

WPMP - Energy Meteorology

Universität Oldenburg
Semester 2016
01.06.2016

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- 3 Vertical wind speed profile

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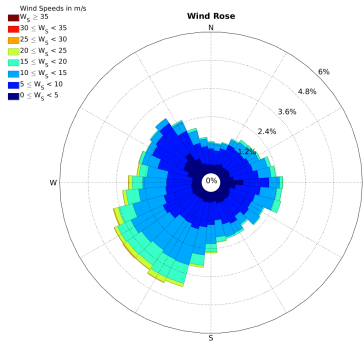
1 Wind Roses

2 Weibull distribution

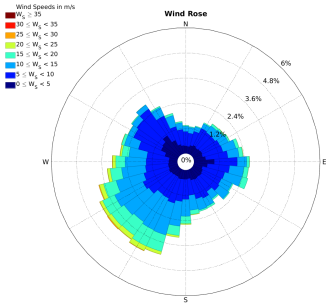
3 Vertical wind speed profile

Wind Rose implementation

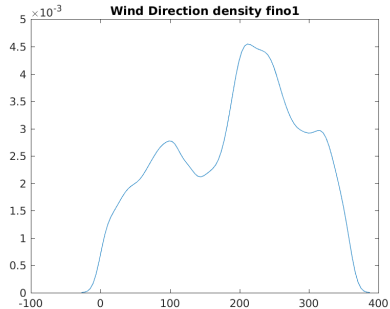
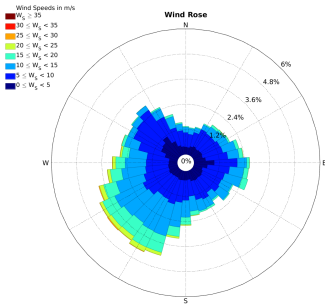
```
1 WindRose( fino1_dgo , fino1_vgo , 'AngleNorth' , 0 , 'AngleEast' , 90 );
```



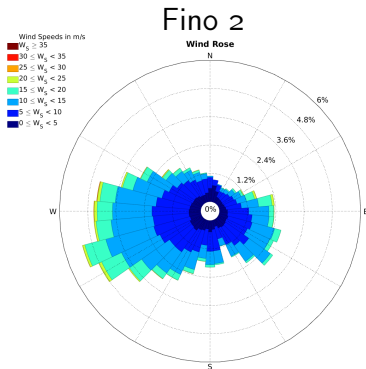
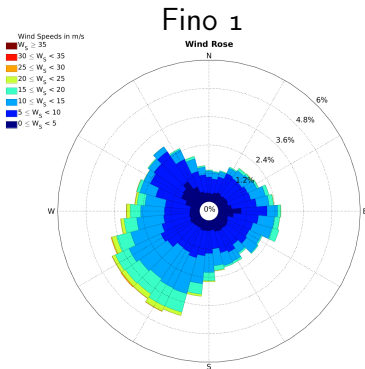
Wind Roses



