# Appendix

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## MSE and $R^2$ averaged over the heights: comparison seasons wise and year wise

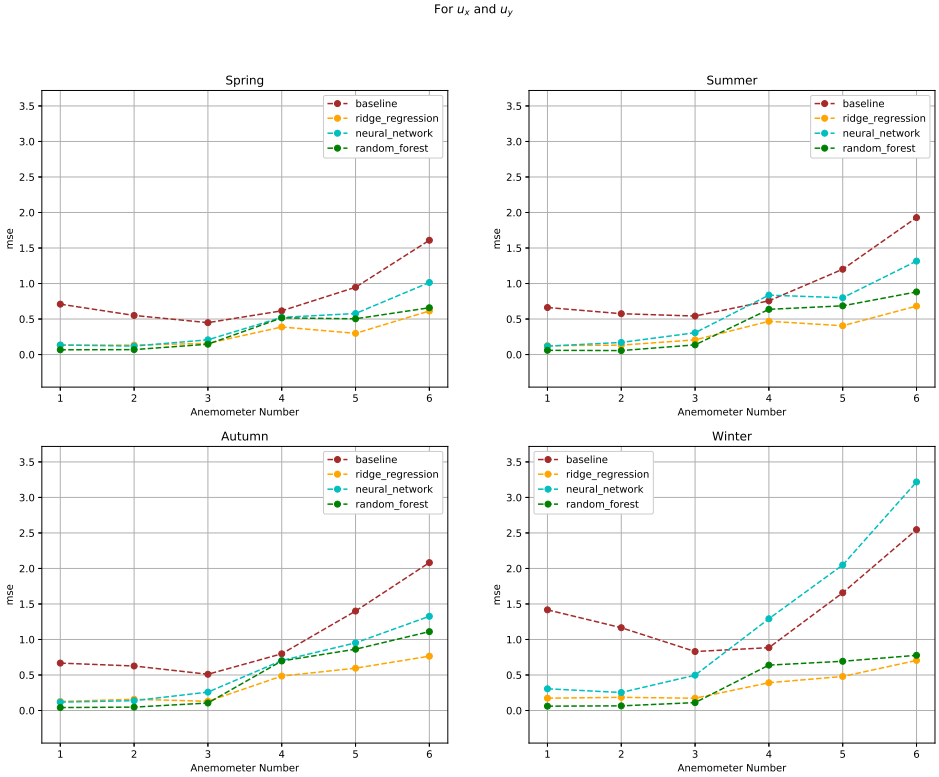


Figure 1: Mean Squared Error for the wind speed

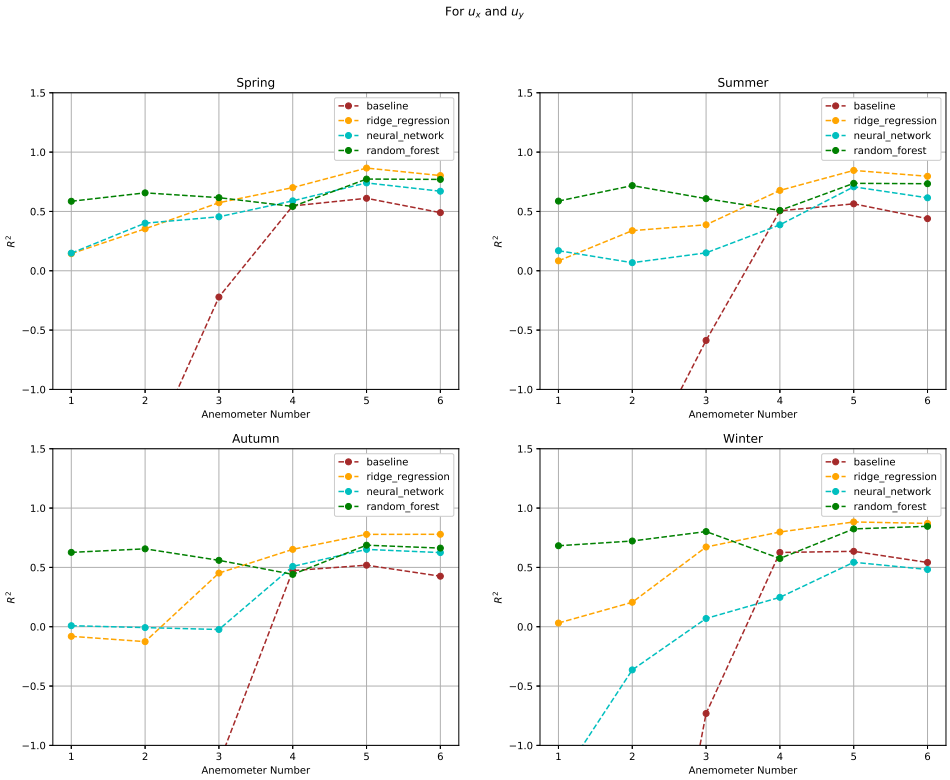


Figure 2: R squared for the wind speed

# Wind profile graphs

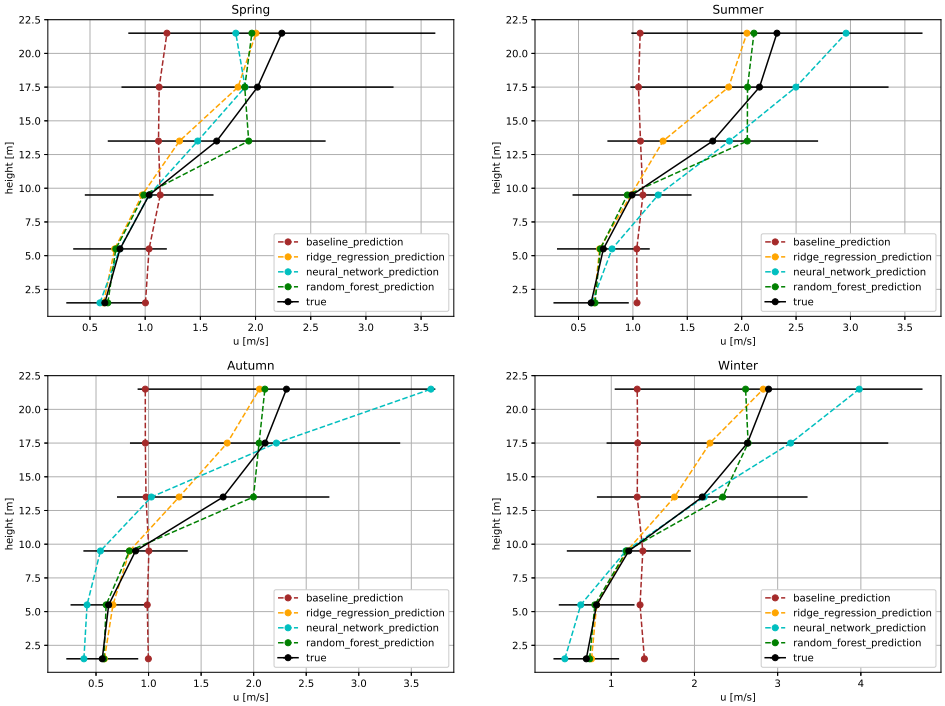


Figure 3: Wind Speed Profile for the different Seasons and regressions methods

## Metrics Comparison Regression Models

Table 1: Mean Squared Errors: Ridge Regression

| Anemometers | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Spring | 0.62 | 0.74 | 0.97 | 1.30 | 1.83 | 2.02 |
| Summer | 0.64 | 0.70 | 0.96 | 1.27 | 1.92 | 2.04 |
| Autumn | 0.58 | 0.65 | 0.83 | 1.29 | 1.70 | 2.02 |
| Winter | 0.75 | 0.82 | 1.18 | 1.76 | 2.16 | 2.79 |

