

**Intercomparison of operational wave forecasting systems against buoys:  
data from ECMWF, MetOffice, FNMOC, DWD, BoM, and SHOM  
June 2008 to August 2008**

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## 0.1 Forewords

Outputs from different operational forecasting centres are compared to buoy and platform data as broadcasted to the meteorological community via the Global Telecommunication System (GTS). On a monthly basis, data are gathered informally from operational weather services with an interest in wave forecasting (Bidlot and Holt, 2006). The different data sets are subsequently merged and made available to all participating partners for further evaluation. In this documents, examples, in graphical and tabular forms, are shown. These results have been processed at ECMWF and should served as an example to the kind of information that could be obtained from such comparison. No statement of quality, nor reasons why the different systems are performing differently will be given.

## 0.2 Data

Before using observations for verification, care has to be taken to process the data to remove any erroneous observations and also in order to match the scale of both model and observations. This scale matching is achieved by averaging the hourly data in  $\pm 2$  hour time windows centered on the four major synoptic times corresponding to the normal model output times. The original quality control and averaging procedure was discussed in Bidlot *et al.* (2002). It was extended to include platform data as described in Sætra and Bidlot (2004). Note that in this paper we refer to these data as buoy data since most of them are from moored buoys, except if stated otherwise.

The intercomparison relies on the exchange of model output at buoy locations. An agreed upon list of locations is used where observations are known to be available. Because buoy networks are changing with time, as witnessed by a rapid increase in the number of buoys available via the GTS since the mid-nineties, updates to the list have been necessary. Not all participating centres have been able to update their list however. Other participants are only running limited area model(s) or do produce the parameter(s) that can be compared to the buoy data. Because of the limited number of buoys, a fair comparison between the different systems can only be achieved if the same number of buoys and the same number of buoy-model collocations are used.

In this document, data that are common to ECMWF, MetOffice, FNMOC, DWD, BoM, and SHOM are used. The other participants are left blank in the plots below.

## References

Bidlot J.-R., D. J. Holmes, P. A. Wittmann, R. Lalbeharry, H. S. Chen, 2002: Intercomparison of the performance of operational ocean wave forecasting systems with buoy data. *Wea. Forecasting*, **17**, 287-310.

Bidlot J.-R. and M.W. Holt, 2006: Verification of operational global and regional wave forecasting systems against measurements from moored buoys. *JCOMM Technical Report*, **30**. WMO/TD-No. 1333.

Sætra, Ø. and J.-R. Bidlot, 2004: On the potential benefit of using probabilistic forecast for waves and marine winds based on the ECMWF ensemble prediction system. *Wea. Forecasting*, **19**, 673-689.

## 0.3 Results

In the remaining pages, some of the results of the comparison with buoys are presented for all common buoys and for common buoys within a sub-area as displayed by the corresponding maps. Summary forecast scores are shown first, followed by density scatter diagrams with associated statistics for each subarea. Only common data to ECMWF, MetOffice, FNMOC, DWD, BoM, and SHOM are used.

### 0.3.1 Comparison for all buoys

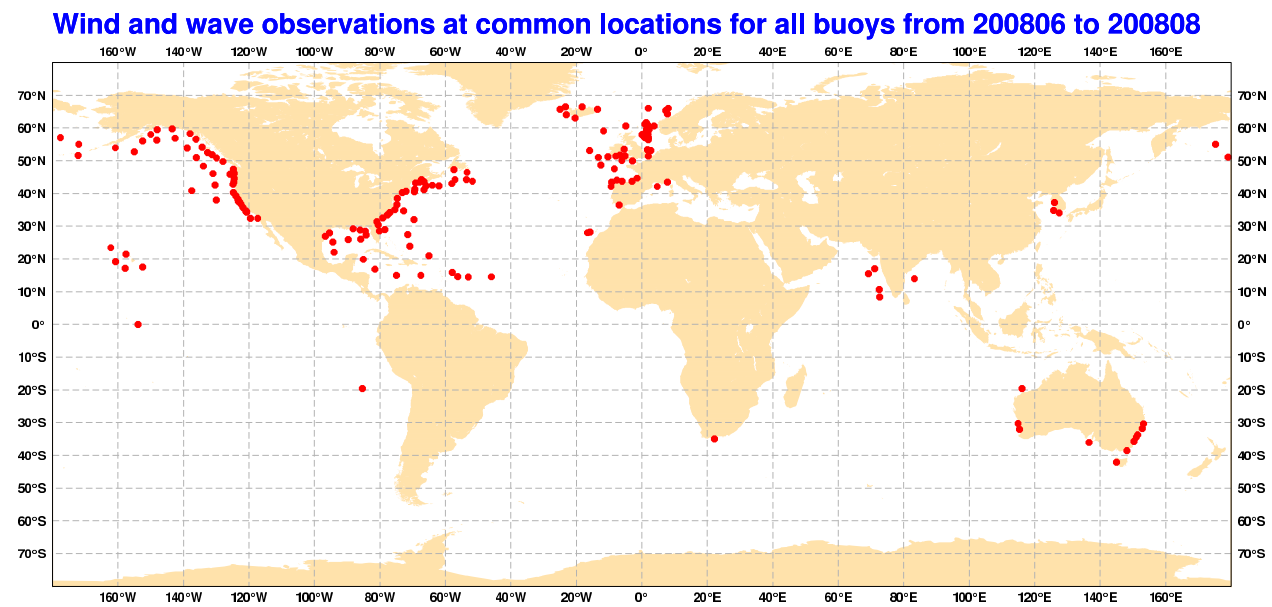
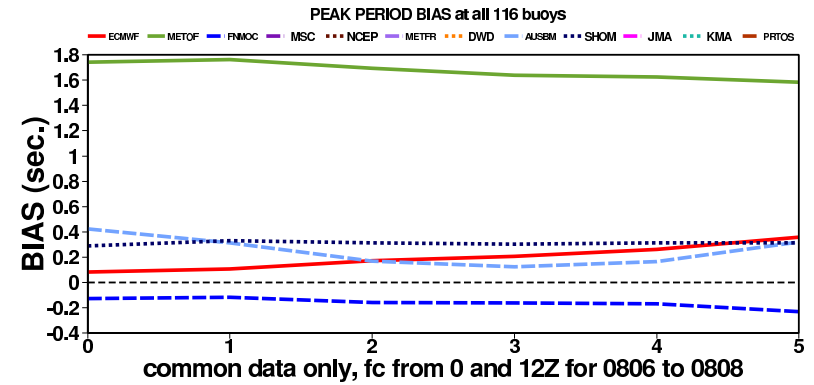
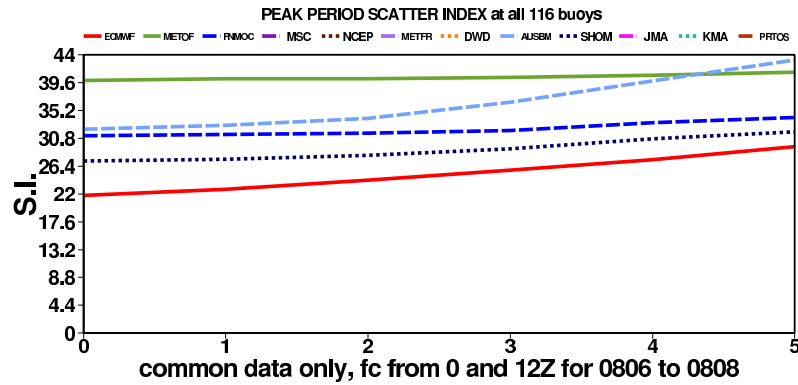
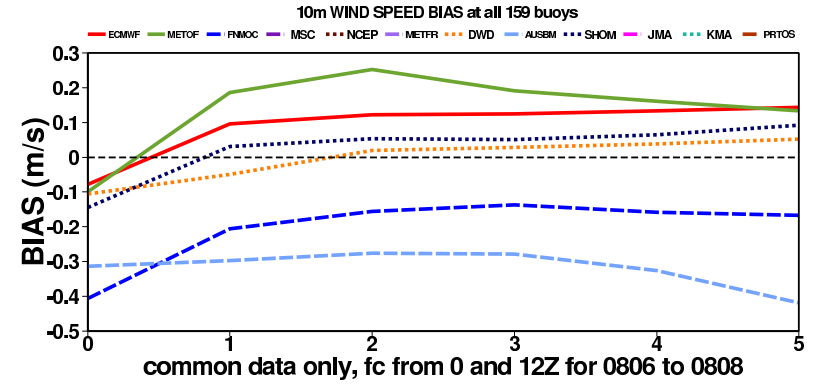
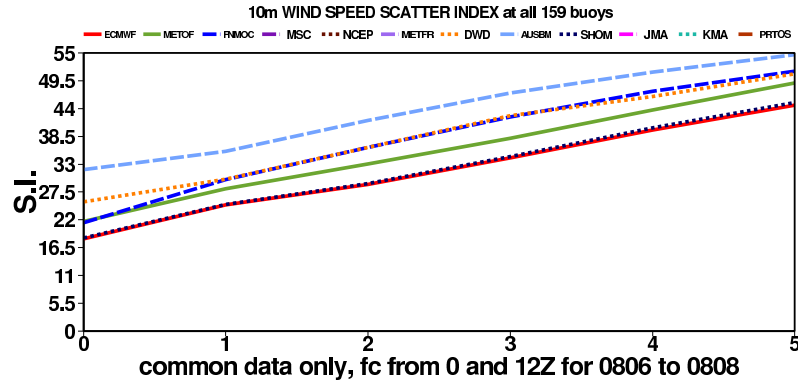
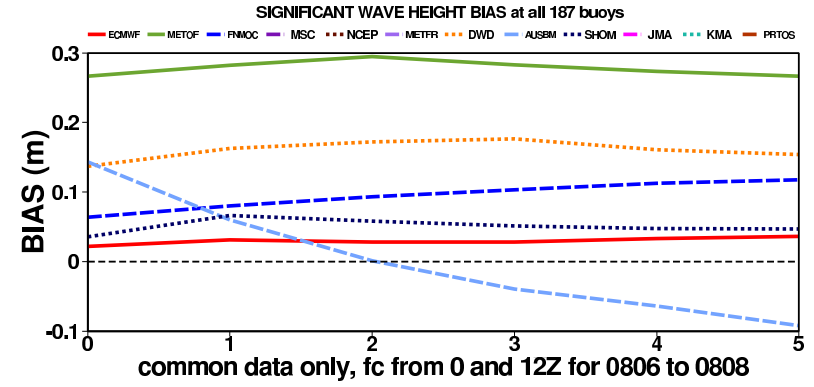
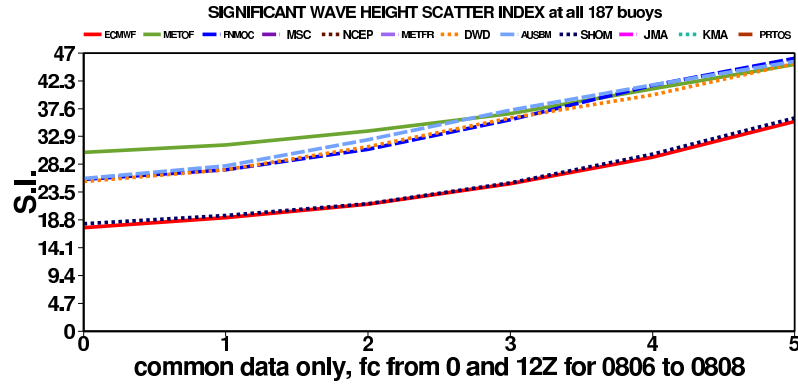


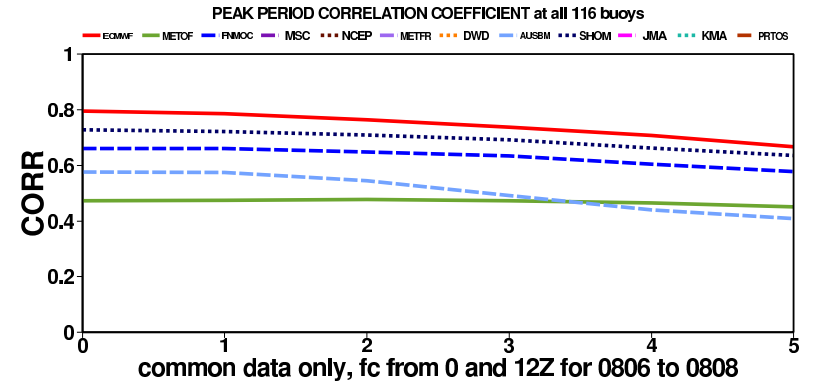
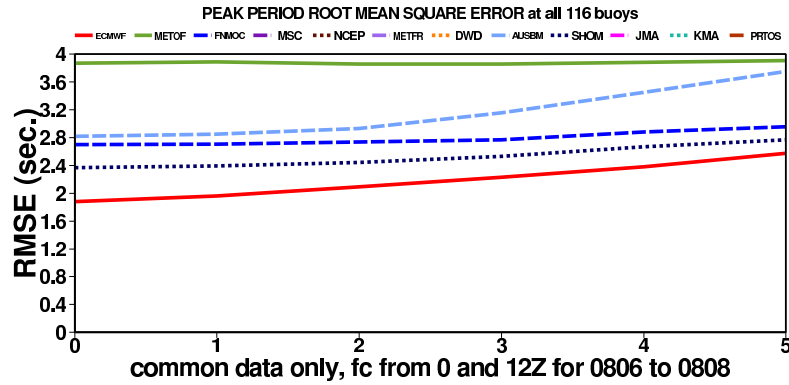
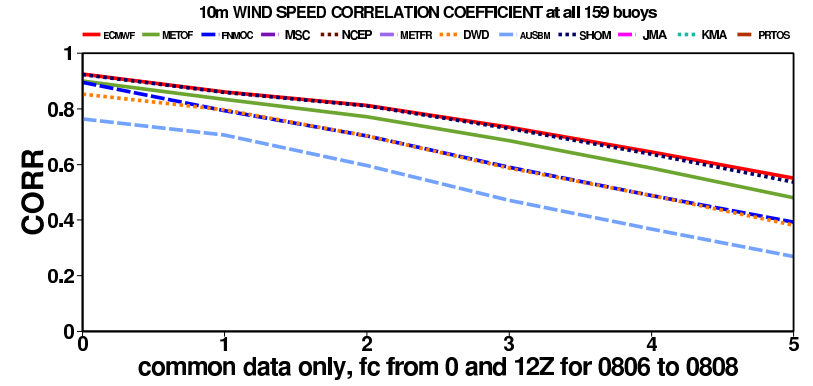
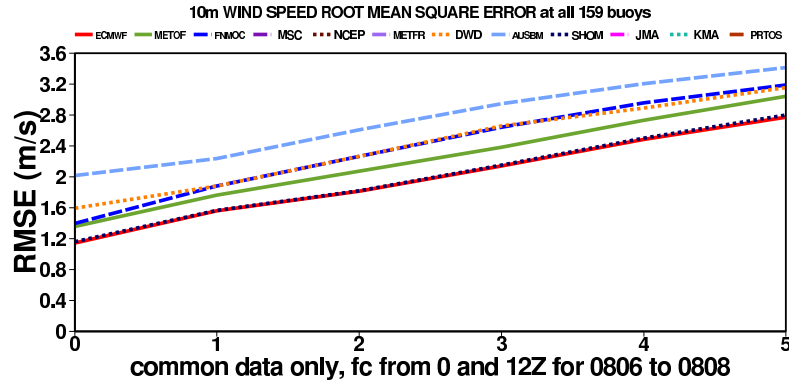
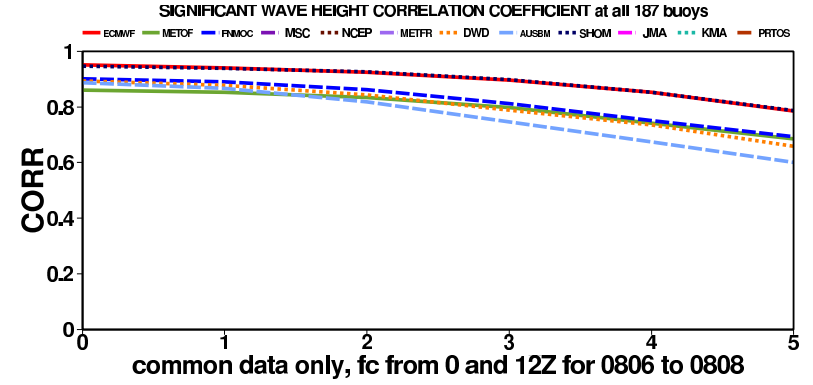
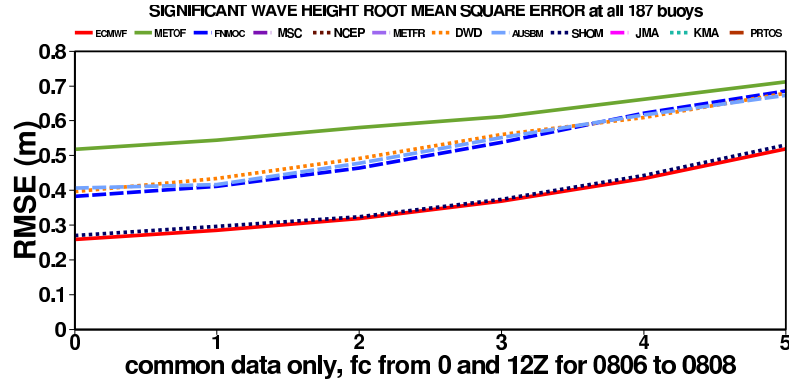
Figure 1: Buoy locations



(a) Scatter Index (%)

(b) Bias (model-buoy)

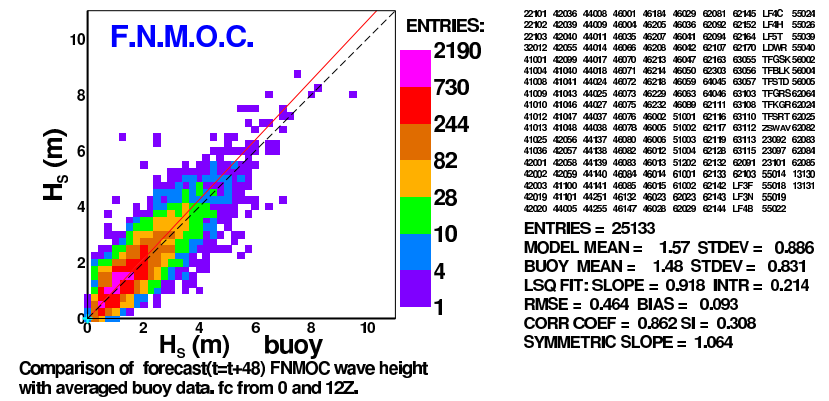
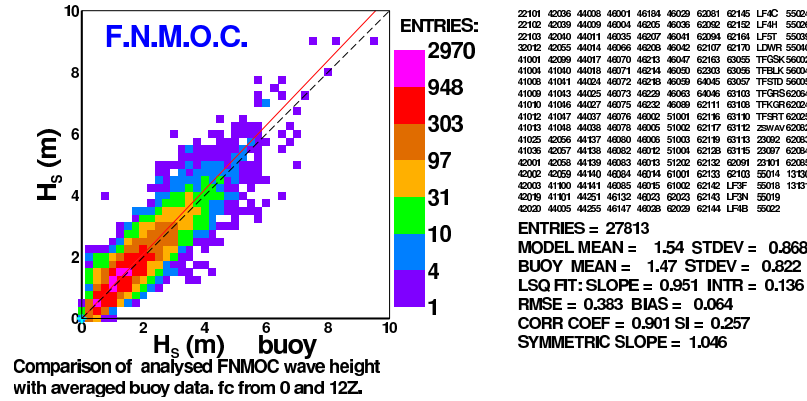
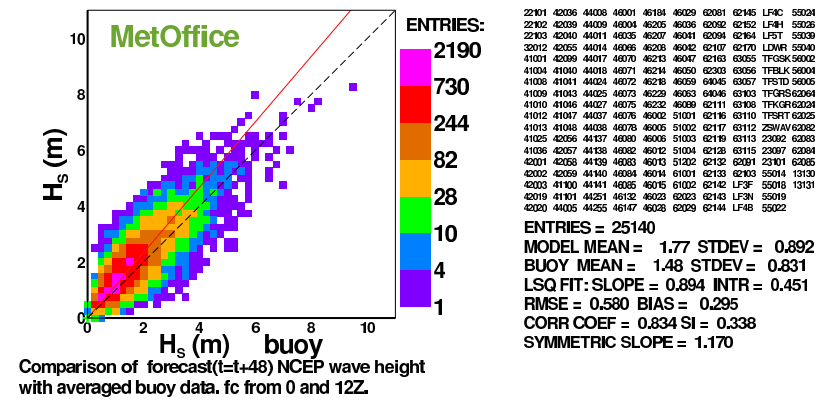
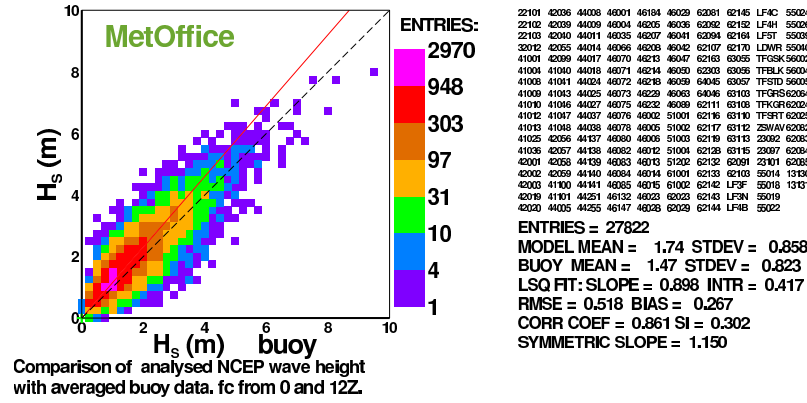
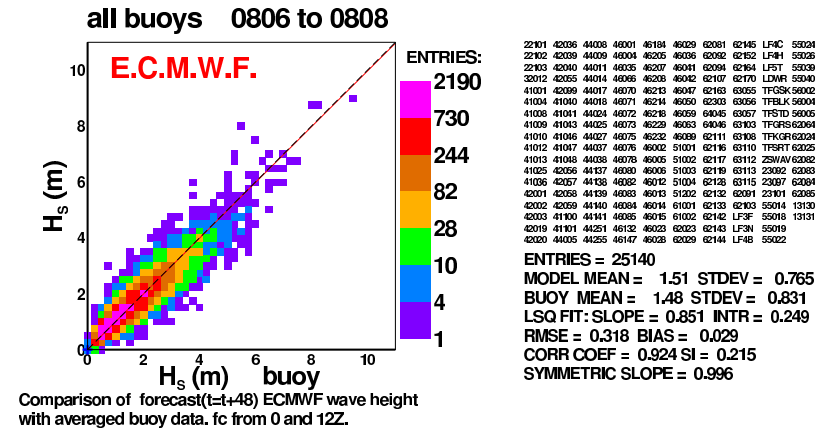
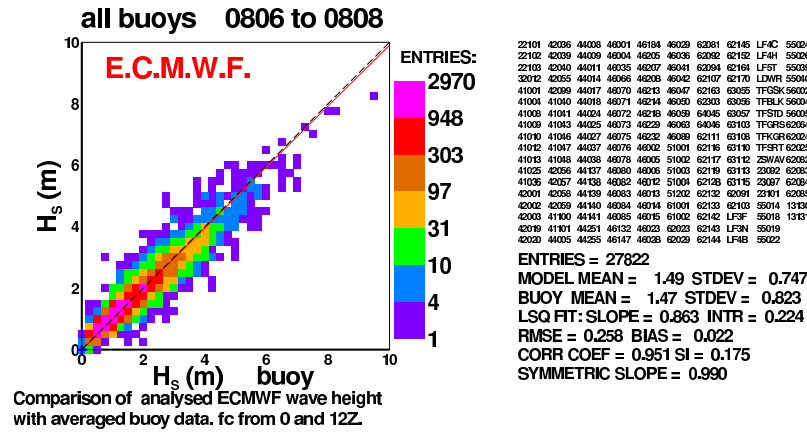
Figure 2: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common all buoys.



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 3: Forecast root mean square error (RMSE) and linear correlation coefficient at common all buoys.

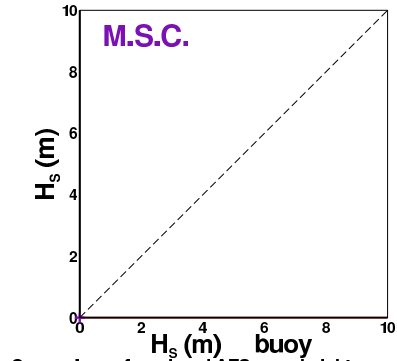


(a) t+0

(b) t+48

Figure 4: Scatter diagrams for wave height at step 0 and 48 for the displayed centres at all buoys.

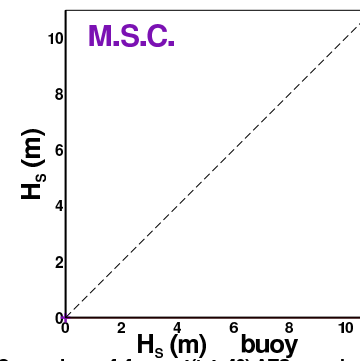
all buoys 0806 to 0808



Comparison of analysed AES wave height with averaged buoy data. fc from 0 and 12Z.

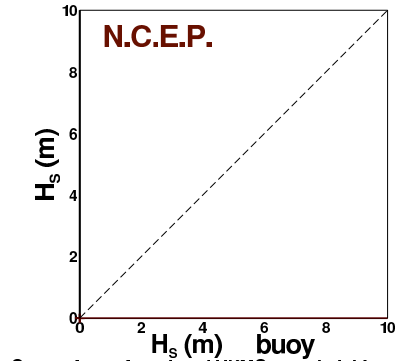
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BUOY MEAN = 0.00 STDEV = 0.000  
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RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

all buoys 0806 to 0808



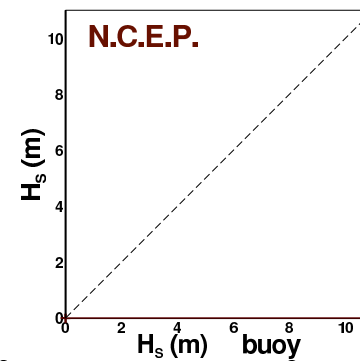
Comparison of forecast(t=t+48) AES wave height with averaged buoy data. fc from 0 and 12Z.

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BUOY MEAN = 0.00 STDEV = 0.000  
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RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



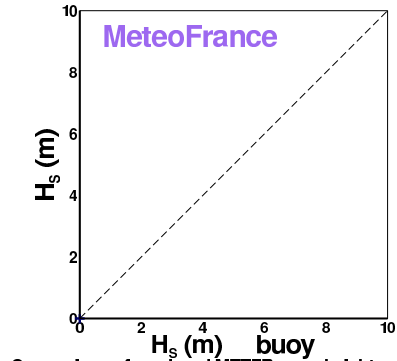
Comparison of analysed UKMO wave height with averaged buoy data. fc from 0 and 12Z.

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BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



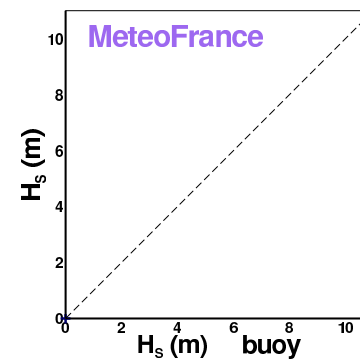
Comparison of forecast(t=t+48) UKMO wave height with averaged buoy data. fc from 0 and 12Z.

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BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of analysed METFR wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of forecast(t=t+48) METFR wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
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RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
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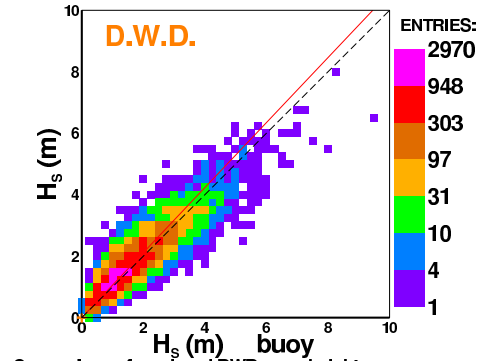
(a) t+0

(b) t+48

Figure 5: Scatter diagrams for wave height at step 0 and 48 for the displayed centres at all buoys.



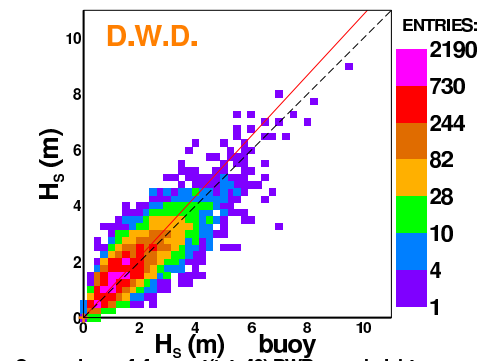
all buoys 0806 to 0808



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22103 42040 44011 46035 46207 46041 62094 62164 LF5T 55039  
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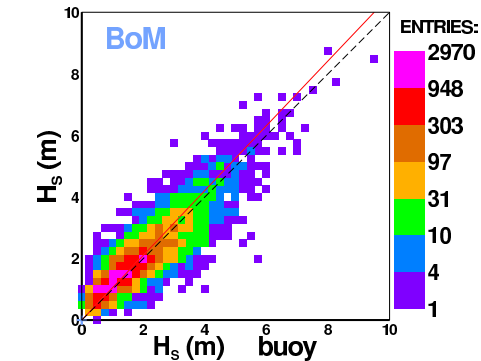
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BUOY MEAN = 1.47 STDEV = 0.823  
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CORR COEF = 0.893 SI = 0.253  
SYMMETRIC SLOPE = 1.058

all buoys 0806 to 0808



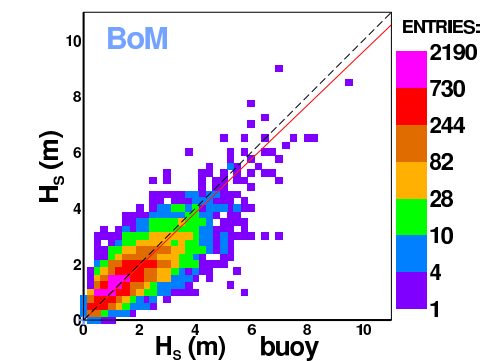
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62020 44005 44255 46147 46028 62029 62144 LF48 55022

ENTRIES = 25140  
MODEL MEAN = 1.65 STDEV = 0.809  
BUOY MEAN = 1.48 STDEV = 0.831  
LSQ FIT: SLOPE = 0.820 INTR = 0.439  
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CORR COEF = 0.842 SI = 0.312  
SYMMETRIC SLOPE = 1.084



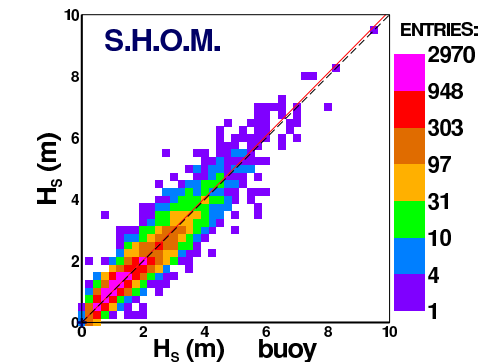
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ENTRIES = 27822  
MODEL MEAN = 1.62 STDEV = 0.733  
BUOY MEAN = 1.47 STDEV = 0.823  
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CORR COEF = 0.887 SI = 0.258  
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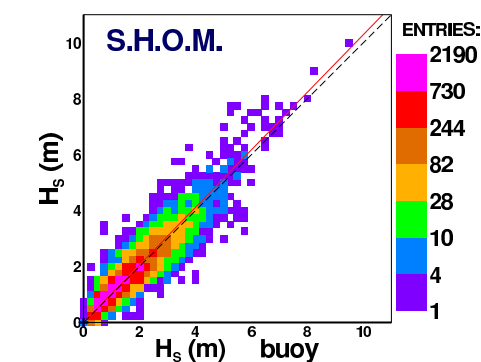
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ENTRIES = 25140  
MODEL MEAN = 1.48 STDEV = 0.680  
BUOY MEAN = 1.48 STDEV = 0.831  
LSQ FIT: SLOPE = 0.669 INTR = 0.491  
RMSE = 0.479 BIAS = 0.001  
CORR COEF = 0.818 SI = 0.324  
SYMMETRIC SLOPE = 0.960



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ENTRIES = 27804  
MODEL MEAN = 1.51 STDEV = 0.803  
BUOY MEAN = 1.47 STDEV = 0.822  
LSQ FIT: SLOPE = 0.923 INTR = 0.149  
RMSE = 0.270 BIAS = 0.036  
CORR COEF = 0.946 SI = 0.182  
SYMMETRIC SLOPE = 1.013



22101 42036 44008 46001 46184 46029 62081 62145 LF4C 55024  
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62020 44005 44255 46147 46028 62029 62144 LF48 55022

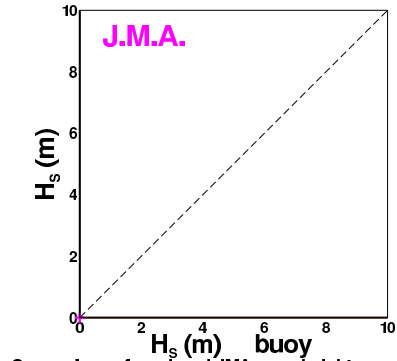
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BUOY MEAN = 1.48 STDEV = 0.831  
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RMSE = 0.324 BIAS = 0.059  
CORR COEF = 0.926 SI = 0.215  
SYMMETRIC SLOPE = 1.028

(a) t+0

(b) t+48

Figure 6: Scatter diagrams for wave height at step 0 and 48 for the displayed centres at all buoys.

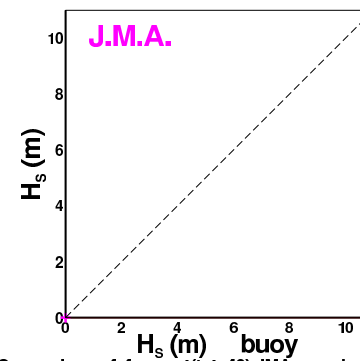
all buoys 0806 to 0808



Comparison of analysed JMA wave height with averaged buoy data. fc from 0 and 12Z.

