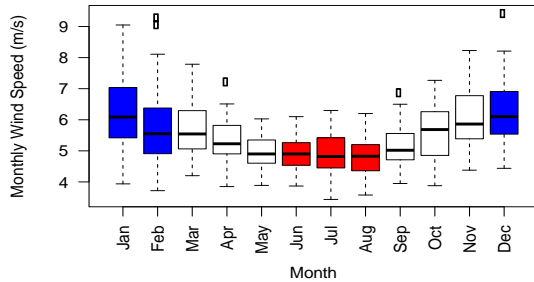


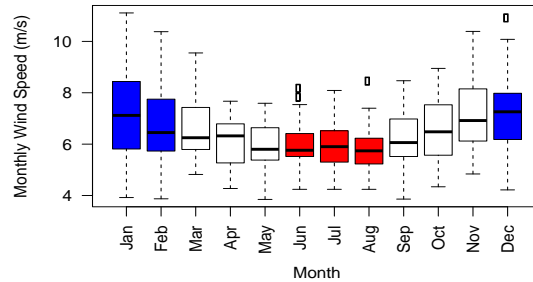
# STAT1006, 2018: report on Dutch wind

## 1. Description of data

Boxplot of Average Wind speed by Months in Vlissingen

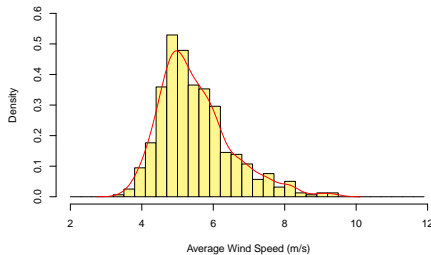


Boxplot of Average Wind speed by Months in Hoek van Holland

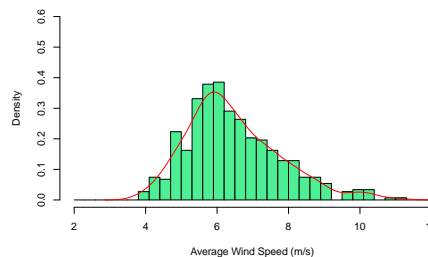


The boxplots for Vlissingen and Hoek van Holland follow a very similar pattern. It is obvious that the monthly average wind speed in winter is relatively higher than that in summer. This may be explained from a geography perspective. As the temperature in winter is lower (compared to summer), then a higher atmospheric pressure is expected, therefore the wind speed should be higher on average. The month with largest average wind speed in Vlissingen is January, which has a value of 6.327 m/s, and the month with the smallest average wind speed is August, with the value 4.828 m/s. For Hoek van Holland, the month with the greatest average wind speed is November, and is of value 7.256 m/s, while August has the smallest average wind speed which is 5.793 m/s. Moreover, the variability of wind speed in winter is greater than that in summer. This might be caused by a change in temperature. Greater fluctuation of temperature causes greater variation in atmospheric pressure in winter, thus the average wind speed in winter is expected to have a higher variance.

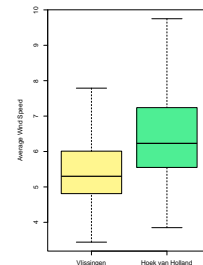
Histogram of Average Wind Speed in Vlissingen



