Assignment 1 (Mean wind speed and the Weibull distribution)**.**

You will investigate two different data sets of wind measurements, in the context of probability functions:

1. Many years of data, including wind speed and direction from a 70 m-tall mast at the island of Sprogø in the Great Belt, Denmark—
   - the file is named `sprogo_1.zip` ;
   - the data columns are time, wind speed at 70m, wind direction at 67.5m and wind direction at 70m ;
   - invalid data are indicated by '`999`' ;
   - all data are 10-minute averages.
2. A few hours data of turbulence measurements from the DTU Høvsøre test station in Jutland, Denmark—
   - the file is named `hovsore_1.zip` ;
   - the 2 columns are time and streamwise wind velocity component;
   - invalid data are indicated by '`999`' ;
   - the data are sampled at 20 Hz .

Inspect the time-series and do the following tasks:

1. Calculate the mean and standard deviation for each data set.
2. Plot the probability density function (pdf) for each data set.
3. Plot the cumulative distribution function for each data set.
4. For the Høvsøre data, also plot the *theoretical* (ideal) predicted pdf on top of the data; use normalized variables.
5. For Sprogø data set you should estimate the A and k parameters of the Weibull distribution using two different methods:
   - estimation based on the first and second (non-central) moments, μ and m_2;
   - estimation based on the third moment, m_3, and the percentile $F(\mu)$ (this is also used in the WaSP/Wind atlas method).
6. Based on the parameters estimated in task 5, plot the theoretical Weibull-pdfs, together with the Sprogø data's pdf from task 2 above.
7. Investigate the Sprogø data conditioned on wind direction: divide the data into twelve directional sectors (30° wide) and centered on 0°, 30°, ... , 330° (be careful around 0°). For each sector, calculate A and k based on one of the two methods discussed in 5 above, and compare the fit to theory with the measured data.
8. What are the seasonal and daily trends in the Sprogø data? Answer this by calculating appropriate statistics, and produce meaningful plots.

What can you additionally conclude from your analysis?