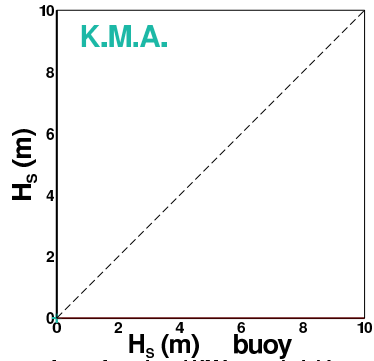
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MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
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SYMMETRIC SLOPE = 0.000

all buoys 0806 to 0808



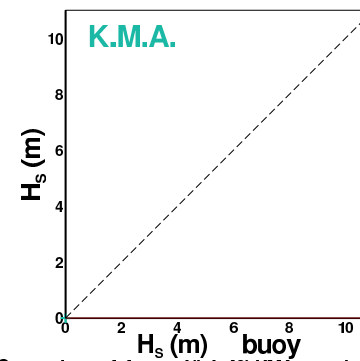
Comparison of forecast( $t=t+48$ ) JMA wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



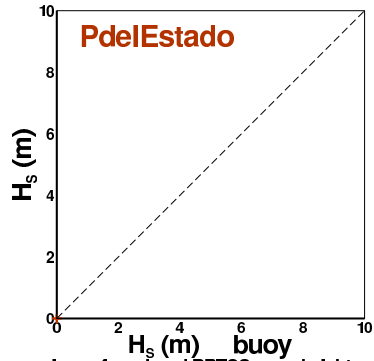
Comparison of analysed KMA wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



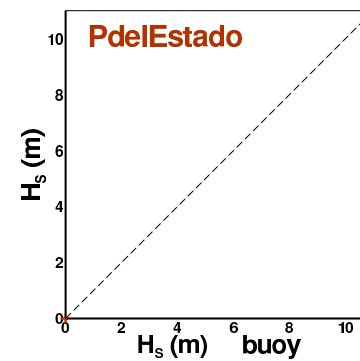
Comparison of forecast( $t=t+48$ ) KMA wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of analysed PRTOS wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



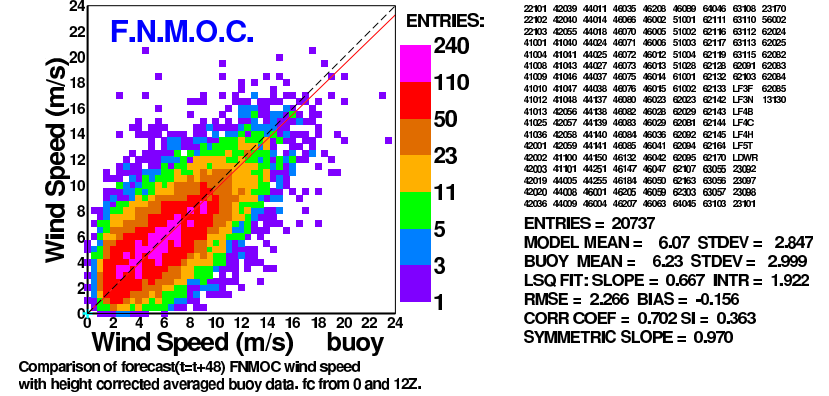
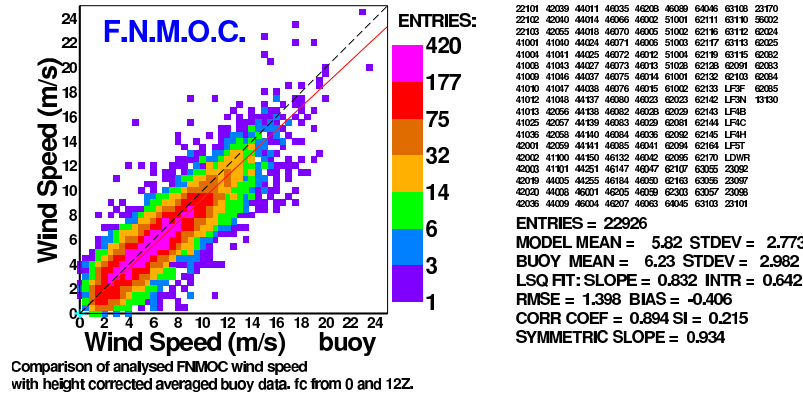
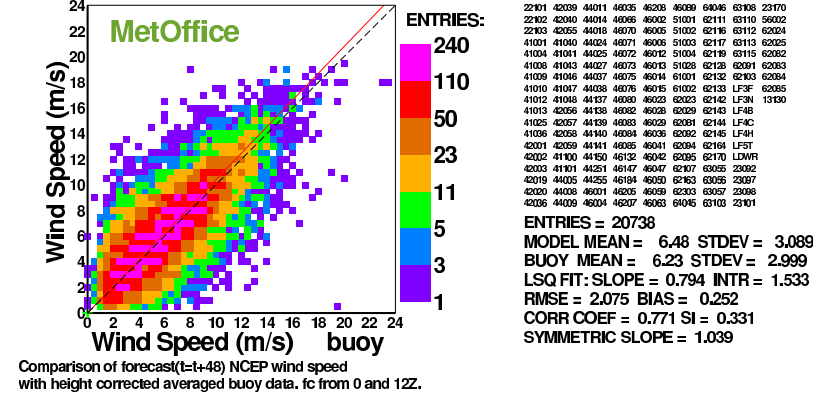
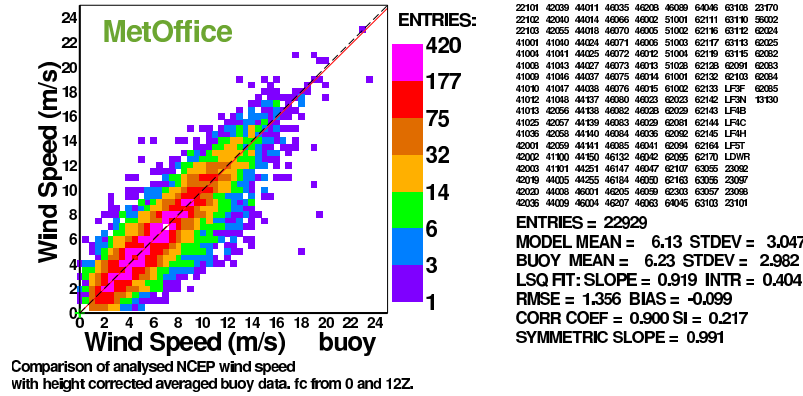
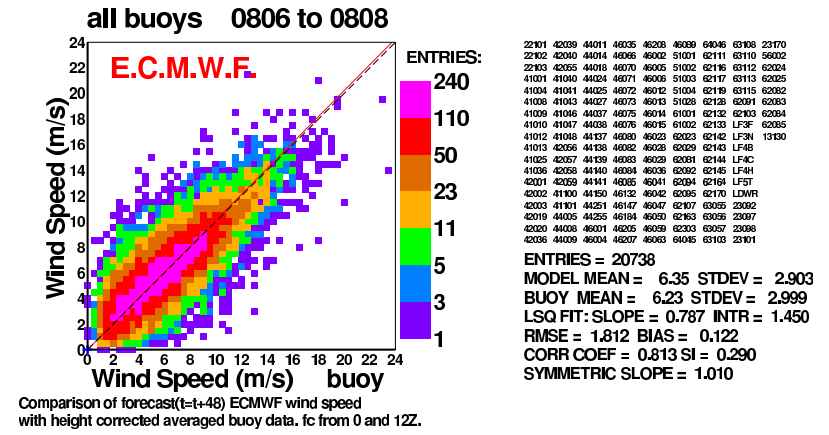
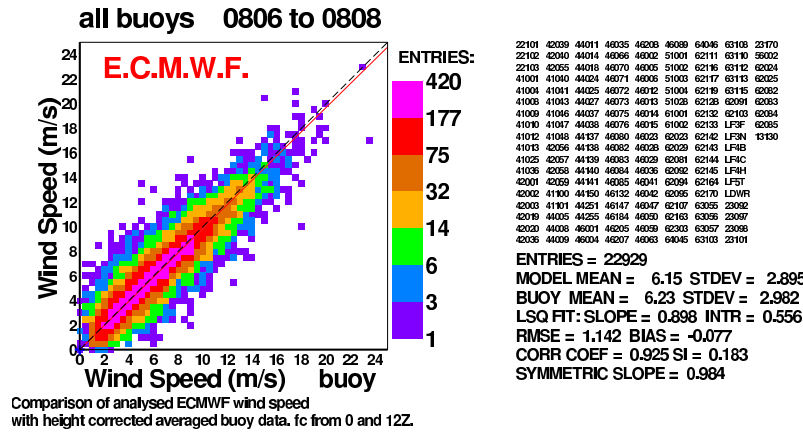
Comparison of forecast( $t=t+48$ ) PRTOS wave height with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

(a)  $t+0$

(b)  $t+48$

Figure 7: Scatter diagrams for wave height at step 0 and 48 for the displayed centres at all buoys.

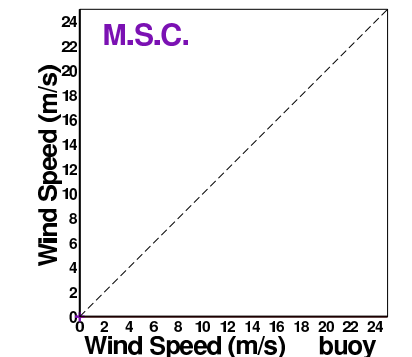


(a) t+0

(b) t+48

Figure 8: Scatter diagrams for wind speed at step 0 and 48 for the displayed centres at all buoys.

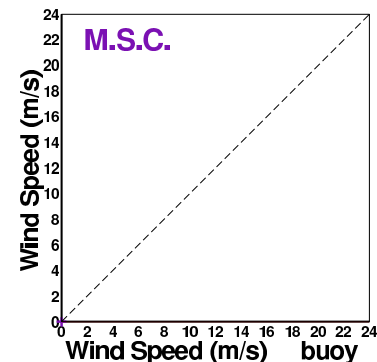
all buoys 0806 to 0808



Comparison of analysed AES wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

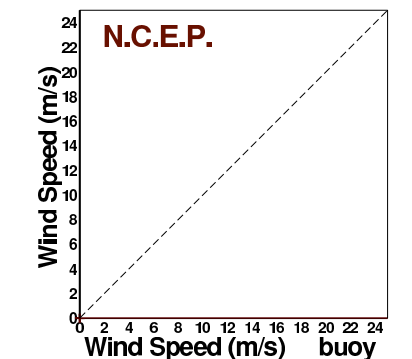
ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

all buoys 0806 to 0808



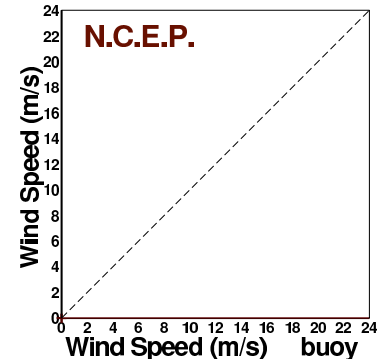
Comparison of forecast(t=t+48) AES wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



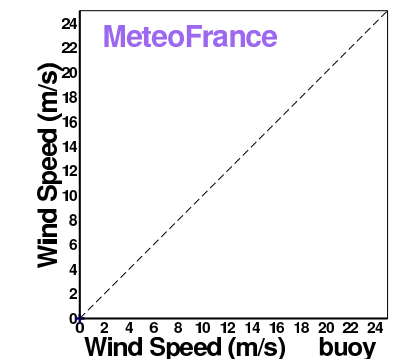
Comparison of analysed UKMO wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



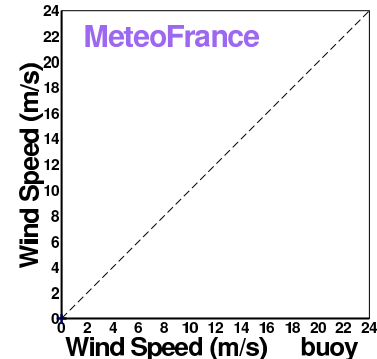
Comparison of forecast(t=t+48) UKMO wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of analysed METFR wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of forecast(t=t+48) METFR wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

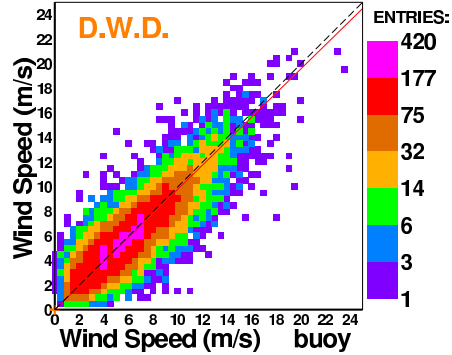
ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

(a) t+0

(b) t+48

Figure 9: Scatter diagrams for wind speed at step 0 and 48 for the displayed centres at all buoys.

all buoys 0806 to 0808

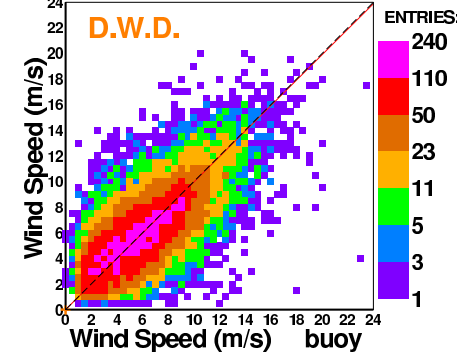


Comparison of analysed DWD wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

22101 42039 44011 46035 46208 46309 64046 63108 23170  
22102 42040 44014 46066 46002 51001 62111 63110 56002  
22103 42055 44018 46070 46005 51002 62116 63112 62004  
41001 41040 44024 46071 46006 51003 62117 63113 62005  
41004 41041 44025 46072 46012 51004 62119 63115 62002  
41008 41043 44027 46073 46013 51028 62128 62001 62003  
41009 41046 44027 46075 46014 51021 62132 62003 62004  
41010 41047 44038 46076 46015 61002 62133 1F3F 62005  
41012 41048 44137 46080 46023 62023 62142 1F3N 13130  
41013 42056 44138 46082 46028 62029 62143 1F48  
41025 42057 44139 46083 46029 62031 62144 1F4C  
41036 42058 44140 46084 46036 62092 62145 1F4H  
42001 42059 44141 46085 46041 62094 62164 1F5T  
42002 41100 44150 46132 46042 62095 62170 1DWR  
42003 41101 44251 46147 46047 62107 63055 23092  
42019 44005 44255 46184 46050 62163 63056 23097  
42020 44008 46001 46205 46099 62303 63057 23098  
42036 44009 46004 46207 46063 64046 63103 23101

ENTRIES = 22929  
MODEL MEAN = 6.12 STDEV = 2.860  
BUOY MEAN = 6.23 STDEV = 2.982  
LSQ FIT: SLOPE = 0.818 INTR = 1.031  
RMSE = 1.595 BIAS = -0.105  
CORR COEF = 0.852 SI = 0.256  
SYMMETRIC SLOPE = 0.979

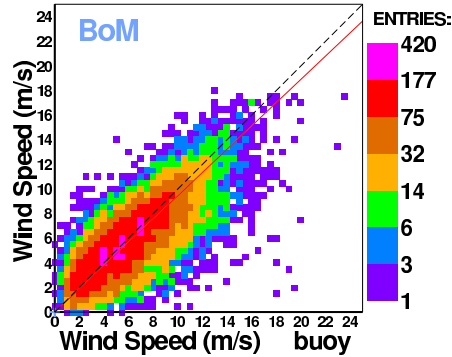
all buoys 0806 to 0808



Comparison of forecast(t=t+48) DWD wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

22101 42039 44011 46035 46208 46309 64046 63108 23170  
22102 42040 44014 46066 46002 51001 62111 63110 56002  
22103 42055 44018 46070 46005 51002 62116 63112 62004  
41001 41040 44024 46071 46006 51003 62117 63113 62005  
41004 41041 44025 46072 46012 51004 62119 63115 62002  
41008 41043 44027 46073 46013 51028 62128 62001 62003  
41009 41046 44027 46075 46014 51021 62132 62003 62004  
41010 41047 44038 46076 46015 61002 62133 1F3F 62005  
41012 41048 44137 46080 46023 62023 62142 1F3N 13130  
41013 42056 44138 46082 46028 62029 62143 1F48  
41025 42057 44139 46083 46029 62031 62144 1F4C  
41036 42058 44140 46084 46036 62092 62145 1F4H  
42001 42059 44141 46085 46041 62094 62164 1F5T  
42002 41100 44150 46132 46042 62095 62170 1DWR  
42003 41101 44251 46147 46047 62107 63055 23092  
42019 44005 44255 46184 46050 62163 63056 23097  
42020 44008 46001 46205 46099 62303 63057 23098  
42036 44009 46004 46207 46063 64046 63103 23101

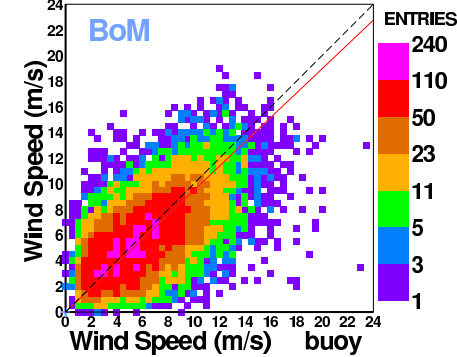
ENTRIES = 20738  
MODEL MEAN = 6.25 STDEV = 2.866  
BUOY MEAN = 6.23 STDEV = 2.999  
LSQ FIT: SLOPE = 0.671 INTR = 2.066  
RMSE = 2.265 BIAS = 0.019  
CORR COEF = 0.703 SI = 0.363  
SYMMETRIC SLOPE = 0.994



Comparison of analysed BoM wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

22101 42039 44011 46035 46208 46309 64046 63108 23170  
22102 42040 44014 46066 46002 51001 62111 63110 56002  
22103 42055 44018 46070 46005 51002 62116 63112 62004  
41001 41040 44024 46071 46006 51003 62117 63113 62005  
41004 41041 44025 46072 46012 51004 62119 63115 62002  
41008 41043 44027 46073 46013 51028 62128 62001 62003  
41009 41046 44027 46075 46014 51021 62132 62003 62004  
41010 41047 44038 46076 46015 61002 62133 1F3F 62005  
41012 41048 44137 46080 46023 62023 62142 1F3N 13130  
41013 42056 44138 46082 46028 62029 62143 1F48  
41025 42057 44139 46083 46029 62031 62144 1F4C  
41036 42058 44140 46084 46036 62092 62145 1F4H  
42001 42059 44141 46085 46041 62094 62164 1F5T  
42002 41100 44150 46132 46042 62095 62170 1DWR  
42003 41101 44251 46147 46047 62107 63055 23092  
42019 44005 44255 46184 46050 62163 63056 23097  
42020 44008 46001 46205 46099 62303 63057 23098  
42036 44009 46004 46207 46063 64046 63103 23101

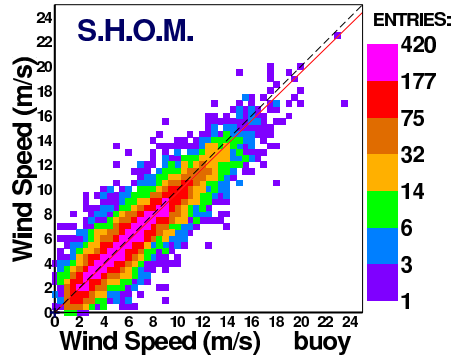
ENTRIES = 22926  
MODEL MEAN = 5.92 STDEV = 2.776  
BUOY MEAN = 6.23 STDEV = 2.982  
LSQ FIT: SLOPE = 0.710 INTR = 1.492  
RMSE = 2.016 BIAS = -0.313  
CORR COEF = 0.763 SI = 0.320  
SYMMETRIC SLOPE = 0.946



Comparison of forecast(t=t+48) BoM wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

22101 42039 44011 46035 46208 46309 64046 63108 23170  
22102 42040 44014 46066 46002 51001 62111 63110 56002  
22103 42055 44018 46070 46005 51002 62116 63112 62004  
41001 41040 44024 46071 46006 51003 62117 63113 62005  
41004 41041 44025 46072 46012 51004 62119 63115 62002  
41008 41043 44027 46073 46013 51028 62128 62001 62003  
41009 41046 44027 46075 46014 51021 62132 62003 62004  
41010 41047 44038 46076 46015 61002 62133 1F3F 62005  
41012 41048 44137 46080 46023 62023 62142 1F3N 13130  
41013 42056 44138 46082 46028 62029 62143 1F48  
41025 42057 44139 46083 46029 62031 62144 1F4C  
41036 42058 44140 46084 46036 62092 62145 1F4H  
42001 42059 44141 46085 46041 62094 62164 1F5T  
42002 41100 44150 46132 46042 62095 62170 1DWR  
42003 41101 44251 46147 46047 62107 63055 23092  
42019 44005 44255 46184 46050 62163 63056 23097  
42020 44008 46001 46205 46099 62303 63057 23098  
42036 44009 46004 46207 46063 64046 63103 23101

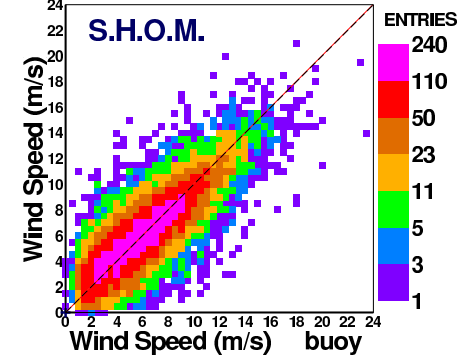
ENTRIES = 20737  
MODEL MEAN = 5.95 STDEV = 2.761  
BUOY MEAN = 6.23 STDEV = 2.999  
LSQ FIT: SLOPE = 0.549 INTR = 2.531  
RMSE = 2.610 BIAS = -0.276  
CORR COEF = 0.597 SI = 0.417  
SYMMETRIC SLOPE = 0.949



Comparison of analysed SHOM wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

22101 42039 44011 46035 46208 46309 64046 63108 23170  
22102 42040 44014 46066 46002 51001 62111 63110 56002  
22103 42055 44018 46070 46005 51002 62116 63112 62004  
41001 41040 44024 46071 46006 51003 62117 63113 62005  
41004 41041 44025 46072 46012 51004 62119 63115 62002  
41008 41043 44027 46073 46013 51028 62128 62001 62003  
41009 41046 44027 46075 46014 51021 62132 62003 62004  
41010 41047 44038 46076 46015 61002 62133 1F3F 62005  
41012 41048 44137 46080 46023 62023 62142 1F3N 13130  
41013 42056 44138 46082 46028 62029 62143 1F48  
41025 42057 44139 46083 46029 62031 62144 1F4C  
41036 42058 44140 46084 46036 62092 62145 1F4H  
42001 42059 44141 46085 46041 62094 62164 1F5T  
42002 41100 44150 46132 46042 62095 62170 1DWR  
42003 41101 44251 46147 46047 62107 63055 23092  
42019 44005 44255 46184 46050 62163 63056 23097  
42020 44008 46001 46205 46099 62303 63057 23098  
42036 44009 46004 46207 46063 64046 63103 23101

ENTRIES = 22929  
MODEL MEAN = 6.08 STDEV = 2.881  
BUOY MEAN = 6.23 STDEV = 2.982  
LSQ FIT: SLOPE = 0.893 INTR = 0.525  
RMSE = 1.158 BIAS = -0.145  
CORR COEF = 0.924 SI = 0.184  
SYMMETRIC SLOPE = 0.975



Comparison of forecast(t=t+48) SHOM wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

22101 42039 44011 46035 46208 46309 64046 63108 23170  
22102 42040 44014 46066 46002 51001 62111 63110 56002  
22103 42055 44018 46070 46005 51002 62116 63112 62004  
41001 41040 44024 46071 46006 51003 62117 63113 62005  
41004 41041 44025 46072 46012 51004 62119 63115 62002  
41008 41043 44027 46073 46013 51028 62128 62001 62003  
41009 41046 44027 46075 46014 51021 62132 62003 62004  
41010 41047 44038 46076 46015 61002 62133 1F3F 62005  
41012 41048 44137 46080 46023 62023 62142 1F3N 13130  
41013 42056 44138 46082 46028 62029 62143 1F48  
41025 42057 44139 46083 46029 62031 62144 1F4C  
41036 42058 44140 46084 46036 62092 62145 1F4H  
42001 42059 44141 46085 46041 62094 62164 1F5T  
42002 41100 44150 46132 46042 62095 62170 1DWR  
42003 41101 44251 46147 46047 62107 63055 23092  
42019 44005 44255 46184 46050 62163 63056 23097  
42020 44008 46001 46205 46099 62303 63057 23098  
42036 44009 46004 46207 46063 64046 63103 23101

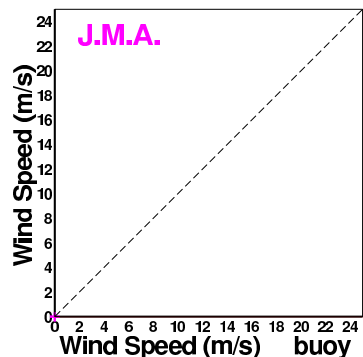
ENTRIES = 20738  
MODEL MEAN = 6.28 STDEV = 2.894  
BUOY MEAN = 6.23 STDEV = 2.999  
LSQ FIT: SLOPE = 0.782 INTR = 1.415  
RMSE = 1.821 BIAS = 0.054  
CORR COEF = 0.810 SI = 0.292  
SYMMETRIC SLOPE = 1.001

(a) t+0

(b) t+48

Figure 10: Scatter diagrams for wind speed at step 0 and 48 for the displayed centres at all buoys.

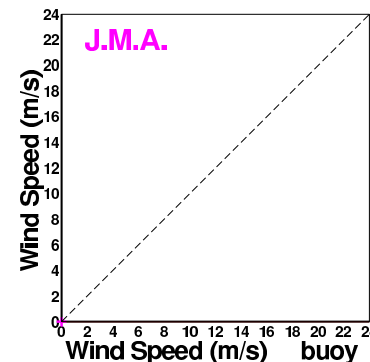
all buoys 0806 to 0808



Comparison of analysed JMA wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

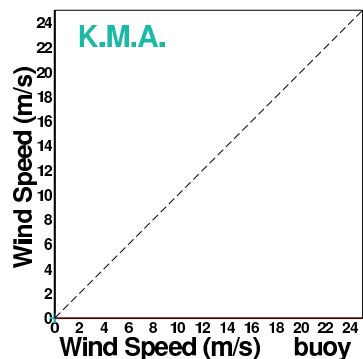
ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

all buoys 0806 to 0808



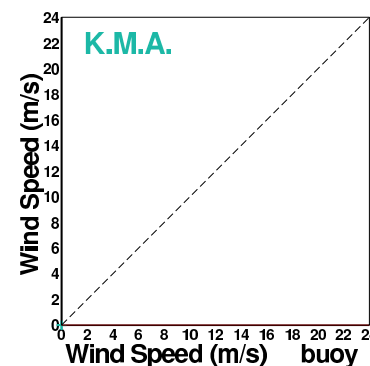
Comparison of forecast(t=t+48) JMA wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



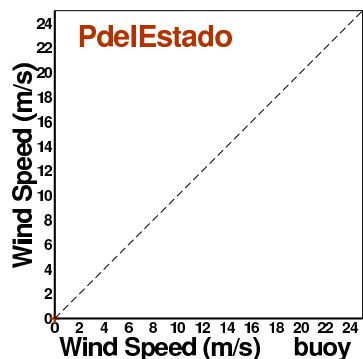
Comparison of analysed KMA wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



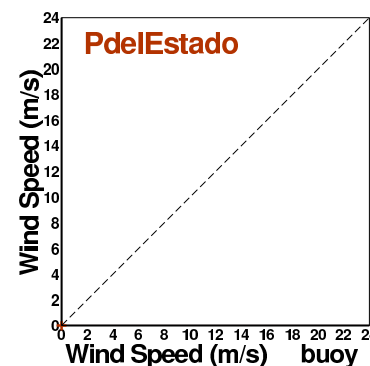
Comparison of forecast(t=t+48) KMA wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of analysed PRTOS wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of forecast(t=t+48) PRTOS wind speed with height corrected averaged buoy data, fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

(a) t+0

(b) t+48

Figure 11: Scatter diagrams for wind speed at step 0 and 48 for the displayed centres at all buoys.

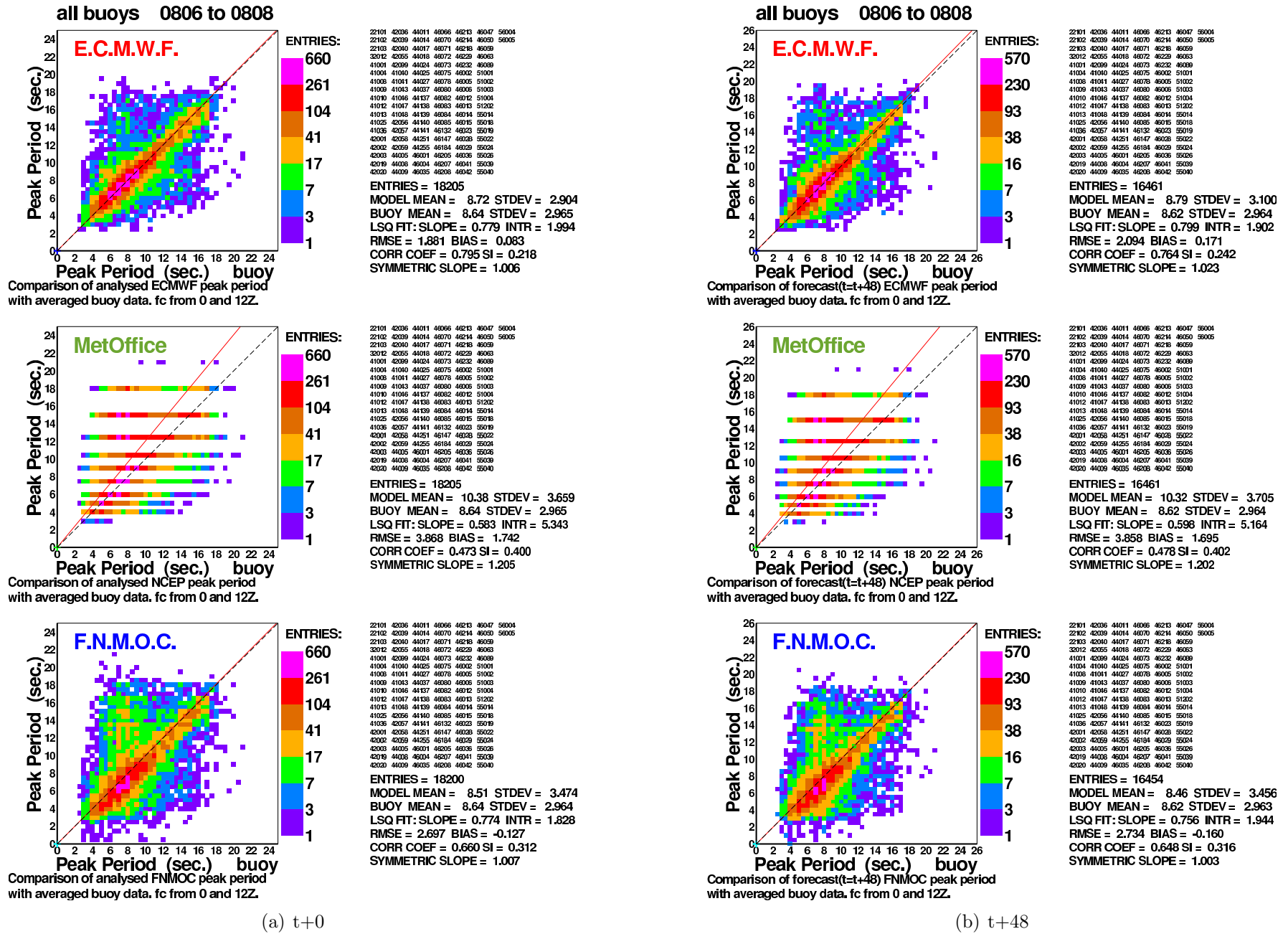
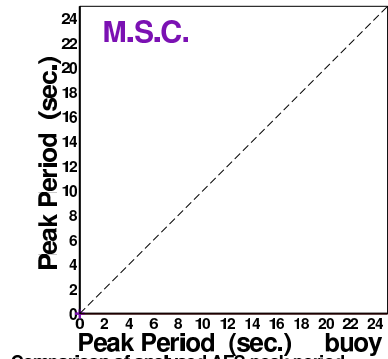


Figure 12: Scatter diagrams for peak period at step 0 and 48 for the displayed centres at all buoys.

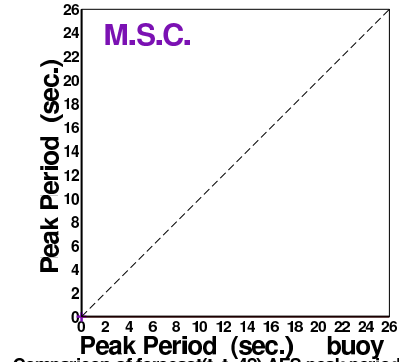
all buoys 0806 to 0808



Comparison of analysed AES peak period with averaged buoy data. fc from 0 and 12Z.

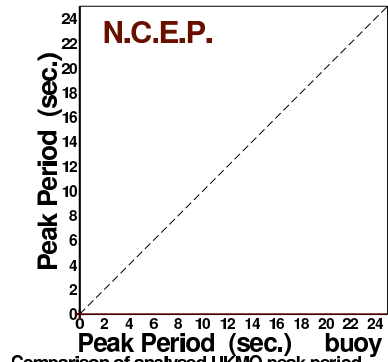
ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

all buoys 0806 to 0808



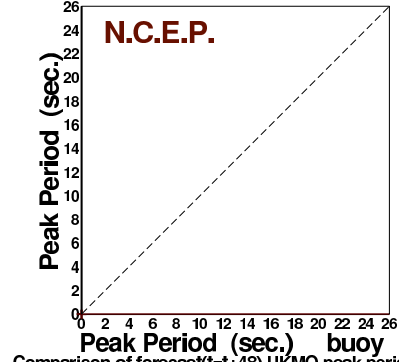
Comparison of forecast(t-t+48) AES peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



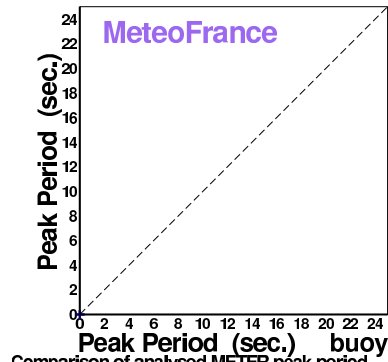
Comparison of analysed UKMO peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



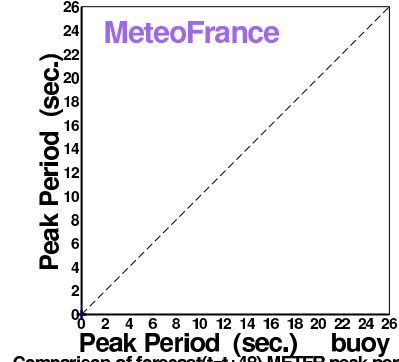
Comparison of forecast(t-t+48) UKMO peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of analysed METFR peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of forecast(t-t+48) METFR peak period with averaged buoy data. fc from 0 and 12Z.