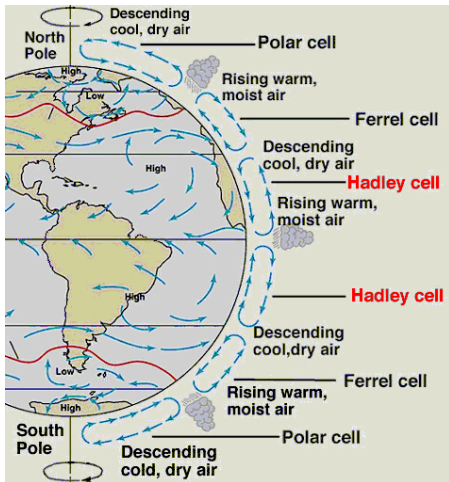
Wind Roses



Wind Roses



Differences



Differences



Obstacles Fino 1

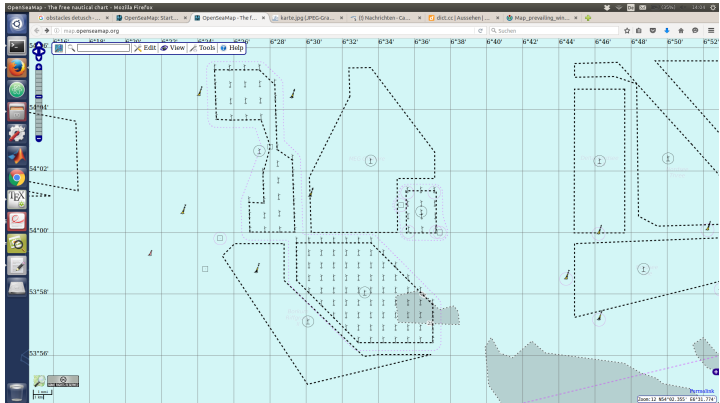


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Computation of Weibull parameters

$$\mu = \lambda \cdot \Gamma\left(1 + \frac{1}{k}\right)$$
$$\sigma^2 = \lambda^2 \cdot \left(\Gamma\left(1 + \frac{2}{k}\right) - \Gamma\left(1 + \frac{1}{k}\right)^2\right)$$

By substitution:

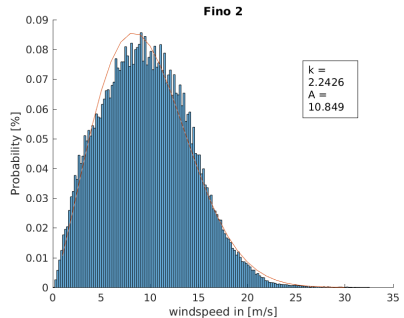
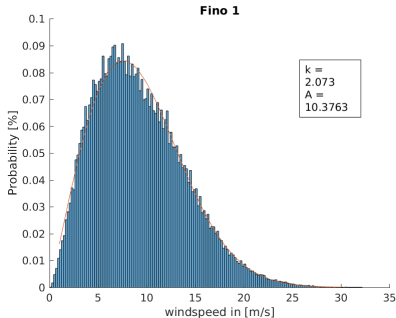
$$\sigma^2 = \left(\frac{\mu}{\Gamma\left(1 + \frac{1}{k}\right)}\right)^2 \cdot \left(\Gamma\left(1 + \frac{2}{k}\right) - \Gamma\left(1 + \frac{1}{k}\right)^2\right)$$

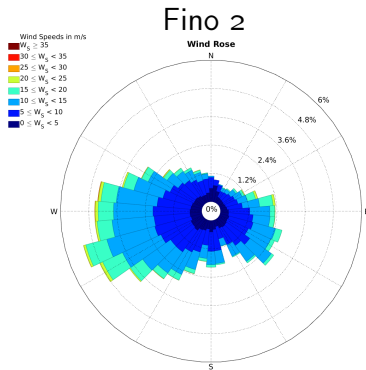
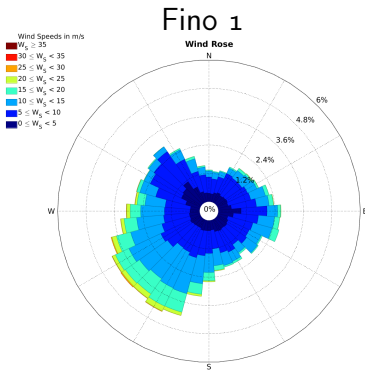
Function to solve:

$$0 = \left(\frac{\mu}{\sigma}\right)^2 \cdot \left(\frac{\Gamma\left(1 + \frac{2}{k}\right)}{\Gamma\left(1 + \frac{1}{k}\right)^2} - 1\right) - 1$$

Weibull Distribution

```
1 k_Fino1 = 1;
  Func_Fino1 = @(k_Fino1) (mean1*mean1/(dev1*dev1))* ...
3  ((gamma(1+2/k_Fino1))/(gamma(1+1/k_Fino1))^2-1)-1
  k_Fino1 = fsolve(Func_Fino1,k_Fino1);
5  A_Fino1 = mean1/gamma(1+1/k_Fino1);
  weibull_Fino1 = wblpdf(1:30,A_Fino1,k_Fino1);
```





5y AEP	Fino 1	Fino 2
Vestas V90 1.8 MW	39,3 GWh	42,6 GWh
Enercon E82 3 MW	46,4 GWh	50,4 GWh