Histogram of Average Wind Speed in Hoek van Holland

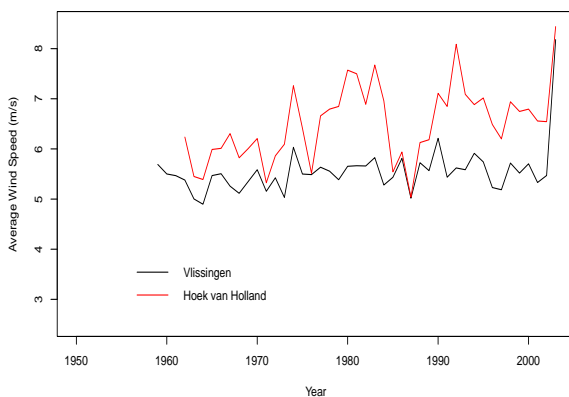


Boxplot of Monthly Average Wind Speed



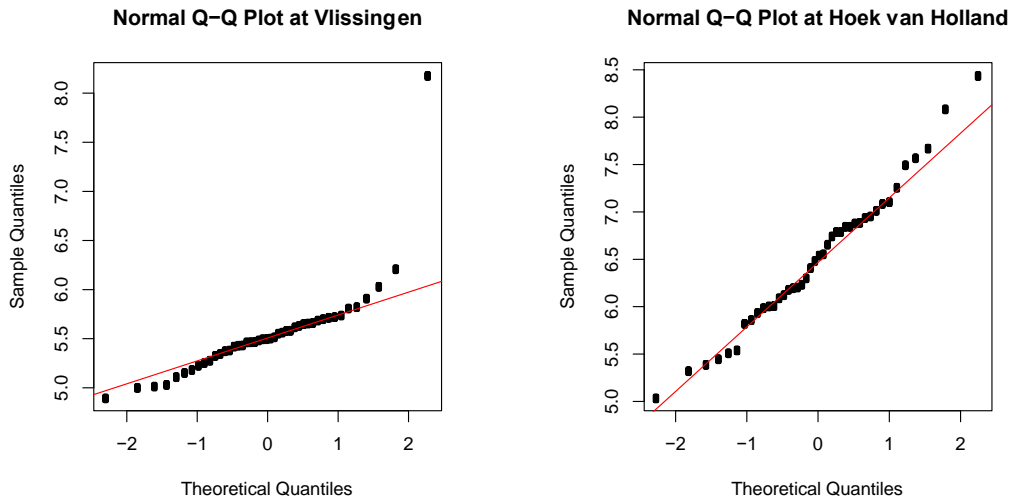
Both histograms of average wind speed at the two locations look positively skewed. The data of Vlissingen is concentrating in the range (4, 6) while those for Hoek van Holland's spread more widely. This can be shown in terms of variance: the variance of average wind speed for Vlissingen is 1.027, the variance for Hoek van Holland is 1.710, which is bigger. And it is quite clear that Hoek van Holland would have a mean (6.465) larger than Vlissingen's (5.499).

Year Average Wind Speeds



The series plot on the left shows that the change in average wind speed each year followed a very similar pattern at these two places. Furthermore, change in wind speeds in Vlissingen each year remains relatively stable, while Hoek van Holland's fluctuated throughout the whole period. And again, it is quite clear that the annual average wind speed of Vlissingen kept below those of Hoek van Holland throughout the whole period, which means it tends to have a smaller mean as the histograms suggest.

## STAT1006, 2018: report on Dutch wind



The shapes of QQ plot of yearly average wind speeds of the two locations are quite different. Data for Hoek van Holland fit the theoretical line quite well, which suggests that the data might follow a normal distribution. Meanwhile, the graph for Vlissingen shows that the data is heavily tailed, and an outlier appears at the top right corner.

### 2. Tests

The null hypothesis and alternative hypothesis are denoted by  $H_0$  and  $H_1$  respectively.

The hypothesis tests used are called “two sample t-test”

In all three cases, the significance level chosen is 1%.

If the p-value is less than 1%, then  $H_0$  will be rejected, otherwise it will not be rejected.

a) Data: The Yearly Average reading of wind speed from 1950 to 1976 and from 1977 to 2003 for Vlissingen. (Note: The data for year 1959 and 2003 has been removed since not all the average readings of every month in these years has been provided and data of 2003 is an outlier.)

$H_0$ : There is no difference in means between average wind speed of 1950 – 1976 and of 1977 – 2003

$H_1$ : Their means are different

The p-value is 0.01528057

The conclusion on the test is that there is insufficient evidence suggest that the yearly average wind speed 1950 – 1976 and 1977 – 2003 for Vlissingen have different means.

b) Data: the average reading of wind speed of Summer (June, July and August) and winter (December, January and February) for Hoek van Holland.

$H_0$ : There is no difference in means between Average Wind Speed in Summer and Winter

$H_1$ : The mean of average wind speed in Summer is less than mean in Winter.

The p-value is 7.214951e-08.

The conclusion on the test is that there is sufficient evidence to suggest that average wind speed in summer is less than in Winter for Hoek van Holland.

c) Data: the average reading of wind speed over the whole period for Hoek van. Holland and Vlissingen.

$H_0$ : The means of Average reading of wind speed over the whole period of Vlissingen and Hoek van Holland are the same.

$H_1$ : The mean of average reading of wind speed over the whole period of Vlissingen is less than the mean for Hoek van Holland.

The p-value is 7.181582e-11

The conclusion on the test is that there is sufficient evidence to suggest that the mean of average reading of wind speed for Vlissingen is less than the mean for Hoek van Holland.