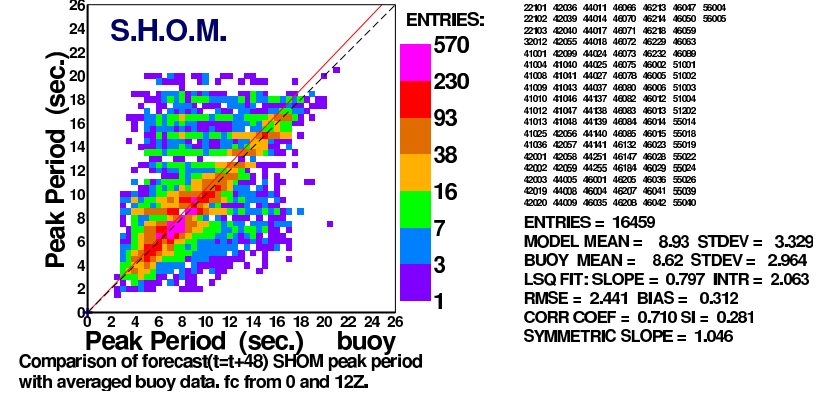
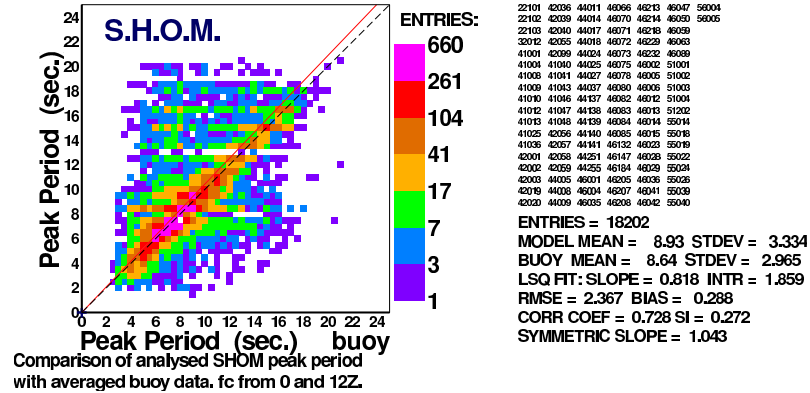
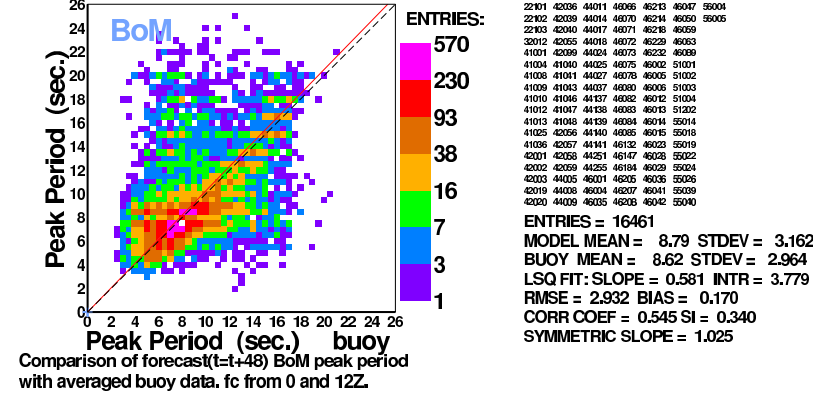
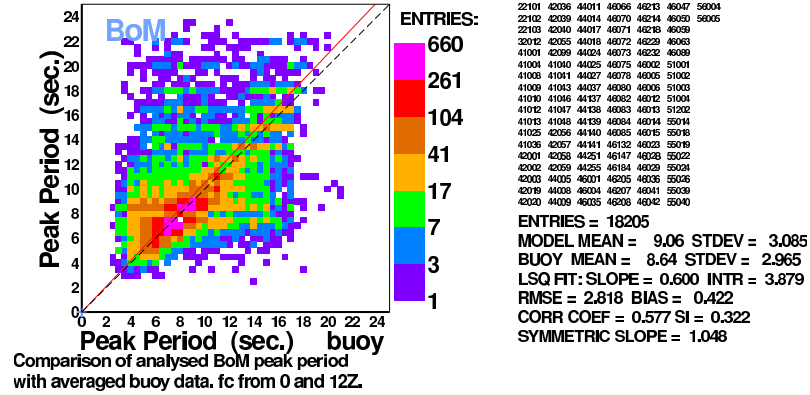
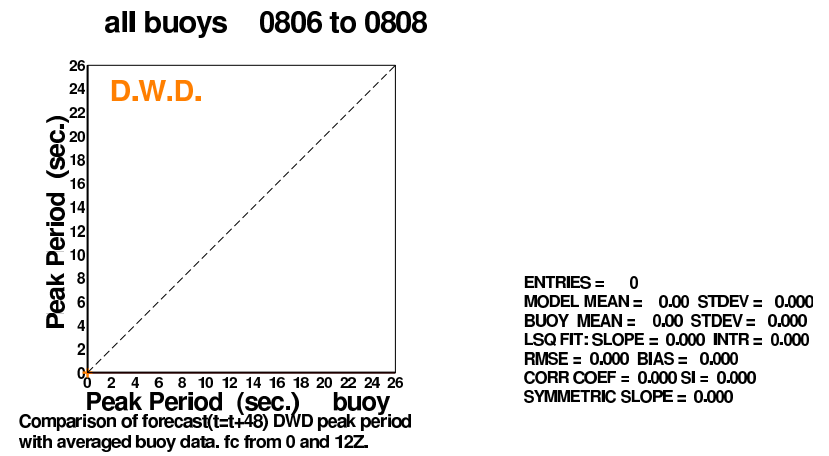
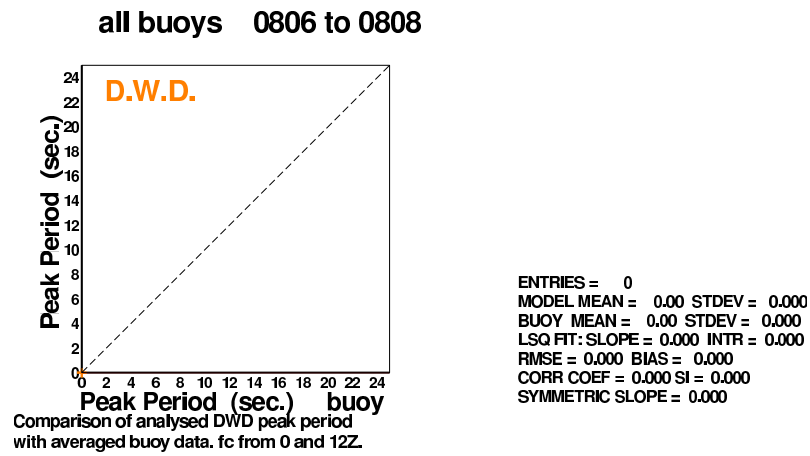
ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

(a) t+0

(b) t+48

Figure 13: Scatter diagrams for peak period at step 0 and 48 for the displayed centres at all buoys.



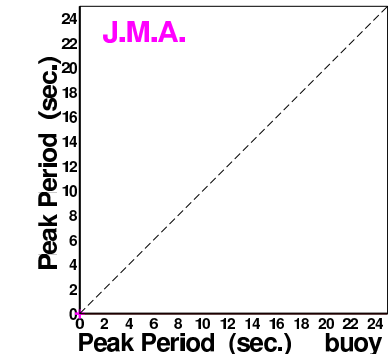


(a) t+0

(b) t+48

Figure 14: Scatter diagrams for peak period at step 0 and 48 for the displayed centres at all buoys.

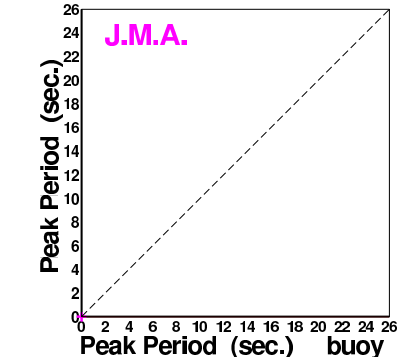
all buoys 0806 to 0808



Comparison of analysed JMA peak period with averaged buoy data. fc from 0 and 12Z.

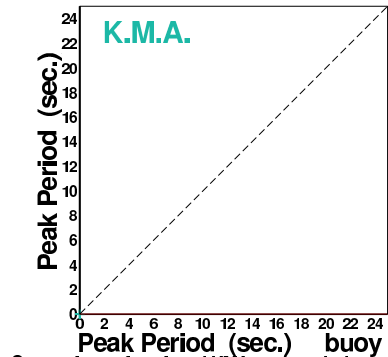
ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

all buoys 0806 to 0808



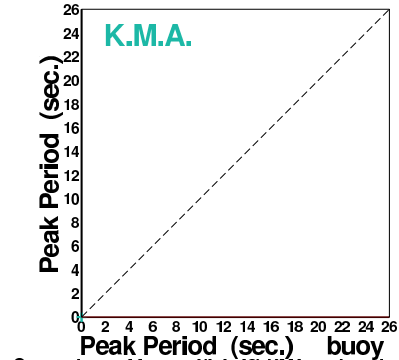
Comparison of forecast(t-t+48) JMA peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



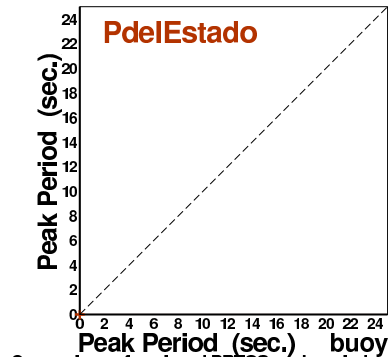
Comparison of analysed KMA peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



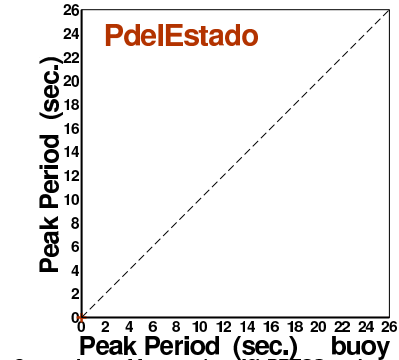
Comparison of forecast(t-t+48) KMA peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of analysed PRTOS peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000



Comparison of forecast(t-t+48) PRTOS peak period with averaged buoy data. fc from 0 and 12Z.

ENTRIES = 0  
MODEL MEAN = 0.00 STDEV = 0.000  
BUOY MEAN = 0.00 STDEV = 0.000  
LSQ FIT: SLOPE = 0.000 INTR = 0.000  
RMSE = 0.000 BIAS = 0.000  
CORR COEF = 0.000 SI = 0.000  
SYMMETRIC SLOPE = 0.000

(a) t+0

(b) t+48

Figure 15: Scatter diagrams for peak period at step 0 and 48 for the displayed centres at all buoys.

### 0.3.2 Comparison for Hawaiian buoys

Number of common observations for Hawaiian buoys (HW) from 200806 to 200808 (wind, Hs, Tp)

1	51001	182	182	182	Hawaii North West	4	51004	15	15	15	Hawaii South East
2	51002	181	181	181	Hawaii South West	5	51028	181	0	0	Christmas Island DWA
3	51003	182	182	182	Hawaii West	6	51202	0	179	179	Hawaii Mokapu Point (scripps 098)

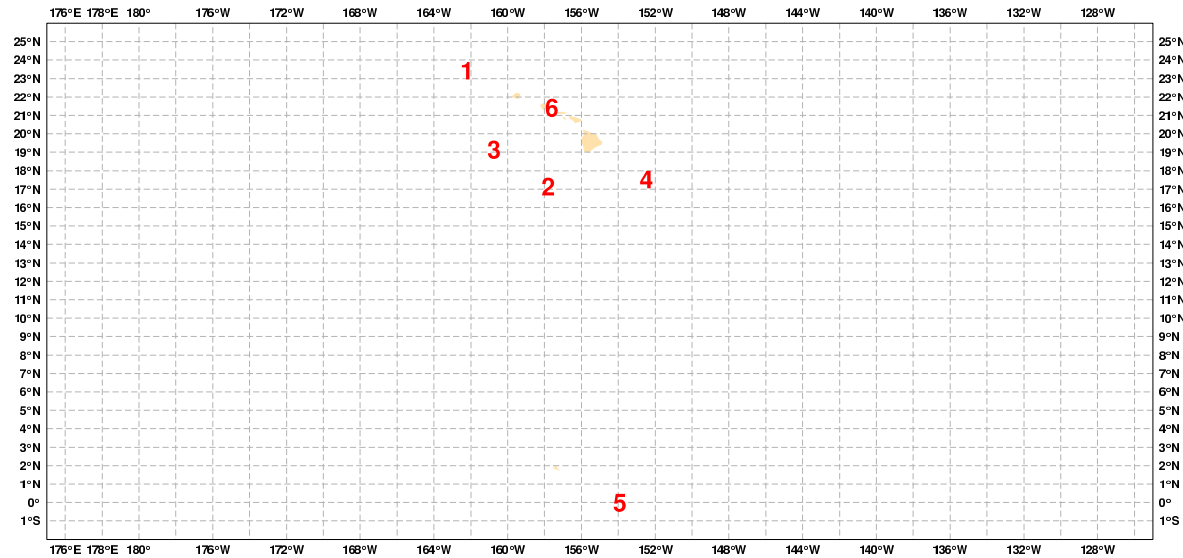
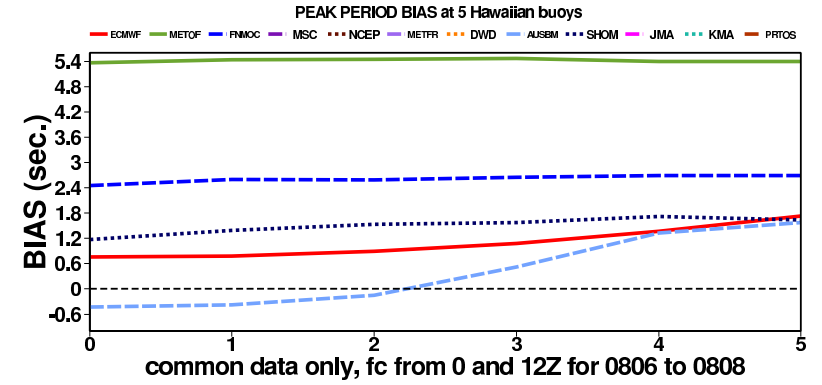
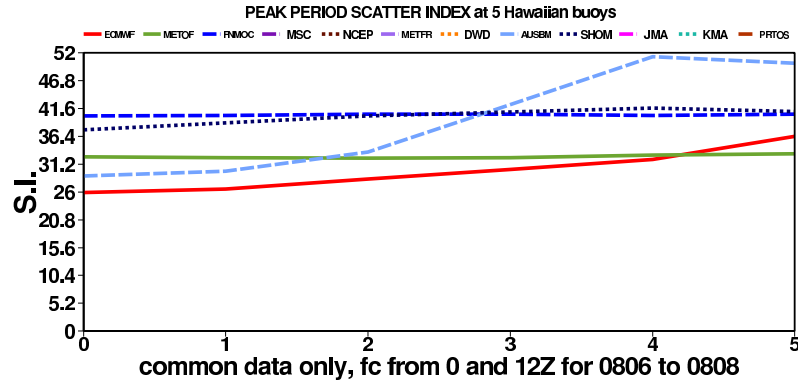
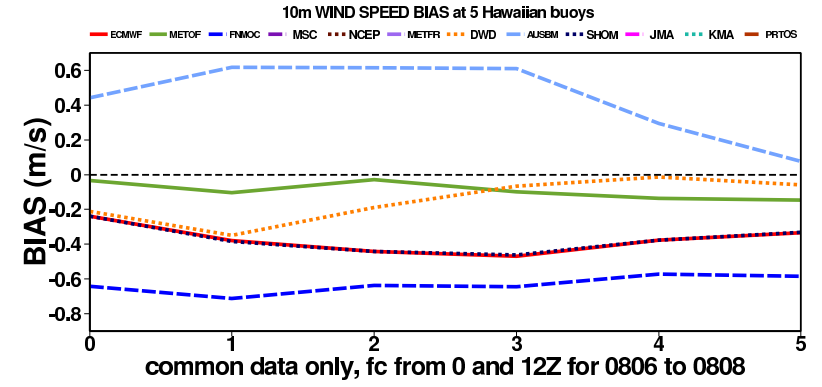
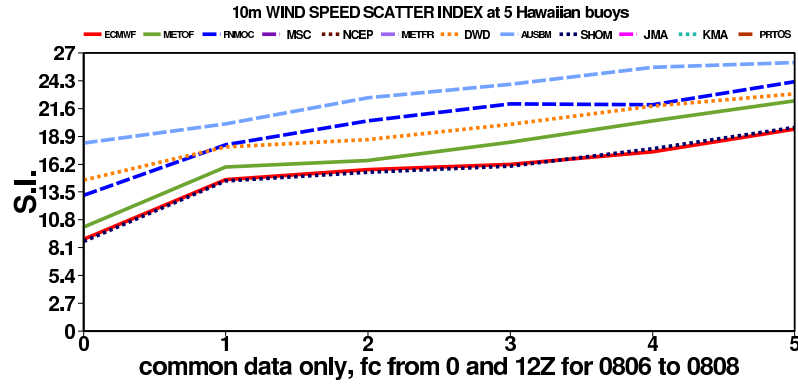
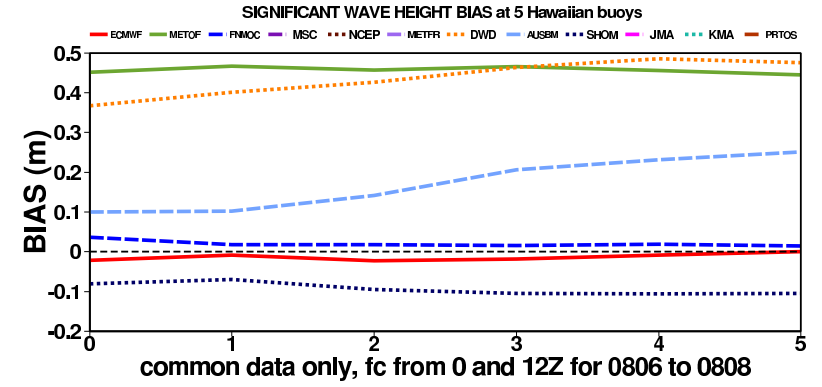
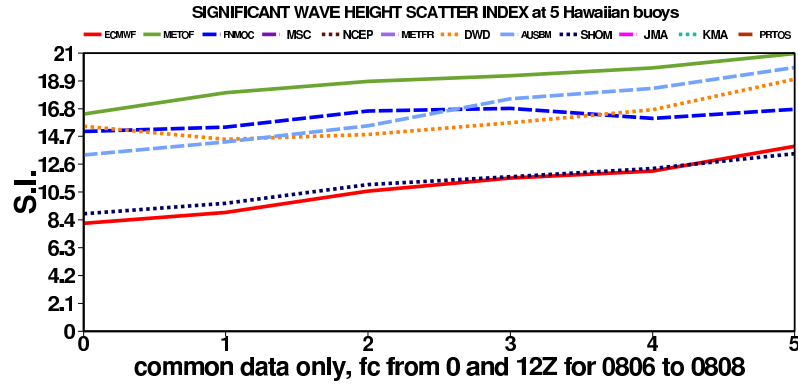


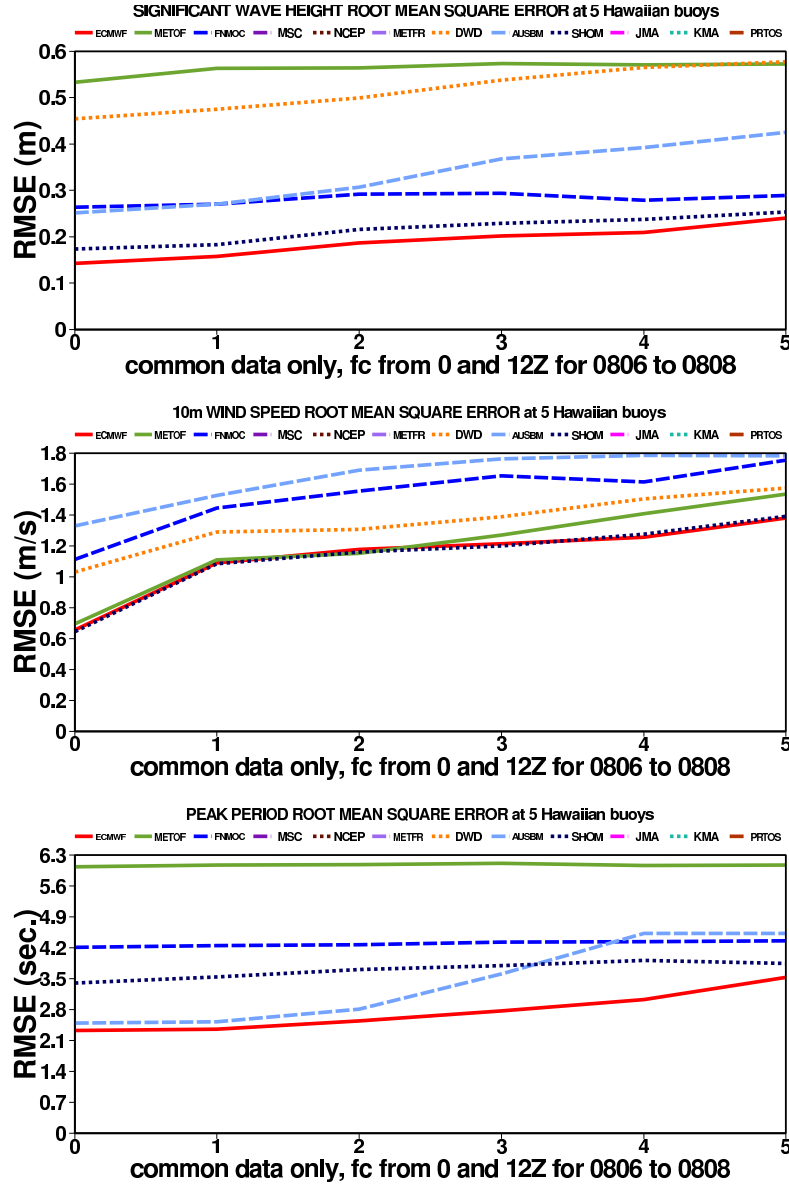
Figure 16: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



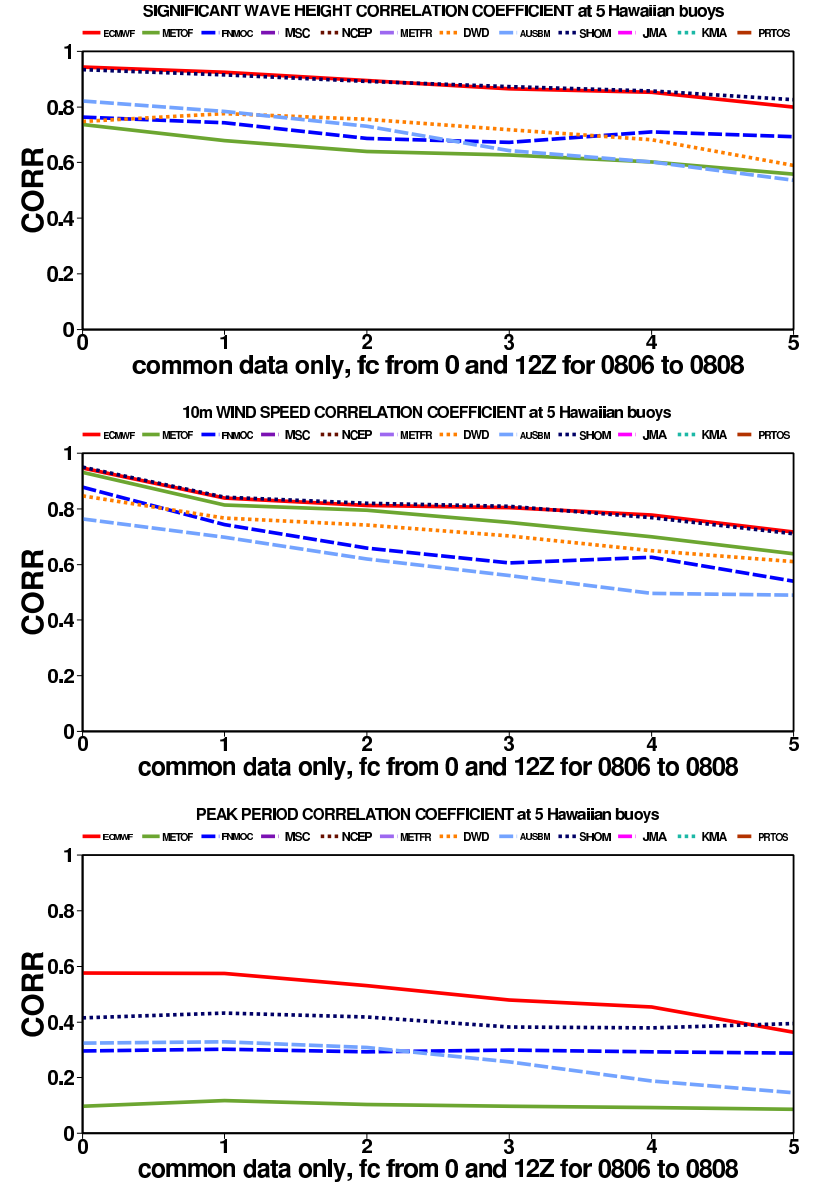
(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 17: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Hawaiian buoys.



(a) R.M.S.E.



(b) Correlation Coefficient

Figure 18: Forecast root mean square error (RMSE) and linear correlation coefficient at common Hawaiian buoys.

### 0.3.3 Comparison for North Pacific buoys

Number of common observations for North Pacific buoys (NPC) from 200806 to 200808 (wind, Hs, Tp)

1	46001	182	182	182	Gulf of Alaska	12	46080	65	67	67	Gulf of Alaska, Kennedy Entrance
2	46004	181	181	181	Canada West Coast, Middle Nomad	13	46082	55	56	56	Gulf of Alaska, Cape Suckling
3	46035	182	181	181	Bering Sea	14	46083	148	182	182	Gulf of Alaska, Fairweather Grounds
4	46066	182	181	182	Gulf of Alaska, S Aleutians	15	46084	181	182	182	Gulf of Alaska, Cape Edgecumbe
5	46070	181	173	173	Southwest Bering Sea	16	46085	178	180	179	Central Gulf of Alaska
6	46071	165	165	165	North Pacific, Western Aleutians	17	46132	182	182	182	Canada West Coast, South Brooks
7	46072	13	182	182	North Pacific, Central Aleutians	18	46147	182	182	182	Canada West Coast, South Moresby
8	46073	182	177	177	Southeast Bering Sea	19	46184	182	182	181	Canada West Coast, North Nomad
9	46075	60	180	180	North Pacific, Shumagin Islands	20	46205	182	182	182	Canada West Coast, W. Dixon Entrance
10	46076	143	144	0	Gulf of Alaska, Cape Clear	21	46207	182	182	182	Canada West Coast, East Dellwood
11	46078	0	178	177	Gulf of Alaska, Albatross Banks	22	46208	182	182	182	Canada West Coast, West Moresby

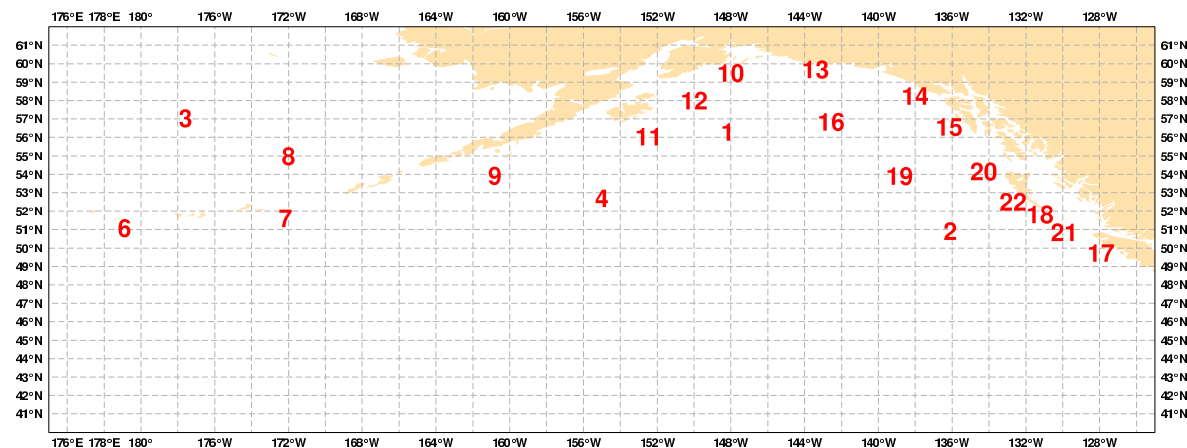
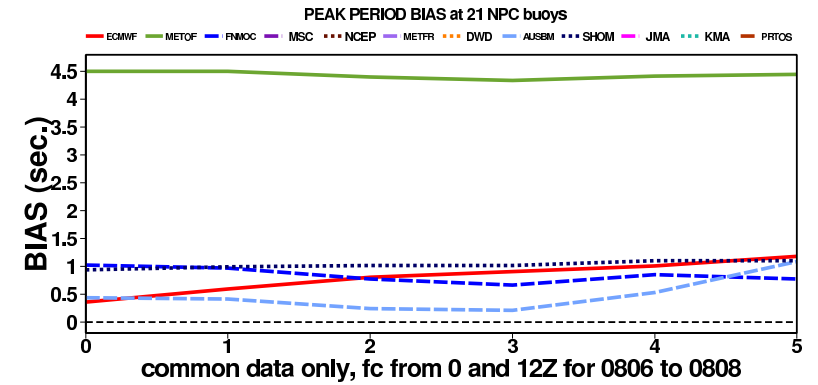
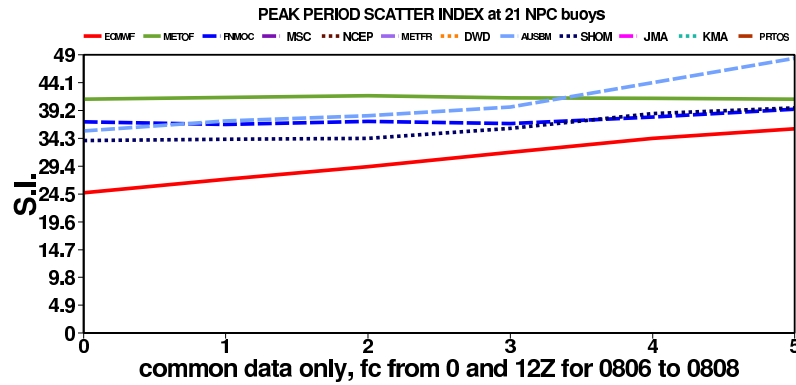
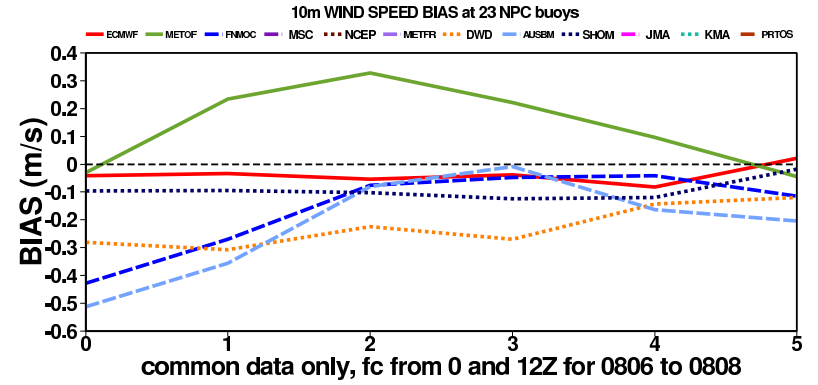
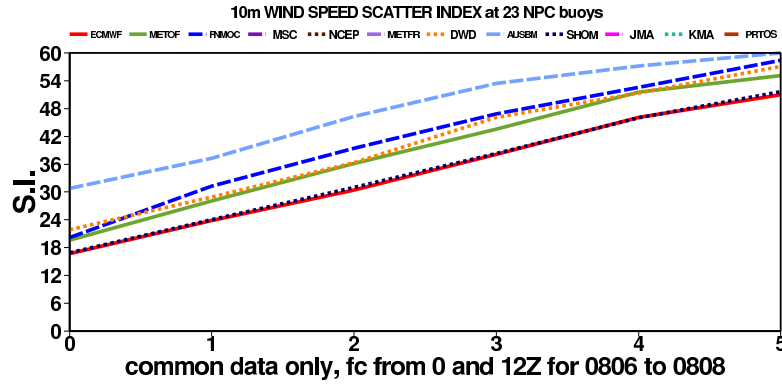
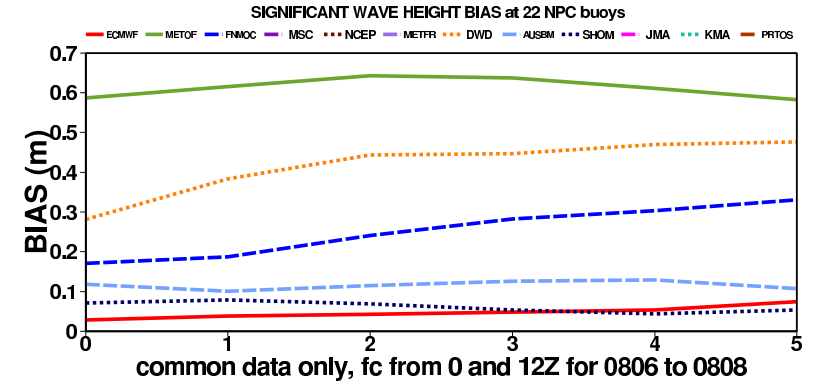
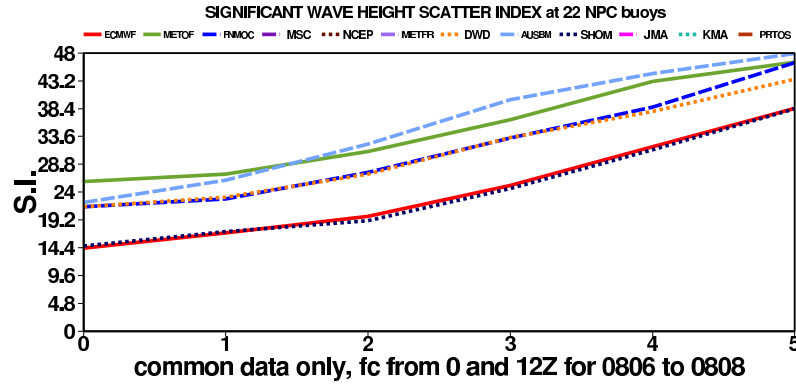


