

Speed reconstruction strategy

M2~Recon60

Reconstruction summary

Input and output speed time series summary

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Signal Name | Signal Height | Valid data [years] | Mean | Start Date | End Date | Date Last Calculated |
| Input | PMC60 | 60m | 1.4176 | 6.4706 | 11/11/2010 03:40 | 28/04/2012 06:20 | 11/07/2022 11:21 |
| Reconstructed | Recon60 | 60m | 1.471 | 6.4315 | 31/10/2010 00:00 | 28/04/2012 06:20 | 11/07/2022 11:22 |

Total reconstruction uncertainty 0.028%

Reconstruction options used

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference wind speed | Records spliced | Data spliced [years] | Max splice potential [years] | Distance from site data [m] | Uncertainty [%] | Weighted uncertainty [%] | SynCheck Energy Error [%] | SynCheck WS Error [%] |
| M2~PMC48 | 30 | 0.0006 | 0.0006 | 12 | 0.2533% | 0.0001% | 0.2044% | 0.358% |
| M2~PMC37 | 531 | 0.0101 | 0.0107 | 23 | 0.4804% | 0.0034% | 0.624% | 1.0982% |
| M3~PMC94 | 2250 | 0.0428 | 0.0534 | 2991 | 0.9611% | 0.0279% | -0.5032% | -0.0778% |

Calculation settings

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| --- | --- |
| Calculation settings |  |
| Turbine type for synthesis checks | Hawaii 2.0 MW |
| Force through origin | True |
| Iterate to site low speed cutoff | True |
| Ref low speed cut off | 3 |
| Direction bin count | 12 |
| Correlation fitting method | PCA |

Excluded reconstruction options

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference wind speed | Max splice potential [years] | Distance from site data [m] | Uncertainty [%] | SynCheck Energy Error [%] | SynCheck WS Error [%] |

Wind rose from reconstructed data

Create Frequency Distribution

|  |  |
| --- | --- |
| Summary |  |
| Speed | M2~Recon60 |
| Direction | M2~D57\_Recon |
| Output frequency distribution | M2ws60wd60\_ReconFD |
| Deseason to time series mean of monthly means | True |

Report windrose

|  |  |
| --- | --- |
| Summary |  |
| Binning rule | Overall |
| Input frequency distribution | M2ws60wd60\_ReconFD |

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| M2ws60wd60\_ReconFD at ## m |

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| Monthly mean wind speeds |

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| --- | --- | --- | --- |
| Monthly | Wind speed [m/s] | Valid wind speed data [months] | Valid direction data [months] |
| January | 6.8553 | 2.0 | 2.0 |
| February | 7.0946 | 2.0 | 2.0 |
| March | 6.55 | 2.0 | 2.0 |
| April | 6.164 | 1.9 | 1.9 |
| May | 5.1511 | 1.0 | 1.0 |
| June | 5.1118 | 1.0 | 1.0 |
| July | 5.2221 | 1.0 | 1.0 |
| August | 5.6173 | 1.0 | 1.0 |
| September | 6.7647 | 1.0 | 1.0 |
| October | 7.8463 | 1.0 | 1.0 |
| November | 7.2731 | 1.8 | 1.7 |
| December | 7.5845 | 2.0 | 2.0 |
| Annual | 6.4324 |  |  |

