University Oldenburg

Wind Physics Measurement Project

Exercise 2 - Energy Meteorology

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Introduction

The goal of this exercise was to perform a comparison between the north sea and the baltic sea. For the comparison, data from the met masts FINO 1, located in the north sea, and FINO 2, located in the baltic sea, has been used. The FINO 1 data includes wind vanes at heights of $33m, 40m, 50m, 60m, 70m, 80m, 90m$ and eight anemometers at heights $33m, 40m, 50m, 60m, 70m, 80m, 90m$ and $100m$. The given data of FINO 2 contains 4 wind vanes at heights $31m, 51m, 71m$ and $91m$ with anemometers at heights $32m, 42m, 52m, 62m, 72m, 82m, 92m, 102m$.

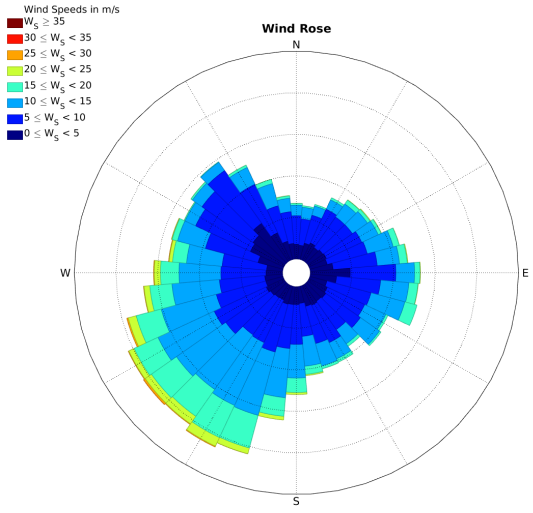
The given time period of ten minutes intervals is of 5 years, starting at 01.01.2010. The following tasks deal with wind roses, Weighbull distributions and vertical wind profile fitting.

1 Wind roses

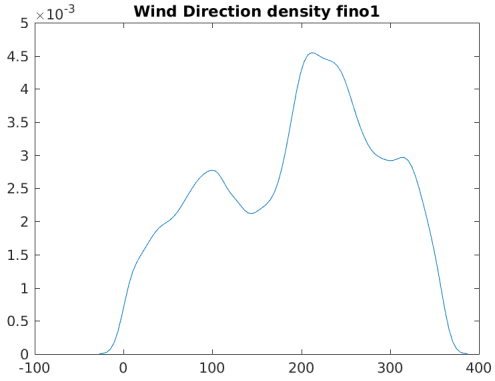
In this task, we were asked to create wind roses for FINO 1 and FINO 2 at around 90m height. We used a already existing routine to create wind roses. (routine used: see ...). In order to obtain correct wind directions we used the following plot routine:

```
1 WindRose(fino1_d90,fino1_v90,'AngleNorth',0,'AngleEast',90);
```

By using the optional arguments *AngleNorth* and *AngleEast* we made sure that our axes are initialized correctly. Before we started to analyse our plots we double checked our wind roses by using a pdf-plot of our wind directions. See **??**.