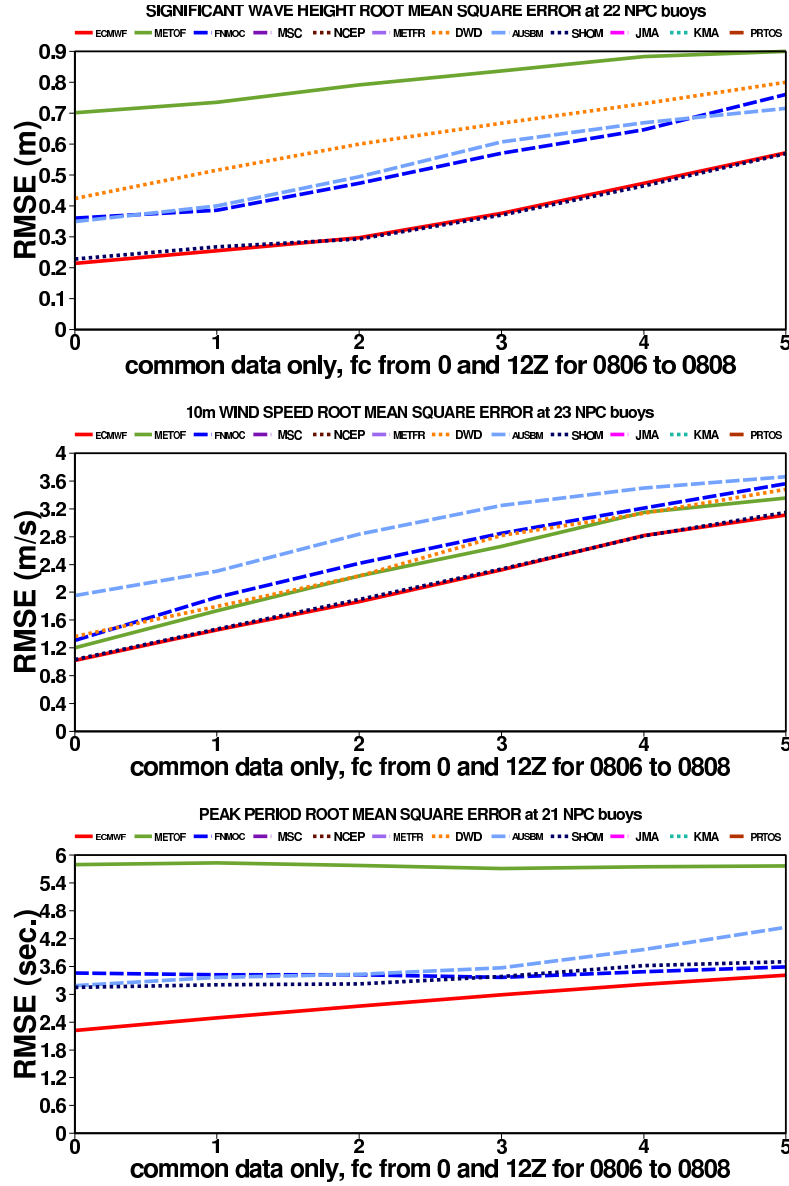
Figure 19: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



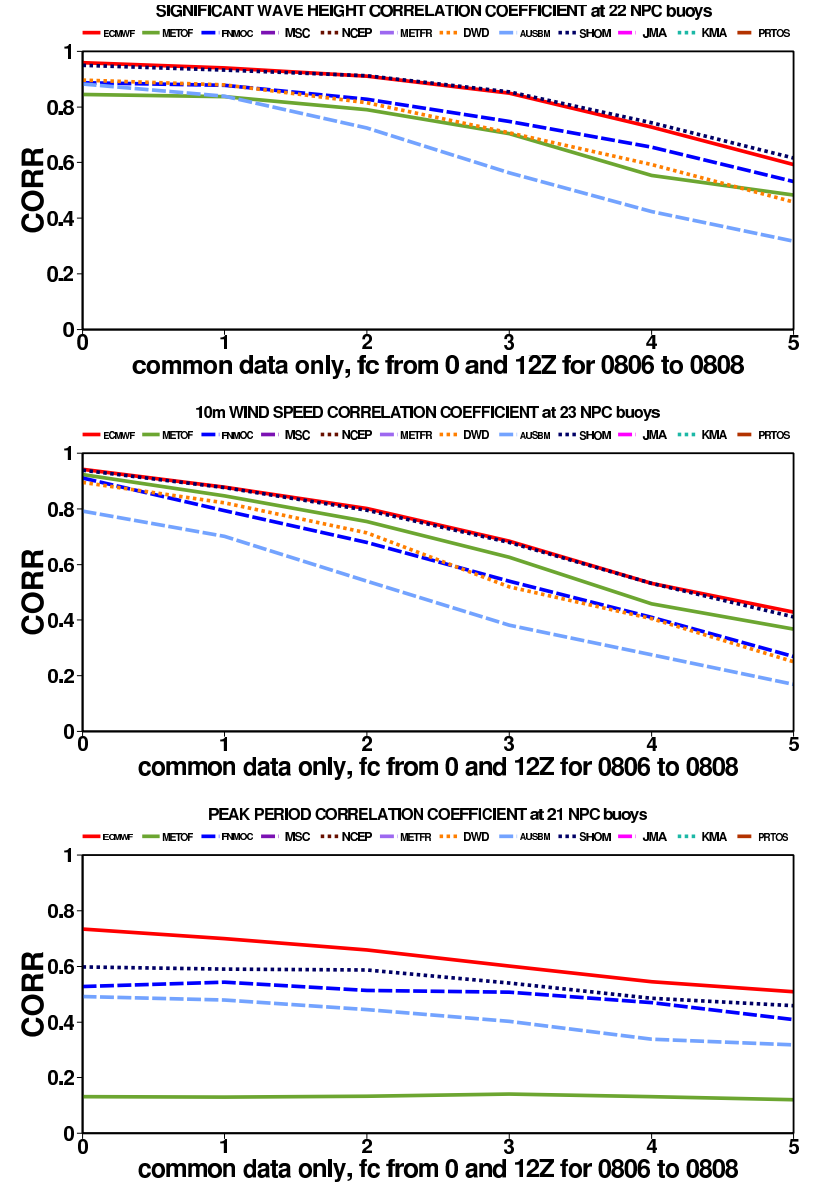
(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 20: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common North Pacific buoys .



(a) R.M.S.E.



(b) Correlation Coefficient

Figure 21: Forecast root mean square error (RMSE) and linear correlation coefficient at common North Pacific buoys .



### 0.3.4 Comparison for US West Coast buoys

Number of common observations for US West Coast buoys (USWC) from 200806 to 200808 (wind, Hs, Tp)

1	46002	134	135	135	US West Coast, Oregon	13	46042	182	146	145	US South-West Coast, Monterey
2	46005	132	132	132	US North-West Coast, W Astoria	14	46047	182	182	182	US South-West Coast, Tanner Banks
3	46006	17	17	17	US West Coast, SW Astoria	15	46050	182	182	182	US West Coast, Yaquina Bay
4	46012	170	170	170	US South-West Coast, Half Moon Bay	16	46059	182	182	182	US West Coast, California
5	46013	182	182	182	US South-West Coast, Bodega	17	46063	182	182	182	US West Coast, Pt Conception
6	46014	182	182	181	US South-West Coast, Point Arena	18	46089	128	128	128	US West Coast, Tillamook, OR
7	46015	120	116	116	US West Coast, Port Orford	19	46213	0	182	182	US South-West Coast, Cape Mendocino (scripps 094)
8	46023	182	182	182	US South-West Coast, Point Arguello	20	46214	0	176	176	US South-West Coast, Point Reyes (scripps 029)
9	46028	182	180	180	US South-West Coast, Cape St Martin	21	46218	0	182	182	US South-West Coast, Harvest (scripps 071)
10	46029	182	182	182	US West Coast, Columbia River Bar	22	46229	0	182	182	US West Coast, Coos Bay (scripps 126)
11	46036	181	182	181	Canada West Coast, South Nomad	23	46232	0	182	181	US South West Coast, Coronado Islands MX (scripps 133)
12	46041	168	182	182	US North-West Coast, Cape Elisabeth						

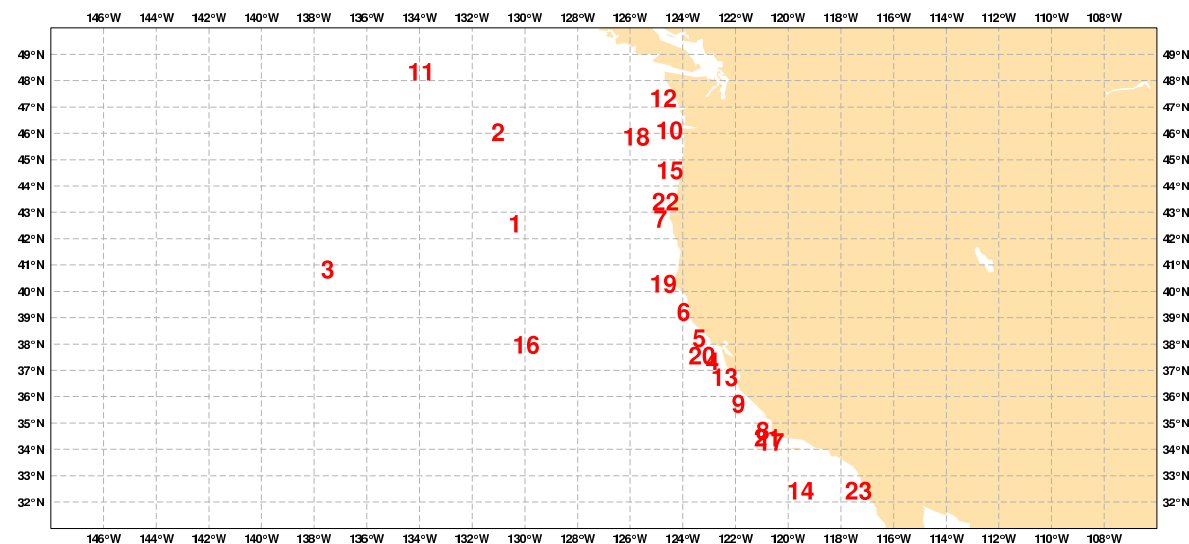
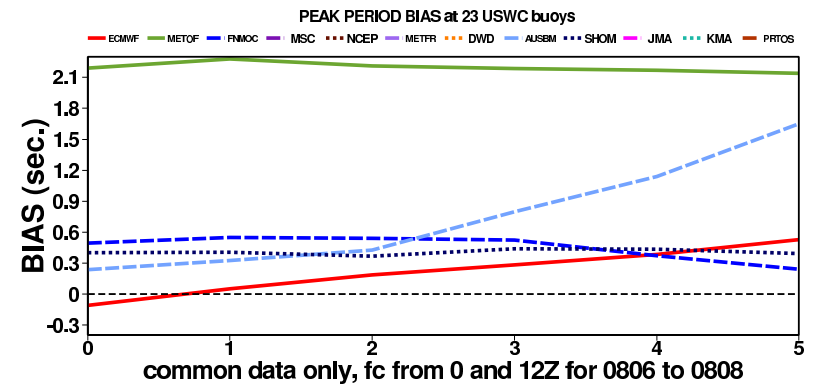
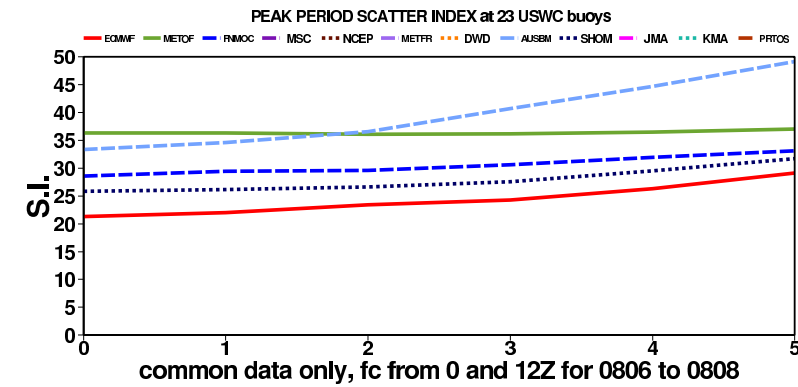
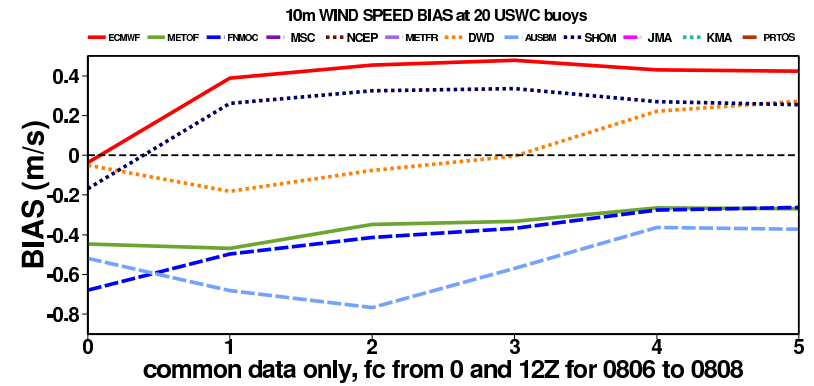
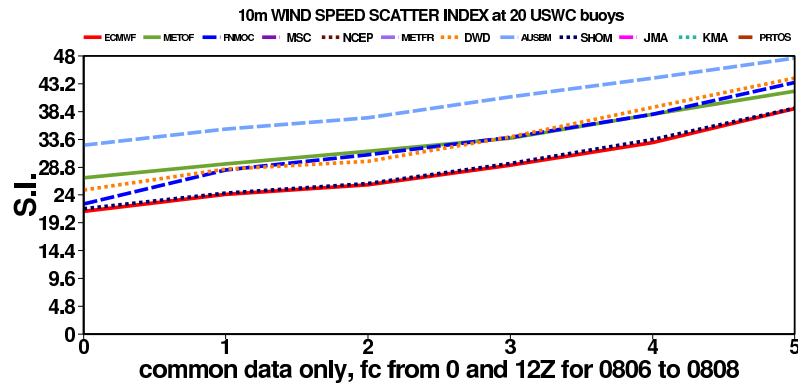
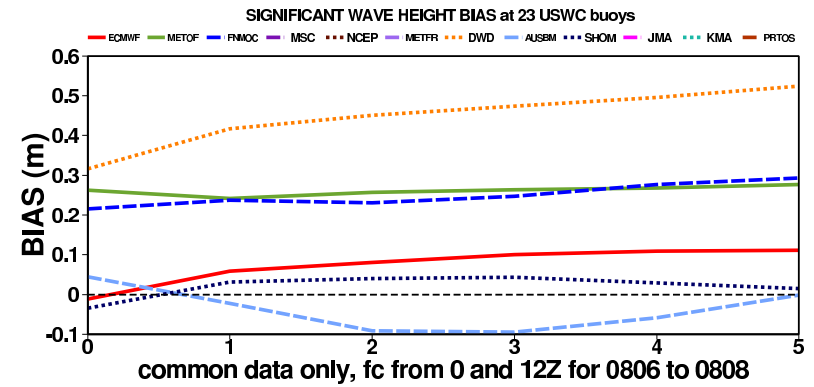
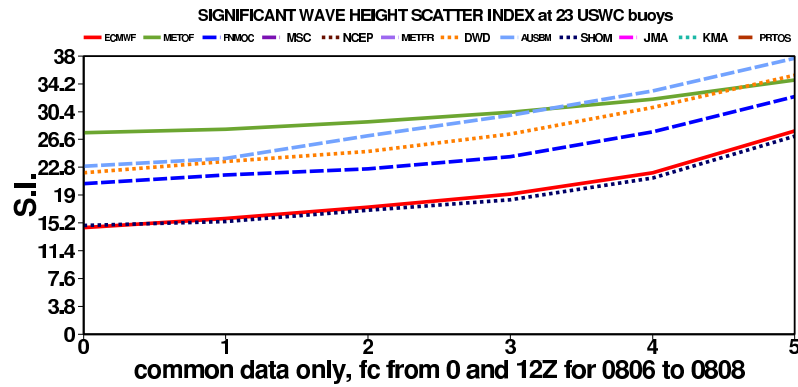


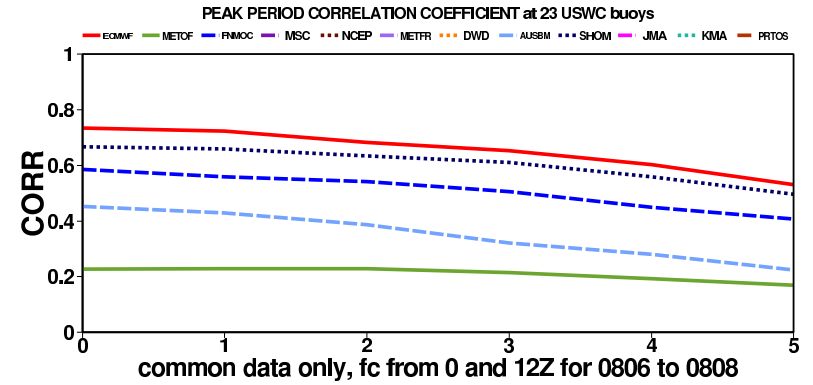
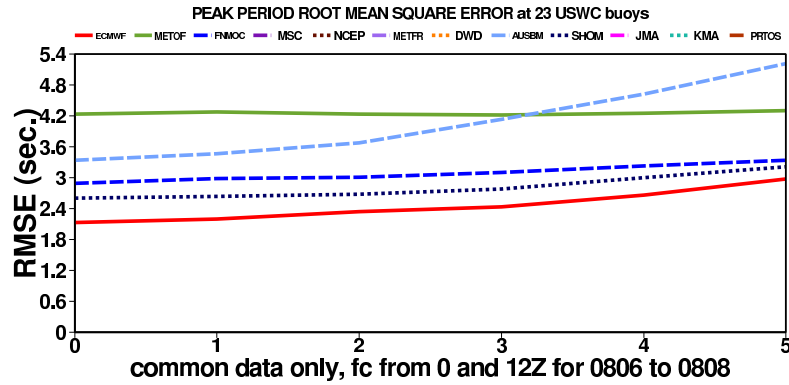
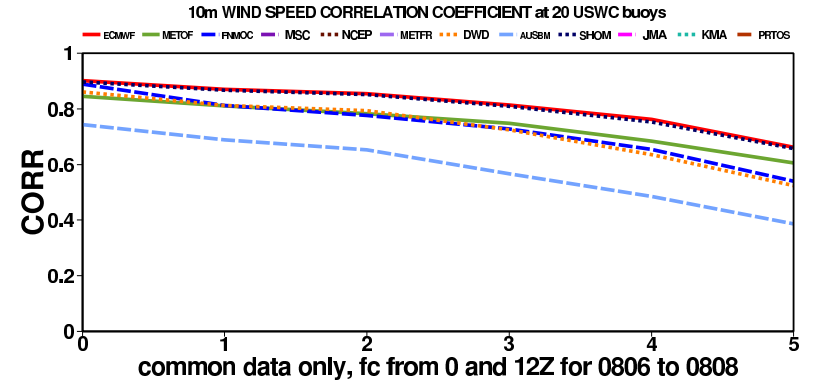
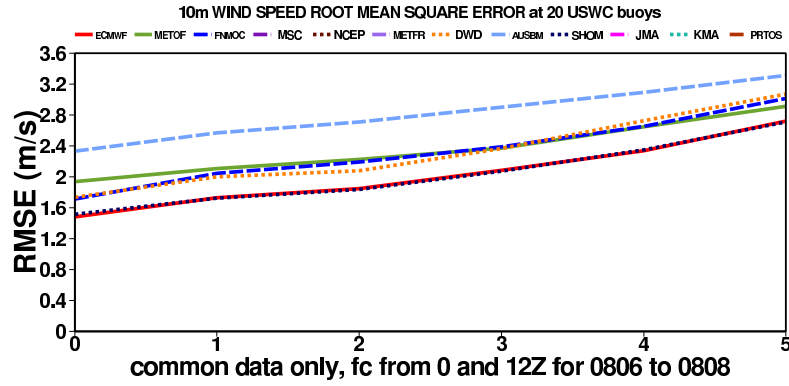
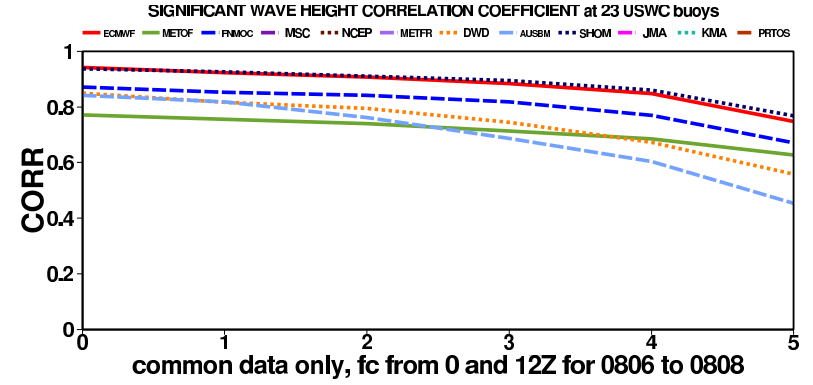
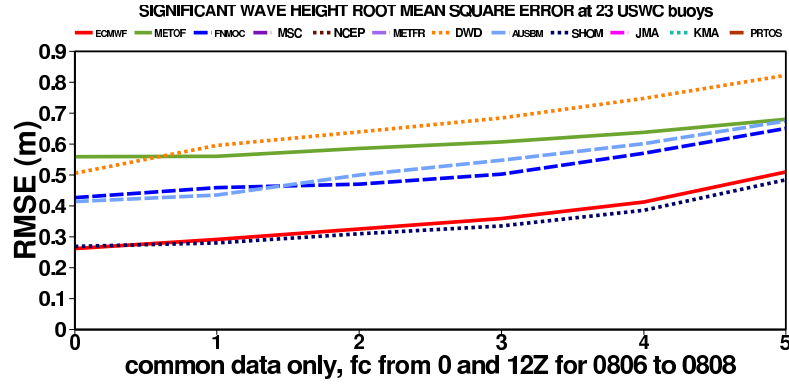
Figure 22: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 23: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common US West Coast buoys .



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 24: Forecast root mean square error (RMSE) and linear correlation coefficient at common US West Coast buoys .

### 0.3.5 Comparison for US East Coast buoys

Number of common observations for US East Coast buoys (USEC) from 200806 to 200808 (wind, Hs, Tp)

1	41001	82	82	82	US East Coast, E Hatteras	12	44008	182	182	182	US North-East Coast, Nantucket
2	41004	177	177	177	US South-East Coast, Edisto	13	44009	181	182	182	US North-East Coast, Delaware bay
3	41008	180	180	180	US South-East Coast, Grays reef	14	44011	179	180	180	US North-East Coast, Georges Bank
4	41009	91	126	126	US East Florida , Cape Canaveral	15	44014	120	120	120	US East Coast, Virginia Beach
5	41010	182	182	182	US East Florida , Cape Canaveral East	16	44017	0	182	182	US North-East Coast, Momaunk Point
6	41012	181	155	155	US East Florida , St Augustine	17	44018	180	182	182	US North-East Coast, SE Cape Cod
7	41013	182	182	182	US South-East Coast , Frying Pan Shoals	18	44024	181	181	181	US North East Coast, Northeast Channel
8	41025	182	171	171	US East Coast, Diamond Shoals (Red Buoy)	19	44025	182	182	182	US North East Coast, Long Island
9	41036	182	182	182	US East Coast, Onslow Bay offshore	20	44027	182	182	177	US North East Coast, Jonesport
10	41048	182	179	179	W Bermuda	21	44037	181	182	181	US North East Coast, Jordan Basin
11	44005	76	76	76	US North East Coast, Gulf of Maine	22	44038	182	182	0	US North East Coast, Scotian Shelf

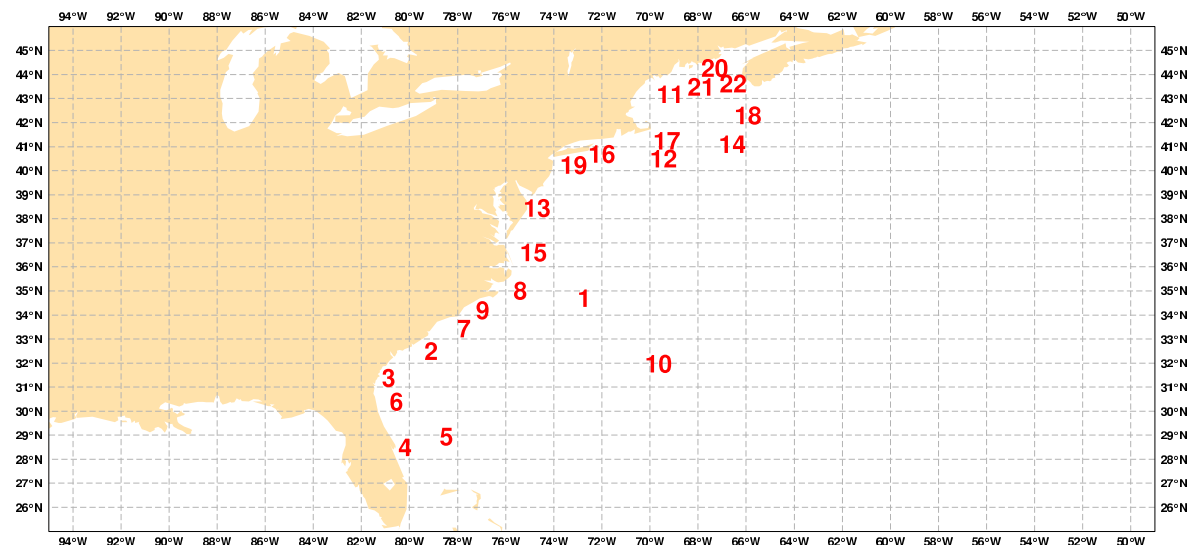
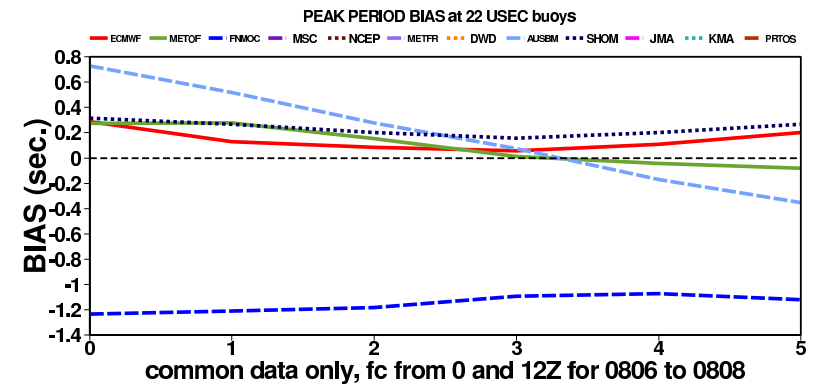
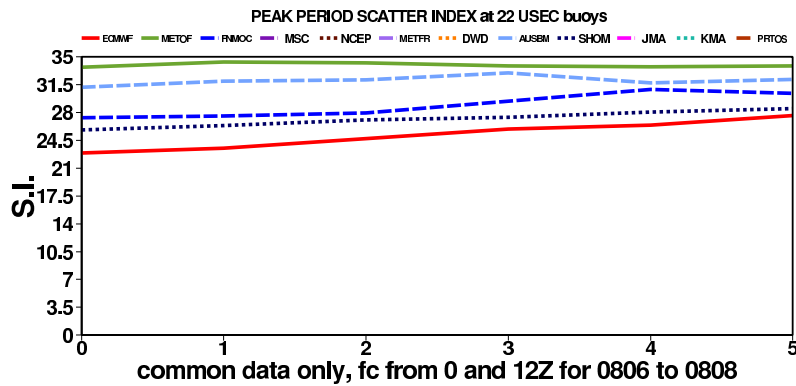
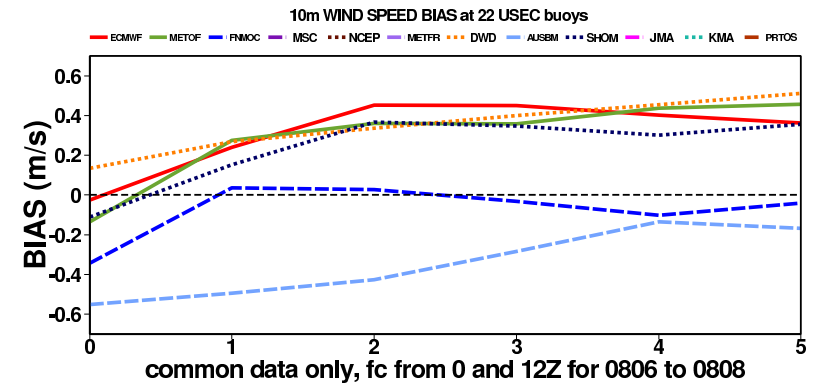
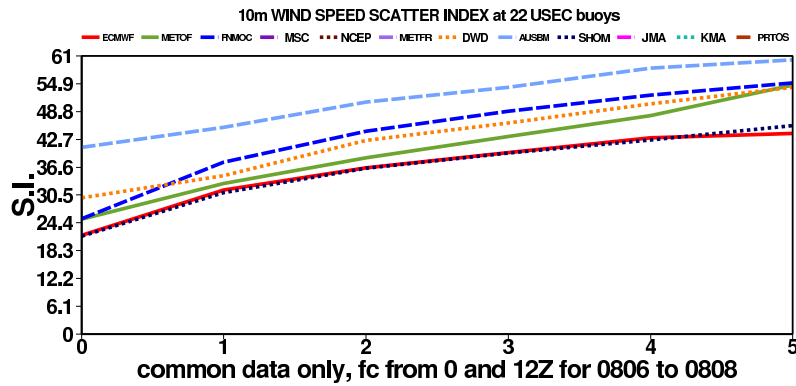
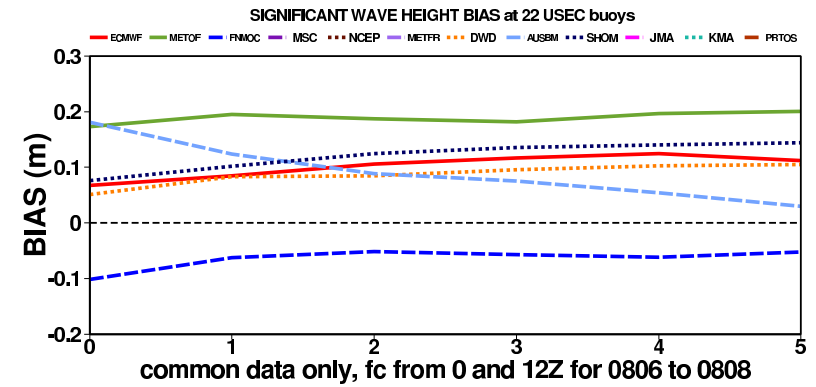
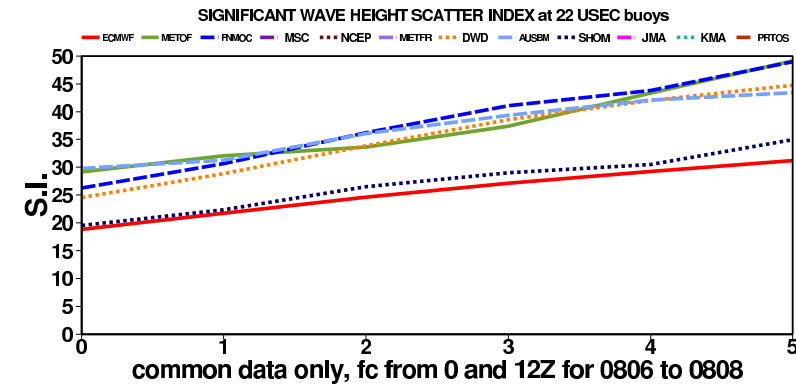


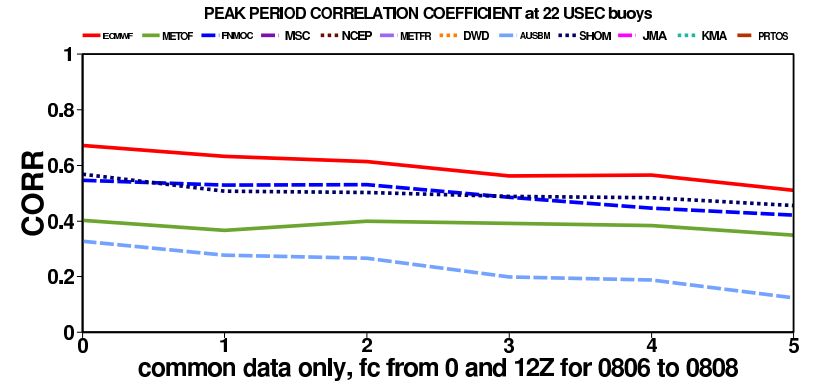
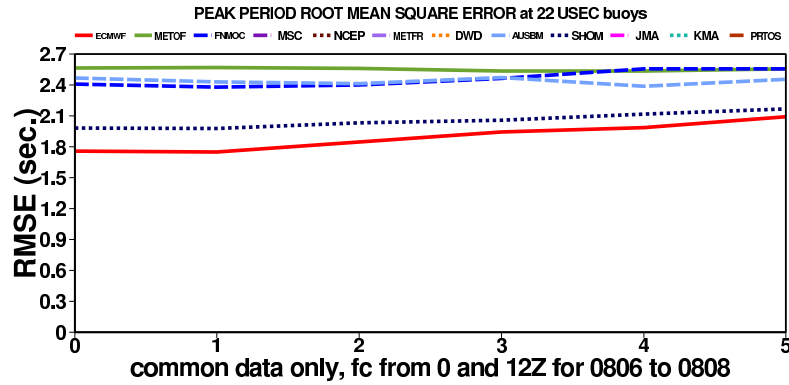
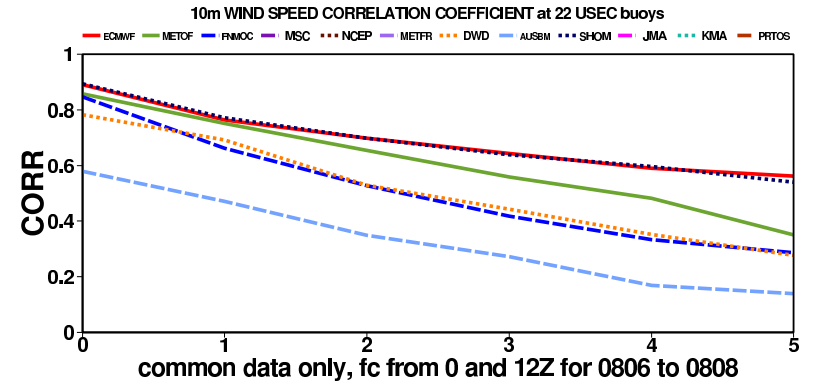
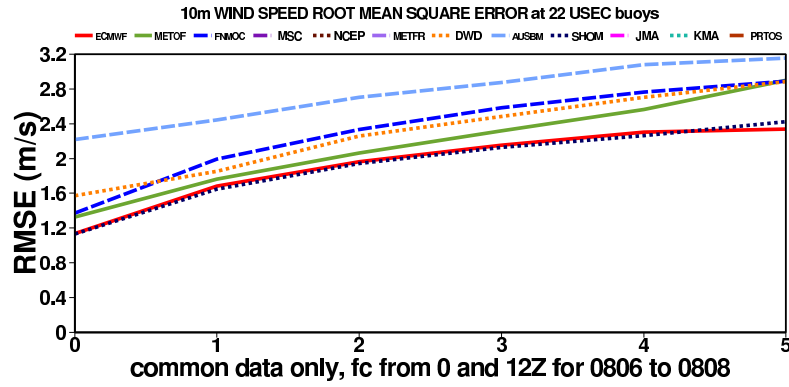
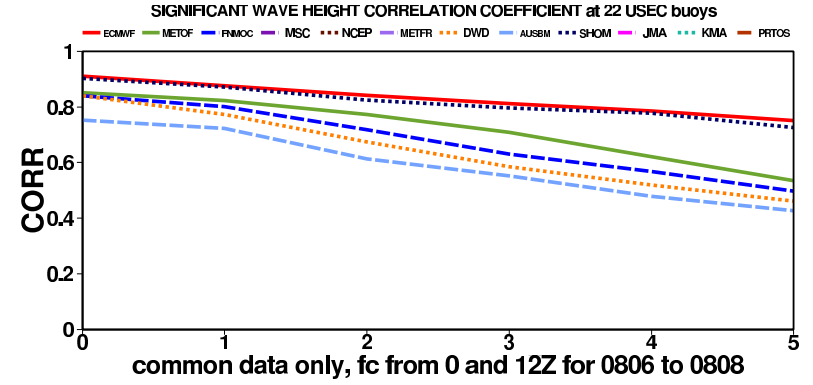
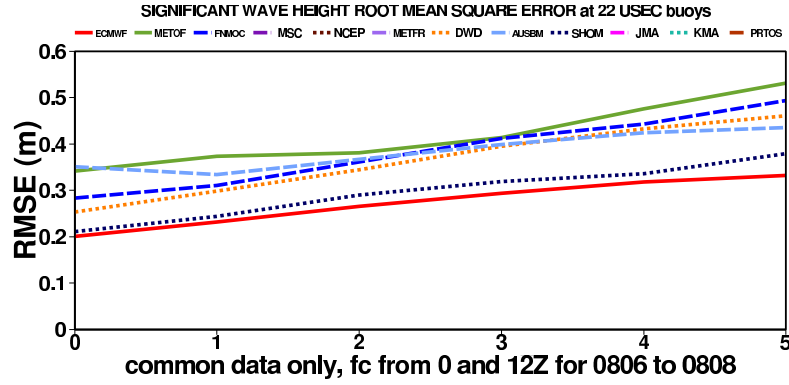
Figure 25: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 26: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common US East Coast buoys .



