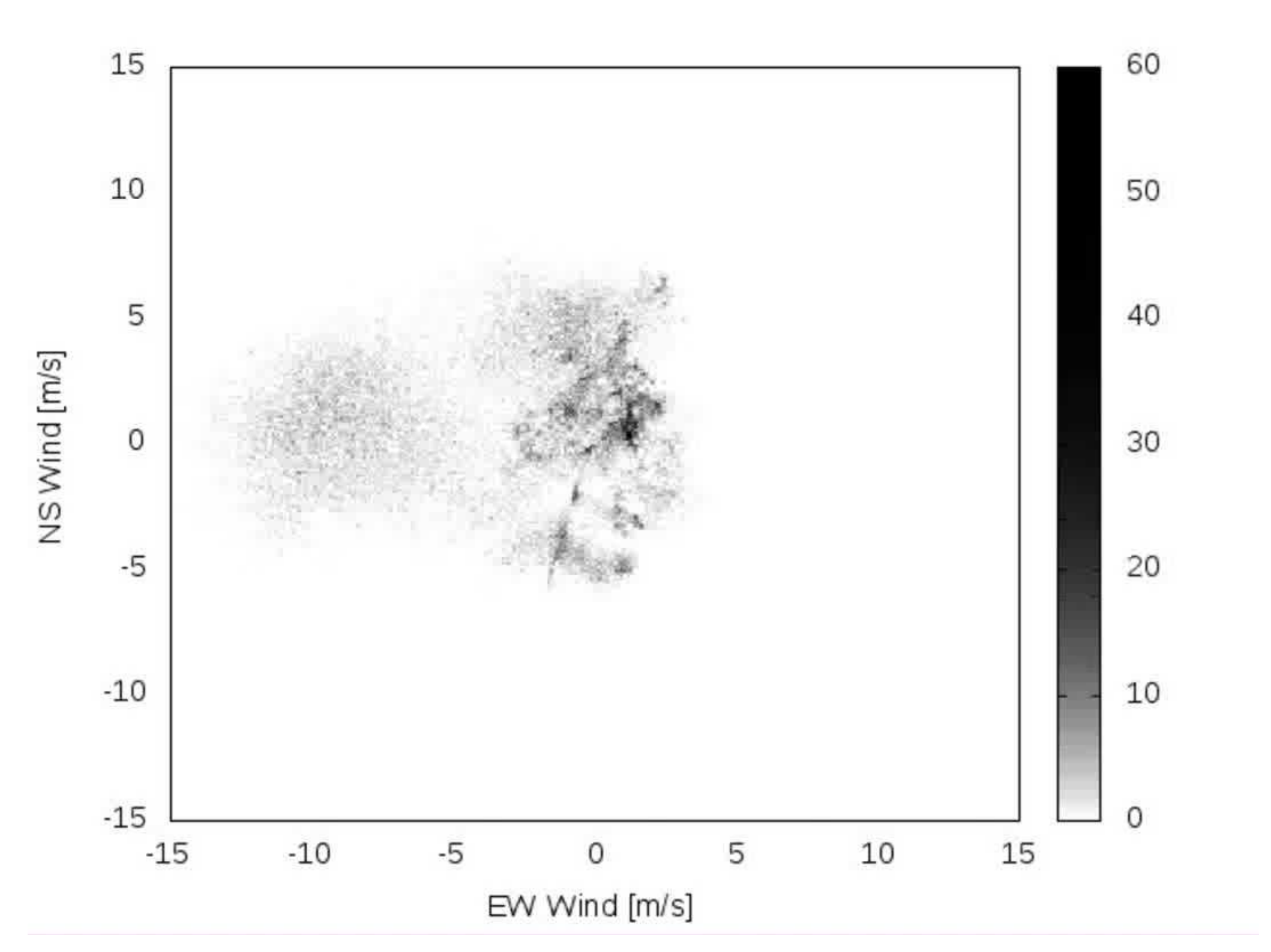


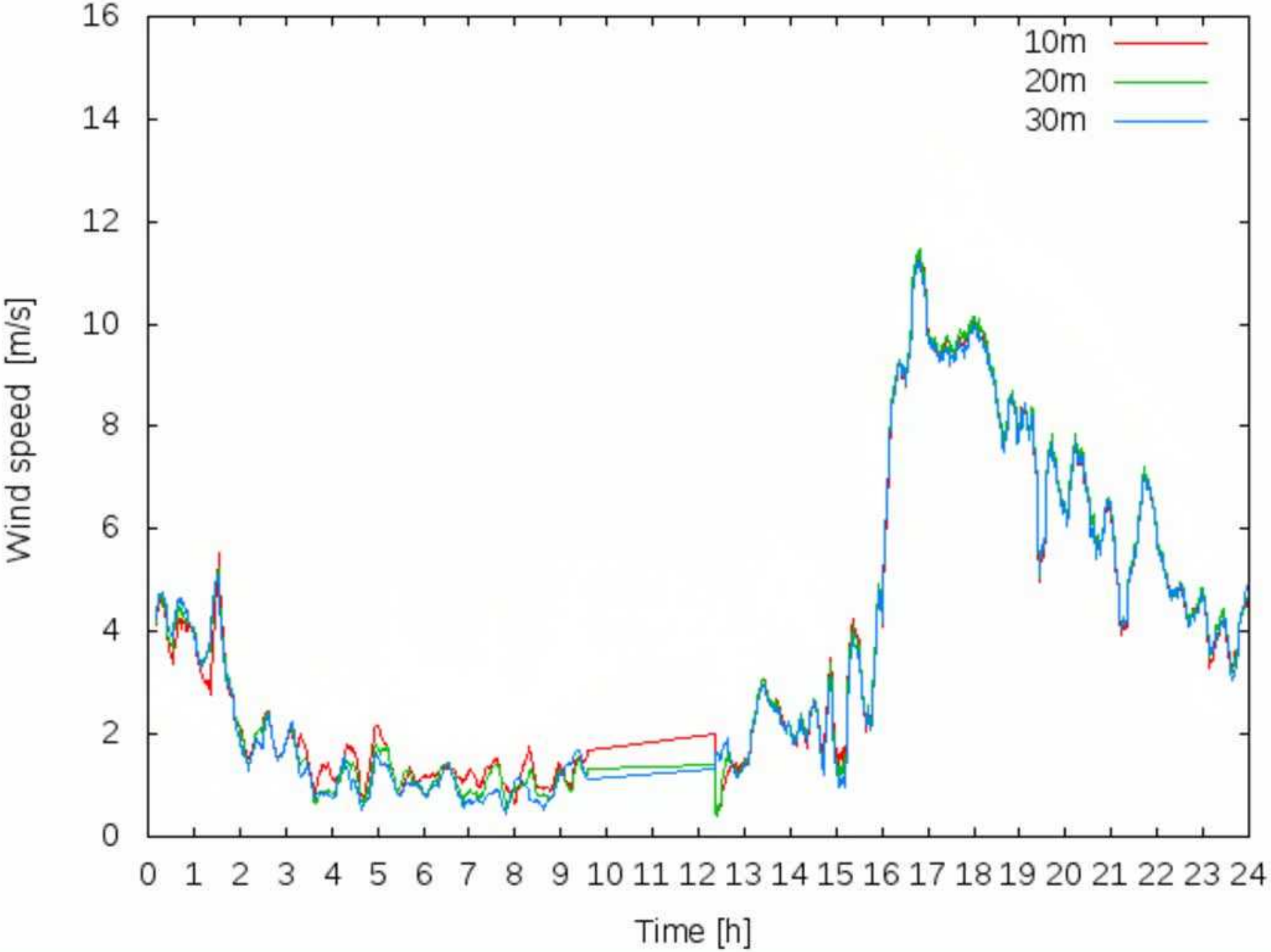
Distribution of strong wind time

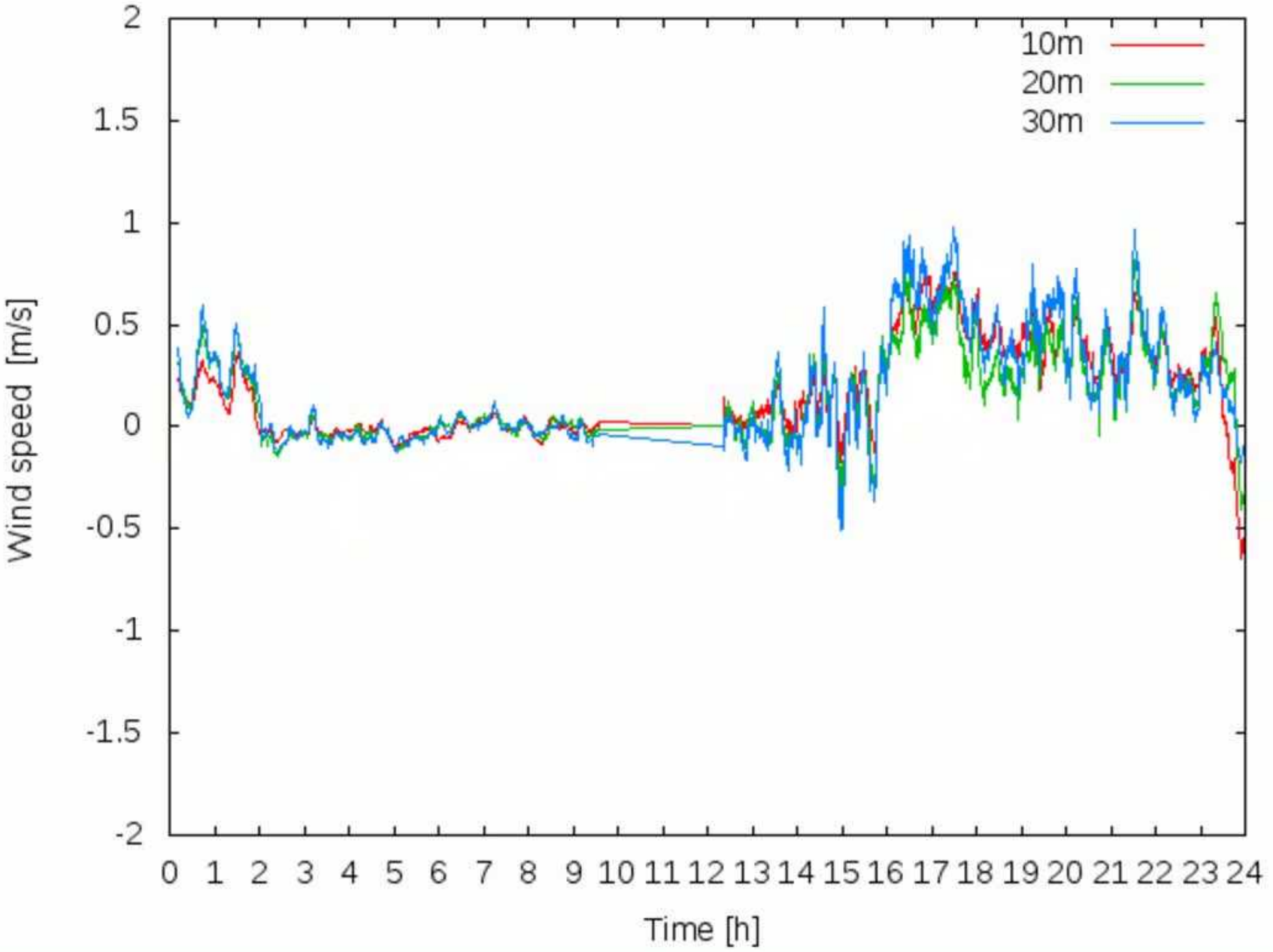