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| Wind speed and direction frequency distribution |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Wind Speed [m/s] | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | No Direction | Total [%] |
| 0 | 0.04 | 0.09 | 0.03 | 0.02 | 0.01 | 0.01 | 0.03 | 0.04 | 0.01 | 0.02 | 0.01 | 0.03 |  | 0.35 |
| 1 | 0.18 | 0.15 | 0.16 | 0.16 | 0.18 | 0.15 | 0.20 | 0.21 | 0.17 | 0.34 | 0.18 | 0.24 |  | 2.30 |
| 2 | 0.42 | 0.31 | 0.36 | 0.28 | 0.33 | 0.31 | 0.40 | 0.42 | 0.42 | 0.78 | 0.51 | 0.69 | 0.01 | 5.25 |
| 3 | 0.55 | 0.45 | 0.53 | 0.46 | 0.61 | 0.62 | 0.64 | 0.46 | 0.64 | 1.14 | 0.83 | 1.20 | 0.03 | 8.15 |
| 4 | 0.70 | 0.60 | 0.76 | 0.82 | 0.91 | 0.73 | 0.81 | 0.68 | 1.09 | 1.86 | 1.07 | 1.40 | 0.09 | 11.52 |
| 5 | 0.73 | 0.59 | 0.89 | 0.96 | 1.00 | 0.74 | 1.03 | 0.78 | 1.45 | 2.74 | 1.33 | 1.47 | 0.20 | 13.91 |
| 6 | 0.92 | 0.66 | 0.88 | 0.93 | 0.66 | 0.59 | 0.83 | 0.83 | 1.38 | 3.14 | 1.47 | 1.36 | 0.17 | 13.82 |
| 7 | 0.83 | 0.57 | 0.73 | 0.70 | 0.40 | 0.34 | 0.60 | 0.87 | 1.37 | 3.28 | 1.57 | 1.34 | 0.09 | 12.68 |
| 8 | 0.61 | 0.50 | 0.50 | 0.50 | 0.19 | 0.20 | 0.26 | 0.66 | 1.12 | 2.49 | 1.37 | 1.00 | 0.13 | 9.53 |
| 9 | 0.46 | 0.45 | 0.42 | 0.33 | 0.12 | 0.08 | 0.13 | 0.40 | 0.82 | 2.13 | 1.21 | 0.88 | 0.07 | 7.52 |
| 10 | 0.36 | 0.31 | 0.39 | 0.17 | 0.07 | 0.06 | 0.05 | 0.30 | 0.43 | 1.48 | 1.01 | 0.56 | 0.02 | 5.21 |
| 11 | 0.27 | 0.24 | 0.25 | 0.12 | 0.03 | 0.03 | 0.05 | 0.16 | 0.23 | 1.04 | 0.73 | 0.40 | 0.01 | 3.55 |
| 12 | 0.15 | 0.10 | 0.20 | 0.05 | 0.02 | 0.02 | 0.03 | 0.08 | 0.15 | 0.85 | 0.47 | 0.23 | + | 2.35 |
| 13 | 0.05 | 0.03 | 0.14 | 0.03 |  | 0.02 | 0.02 | 0.03 | 0.08 | 0.68 | 0.31 | 0.12 |  | 1.52 |
| 14 | 0.02 | 0.04 | 0.09 | 0.03 |  | 0.01 | 0.01 | 0.01 | 0.06 | 0.48 | 0.24 | 0.08 |  | 1.05 |
| 15 | 0.02 | 0.02 | 0.07 | 0.01 |  | 0.01 | + |  | 0.02 | 0.26 | 0.17 | 0.04 |  | 0.61 |
| 16 | 0.02 | 0.01 | 0.04 | + |  | + | + | + | + | 0.15 | 0.09 | 0.02 |  | 0.34 |
| 17 | 0.01 |  | 0.02 |  |  |  | + |  |  | 0.09 | 0.05 | 0.01 |  | 0.19 |
| 18 | 0.01 |  | 0.01 |  |  |  |  |  | + | 0.06 | 0.01 | + |  | 0.09 |
| 19 |  |  | 0.01 |  |  |  | + |  |  | 0.04 | 0.01 |  |  | 0.06 |
| 20 |  |  |  |  |  |  |  |  |  | 0.01 | + |  |  | 0.01 |
| 21 |  |  |  |  |  |  |  |  |  | + | + |  |  | 0.01 |
| 22 |  |  |  |  |  |  |  |  |  |  | + |  |  | + |
| 23 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30+ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total [%] | 6.34 | 5.12 | 6.47 | 5.56 | 4.51 | 3.91 | 5.08 | 5.93 | 9.44 | 23.07 | 12.64 | 11.09 | 0.83 | 100.00 |
| Mean Speed | 6.26 | 6.20 | 6.58 | 5.78 | 4.85 | 4.90 | 5.03 | 5.96 | 6.31 | 7.34 | 7.33 | 6.16 | 6.16 | 6.43 |