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 27: Forecast root mean square error (RMSE) and linear correlation coefficient at common US East Coast buoys .

### 0.3.6 Comparison for Gulf of Mexico buoys

Number of common observations for Gulf of Mexico buoys (GM) from 200806 to 200808 (wind, Hs, Tp)

1	42001	182	181	174	Mid Gulf of Mexico	6	42036	181	182	165	Gulf of Mexico W Tampa
2	42002	182	178	171	Western Gulf of Mexico	7	42039	181	181	173	Gulf of Mexico Pensacola S
3	42003	180	180	178	East Gulf of Mexico	8	42040	181	182	173	Gulf of Mexico Mobile S
4	42019	182	182	181	Gulf of Mexico Lanelle	9	42055	181	181	178	Bay of Campeche
5	42020	182	182	179	Gulf of Mexico Corpus Christi	10	42099	0	180	173	Gulf Mexico, St Peterburg (scripps 144)

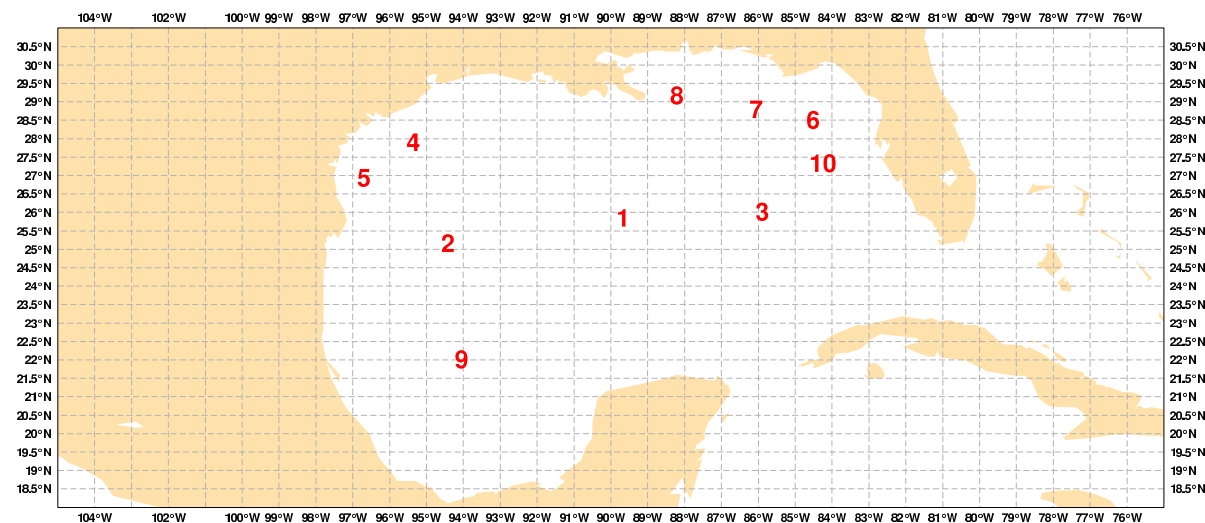
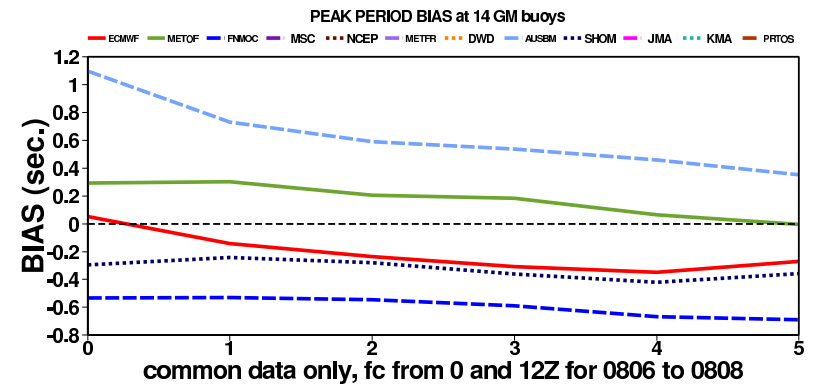
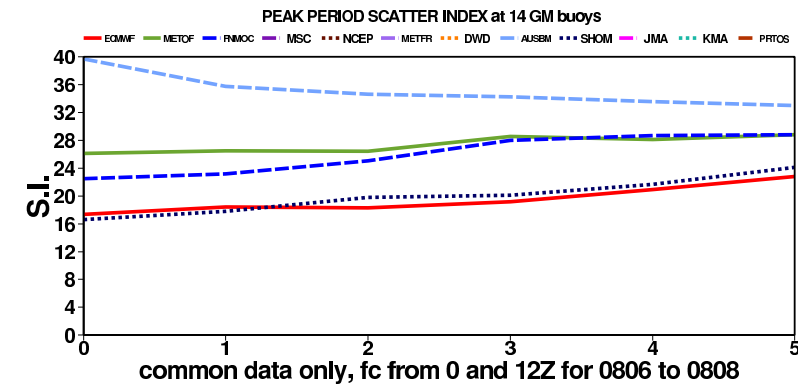
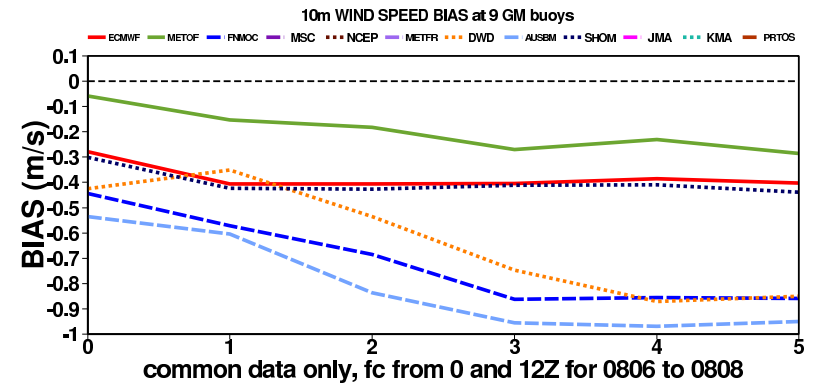
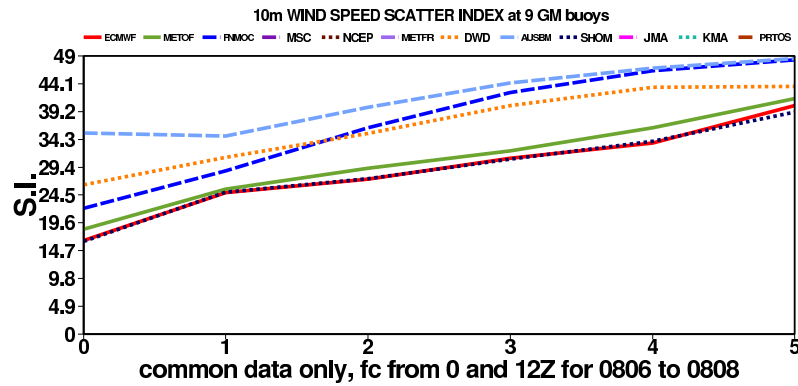
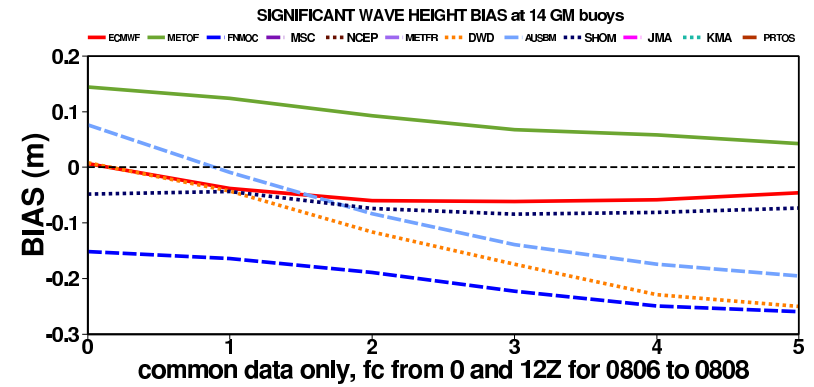
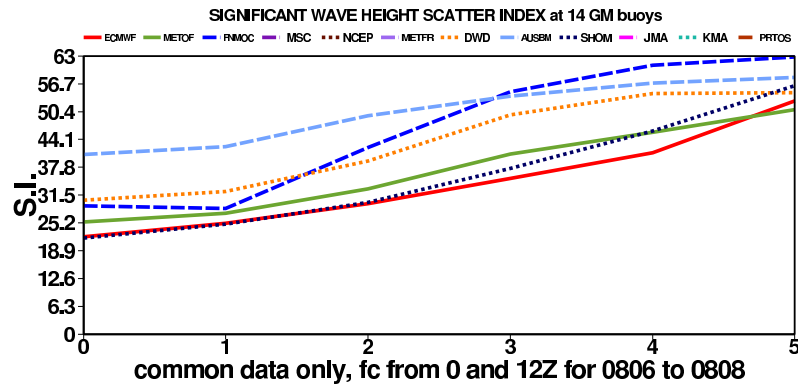


Figure 28: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.

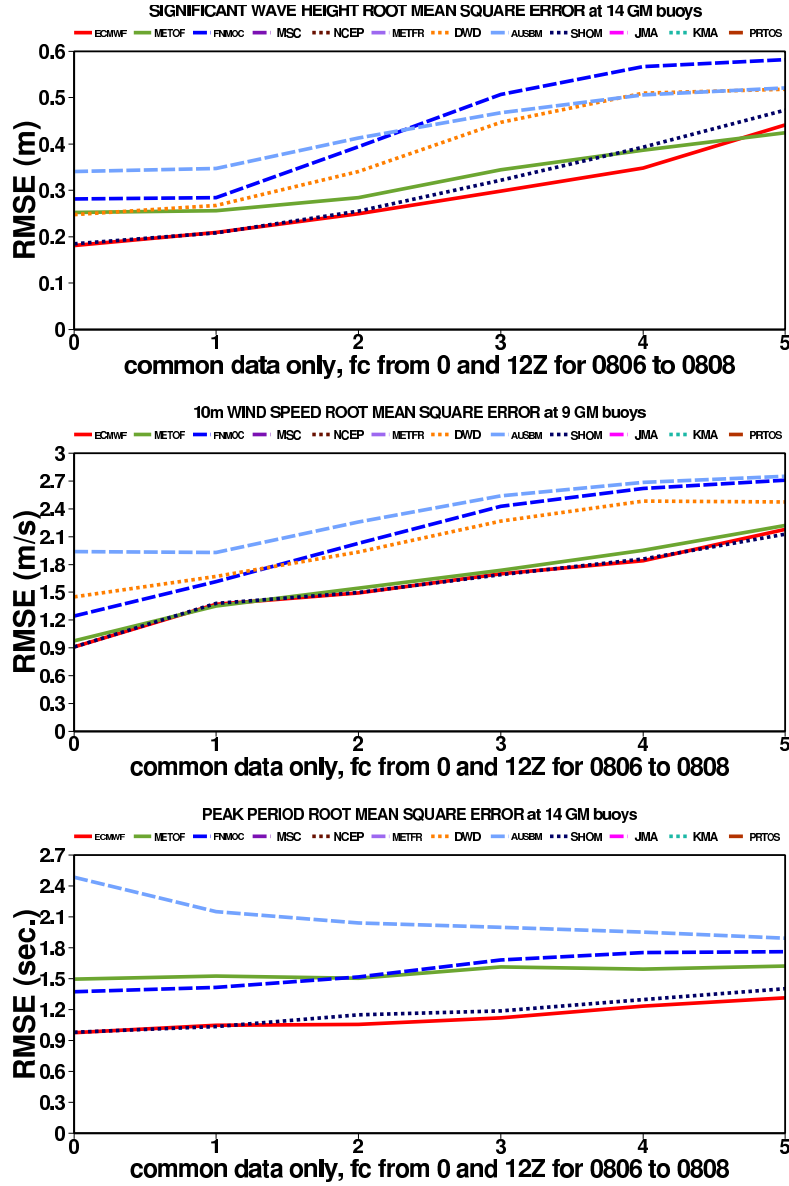


(a) Scatter Index (%)

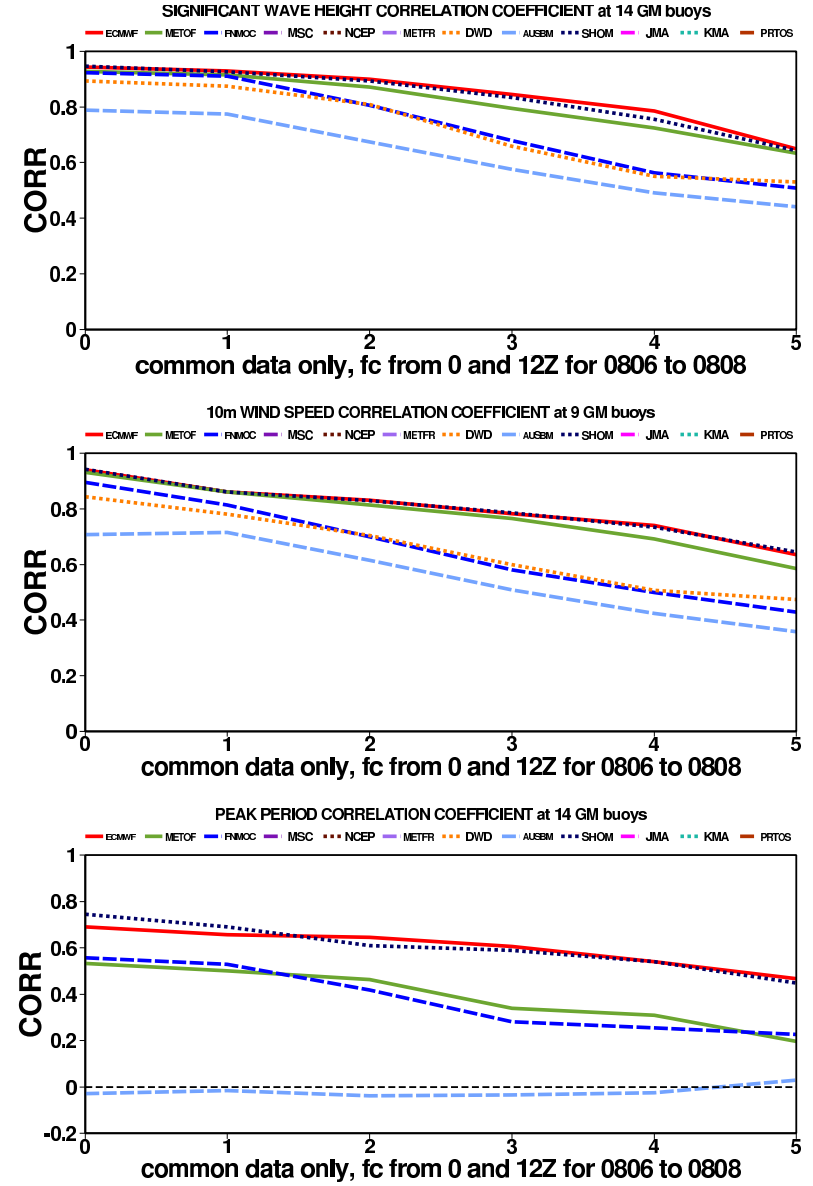
(b) Bias (model-buoy)

Figure 29: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Gulf of Mexico buoys .





(a) R.M.S.E.



(b) Correlation Coefficient

Figure 30: Forecast root mean square error (RMSE) and linear correlation coefficient at common Gulf of Mexico buoys .

### 0.3.7 Comparison for Canadian East Coast buoys

Number of common observations for Canadian East Coast buoys (CANEC) from 200806 to 200808 (wind, Hs, Tp)

1	44137	104	180	180	Nova Scotia, East Scotia slope	5	44141	24	177	176	Nova Scotia, Laurentian Fan
2	44138	182	182	182	Newfoundland, SW Grand Bank	6	44150	182	0	0	Nova Scotia, La Have Bank
3	44139	181	180	181	Newfoundland, Banquereau	7	44251	153	153	153	Newfoundland, Nickerson Bank
4	44140	167	17	17	Newfoundland, Tail Of The Bank	8	44255	180	175	175	Newfoundland, NE Bugeo Bank

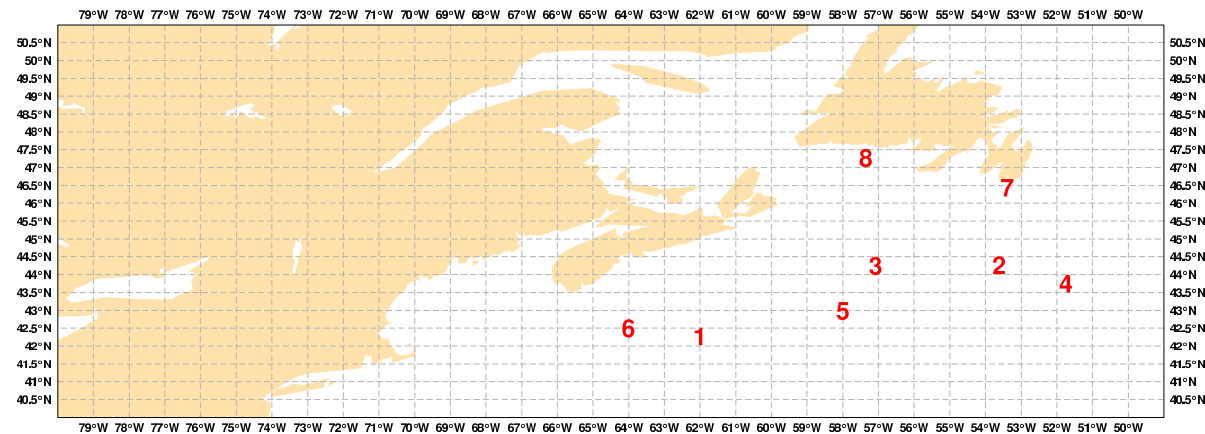
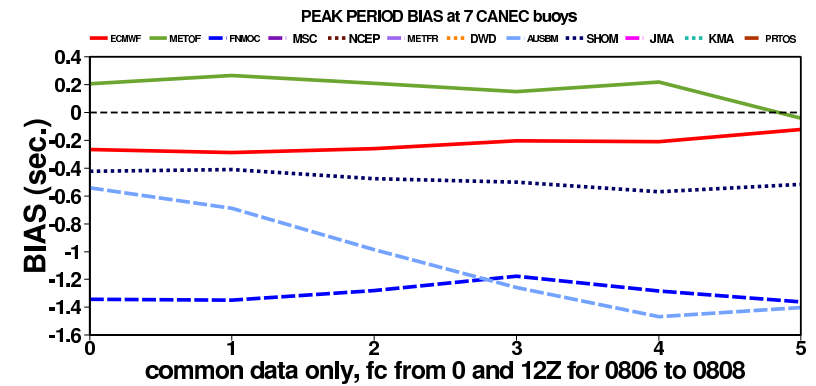
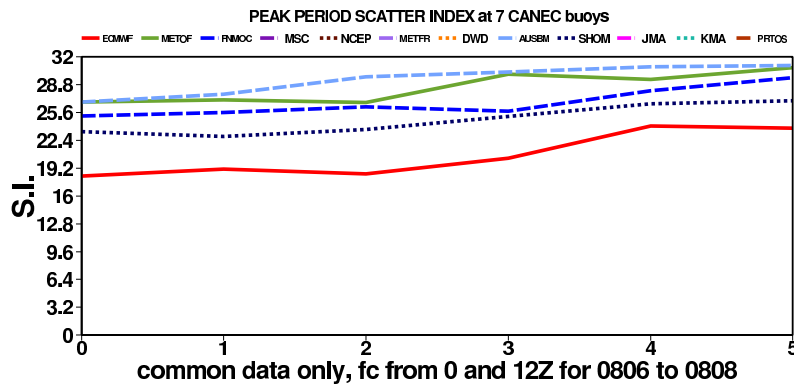
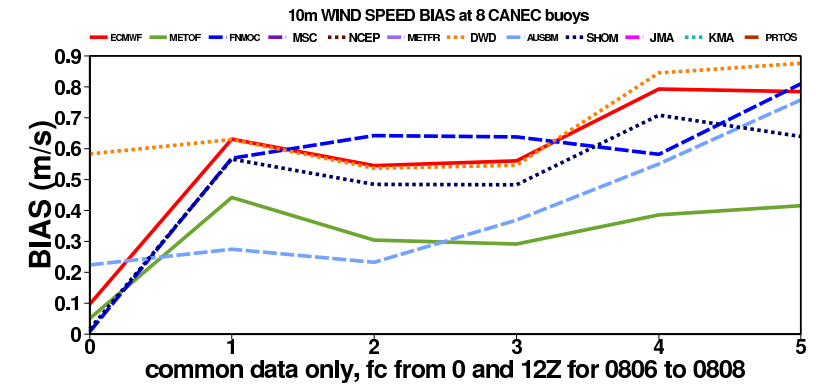
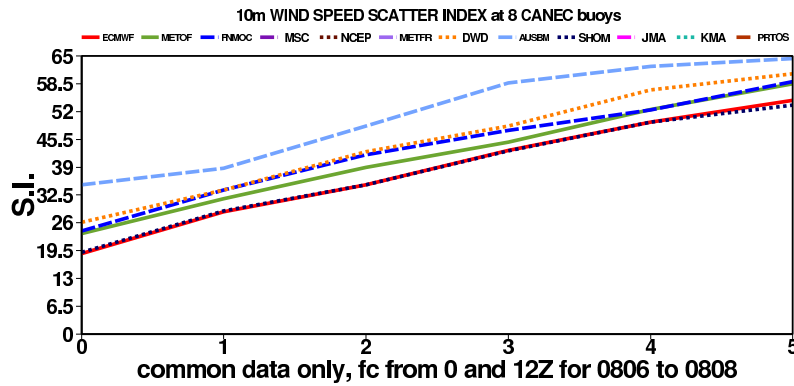
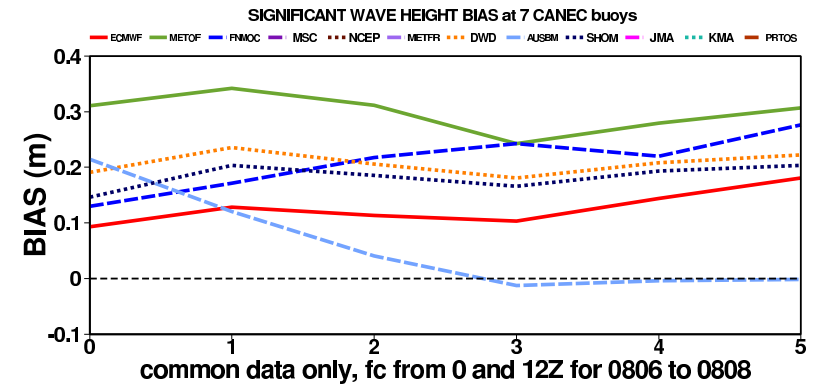
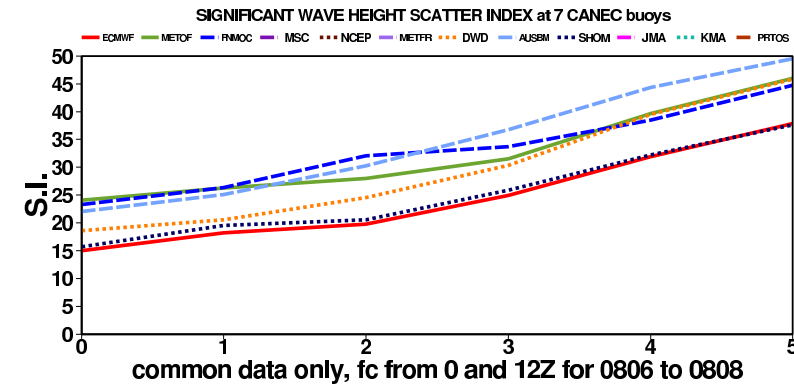


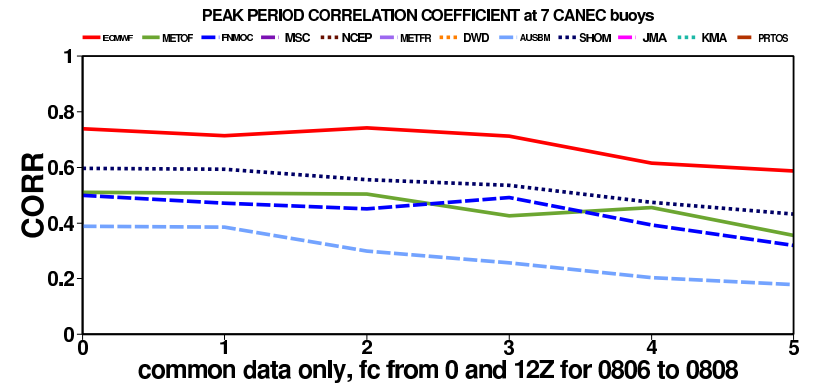
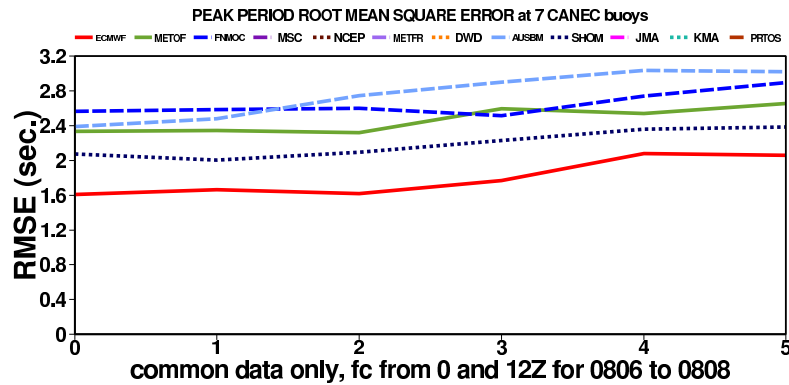
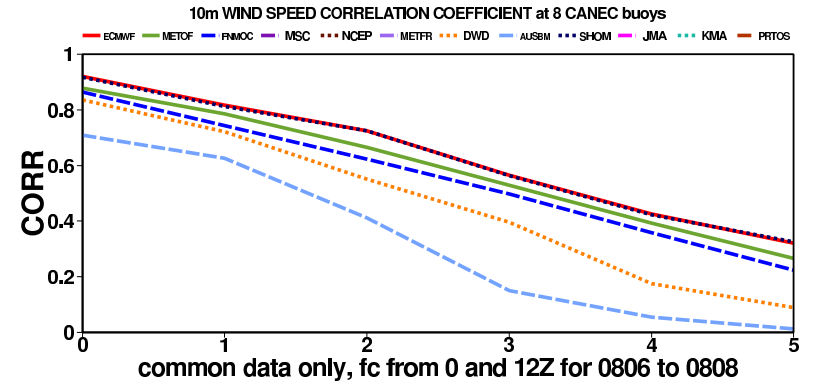
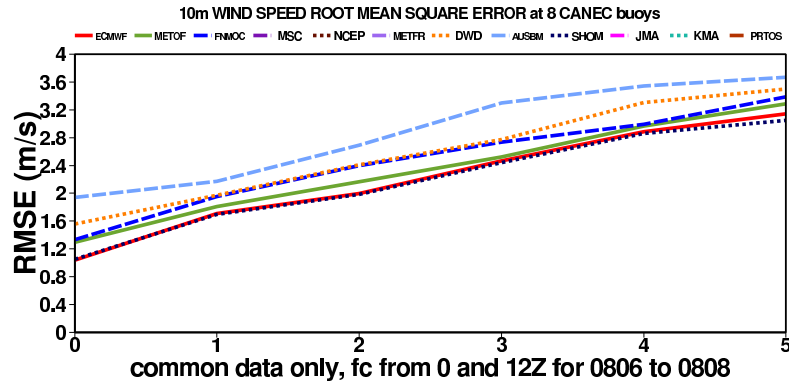
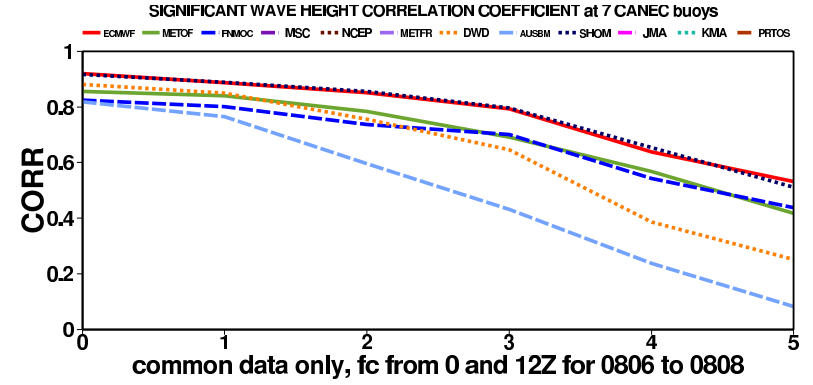
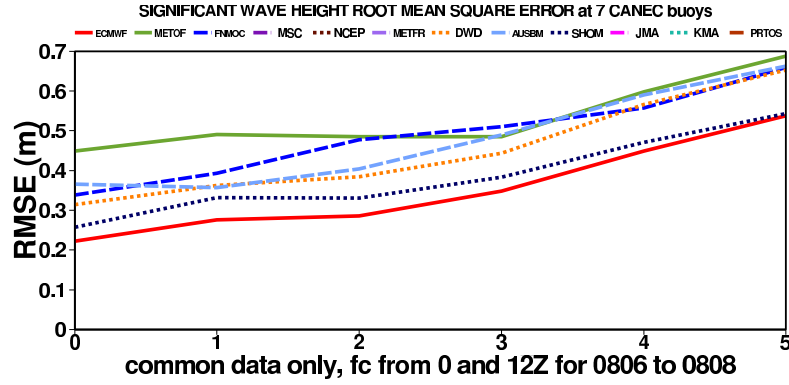
Figure 31: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 32: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Canadian East Coast buoys .



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 33: Forecast root mean square error (RMSE) and linear correlation coefficient at common Canadian East Coast buoys .