Table 2: Mean Squared Errors: Random Forest

| Anemometers | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Spring | 0.068 | 0.070 | 0.137 | 0.517 | 0.500 | 0.657 |
| Summer | 0.059 | 0.057 | 0.138 | 0.634 | 0.687 | 0.882 |
| Autumn | 0.042 | 0.048 | 0.104 | 0.698 | 0.864 | 1.115 |
| Winter | 0.062 | 0.065 | 0.118 | 0.635 | 0.686 | 0.775 |

Table 3: Mean Squared Errors: Neural Network

| Anemometers | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Spring | 0.134 | 0.119 | 0.207 | 0.523 | 0.578 | 1.014 |
| Summer | 0.118 | 0.170 | 0.307 | 0.836 | 0.800 | 1.316 |
| Autumn | 0.118 | 0.139 | 0.259 | 0.703 | 0.952 | 1.326 |
| Winter | 0.306 | 0.253 | 0.497 | 1.292 | 2.049 | 3.218 |

Table 4: R squared: Neural Network

| Anemometers | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Spring | 0.134 | 0.119 | 0.207 | 0.523 | 0.578 | 1.014 |
| Summer | 0.118 | 0.170 | 0.307 | 0.836 | 0.800 | 1.316 |
| Autumn | 0.118 | 0.139 | 0.259 | 0.703 | 0.952 | 1.326 |
| Winter | 0.306 | 0.253 | 0.497 | 1.292 | 2.049 | 3.218 |

# Example of Ridge regression fitting behaviour, Summer

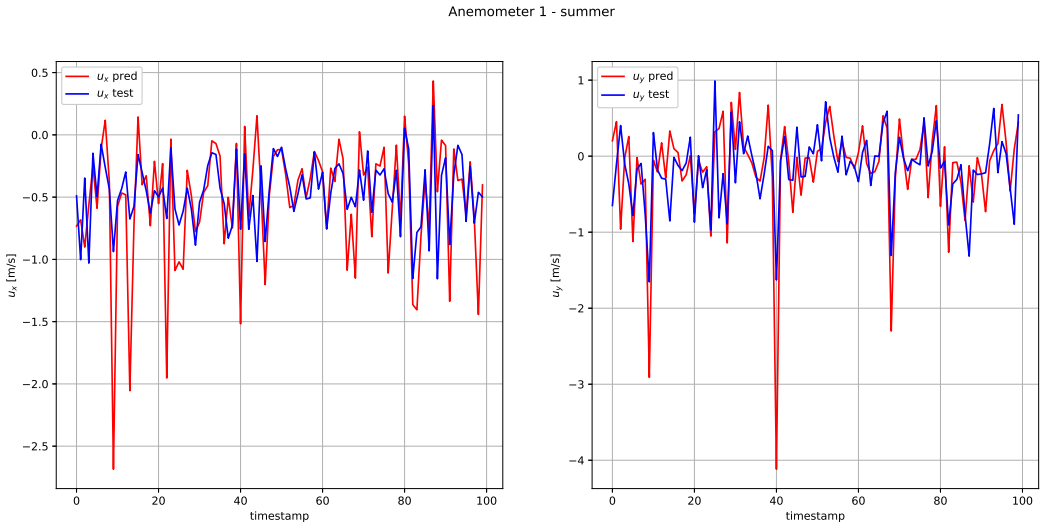


Figure 4: Graphical representation of the regression fit of the testing sample for anemometer 1 in Summer