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| Note: '+' indicates non-zero percentage <0.005%, blank indicates zero percentage |

Calculation Steps

Reconstruction stage : Synthesis from M2~PMC48

Correlation

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| --- | --- |
| Correlate wind speeds and directions |  |
| Reference speed | M2~PMC48 |
| Reference direction | M2~D57\_Recon |
| Site speed | M2~PMC60 |
| Site direction | M2~D57\_Recon |
| Reference low windspeed cut off | 3 |
| Site low windspeed cut off | 3.108087 |
| Iterate to site cut off | True |
| Force through origin | True |

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Directional correlation ratios

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| --- | --- | --- | --- | --- | --- |
| Bin centres [degrees] | Speedup ratio | Offset | Number of records | Error in speedup | Pearson R² |
| 0.0 | 1.037 | 0.00000 | 3922 | 0.001164 | 1.00 |
| 30.0 | 1.022 | 0.00000 | 3151 | 0.001094 | 1.00 |
| 60.0 | 1.024 | 0.00000 | 4154 | 0.000752 | 1.00 |
| 90.0 | 1.028 | 0.00000 | 3569 | 0.001408 | 0.99 |
| 120.0 | 1.050 | 0.00000 | 2713 | 0.002734 | 0.98 |
| 150.0 | 1.063 | 0.00000 | 2213 | 0.002569 | 0.99 |
| 180.0 | 1.053 | 0.00000 | 3007 | 0.002574 | 0.98 |
| 210.0 | 1.057 | 0.00000 | 3842 | 0.002243 | 0.98 |
| 240.0 | 1.055 | 0.00000 | 6170 | 0.001518 | 0.99 |
| 270.0 | 1.038 | 0.00000 | 15555 | 0.000736 | 0.99 |
| 300.0 | 1.022 | 0.00000 | 8607 | 0.000612 | 1.00 |
| 330.0 | 1.033 | 0.00000 | 7032 | 0.000797 | 1.00 |
| All directional | 1.036 | 0.00000 | 64596 | 0.000353 | 0.99 |

Speedup Series

|  |  |
| --- | --- |
| Summary |  |
| Speed Series | M2~PMC48 |
| Direction series | M2~D57\_Recon |
| Speed Trend | - |
| Destination speed series | M2~PMC48\_SpdUp |

|  |  |
| --- | --- |
| Directional speedups |  |
| Bin centre (degrees) | Speedup ratio |
| 0 | 1.0367 |
| 30 | 1.0224 |
| 60 | 1.024 |
| 90 | 1.0282 |
| 120 | 1.0504 |
| 150 | 1.0632 |
| 180 | 1.0529 |
| 210 | 1.057 |
| 240 | 1.0548 |
| 270 | 1.0383 |
| 300 | 1.0223 |
| 330 | 1.0326 |
| All directional | 1.036 |

Compare Frequency Distribution

|  |  |
| --- | --- |
| Summary |  |
| Frequency distribution 1 | matchedSiteFD |
| Frequency distribution 2 | syntheticMatchedSiteFD |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Frequency distribution name | Mean windspeed (m/s) | Energy production (GWh/annum) |
| Frequency Distribution 1 | matchedSiteFD | 6.612324 | 4.718668 |
| Frequency Distribution 2 | syntheticMatchedSiteFD | 6.588740 | 4.709041 |
| FD 1/FD 2 |  | 100.4% | 100.2% |