### 0.3.8 Comparison for Caribbean Sea buoys

Number of common observations for Caribbean Sea buoys (CRB) from 200806 to 200808 (wind, Hs, Tp)

1	41040	182	182	182	Tropical Atlantic, West Atlantic	7	41101	181	181	0	French West Indies (Antilles 2)
2	41041	182	181	180	Tropical Atlantic, Middle Atlantic	8	42056	181	181	182	Yucatan Basin
3	41043	177	177	177	South Western Atlantic	9	42057	182	182	182	Western Caribbean
4	41046	180	179	180	E Bahamas	10	42058	181	180	180	Central Caribbean
5	41047	181	180	181	NE Bahamas	11	42059	181	181	181	Eastern Caribbean
6	41100	179	182	0	French West Indies (Antilles 1)						

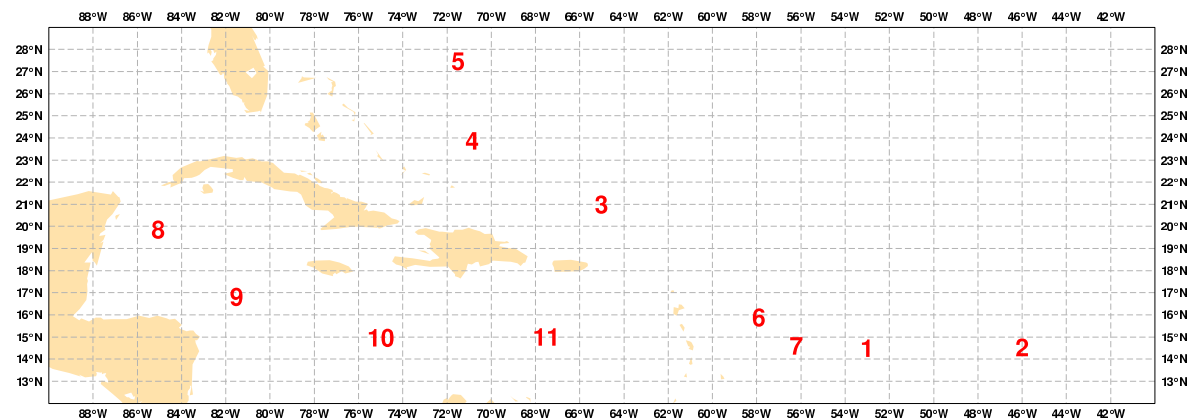
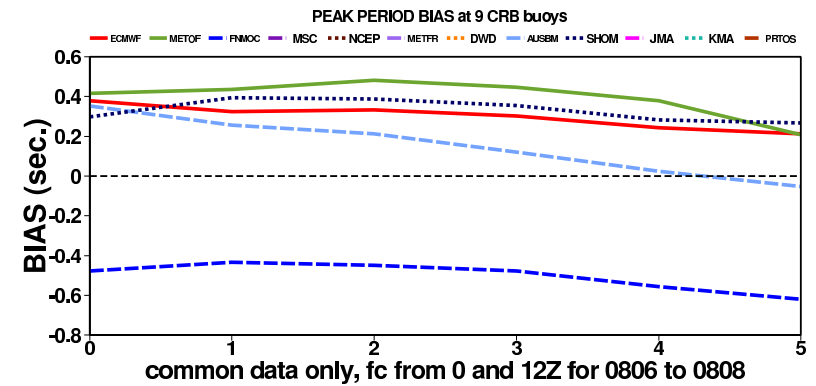
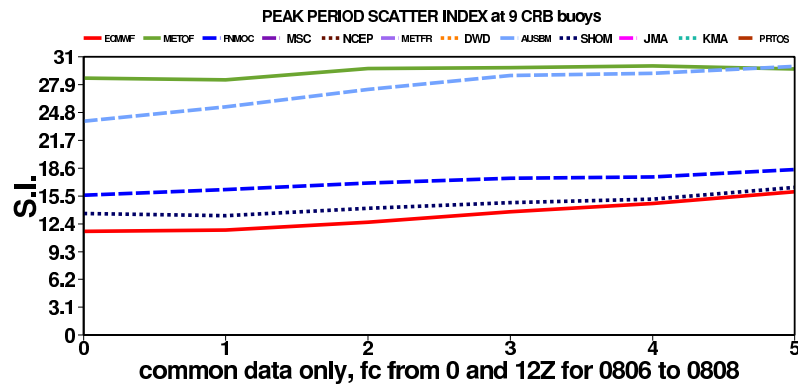
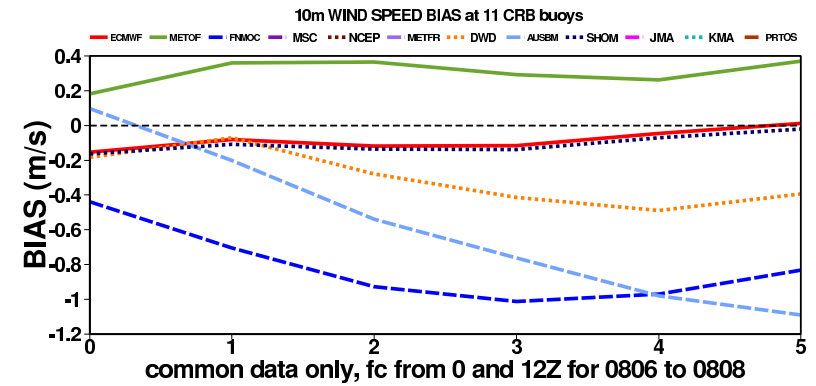
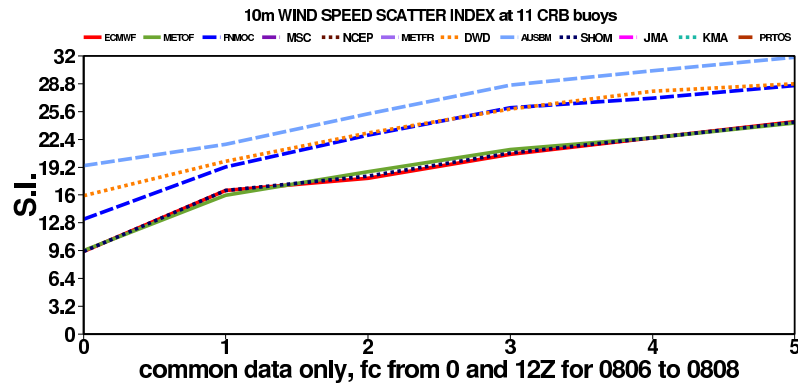
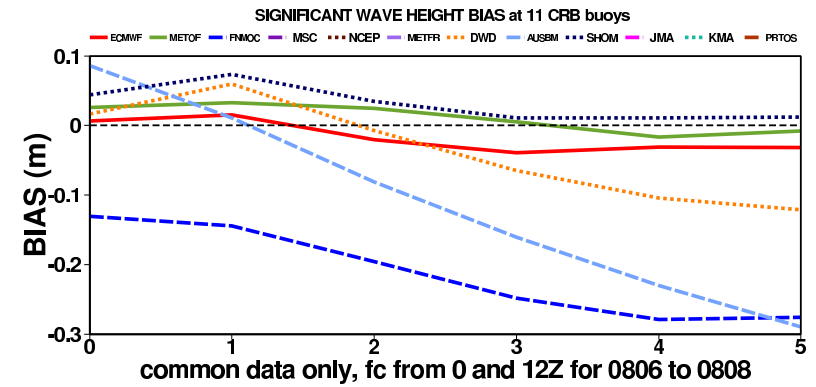
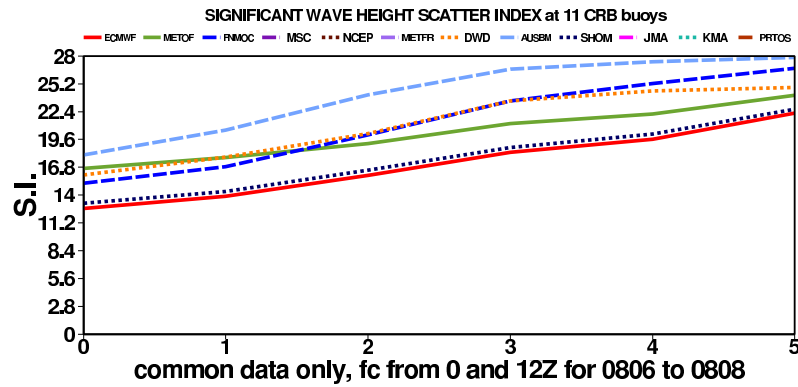


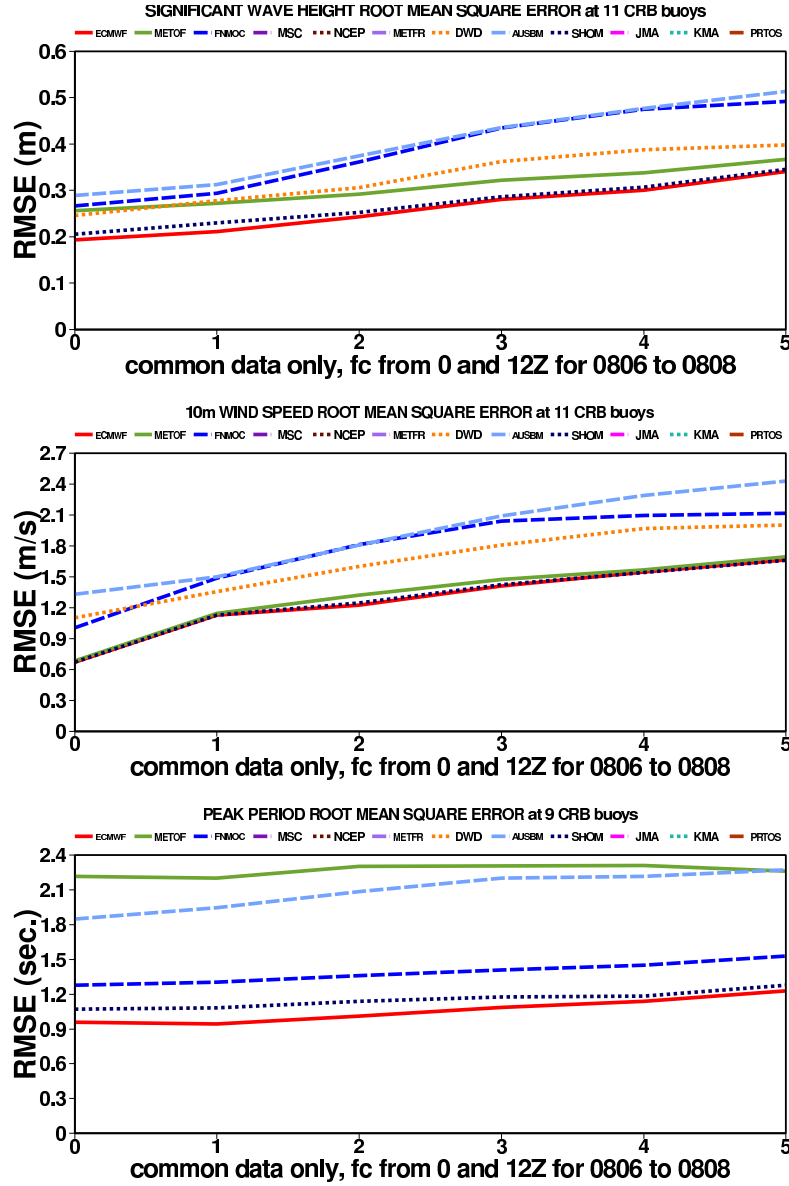
Figure 34: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



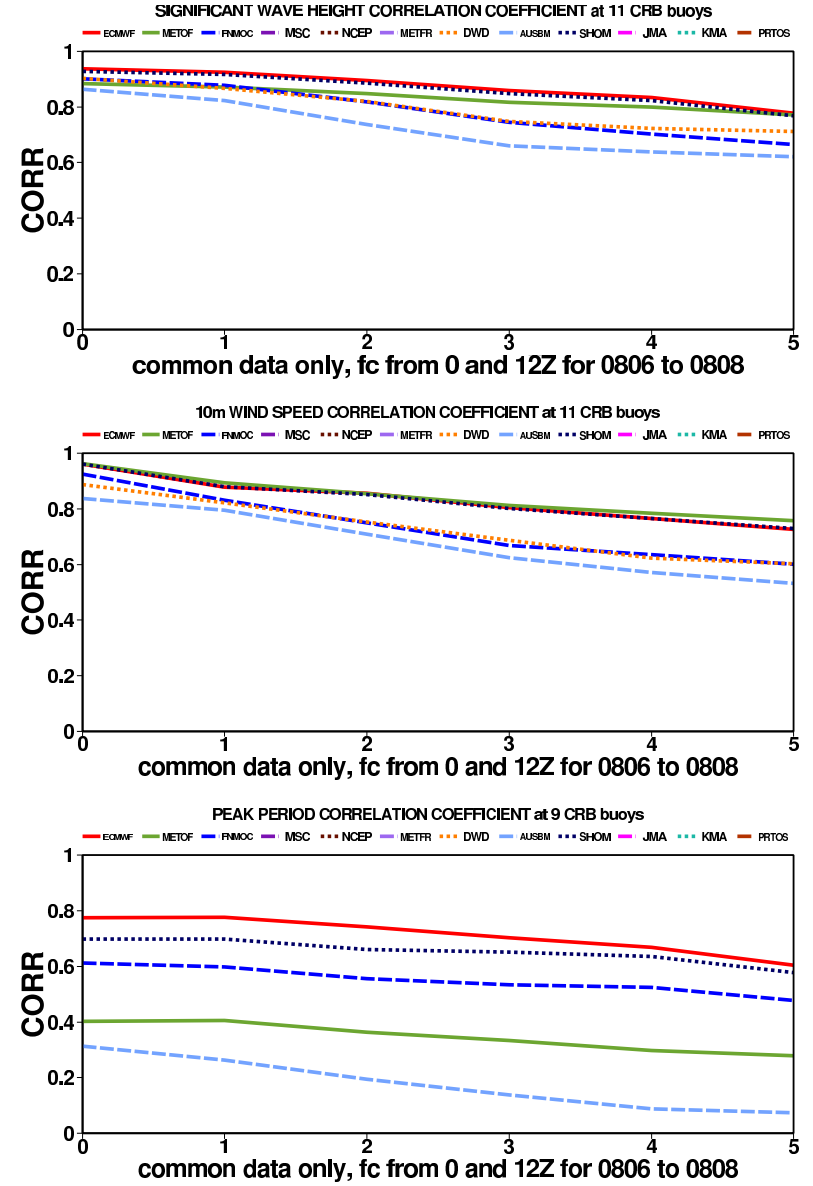
(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 35: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Caribbean Sea buoys.



(a) R.M.S.E.



(b) Correlation Coefficient

Figure 36: Forecast root mean square error (RMSE) and linear correlation coefficient at common Caribbean Sea buoys.

### 0.3.9 Comparison for North East Atlantic buoys

Number of common observations for North East Atlantic buoys (NEATL) from 200806 to 200808 (wind, Hs, Tp)

1	62023	162	163	0	South Ireland, Marathon rig	10	62085	147	168	0	Cadiz (Spain)
2	62024	99	100	0	Bilbao (Spain)	11	62092	8	182	0	South West Ireland (M3), Mizen Head
3	62025	166	169	0	Cabo de Penas (Spain)	12	62094	181	181	0	South Ireland (M5), South East
4	62029	177	181	0	UK Celtic Sea shelf break (K1)	13	62095	122	0	0	West Ireland (M6), West Coast
5	62064	0	95	0	SHOM (Cape Ferret)	14	62107	180	180	0	Isle of Scilly (7 stones)
6	62081	182	182	0	UK East Atlantic (K2)	15	62163	133	182	0	UK Celtic Sea shelf break (Brittany)
7	62082	155	155	0	Estaca de Bares (Spain)	16	62303	179	180	0	Bristol Channel (Pembroke buoy)
8	62083	169	169	0	Villano-Sisargas (Spain)	17	64045	81	178	0	UK North-East Atlantic (K5)
9	62084	167	167	0	Silleiro Spain)	18	64046	173	165	0	UK North-East Atlantic (K7)

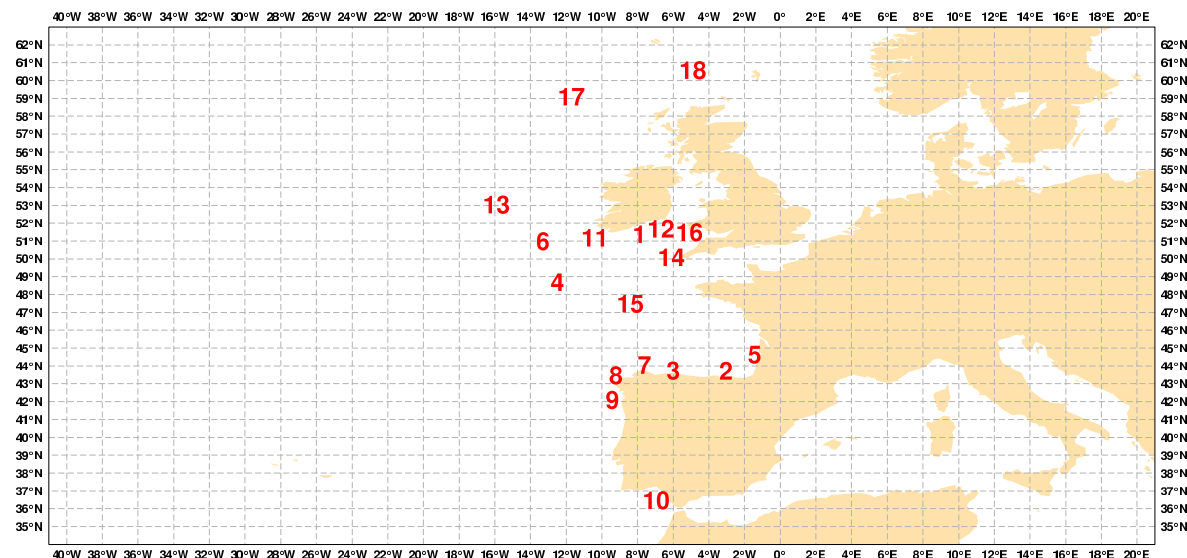
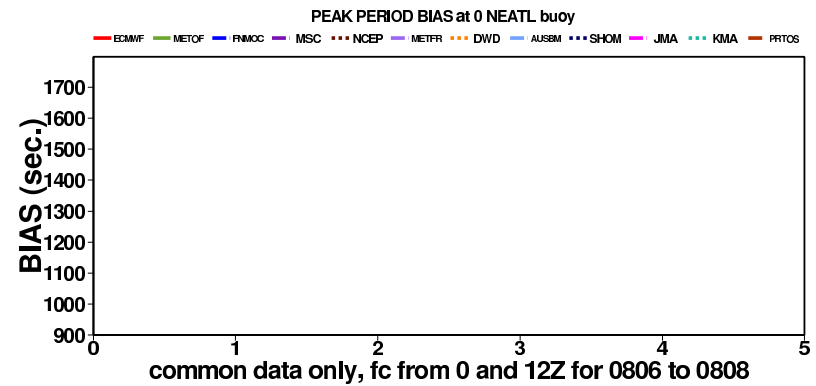
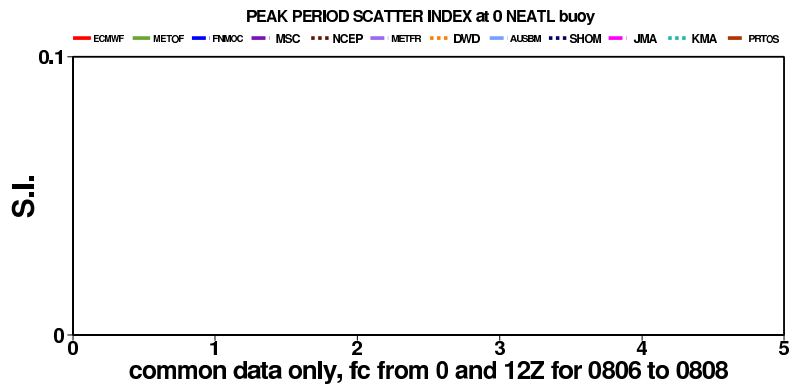
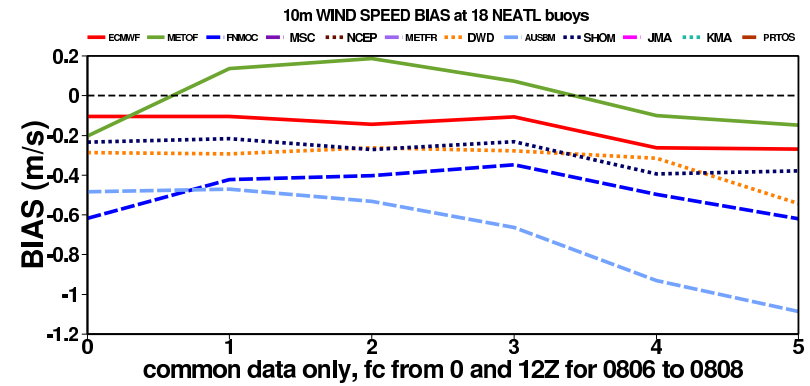
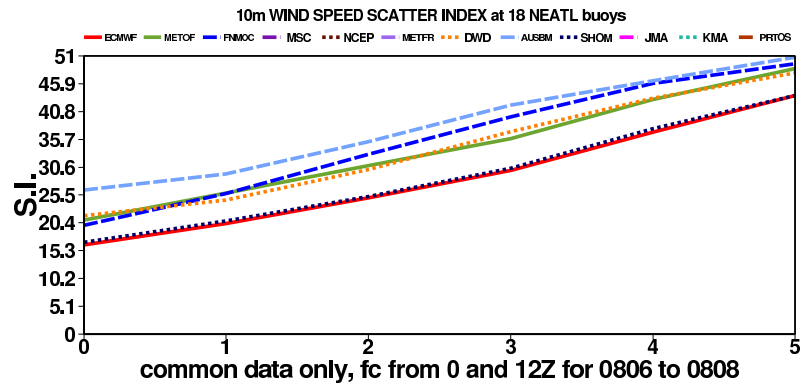
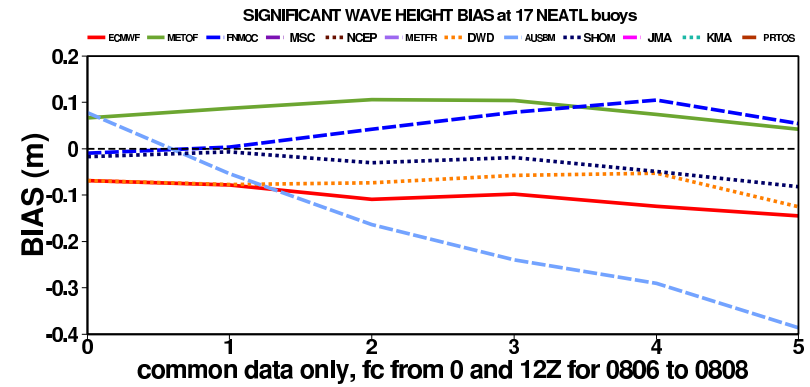
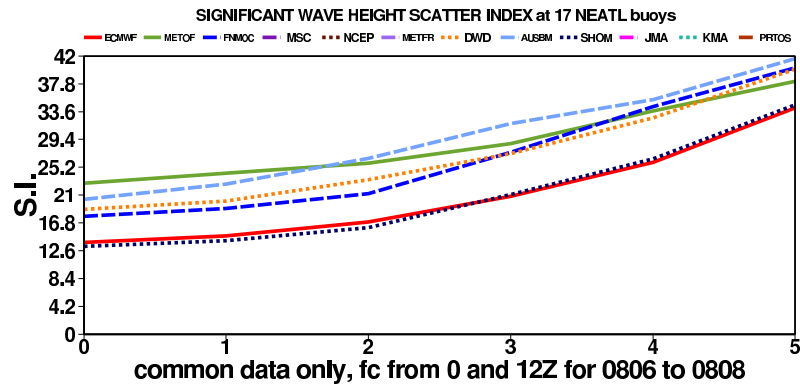


Figure 37: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.

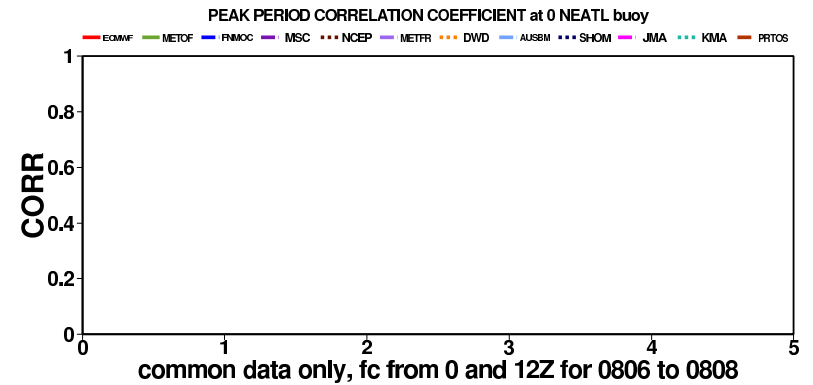
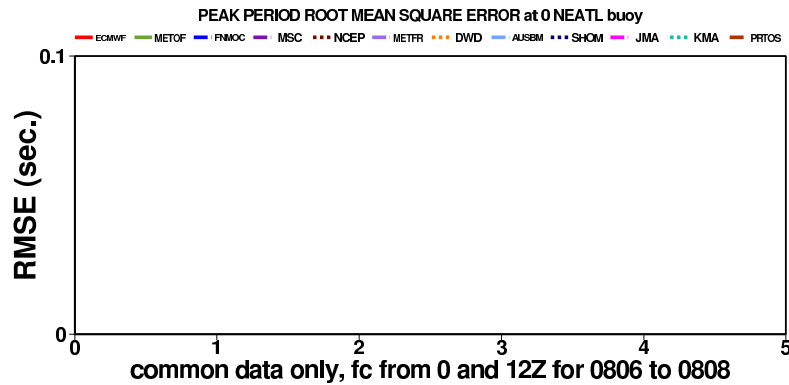
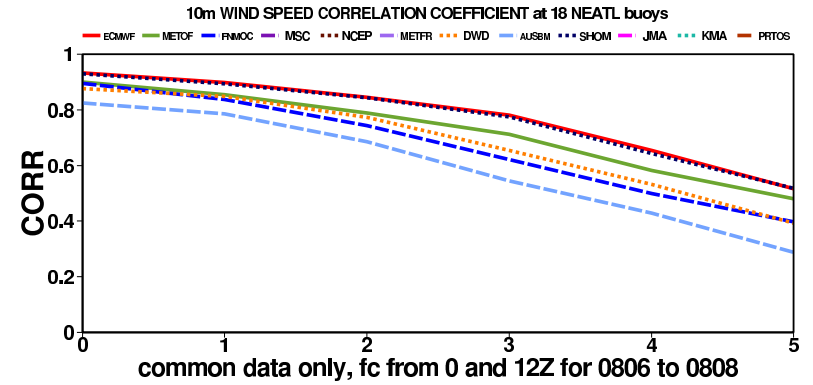
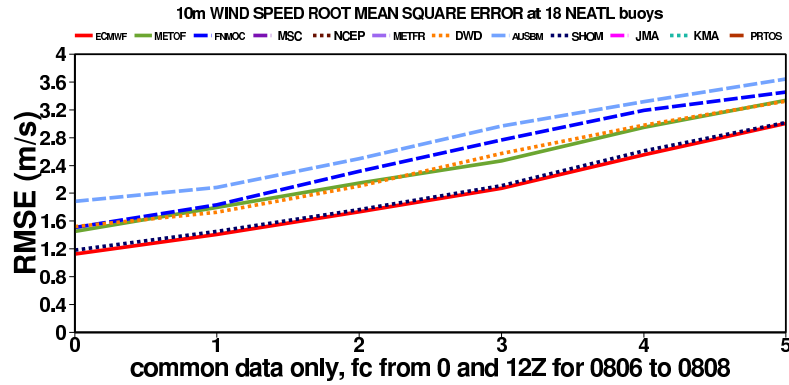
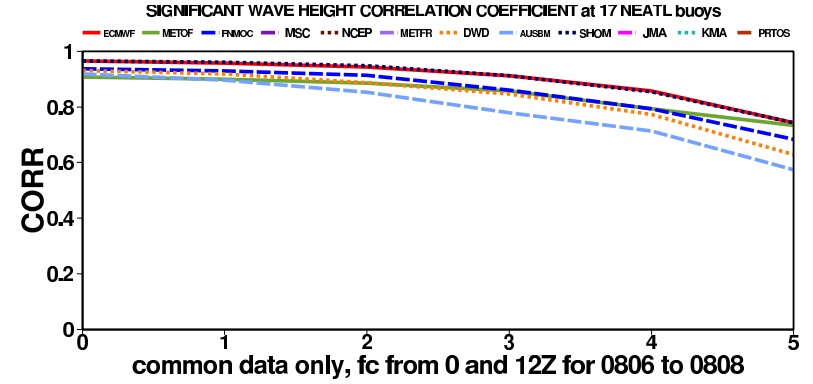
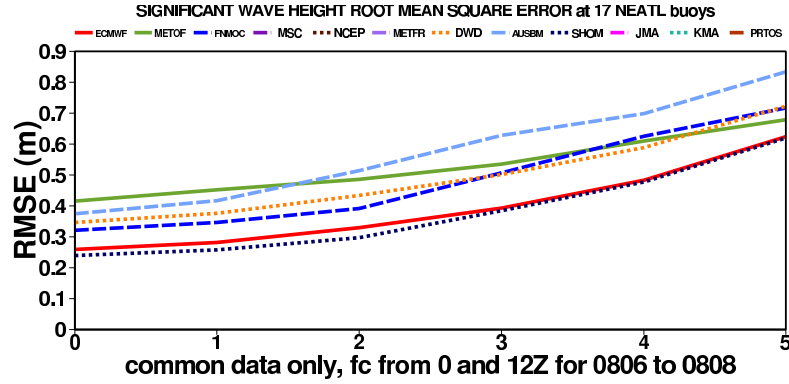




(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 38: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common North East Atlantic buoys .



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 39: Forecast root mean square error (RMSE) and linear correlation coefficient at common North East Atlantic buoys .

## 0.3.10 Comparison for North Sea platforms

Number of common observations for North Sea (NSEA) from 200806 to 200808 (wind, Hs, Tp)

1	62111	180	180	0	North Sea (Ivanhoe)	13	62164	64	126	0	North Sea (Anasuria)
2	62116	156	178	0	North Sea (Nelson)	14	62170	164	161	0	Channel (F3 light vessel)
3	62117	46	64	0	North Sea (??????)	15	63055	37	136	0	North Sea shelf break (????????)
4	62119	132	130	0	North Sea (??????)	16	63056	129	11	0	North Sea shelf break (????????)
5	62128	125	123	0	North Sea (??????)	17	63057	6	6	0	North Sea shelf break (????????)
6	62132	34	34	0	North Sea (Auk A)	18	63103	179	179	0	S Norwegian Sea (North Cormorant)
7	62133	179	179	0	North Sea (Gannet)	19	63108	179	179	0	S Norwegian Sea (North Alwyn)
8	62142	180	180	0	North Sea (Leman)	20	63110	89	91	0	North Sea shelf break (?????)
9	62143	177	177	0	North Sea (??????)	21	63112	175	176	0	North Sea shelf break (????????)
10	62144	160	154	0	North Sea (Clipper)	22	63113	57	57	0	North Sea shelf break
11	62145	180	170	0	North Sea (Sean P)	23	63115	177	177	0	North Sea shelf break (?????)
12	62152	0	178	0	North Sea (??????)						