Data from 30 meter tower

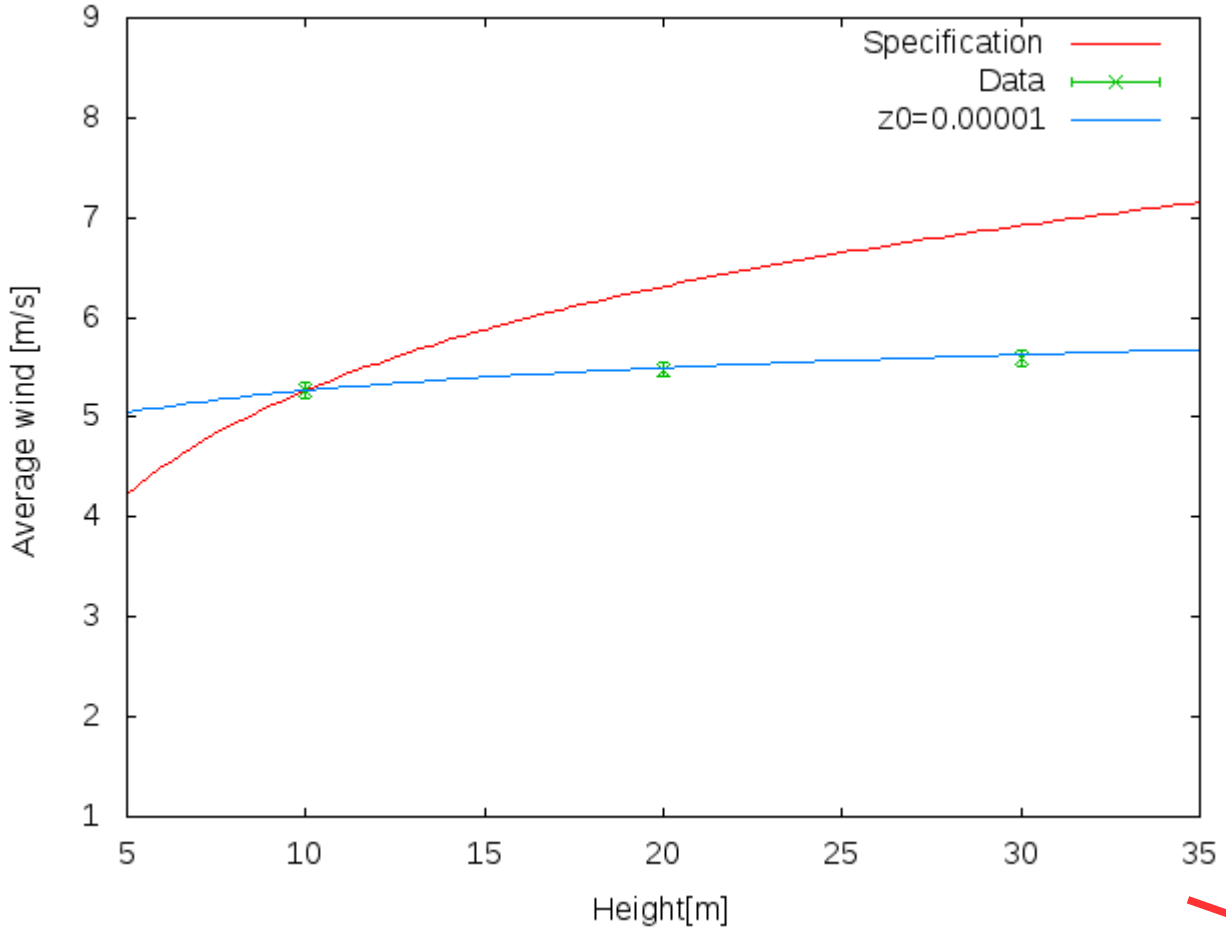
- Wind profile
- Wind turbulence


15
10
5
0
-5
-10
-15
NS Wind [m/s]
-15
-10
-5
0
5
10
15
EW Wind [m/s]
60
50
40
30
20
10
0


10m
20m
30m
Wind speed [m/s]
Time [h]
0
2
4
6
8
10
12
14
16
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24


10m
20m
30m
Wind speed [m/s]
Time [h]
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Wind profile