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Reconstruction stage : Synthesis from M2~PMC37

Correlation

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| --- | --- |
| Correlate wind speeds and directions |  |
| Reference speed | M2~PMC37 |
| Reference direction | M2~D57\_Recon |
| Site speed | M2~PMC60 |
| Site direction | M2~D57\_Recon |
| Reference low windspeed cut off | 3 |
| Site low windspeed cut off | 3.248907 |
| Iterate to site cut off | True |
| Force through origin | True |

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Directional correlation ratios

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bin centres [degrees] | Speedup ratio | Offset | Number of records | Error in speedup | Pearson R² |
| 0.0 | 1.080 | 0.00000 | 3764 | 0.002197 | 0.99 |
| 30.0 | 1.056 | 0.00000 | 3042 | 0.002016 | 0.99 |
| 60.0 | 1.061 | 0.00000 | 4070 | 0.001651 | 0.99 |
| 90.0 | 1.062 | 0.00000 | 3428 | 0.002774 | 0.98 |
| 120.0 | 1.103 | 0.00000 | 2468 | 0.005445 | 0.94 |
| 150.0 | 1.142 | 0.00000 | 2058 | 0.005797 | 0.95 |
| 180.0 | 1.127 | 0.00000 | 2834 | 0.005272 | 0.94 |
| 210.0 | 1.128 | 0.00000 | 3633 | 0.004618 | 0.94 |
| 240.0 | 1.123 | 0.00000 | 5898 | 0.003154 | 0.96 |
| 270.0 | 1.089 | 0.00000 | 15487 | 0.001491 | 0.97 |
| 300.0 | 1.059 | 0.00000 | 8679 | 0.001165 | 0.99 |
| 330.0 | 1.071 | 0.00000 | 6834 | 0.001550 | 0.99 |
| All directional | 1.083 | 0.00000 | 62855 | 0.000713 | 0.97 |

Speedup Series

|  |  |
| --- | --- |
| Summary |  |
| Speed Series | M2~PMC37 |
| Direction series | M2~D57\_Recon |
| Speed Trend | - |
| Destination speed series | M2~PMC37\_SpdUp |

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| --- | --- |
| Directional speedups |  |
| Bin centre (degrees) | Speedup ratio |
| 0 | 1.0798 |
| 30 | 1.056 |
| 60 | 1.0614 |
| 90 | 1.0624 |
| 120 | 1.1033 |
| 150 | 1.1423 |
| 180 | 1.1274 |
| 210 | 1.128 |
| 240 | 1.1227 |
| 270 | 1.0888 |
| 300 | 1.0592 |
| 330 | 1.0708 |
| All directional | 1.083 |

Compare Frequency Distribution

|  |  |
| --- | --- |
| Summary |  |
| Frequency distribution 1 | matchedSiteFD |
| Frequency distribution 2 | syntheticMatchedSiteFD |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Frequency distribution name | Mean windspeed (m/s) | Energy production (GWh/annum) |
| Frequency Distribution 1 | matchedSiteFD | 6.619218 | 4.731320 |
| Frequency Distribution 2 | syntheticMatchedSiteFD | 6.547318 | 4.701980 |
| FD 1/FD 2 |  | 101.1% | 100.6% |

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Reconstruction stage : Synthesis from M3~PMC94

Correlation

|  |  |
| --- | --- |
| Correlate wind speeds and directions |  |
| Reference speed | M3~PMC94 |
| Reference direction | M3~D94\_Recon |
| Site speed | M2~PMC60 |
| Site direction | M2~D57\_Recon |
| Reference low windspeed cut off | 3 |
| Site low windspeed cut off | 2.632971 |
| Iterate to site cut off | True |
| Force through origin | True |

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Directional correlation ratios