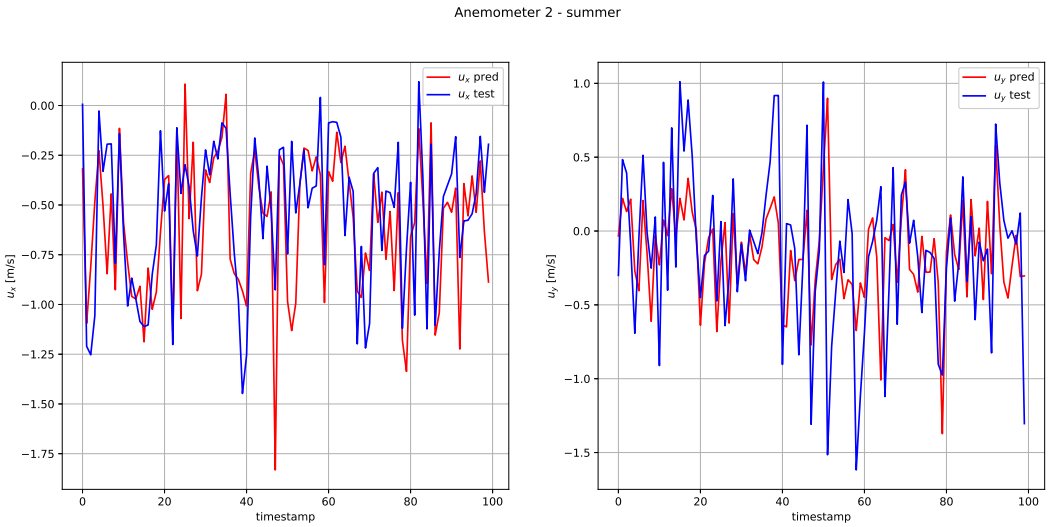


Figure 5: Graphical representation of the regression fit of the testing sample for anemometer 2 in Summer

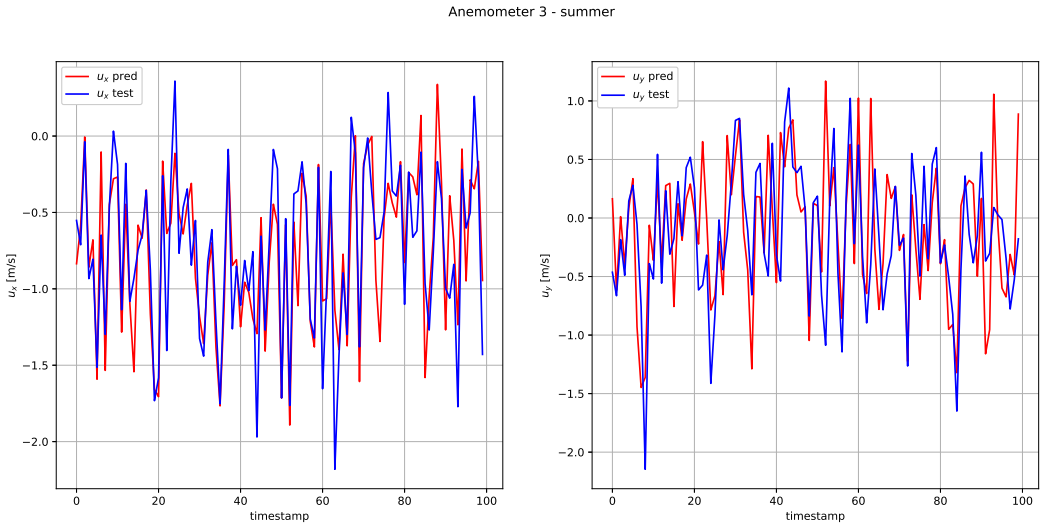


Figure 6: Graphical representation of the regression fit of the testing sample for anemometer 3 in Summer

