Engineering 1D04
Assignment IX

The following is due at the **BEGINNING** of the tutorial (JHE/317-319) the week of March 24 to 28, 2003:

1) The pseudo-code for the given problem. This must be typed, not hand-written. Make sure that you keep a copy of the pseudo-code so that you can use it to develop your C code. You will also need a copy to hand-in as an appendix for the next assignment.
2) Answers to the question(s) provided at the end of this assignment.

NOTE: Please include your tutorial number on every assignment. Also, remember that at the top of the first page of every assignment the following must be included:

"This assignment represents my own work"

followed by your signature, and your e-mail address. You need to include this information, or your assignment mark will be ZERO. Late assignments should be taken to the Drop-In-Centre (ITB/101). Late assignments will not be accepted after 4:30 on the day of your tutorial.

Problem

During scientific and engineering experiments, large volumes of raw data are often produced. Recently an experiment on contaminant transport was performed in the North Atlantic. Among others values, the measurements of wind velocity W over the ocean surface were carried out. To make measurements a sonic anemometer was used. The wind velocity was measured systematically every Δt seconds producing several thousand readings.

You are required to make a preliminary analysis of field data to describe the behaviour of a single dust particle over the ocean surface and to estimate the surface drift currents and surface conditions during the field experiment. You can assume that a particle has the same density as the surrounding medium, and is influenced only by the wind blowing along the x-axis (one dimensional problem)

The assignment is a continuation and modification of Assignment 7. You can use any part(s) of Assignment 7 to develop data declaration and a pseudo-code to accomplish the following:

(a) Input the raw data from a text file that contains one column of data, that are the values of wind velocities (m/s) in the sequential moments of time. The first measurement was done at t_0

(b) Your pseudo-code must allow to a user
- to input the initial time (t_0) of the beginning of measurements and
- to input the time step (Δt) and
- to compute the times of the measurements, using the following formula: $t_{i+1} = t_i + \Delta t$.

The text file storing the raw data is called *data.txt* and it is available on the course web site. The data file has at most 3×10^3 data points.

The raw data is read into an array of structures. Each structure contains two fields: the moments of time when the measurement was done (you have to calculate it using the above formula for t_{i+1}) and the wind velocity.

(c) Divide the set of field data into some separate sections (let us say the number of sections will be NS); each section should have the same number of the data points, and data points should be for consecutive time steps.

- You can assume that the number of data points will be evenly divisible by the number of sections (NS). For this assignment, assign the value of 5 to the constant NS.

(d) Calculate for **each section:**

(i) the average value of the surface drift currents for the period of measurements (within each section).
(ii) the maximum magnitude of the acceleration values for a single dust particle in the atmosphere near the water surface for the period of measurements (within each section).
(iii) the average value of wind velocity for the period of measurements (within each section).
(iv) the surface conditions using the approach of Assignment 7, except that in this case it is the average wind velocity that determines the surface condition value.

- The computations for each separate section should be stored in an array of structures containing four fields

(e) Calculate using the **entire data set**

(i) the total time elapsed
(ii) the average value of wind velocity

(f) Output the results of (d) and (e) to the screen and to a text file

- The results of calculations obtained within the part (d) should be presented in a form of a simple table containing four fields

NOTES:

- The assumptions about the contaminant transport as well as the mathematical model of the Assignment 7 can be used to solve this problem.
- As in Assignment 7, the main program should simply be a combination of subroutines.