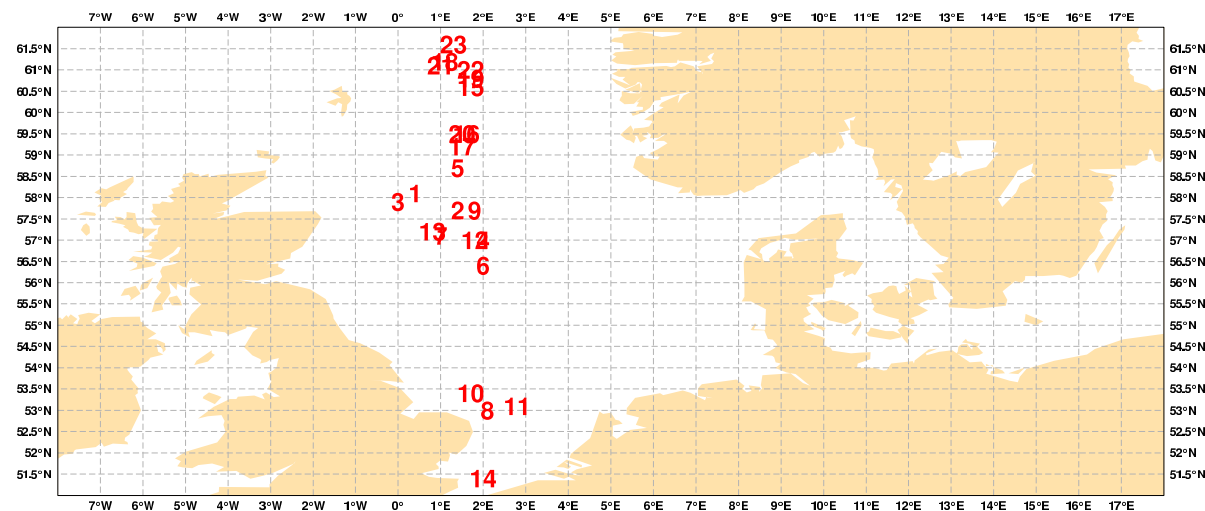
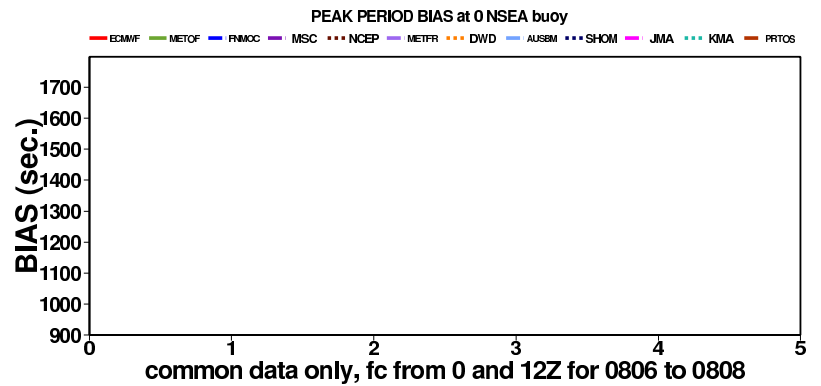
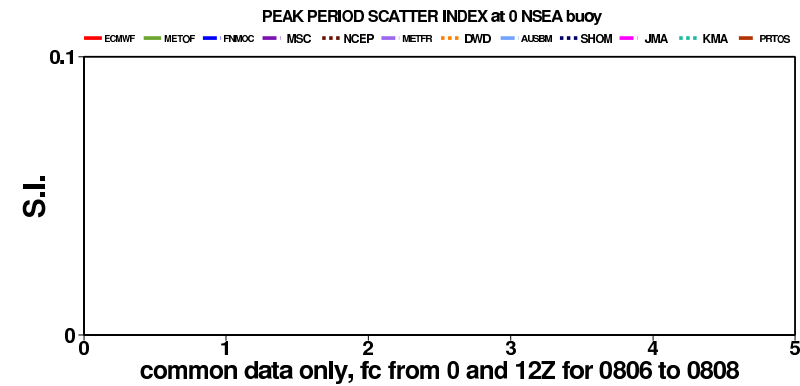
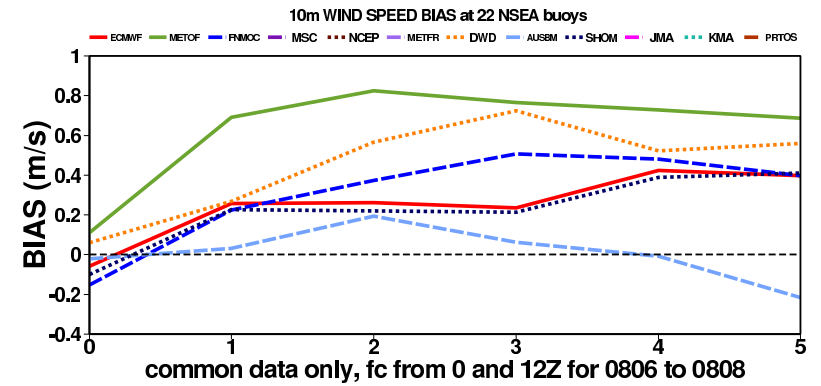
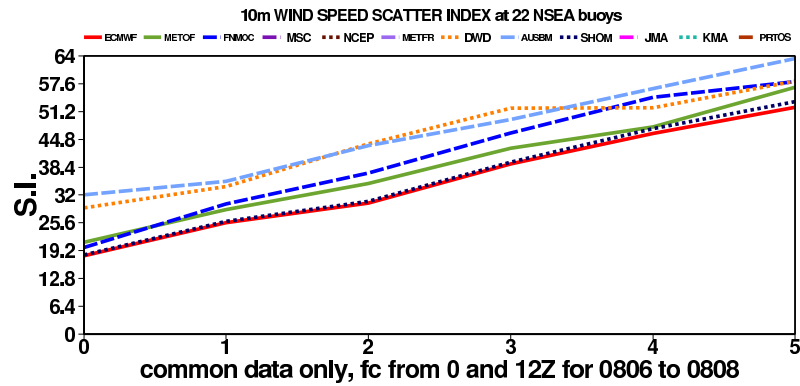
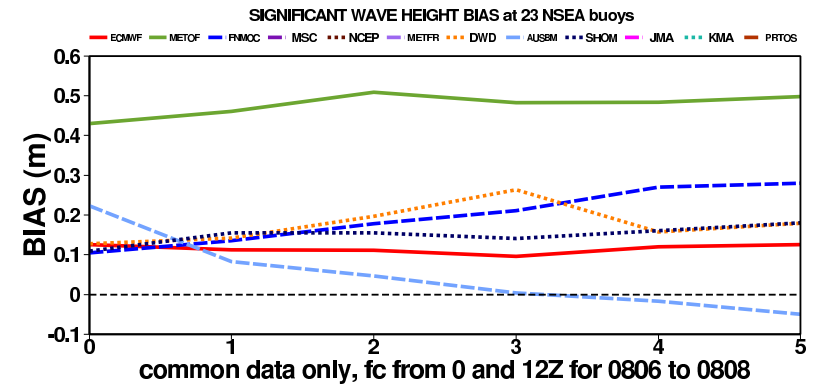
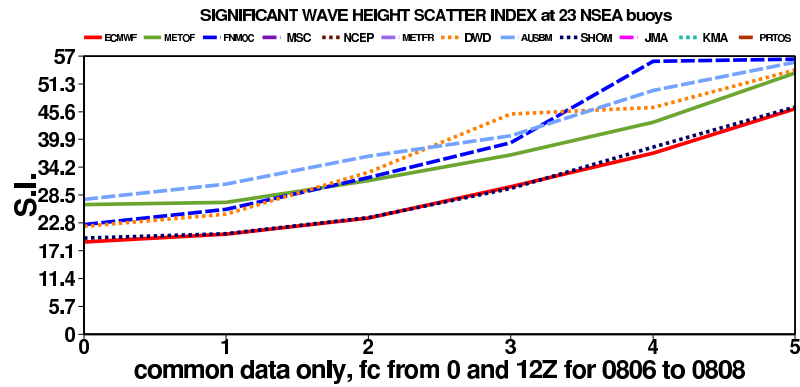


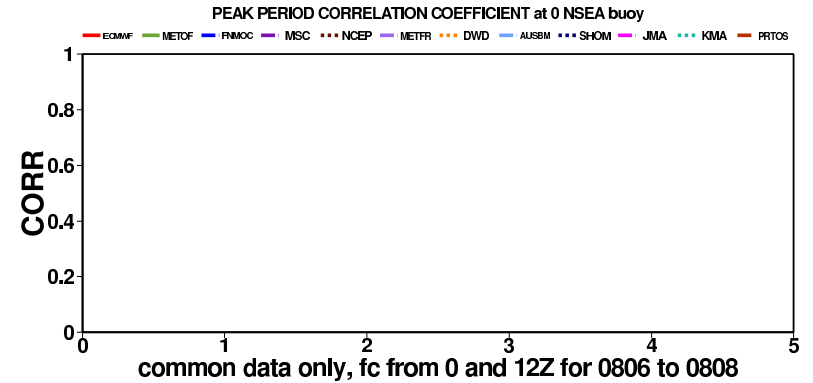
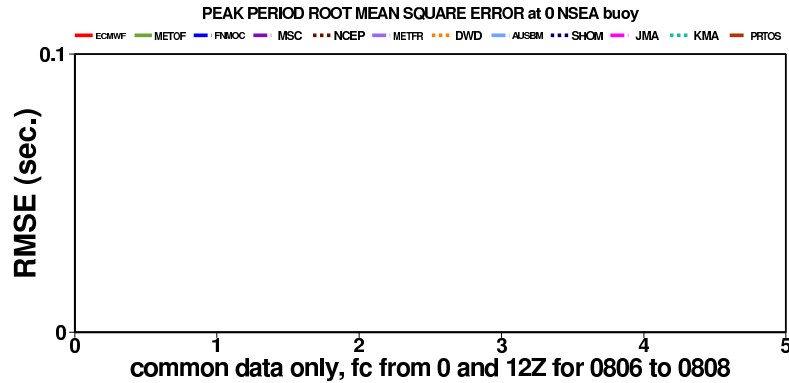
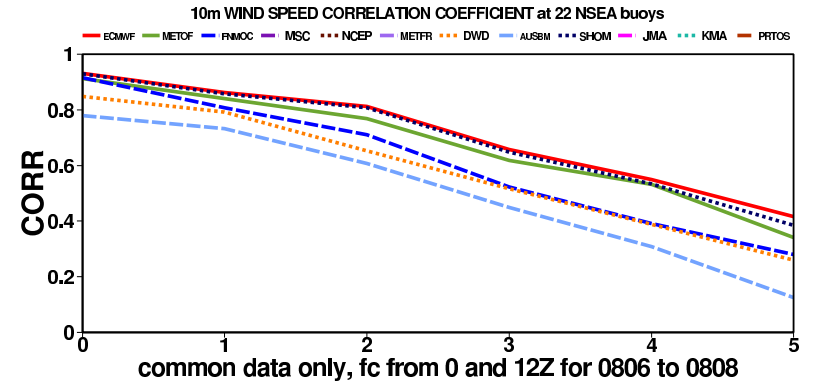
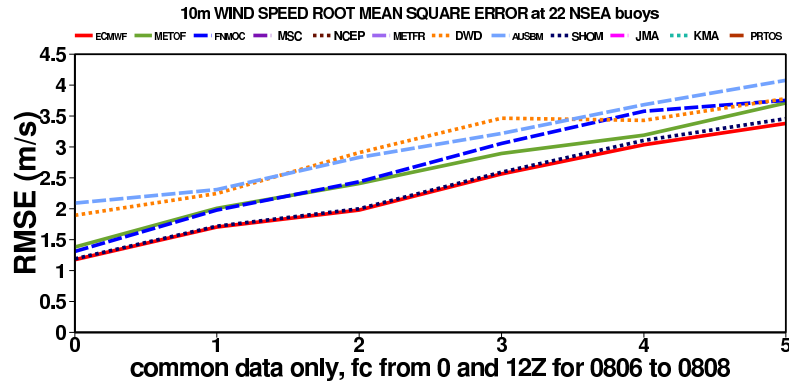
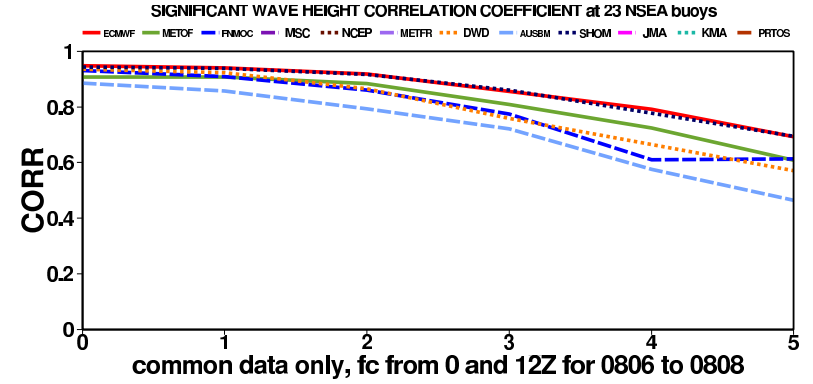
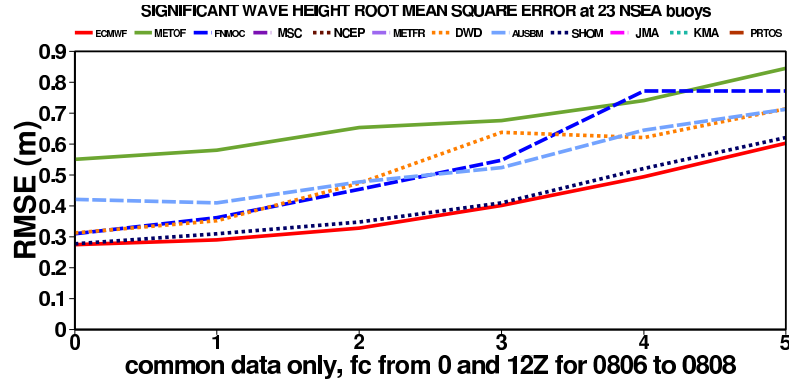
Figure 40: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 41: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common North Sea platforms.



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 42: Forecast root mean square error (RMSE) and linear correlation coefficient at common North Sea platforms.

### 0.3.11 Comparison for Icelandic buoys and Norwegian platforms

Number of common observations for Iceland and Norway (NRDIC) from 200806 to 200808 (wind, Hs, Tp)

1	LDWR	178	178	0	N Norwegian Sea (Mike)	8	TFBLK	0	156	0	West Iceland (Blakksnes)
2	LF3F	158	96	0	N Norwegian Sea (Draugen)	9	TFGRS	0	151	0	North Iceland (Grimseyjarsund)
3	LF3N	179	169	0	N Norwegian Sea (Heidrun)	10	TFGSK	0	152	0	West Iceland (Gardskagi)
4	LF4B	176	93	0	S Norwegian Sea (Troll A)	11	TFKGR	0	114	0	East Iceland (Kogur)
5	LF4C	169	108	0	North Sea (Sleipner)	12	TFSRT	0	132	0	South Iceland (Surtsey)
6	LF4H	182	182	0	S Norwegian Sea (Heimdal)	13	TFSTD	0	165	0	North West Iceland (Straumnes)
7	LF5T	127	55	0	N Norwegian Sea (Norne)						

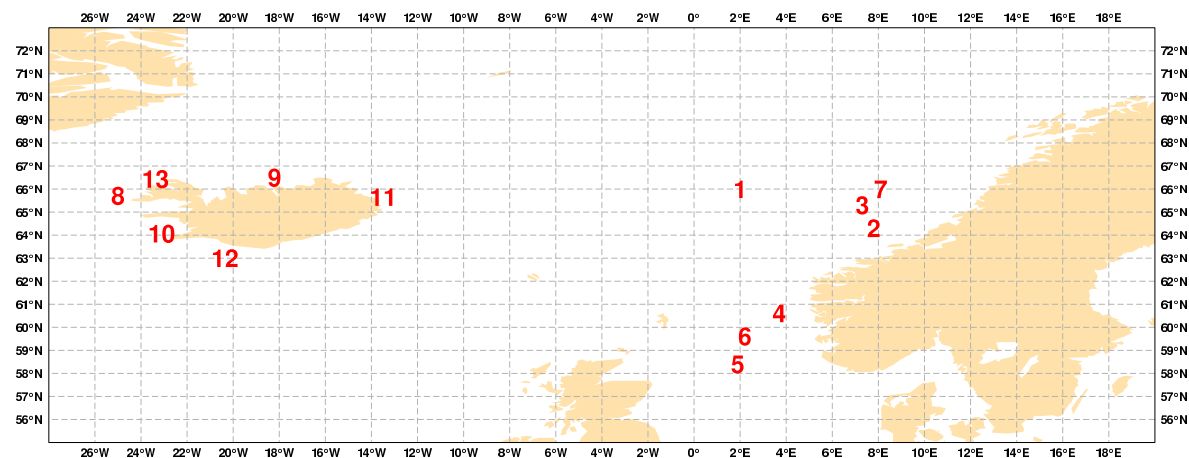
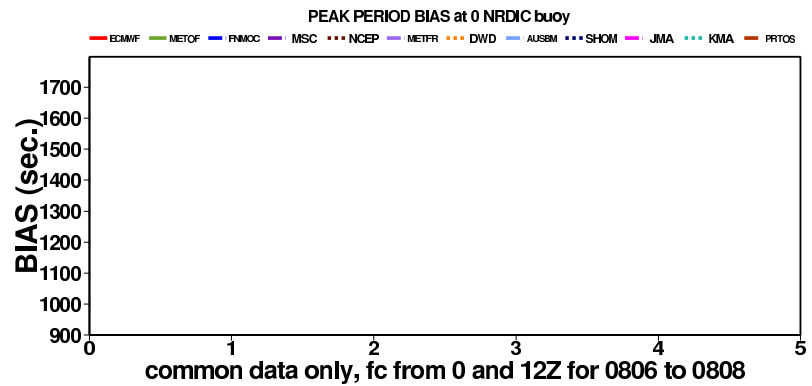
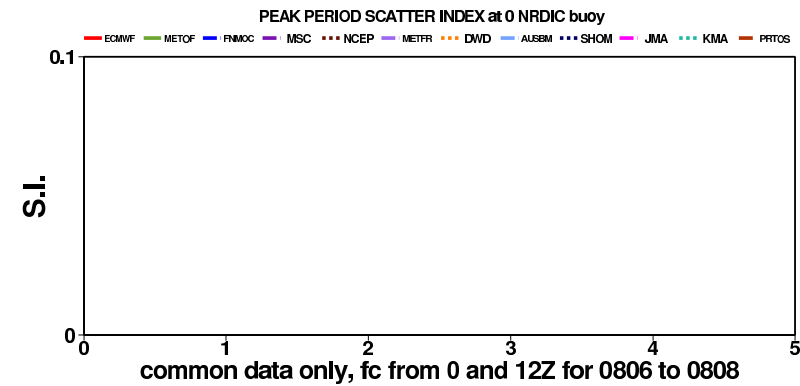
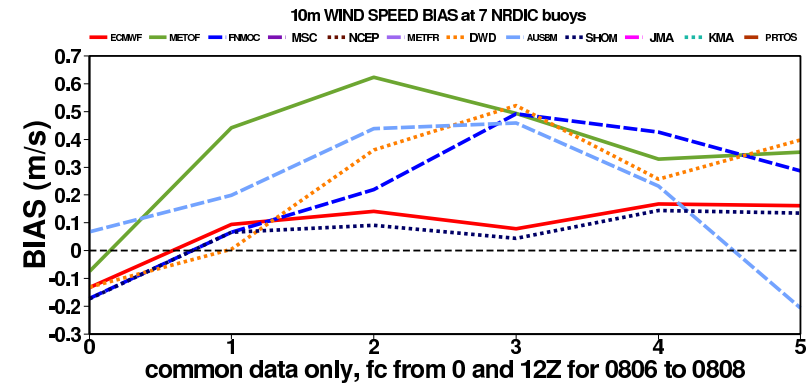
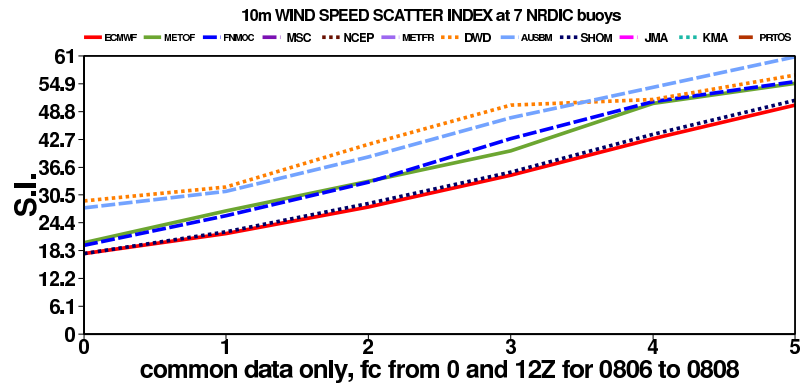
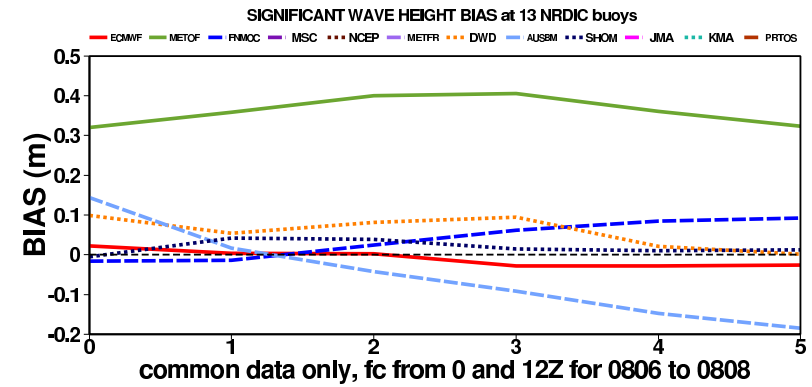
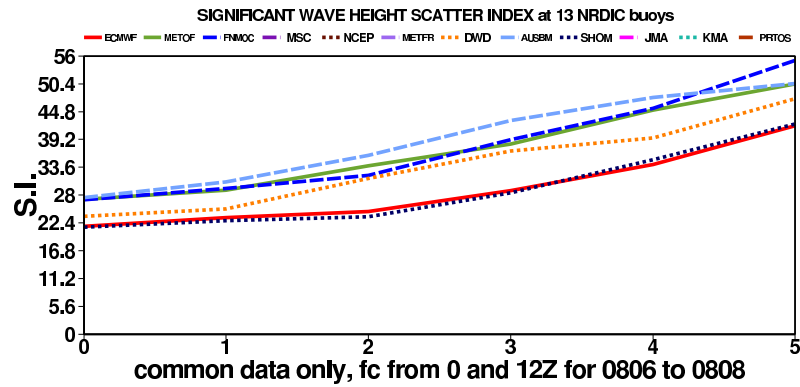


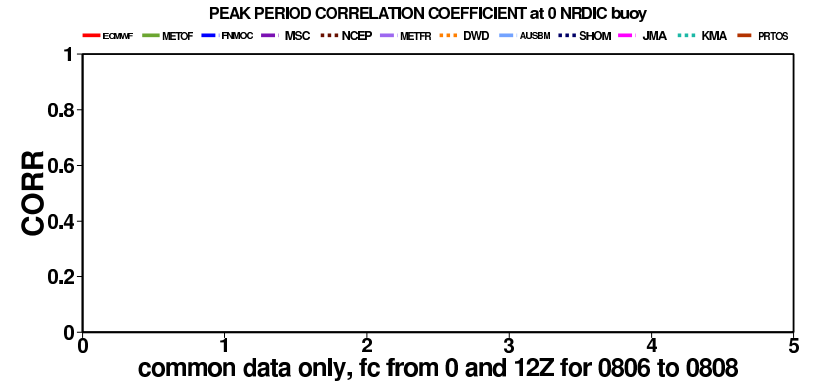
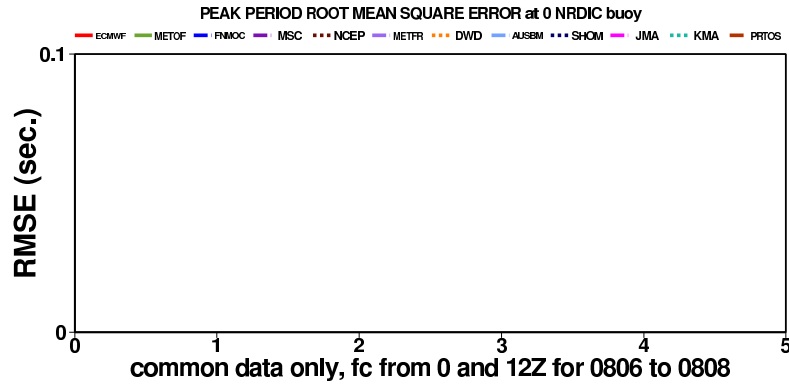
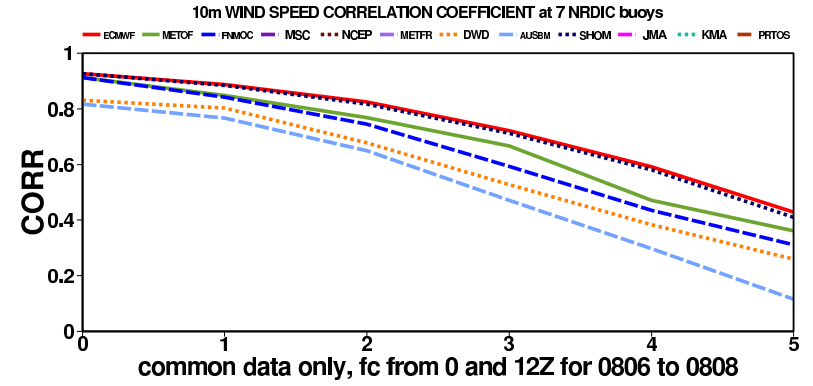
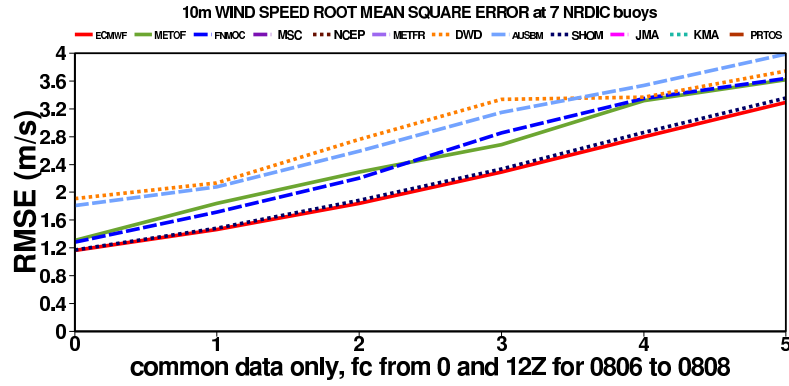
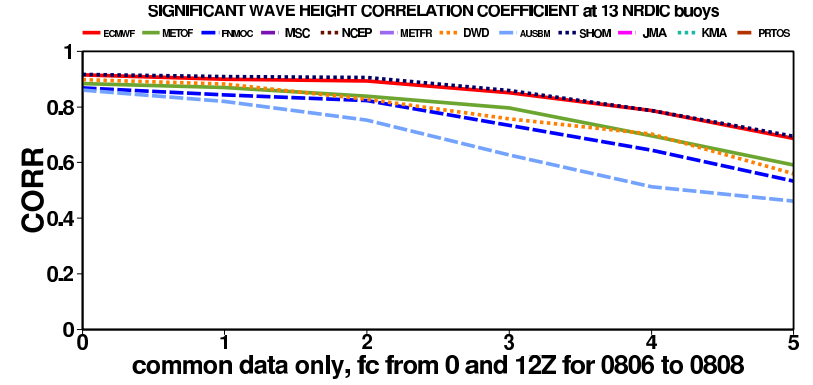
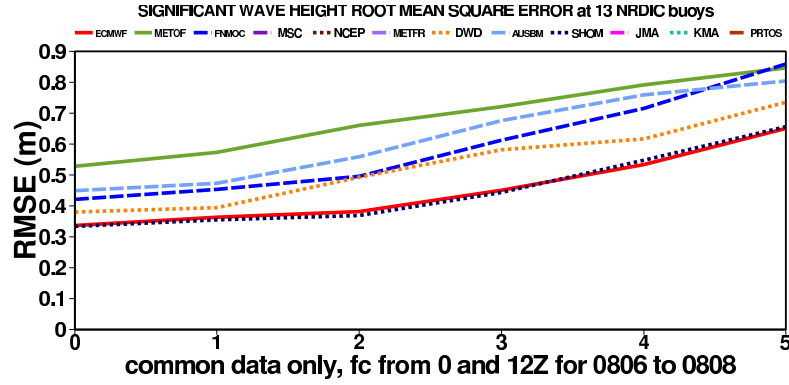
Figure 43: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 44: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Icelandic buoys and Norwegian platforms .



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 45: Forecast root mean square error (RMSE) and linear correlation coefficient at common Icelandic buoys and Norwegian platforms .



### 0.3.12 Comparison for South African platform

Number of common observations for South Africa (SA) from 200806 to 200808 (wind, Hs, Tp)

1	ZSWAV	0	178	0	SA Agulhas Bank
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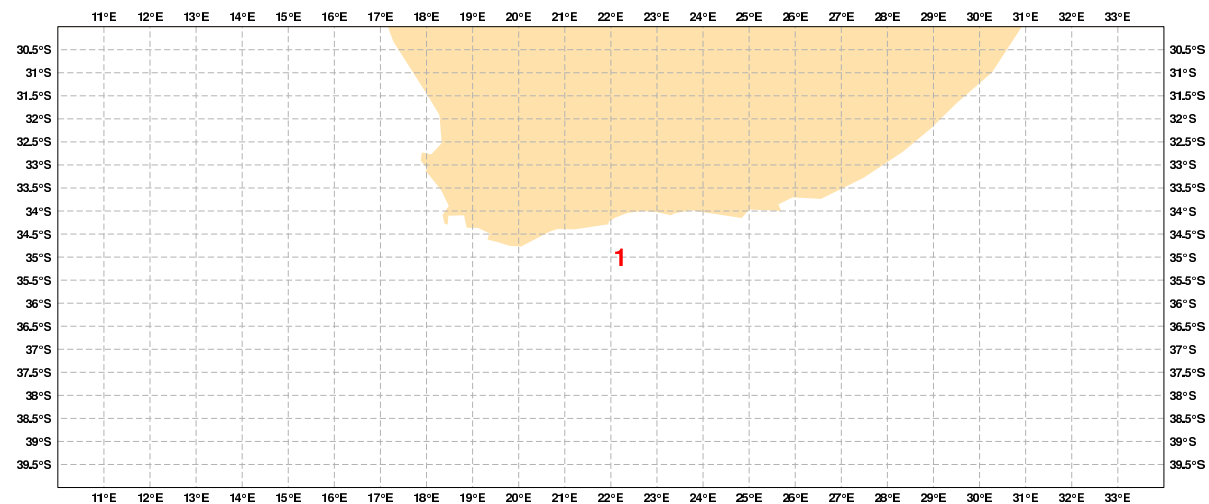
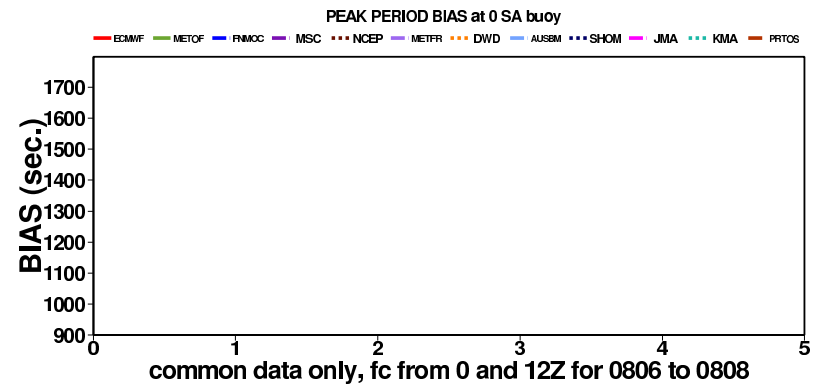
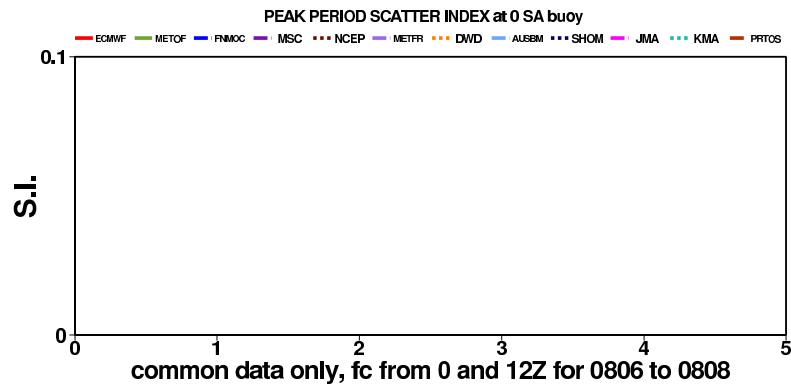
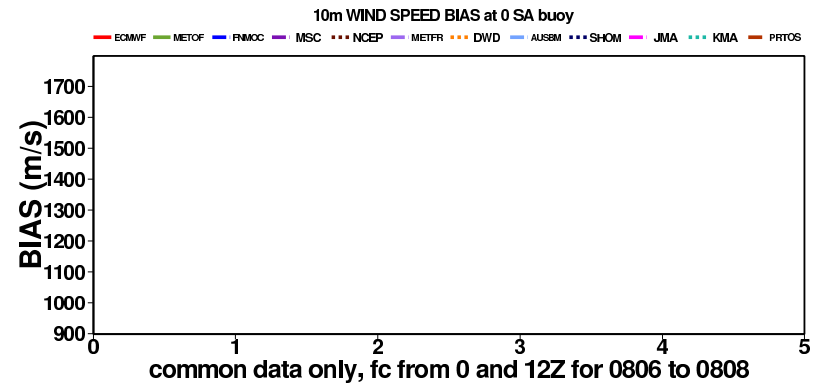
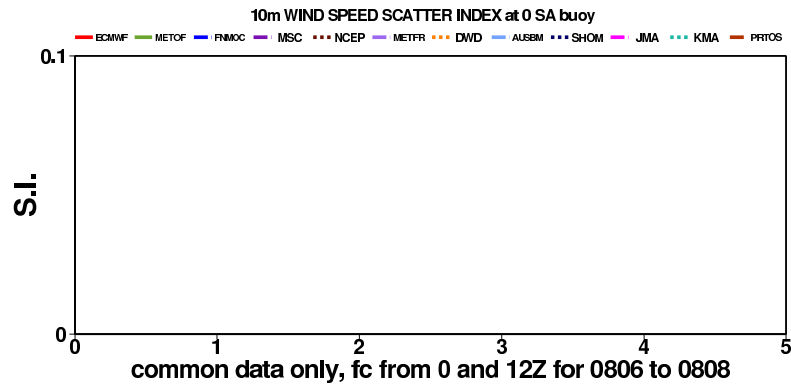
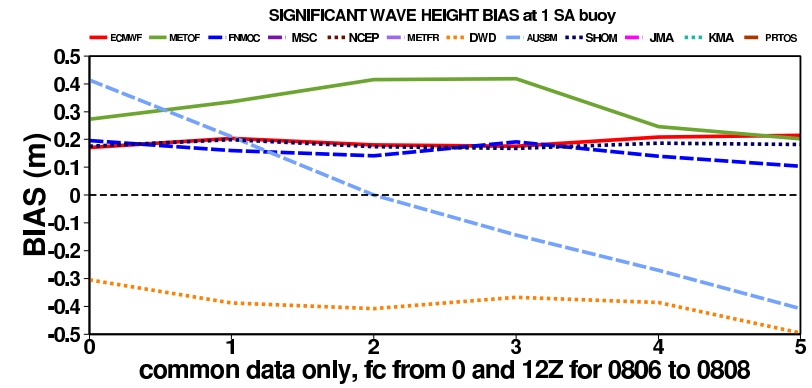
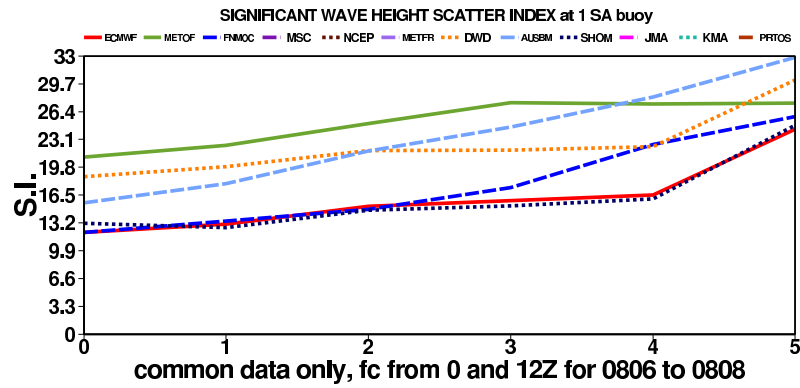