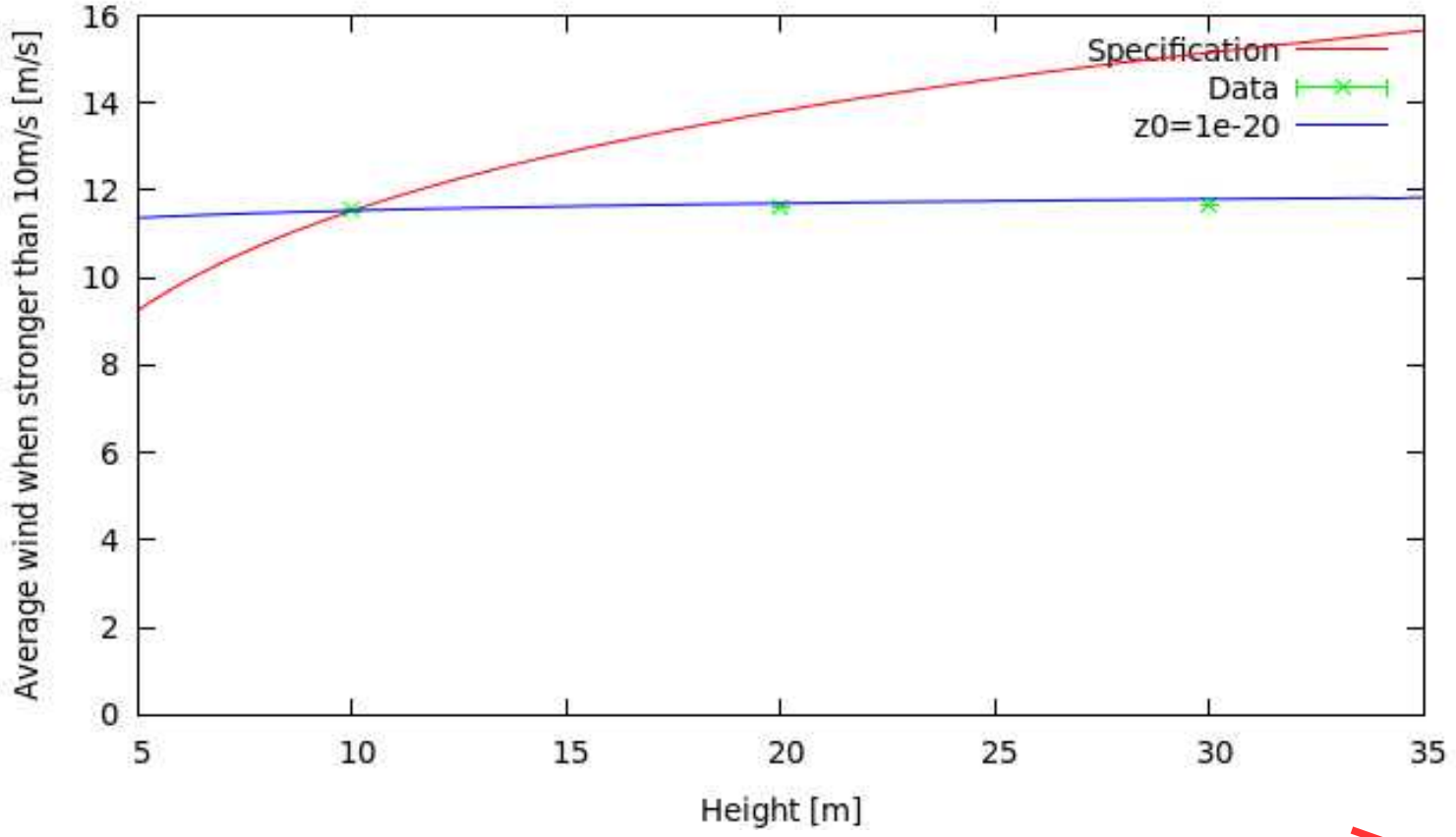


$$V(h) = V(10\mathrm{m}) \times \frac{\ln(h/z_0)}{\ln(10\mathrm{m}/z0)}$$

~~$z_0 = 0.3\,\mathrm{m}$~~

$z_0 = 10^{-5}\,\mathrm{m}$

Wind profile for strong winds



