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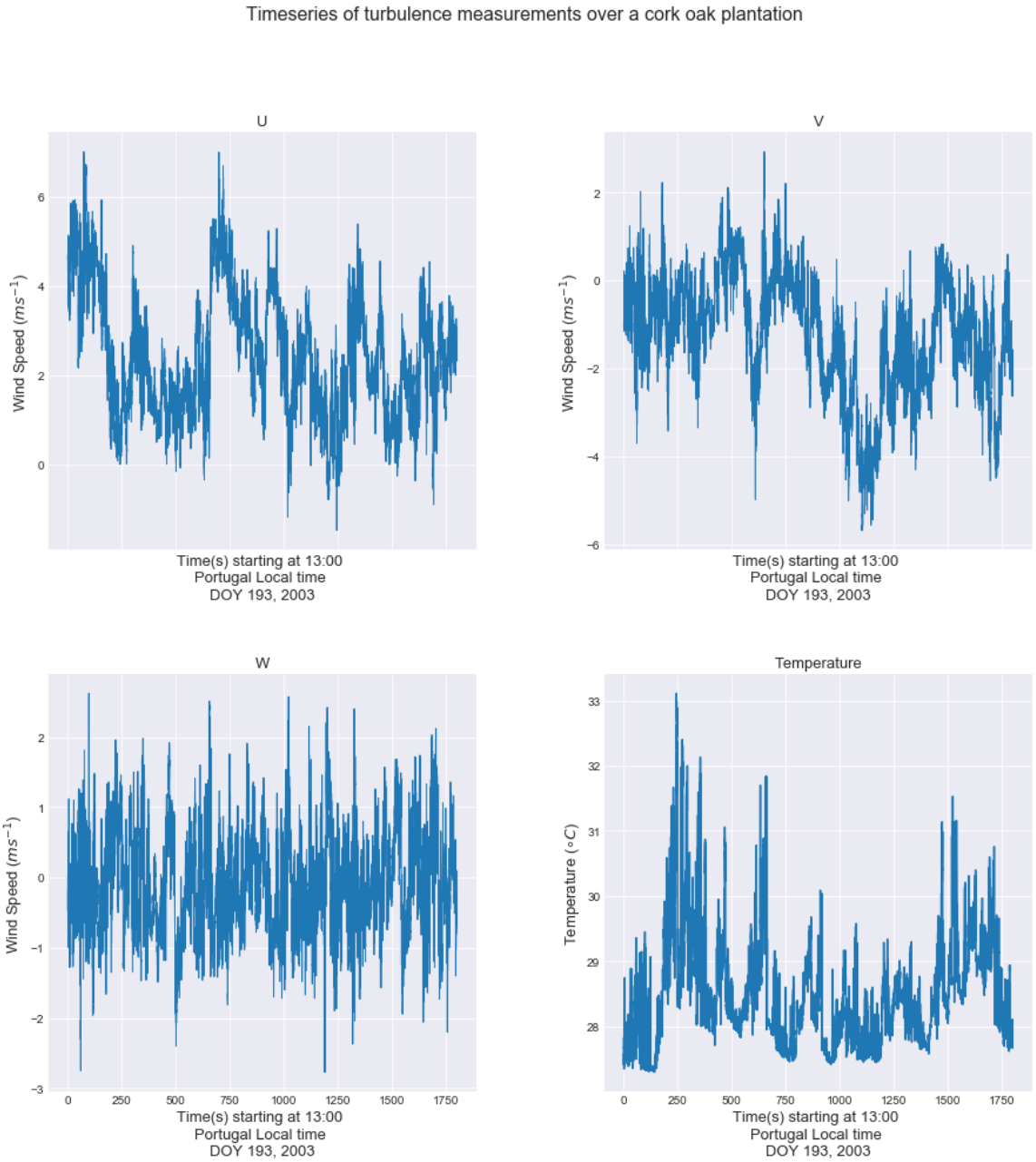
UBC ATSC 303 Lab 10