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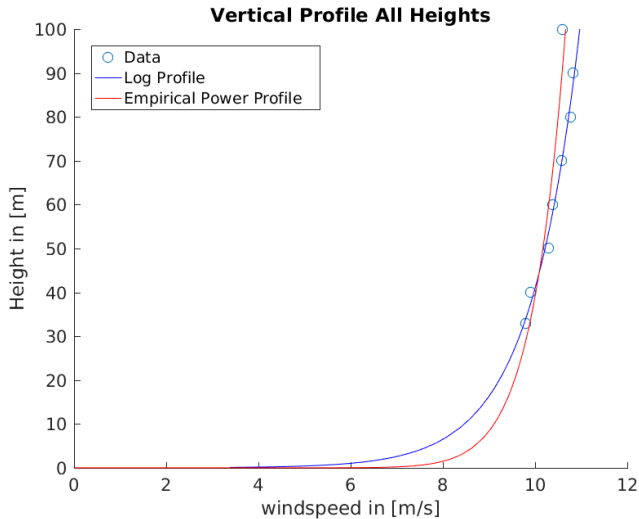
2 Weibull distribution

3 Vertical wind speed profile

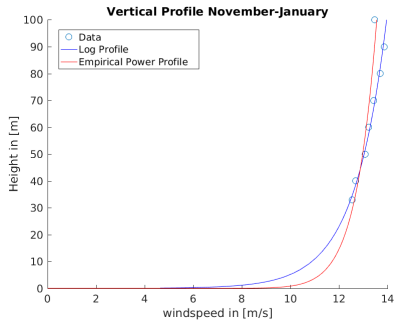
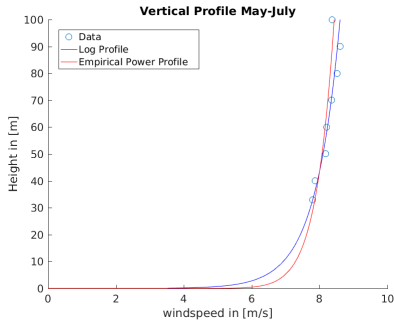
Non-linear regression of vertical profile

```
logProfileModel = @(b,z) b(1)/0.4 * (log(z/b(2)));
2 logProfileCoeffs = nlinfit([33,40,50,60,70,80,90,100], avgPerHeight,
    logProfileModel, [0.2, 10^-6], opts);
[x,y]=fplot(@(z) logProfileCoeffs(1)/0.4 * (log(z/logProfileCoeffs(2))), [0 100])
4
empPowerModel = @(c,x) avgPerHeight(8) * ((x/90).^c(1));
6 empPowerCoeff = real(nlinfit([33,40,50,60,70,80,90,100], avgPerHeight,
    empPowerModel, [0.1 1], opts));
[x,y]=fplot(@(z) avgPerHeight(8) * (z/90)^(empPowerCoeff), [0 100]);
```

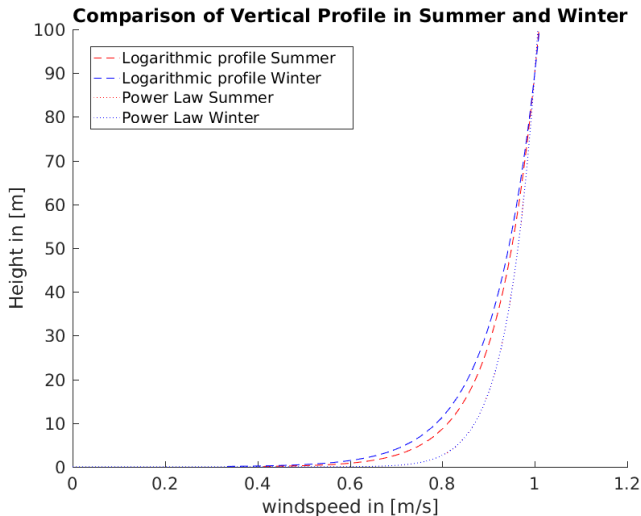
Verticale Profiles for FINO 1



Seasonal analysis of vertical profile



Comparison of regression models



Thanks!