$$V(h) = V(10\mathrm{m}) \times \frac{\ln(h/z_0)}{\ln(10\mathrm{m}/z0)}$$

~~$z_0 = 0.3\,\mathrm{m}$~~

$z_0 = 10^{-20}\,\mathrm{m}$

Wind power spectrum

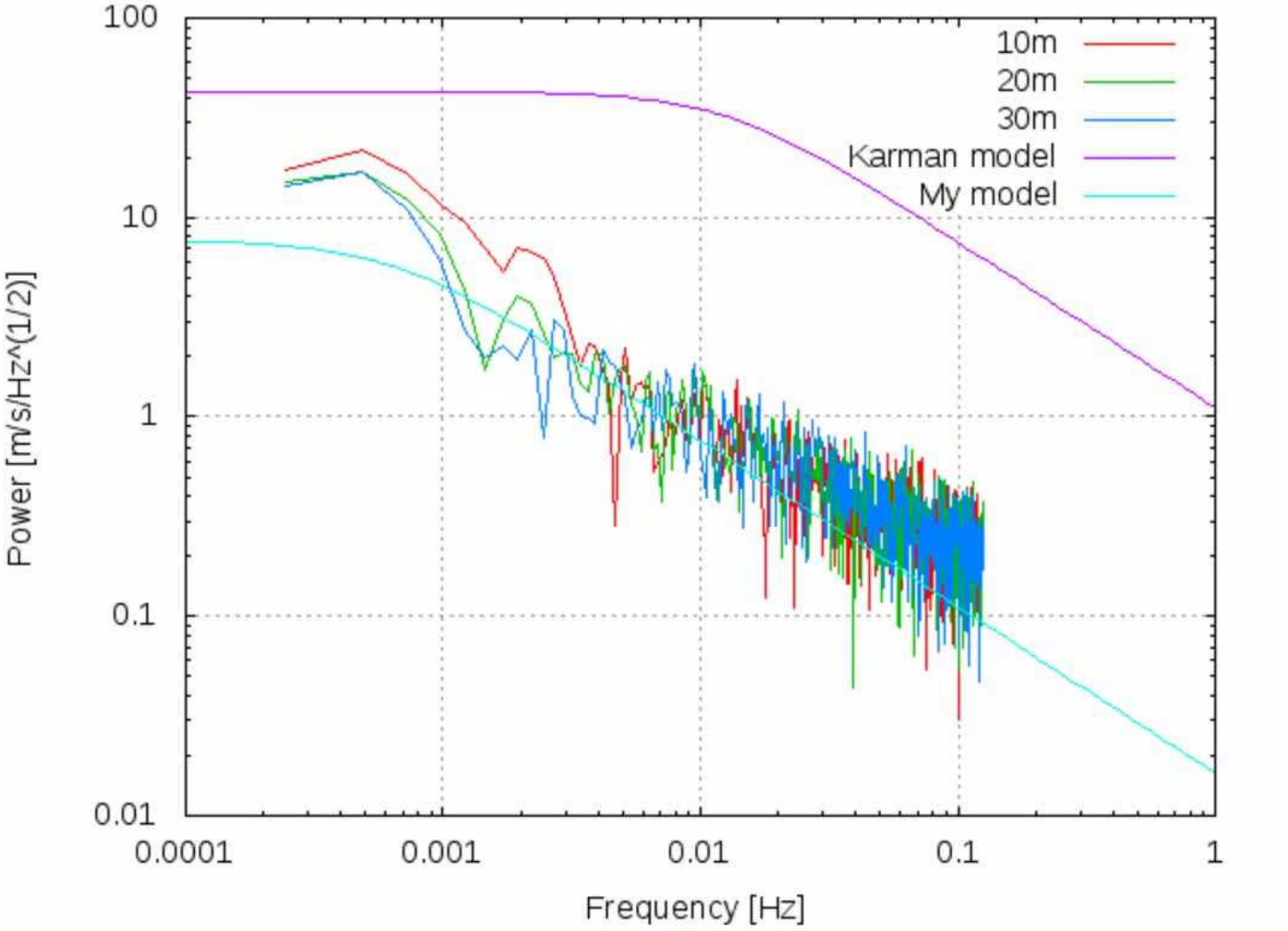
$$s(f) = (IU)^2 \frac{4L/U}{(1 + 70.8(fL/U)^2)^{5/6}}$$