Eddy Correlation and Sensible and Latent Turbulent Heat Fluxes

Part 1

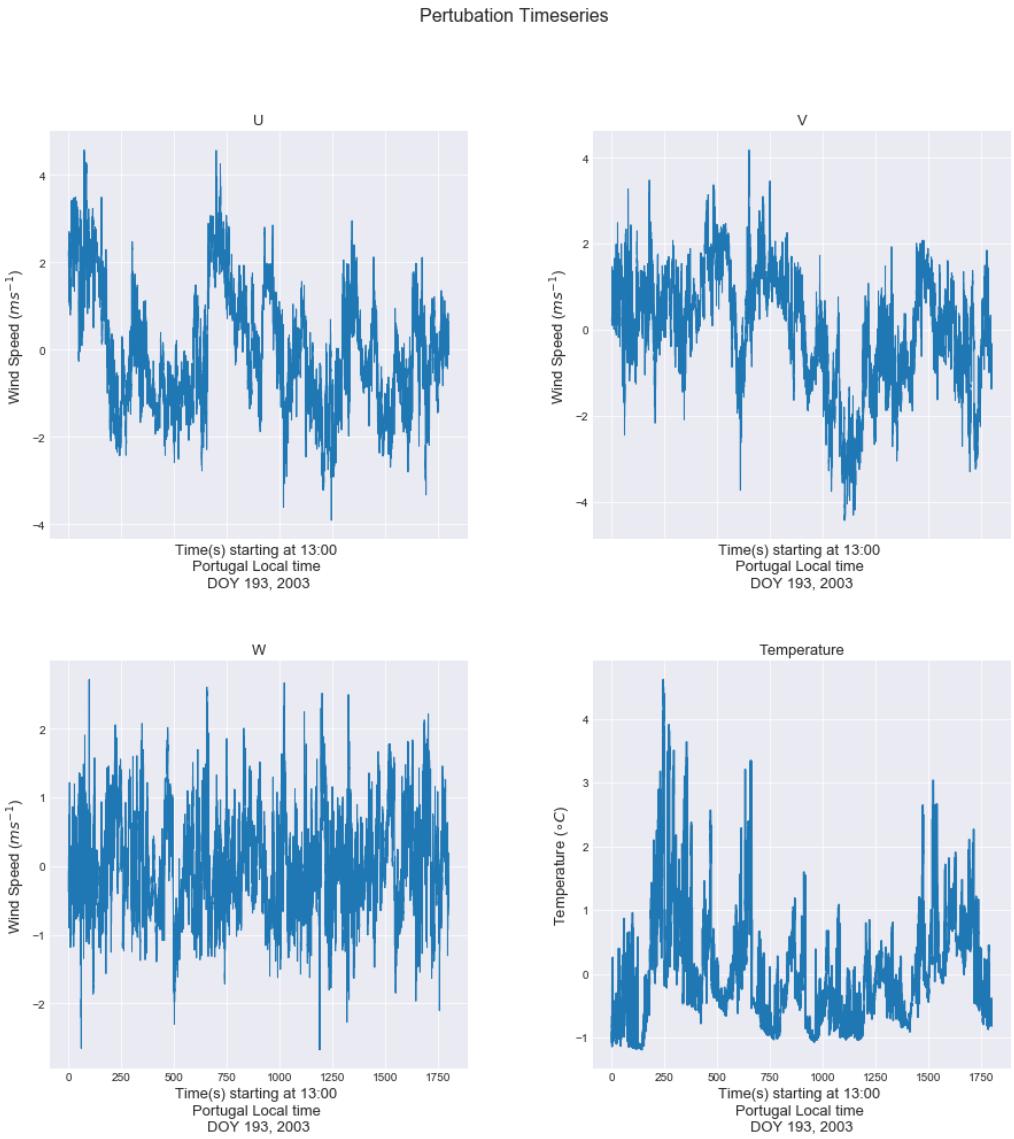
1. Timeseries of the raw data



2. Mean values are as follows:

Average U is 2.4259 ms^{-1}
Average V is -1.2518 ms^{-1}
Average W is -0.0967 ms^{-1}
Average TEMP is 28.4918 ℃

3. Perturbation timeseries



4. Mean value of each perturbation is 0 because the perturbations itself are like de-trending and setting the mean to 0. So the mean of that value is thus also 0.

5. Variance of U is 1.8589 $m^2\ s^{-2}$
Variance of V is 1.7282 $m^2\ s^{-2}$
Variance of W is 0.4779 $m^2\ s^{-2}$
Variance of T is 0.7337$℃^2$
The turbulence is *not* isotropic since $\sigma_u^2 \neq \sigma_v^2 \neq \sigma_w^2$

6. $TKE = \frac{1}{2} * (\sigma_u^2 + \sigma_v^2 + \sigma_w^2)$
   TKE is 2.0325 $m^2\ s^{-2}$
7. Turbulent Intensity of U is 0.562
   Turbulent Intensity of V is -1.0502
   Turbulent Intensity of W is -7.1471
   Turbulent Intensity of T is 0.0301

   The turbulent intensity is greatest in the W direction.
8. Average U'W' is -0.2848 $m^2\ s^{-2}$ → Reynold's Stress/ Turbulent momentum flux
   Average V'W' is 0.1021 $m^2\ s^{-2}$ → Turbulent momentum flux
   Average T'W' is 0.3086 C m s^{-1} → Kinematic vertical heat flux

9. Sensible Heat Flux is 310.0416 Wm^{-2}
   Stress is 0.2848 Pa (Using Stull 18.38c) = 0.0002848 kPa.

10. 775.1041 Wm^{-2}
11. 0.31 mm per day
12. $0 = F^* + F_H + F_E - F_G =$
    $0 = F^* + 310.0416 + 775.1041 - 0.1F^*$
    $0.9F^* = -1085.1457$
    $F^* = -1205.7174\ Wm^{-2}$

Part 2

1. Average mixing ratios
   a. Average 2m Mixing Ratio is 2.5717
   b. Average 10m Mixing Ratio is 2.6569

2. Using Stull 3.57,3.58 and 3.59:
   Average Sensible Heat Flux is -29.4949
   Average Latent Heat Flux is -2.1586

3. The sensible heat flux is much larger than the latent heat flux, with both pointing down into the surface (negative). This would mean heat is transferred from the atmosphere to the ground and condensation is taking place. The negative sensitive heat flux could happen mainly at nighttime or in this case due to overcast skies.
4. Instantaneous data might not show the overall energy transfer and is too turbulent due to which averages were used.