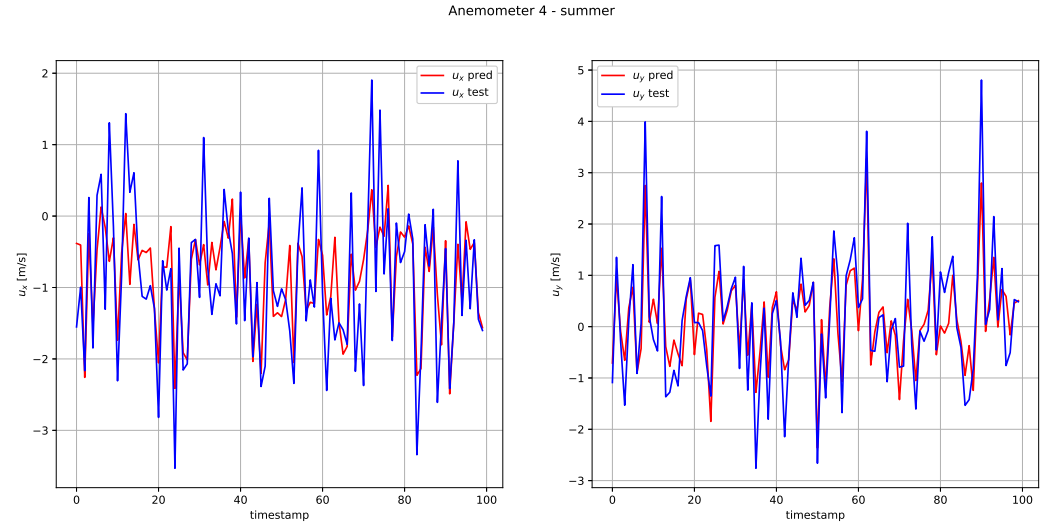


Figure 7: Graphical representation of the regression fit of the testing sample for anemometer 4 in Summer

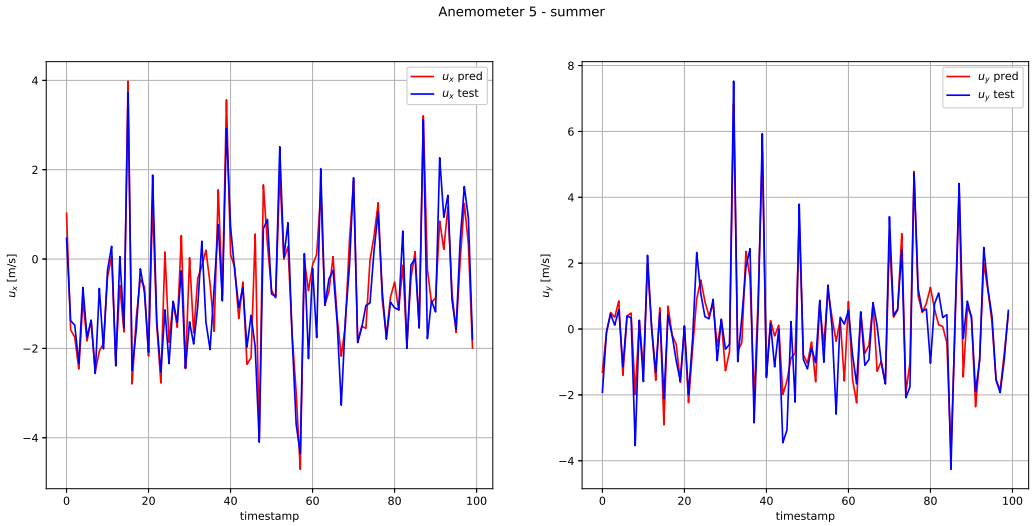


Figure 8: Graphical representation of the regression fit of the testing sample for anemometer 5 in Summer

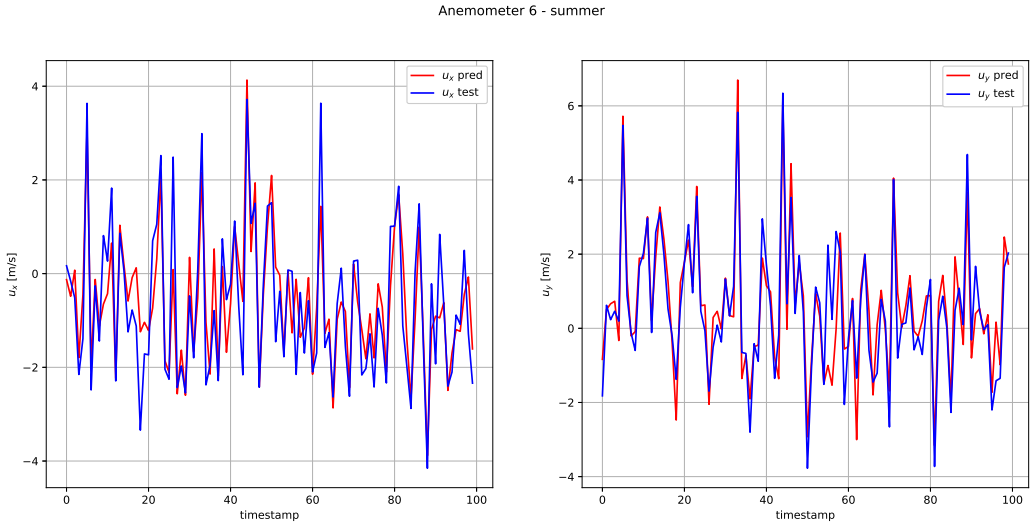


Figure 9: Graphical representation of the regression fit of the testing sample for anemometer 6 in Summer