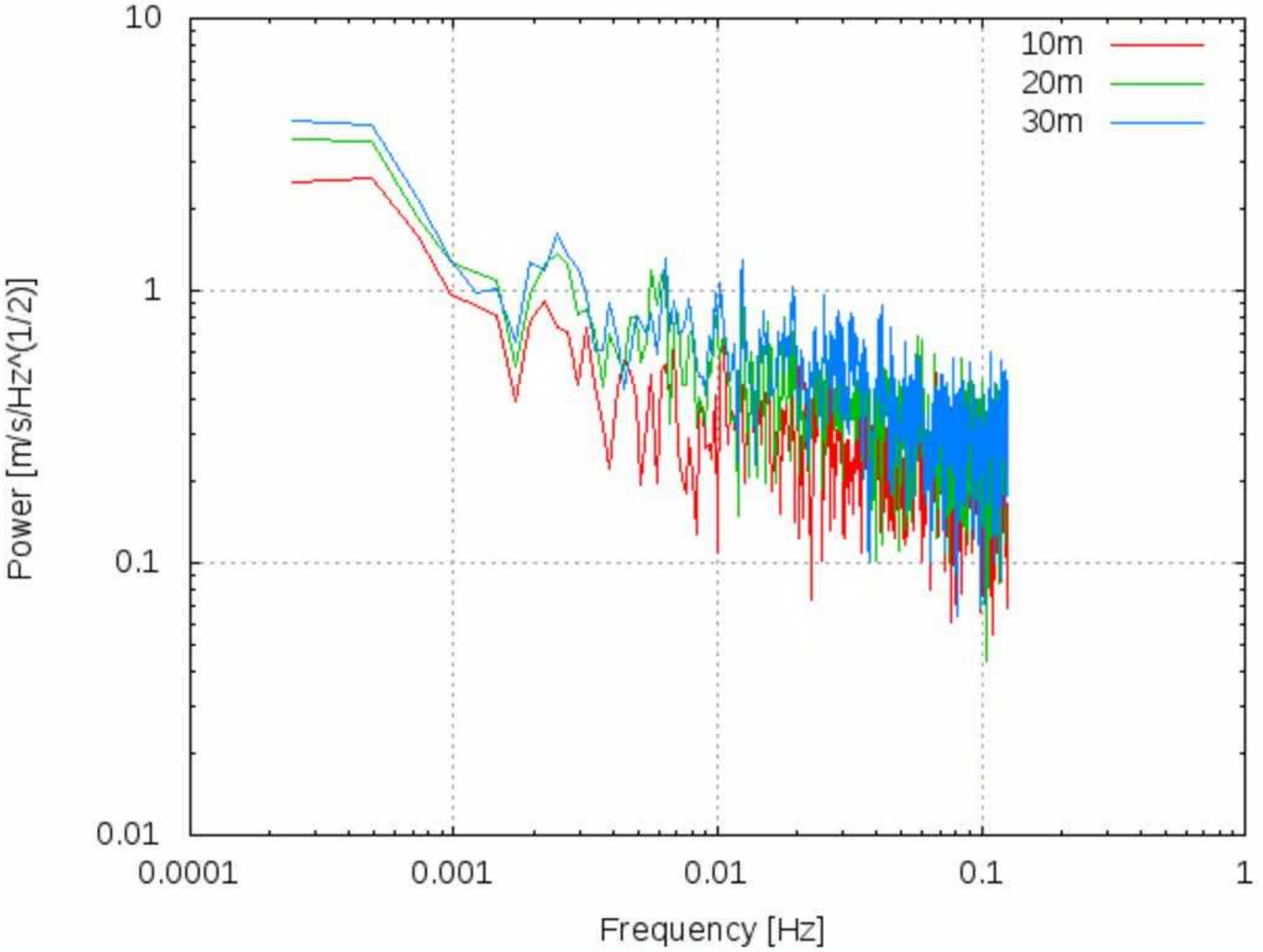
Specification (Karman model)

$$I = 0.25 \quad L = 50m$$ Wrong!

My model – roughly fitting data.

$$I = 0.01 \quad L = 1000m$$


100
10
1
0.1
0.01
0.0001
0.001
0.01
0.1
1
Power [m/s/Hz^(1/2)]
Frequency [Hz]
10m
20m
30m
Karman model
My model


10
1
0.1
0.01
0.0001
0.001
0.01
0.1
1
Power [m/s/Hz^(1/2)]
Frequency [Hz]
10m
20m
30m

Wind conclusions

- Wind profile nearly flat: the air moves at nearly the same speed at all heights
- Wind power spectrum much flatter than assumed for construction
- Probably the observation state requirement can be relaxed, and the observation time will be increased

Summary

- Temprature is within operating range
- Humidity is typically low but not a big problem
- Strong wind episodes but the observing condition can likely be relaxed
- Still analyzing seismic data

Next steps

- Revive the ASC complex power
- Move the 30 meter tower to the actual LST location

12/02/2015 01:26:07