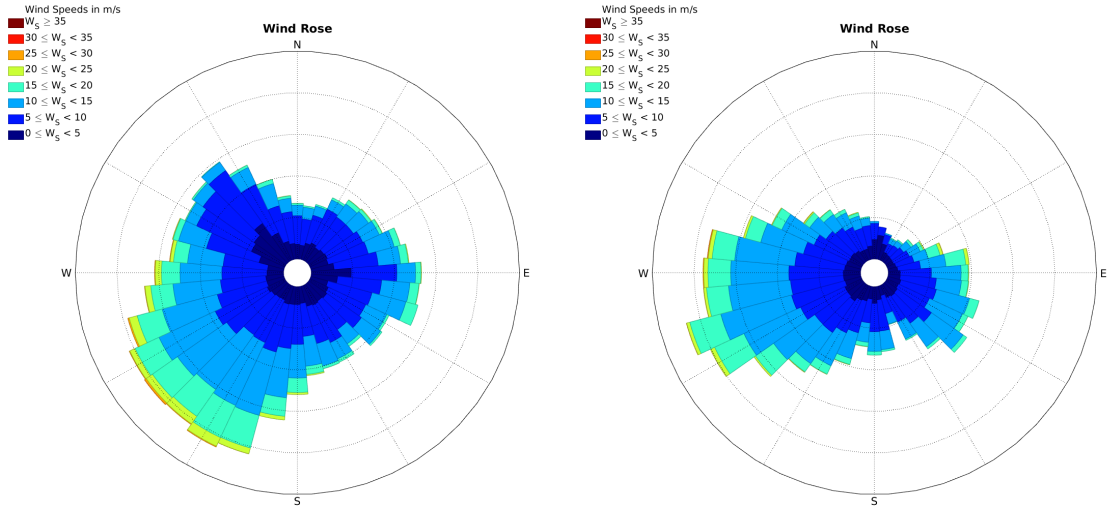


(a) Wind rose of FINO 1



(b) pdf plot FINO 1

The pdf plot confirms that most of the wind is coming from south-west direction. This is identical with our FINO 1 wind rose. The same approach was used to confirm the wind rose created from FINO 2. (see Appendix) After confirming our plots we compared the wind roses. See



(a) Wind rose of FINO 1

(b) Wind rose of FINO 2

We observe that wind directions measured at FINO 1 are more likely to have a south-western direction. Most of the wind is coming from that direction. For FINO 2, located in the baltic sea, the wind directions are less distributed and have almost exclusively western and eastern directions. The difference in wind directions might be due to different pressure fields in the north sea and Baltic sea.

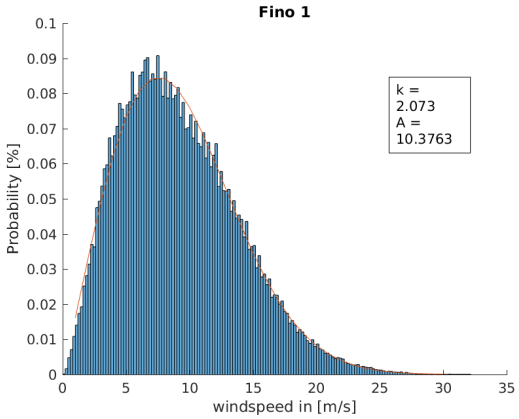
2 Weighbull distribution

In Task 2 we created histograms at around $90m$ height. Next we we calculated the weibull parameters, with the mean and standard deviation of the measured wind speeds. For the further calculation we used the equations provided during the lecture. We implemented the functions in Matlab and solved for the weibull parameters A and k. With the calculated parameters we created our weibull distribution.

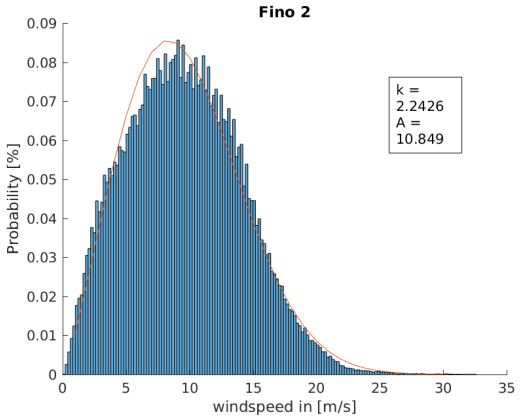
```
%% Task 2
mean1 = nanmean(fino1_v90);
dev1 = nanstd(fino1_v90);

mean2 = nanmean(fino2_v92);
dev2 = nanstd(fino2_v92);

% interpolate
k_Fino1 = 1;
Func_Fino1 = @(k_Fino1) (mean1*mean1/(dev1*dev1))*((gamma(1+2/k_Fino1))/(gamma(1+1/
    k_Fino1))^2-1)-1
k_Fino1 = fsolve(Func_Fino1,k_Fino1);
disp(k_Fino1);
A_Fino1 = mean1/gamma(1+1/k_Fino1);
weibull_Fino1 = wblpdf(1:30,A_Fino1,k_Fino1);

k_Fino2 = 1;
Func_Fino2 = @(k_Fino2) (mean2*mean2/(dev2*dev2))*((gamma(1+2/k_Fino2))/(gamma(1+1/
    k_Fino2))^2-1)-1
k_Fino2 = fsolve(Func_Fino2,k_Fino2);
disp(k_Fino2);
A_Fino2 = mean2/gamma(1+1/k_Fino2);
weibull_Fino2 = wblpdf(1:30,A_Fino2,k_Fino2);
```

Figure shows the histogram for Fino 1 and Fino 2 with the corresponding weibull fit.

3 Vertical wind profiles



(a) Histogram with weibull fit FINO 1



(b) Histogram with weibull fit FINO 2