## Ridge Prediction: year wise vs season wise training

Table 5: Mean Squared Errors produced with the Ridge Regression

| **MSE per Anemometer** | | | | | | |
|---|---|---|---|---|---|---|
| *1* | *2* | *3* | *4* | *5* | *6* | **Season/Year** |
| 0.13 | 0.13 | 0.16 | 0.39 | 0.30 | 0.61 | Spring |
| 0.12 | 0.13 | 0.21 | 0.47 | 0.41 | 0.68 | Summer |
| 0.13 | 0.16 | 0.13 | 0.48 | 0.60 | 0.76 | Autumn |
| 0.17 | 0.19 | 0.17 | 0.39 | 0.48 | 0.70 | Winter |
| 0.43 | 0.49 | 0.45 | 0.76 | 0.92 | 1.15 | All Year |

Table 6: $R^2$ produced with the Ridge Regression

| $R^2$ **per Anemometer** | | | | | | |
|---|---|---|---|---|---|---|
| *1* | *2* | *3* | *4* | *5* | *6* | **Season/Year** |
| 0.14 | 0.35 | 0.57 | 0.70 | 0.87 | 0.80 | Spring |
| 0.08 | 0.34 | 0.39 | 0.68 | 0.85 | 0.80 | Summer |
| -0.08 | -0.13 | 0.45 | 0.65 | 0.78 | 0.78 | Autumn |
| 0.03 | 0.21 | 0.67 | 0.80 | 0.88 | 0.87 | Winter |
| -1.57 | -1.33 | -0.14 | 0.57 | 0.72 | 0.72 | All Year |

# Neural Network MSE training behaviour

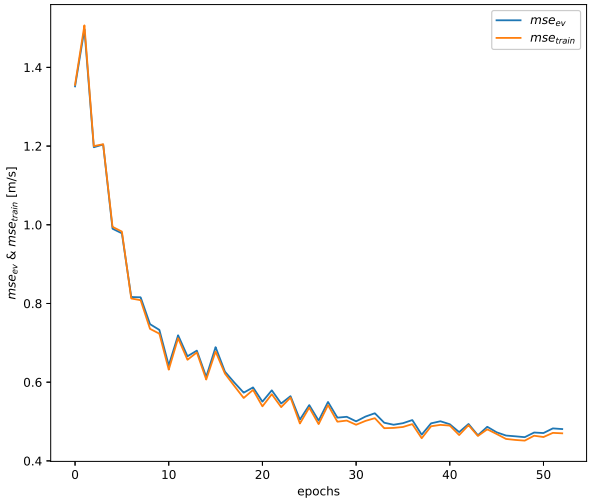


Figure 10: Mean Squared Error in function of the number of epochs during the training of the neural network