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bin centres [degrees] | Speedup ratio | Offset | Number of records | Error in speedup | Pearson R² |
| 0.0 | 0.855 | 0.00000 | 4294 | 0.005128 | 0.86 |
| 30.0 | 0.935 | 0.00000 | 3116 | 0.005883 | 0.89 |
| 60.0 | 0.967 | 0.00000 | 3509 | 0.004156 | 0.94 |
| 90.0 | 0.938 | 0.00000 | 3019 | 0.006837 | 0.86 |
| 120.0 | 0.905 | 0.00000 | 2110 | 0.008416 | 0.83 |
| 150.0 | 0.845 | 0.00000 | 1706 | 0.008336 | 0.84 |
| 180.0 | 0.832 | 0.00000 | 2219 | 0.008121 | 0.81 |
| 210.0 | 0.786 | 0.00000 | 2953 | 0.006191 | 0.83 |
| 240.0 | 0.799 | 0.00000 | 4808 | 0.005123 | 0.82 |
| 270.0 | 0.878 | 0.00000 | 13868 | 0.002461 | 0.90 |
| 300.0 | 0.883 | 0.00000 | 7020 | 0.003199 | 0.91 |
| 330.0 | 0.893 | 0.00000 | 6552 | 0.003798 | 0.89 |
| All directional | 0.878 | 0.00000 | 55449 | 0.001365 | 0.87 |

Speedup Series

|  |  |
| --- | --- |
| Summary |  |
| Speed Series | M3~PMC94 |
| Direction series | M3~D94\_Recon |
| Speed Trend | - |
| Destination speed series | M3~PMC94\_SpdUp |

|  |  |
| --- | --- |
| Directional speedups |  |
| Bin centre (degrees) | Speedup ratio |
| 0 | 0.8546 |
| 30 | 0.9348 |
| 60 | 0.9669 |
| 90 | 0.9382 |
| 120 | 0.905 |
| 150 | 0.8451 |
| 180 | 0.8319 |
| 210 | 0.7856 |
| 240 | 0.7992 |
| 270 | 0.8781 |
| 300 | 0.8825 |
| 330 | 0.8935 |
| All directional | 0.8777 |

Compare Frequency Distribution

|  |  |
| --- | --- |
| Summary |  |
| Frequency distribution 1 | matchedSiteFD |
| Frequency distribution 2 | syntheticMatchedSiteFD |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Frequency distribution name | Mean windspeed (m/s) | Energy production (GWh/annum) |
| Frequency Distribution 1 | matchedSiteFD | 6.671681 | 4.855429 |
| Frequency Distribution 2 | syntheticMatchedSiteFD | 6.676874 | 4.879984 |
| FD 1/FD 2 |  | 99.9% | 99.5% |

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Splicing steps to reconstruct final output

Splice Series

|  |  |
| --- | --- |
| Summary |  |
| Input high priority series | M2~PMC60 |
| Input low priority series | M2~PMC48\_SpdUp |
| Output series | M2~PMC60\_Splice1 |

|  |  |
| --- | --- |
| Coverage |  |
| High priority input coverage | 1.42 years |
| Output coverage | 1.42 years |
| Proportion of spliced data in output | 0.040220% |

Splice Series

|  |  |
| --- | --- |
| Summary |  |
| Input high priority series | M2~PMC60\_Splice1 |
| Input low priority series | M2~PMC37\_SpdUp |
| Output series | M2~PMC60\_Splice2 |

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| --- | --- |
| Coverage |  |
| High priority input coverage | 1.42 years |
| Output coverage | 1.43 years |
| Proportion of spliced data in output | 0.706869% |

Splice Series

|  |  |
| --- | --- |
| Summary |  |
| Input high priority series | M2~PMC60\_Splice2 |
| Input low priority series | M3~PMC94\_SpdUp |
| Output series | M2~Recon60 |

|  |  |
| --- | --- |
| Coverage |  |
| High priority input coverage | 1.43 years |
| Output coverage | 1.47 years |
| Proportion of spliced data in output | 2.908104% |