# Feature Importance

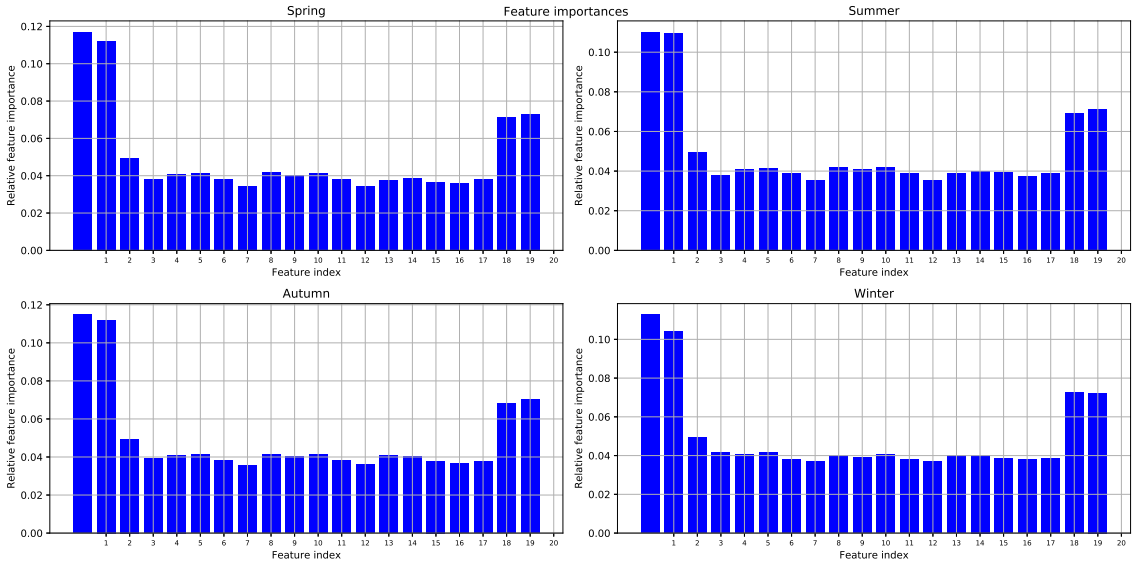


Figure 11: Feature Importance obtained with Random Forest for different seasons

Table 7: Legend of the feature importance

| | |
|---|---|
| Sonic Temperature [C] | 0 |
| Height [m] | 1 |
| $u_{top}$ z [m/s] | 2 |
| Sonic Temperature at Top [C] | 3 |
| Pyranometer Upper Irradiance [W/m$^2$] | 4 |
| Pyranometer Lower Irradiance [W/m$^2$] | 5 |
| Pyrgeometer Upper Irradiance [W/m$^2$] | 6 |
| Pyrgeometer Lower Irradiance [W/m$^2$] | 7 |
| Net Solar radiation [W/m$^2$] | 8 |
| Net (total) radiation [W/m$^2$] | 9 |
| Net Far Infrared radiation [W/m$^2$] | 10 |
| Sky temperature [C] | 11 |
| Radiometer Ground temperature [C] | 12 |
| Sensor Ground temperature [C] | 13 |
| North temperature [C] | 14 |
| East temperature [C] | 15 |
| South temperature [C] | 16 |
| West temperature [C] | 17 |
| $u_{top}$ x [m/s] | 18 |
| $u_{top}$ y [m/s] | 19 |

## Ridge Prediction: one dimensional target variable $u_y$

Table 8: $R^2$ produced with the Ridge Regression with the target variable being the y direction of the speed

| $R^2$ **per Anemometer** | | | | | | |
|---|---|---|---|---|---|---|
| *1* | *2* | *3* | *4* | *5* | *6* | **Season/Year** |
| 0.25 | 0.12 | 0.45 | 0.77 | 0.91 | 0.80 | Spring |
| -0.07 | -0.27 | -0.28 | 0.76 | 0.83 | 0.80 | Summer |
| -0.13 | -0.41 | 0.24 | 0.76 | 0.87 | 0.80 | Autumn |
| 0.05 | -0.14 | 0.71 | 0.89 | 0.94 | 0.88 | Winter |

Table 9: Mean Squared Errors produced with the Ridge Regression with the target variable being the y direction of the speed

| **MSE per Anemometer** | | | | | | |
|---|---|---|---|---|---|---|
| *1* | *2* | *3* | *4* | *5* | *6* | **Season/Year** |
| 0.18 | 0.20 | 0.21 | 0.49 | 0.28 | 0.78 | Spring |
| 0.24 | 0.29 | 0.42 | 0.56 | 0.58 | 0.83 | Summer |
| 0.19 | 0.23 | 0.17 | 0.59 | 0.47 | 0.92 | Autumn |
| 0.24 | 0.31 | 0.20 | 0.48 | 0.37 | 0.81 | Winter |