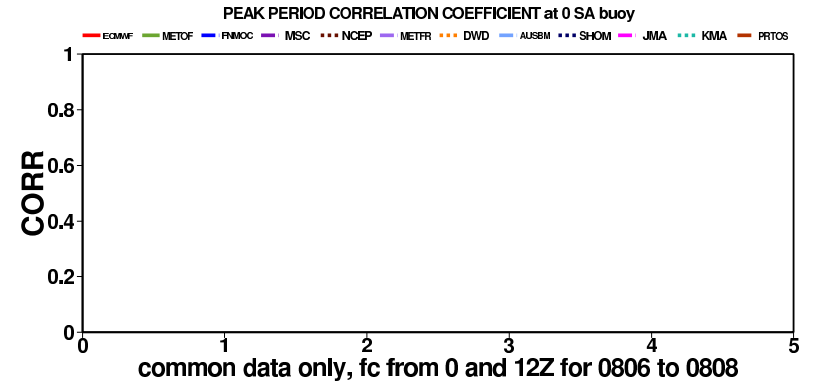
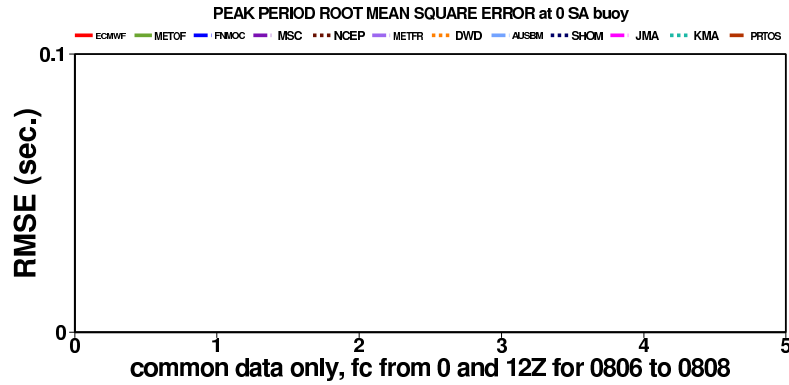
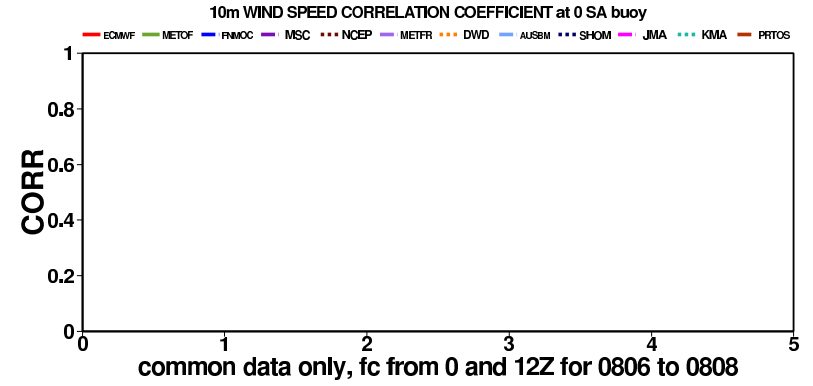
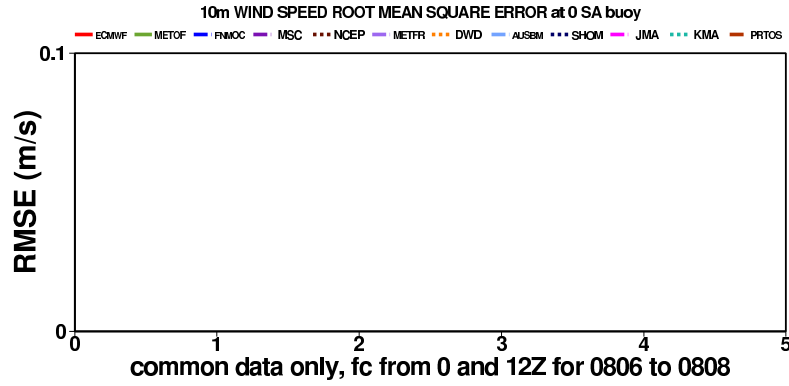
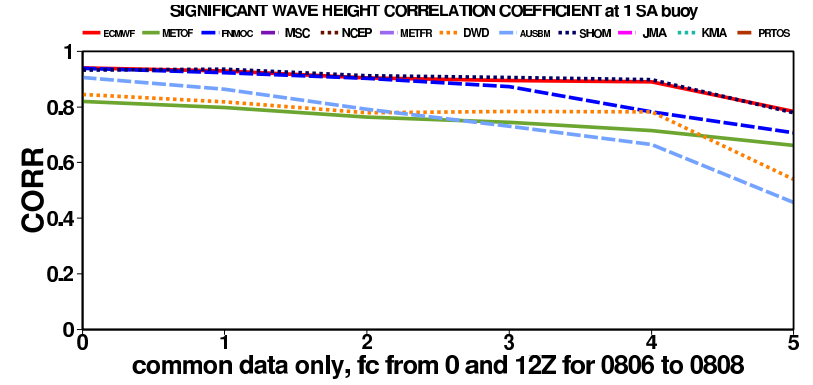
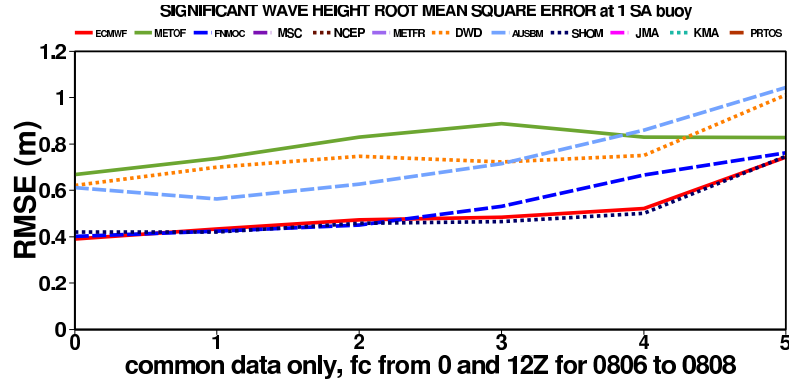
Figure 46: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 47: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common South African platform.



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 48: Forecast root mean square error (RMSE) and linear correlation coefficient at common South African platform.

### 0.3.13 Comparison for Indian buoys

Number of common observations for India (INDIA) from 200806 to 200808 (wind, Hs, Tp)

1	23092	73	74	0	Arabian Sea	4	23101	22	17	0	Bay of Bengal
2	23097	4	4	0	Arabian Sea	5	23170	26	0	0	Arabian Sea
3	23098	13	0	0	Arabian Sea						

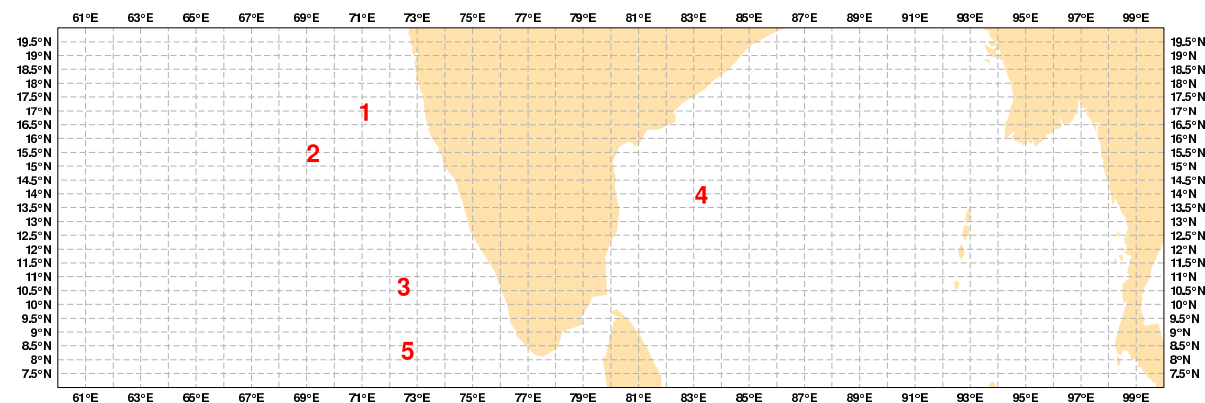
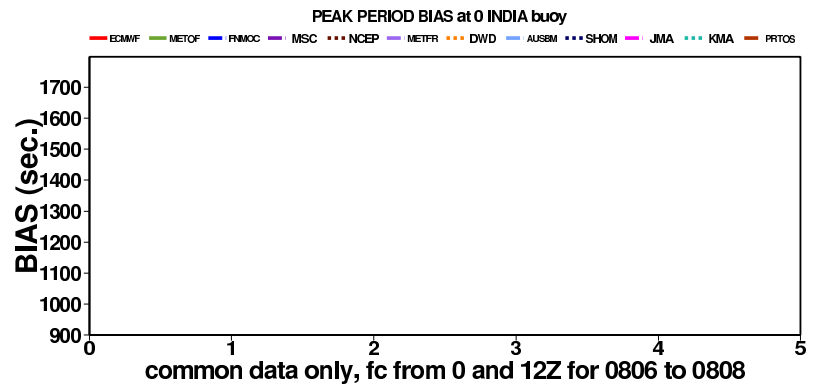
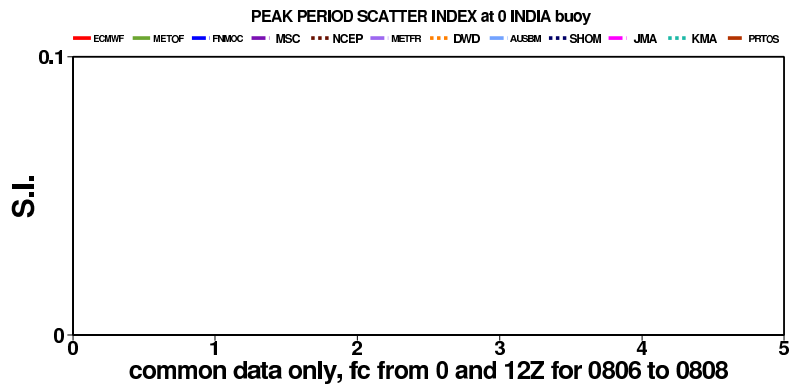
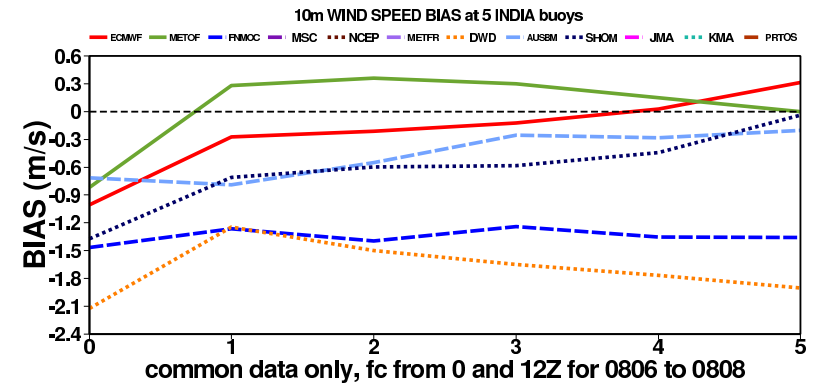
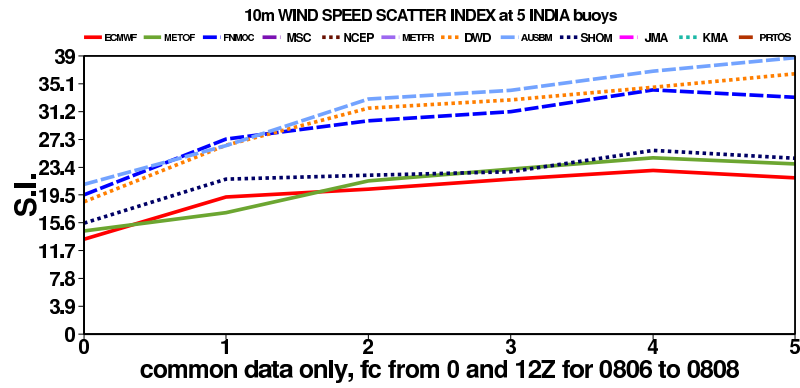
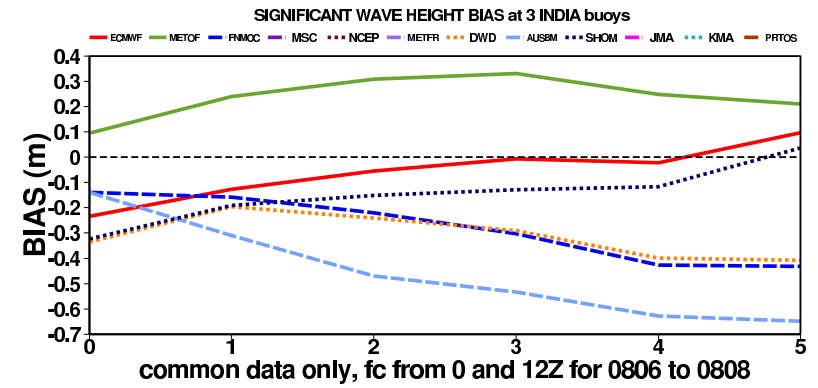
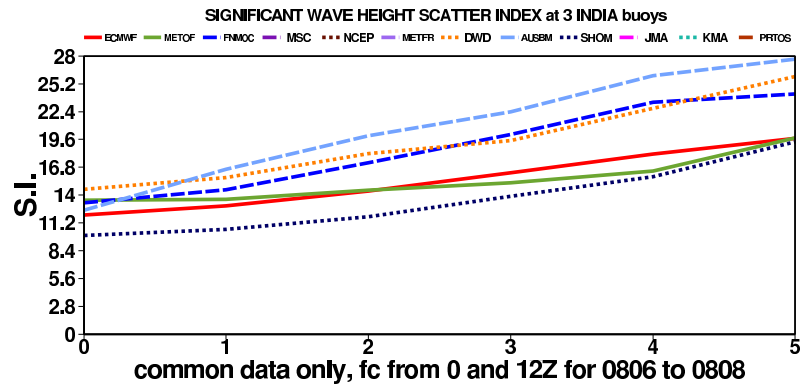


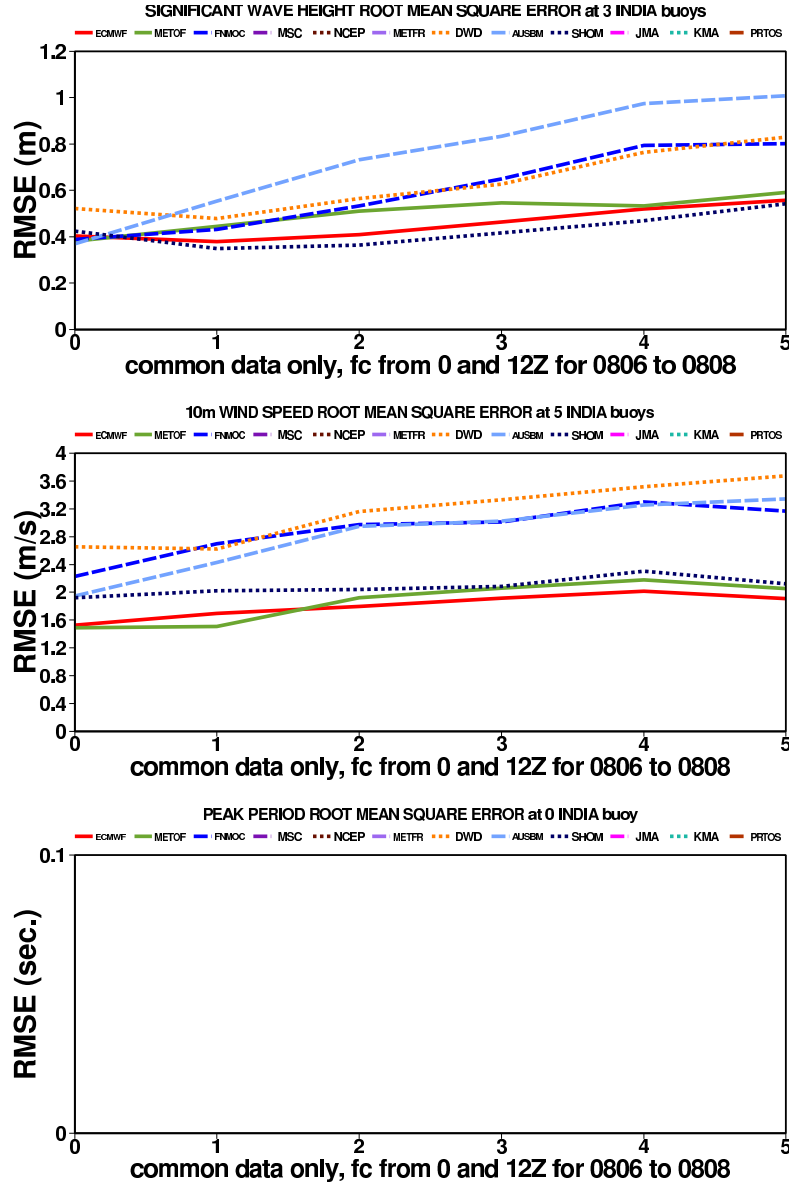
Figure 49: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



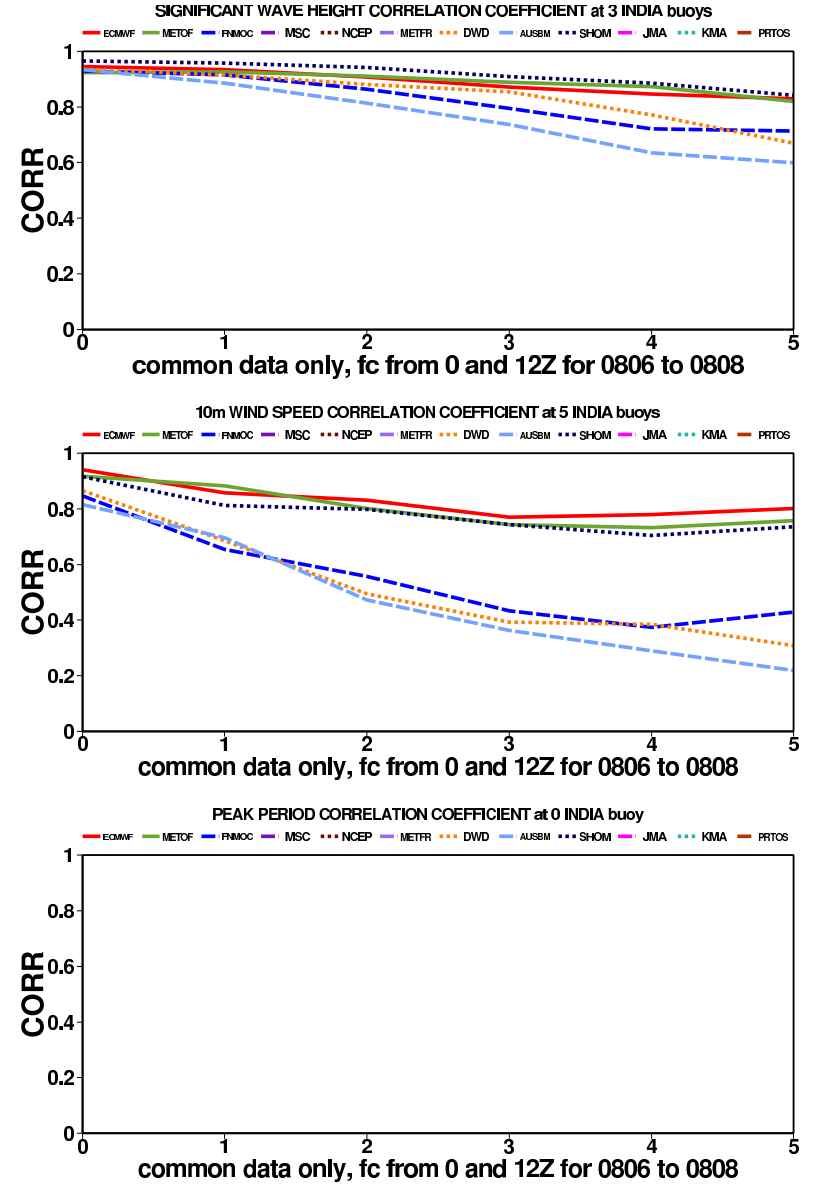
(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 50: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Indian buoys.



(a) R.M.S.E.



(b) Correlation Coefficient

Figure 51: Forecast root mean square error (RMSE) and linear correlation coefficient at common Indian buoys.

### 0.3.14 Comparison for Australian South East Coast buoys

Number of common observations for Australian South East Coast (ASEC) from 200806 to 200808 (wind, Hs, Tp)

1	55014	0	150	150	Bateman's Bay	4	55022	0	120	120	Port Kembla
2	55018	0	172	172	Coffs Harbour	5	55024	0	178	178	Sydney
3	55019	0	170	170	Crowdy Head	6	55039	0	182	179	Kingfish B

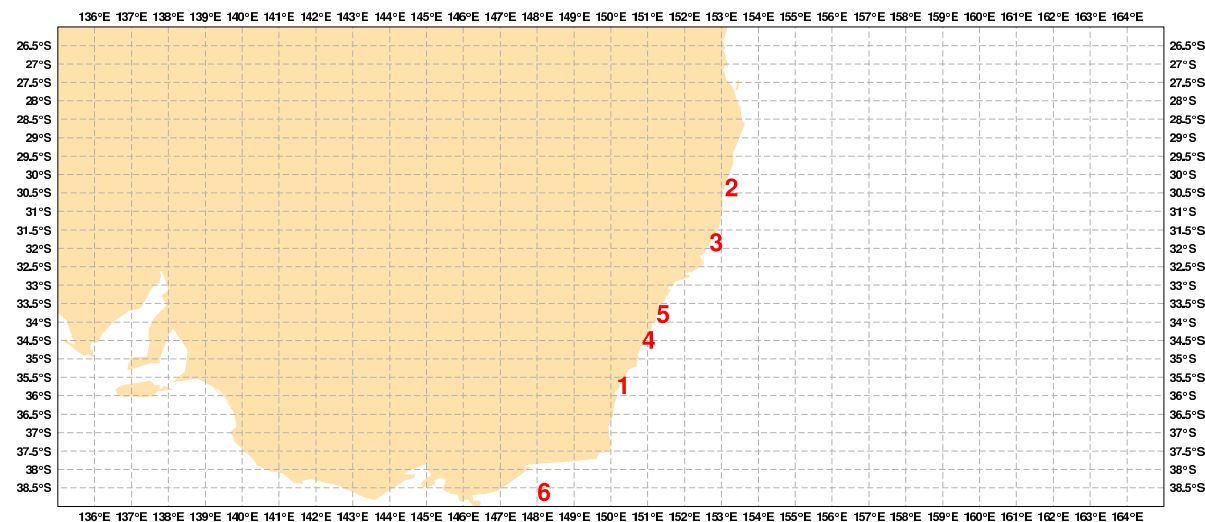
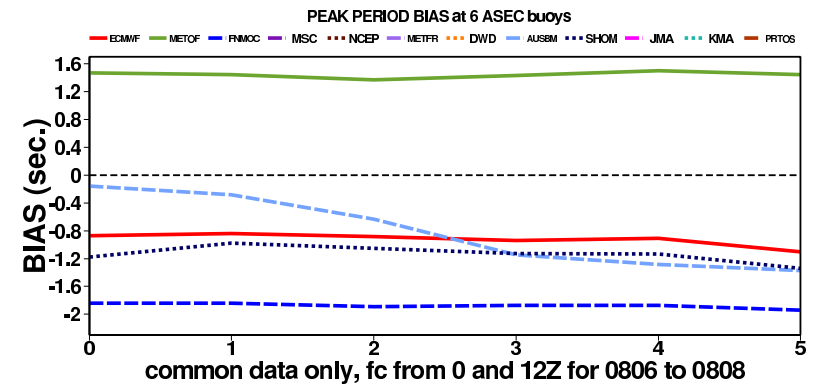
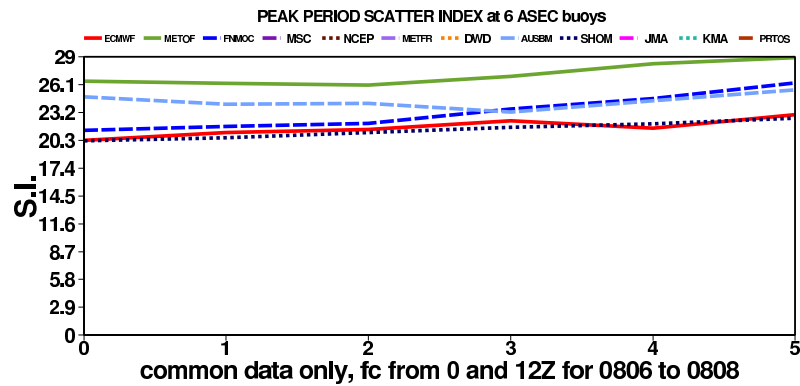
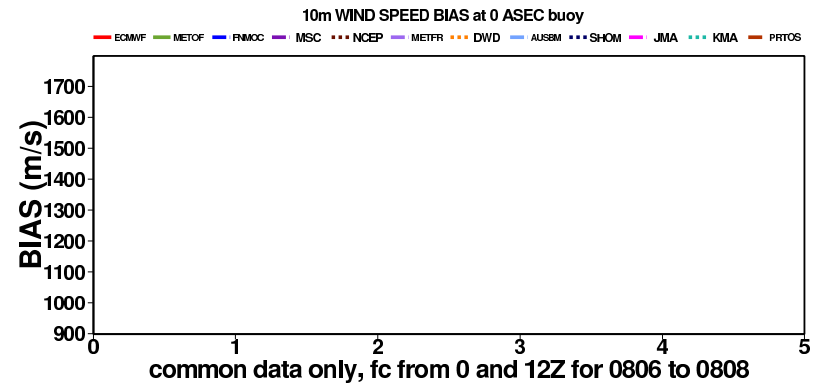
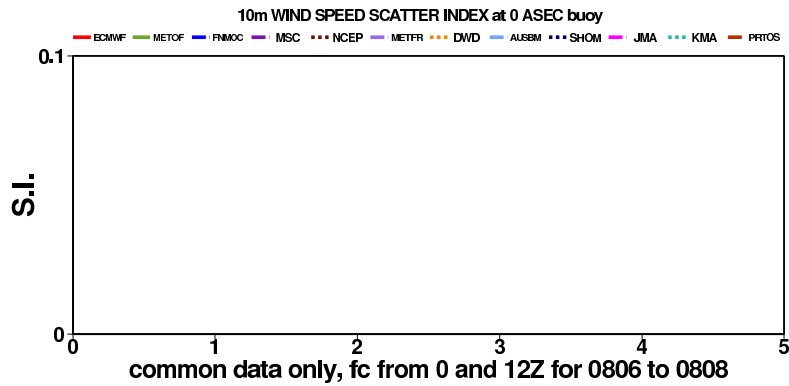
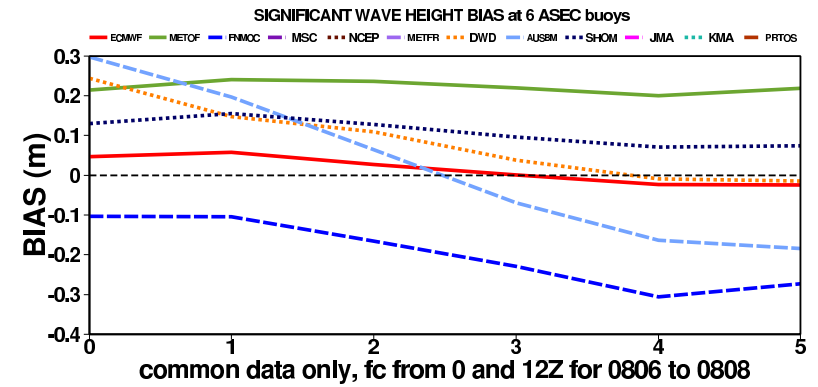
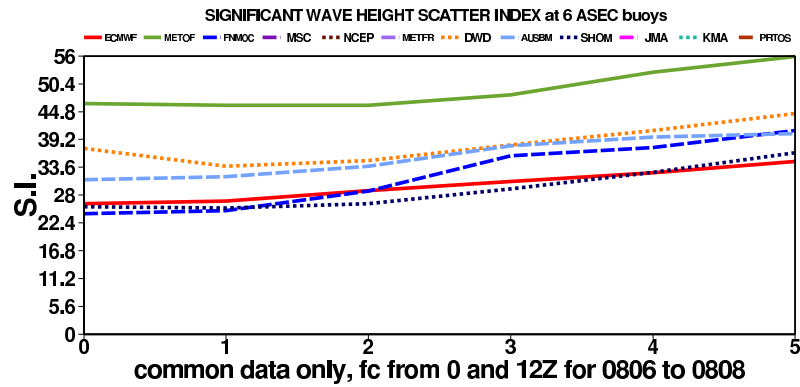


Figure 52: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.

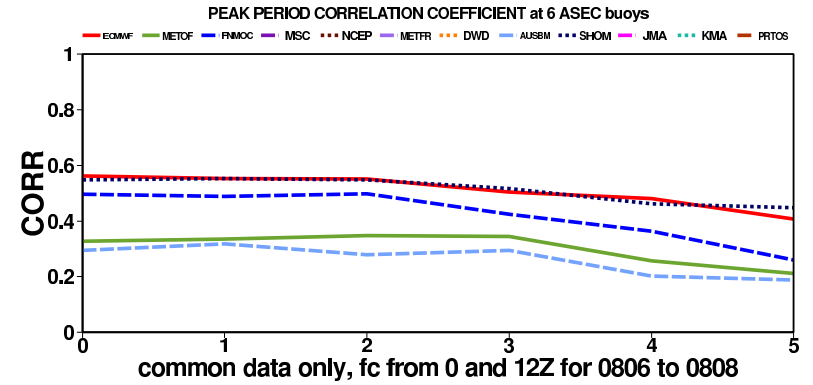
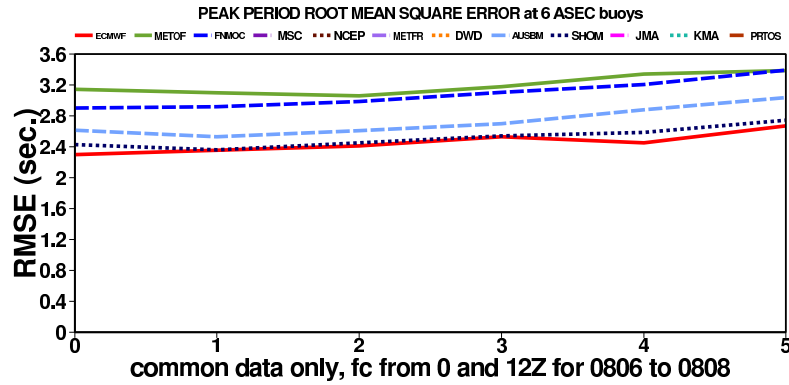
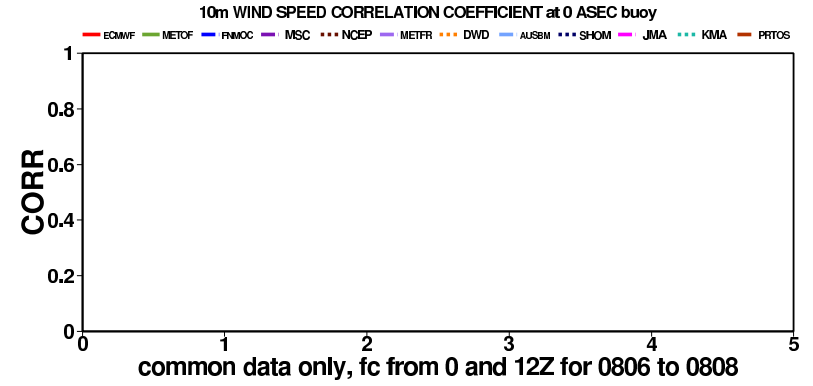
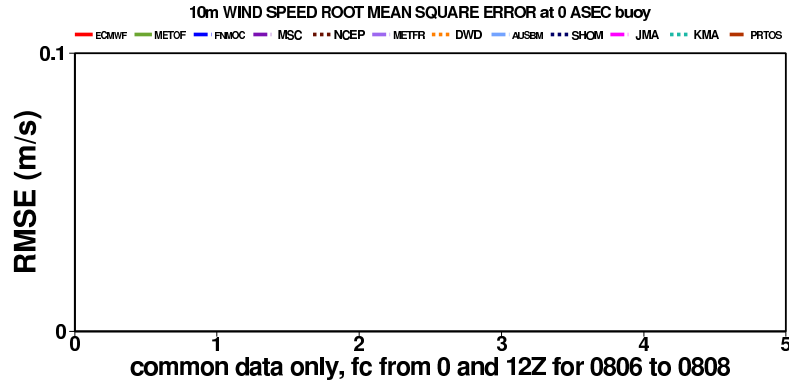
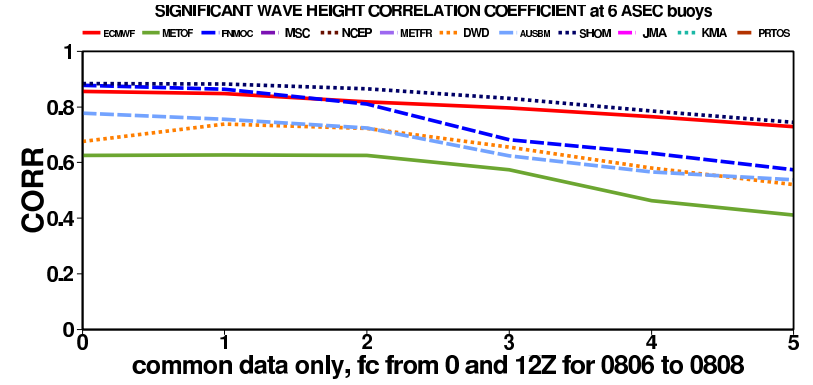
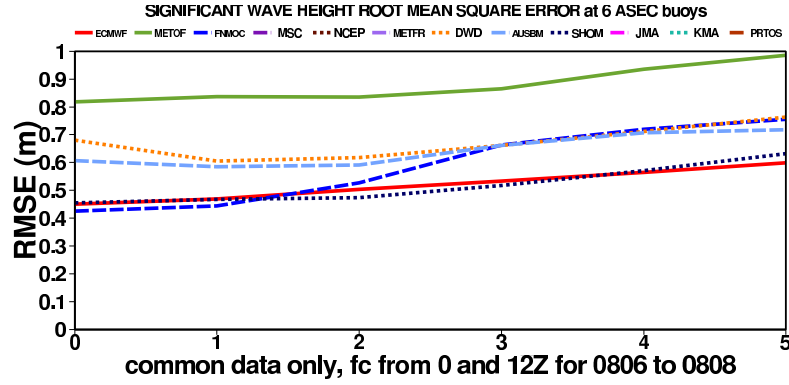


(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 53: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Australian South East Coast buoys.





(a) R.M.S.E.

(b) Correlation Coefficient

Figure 54: Forecast root mean square error (RMSE) and linear correlation coefficient at common Australian South East Coast buoys.

### 0.3.15 Comparison for Australian Great Barrier Reef buoys

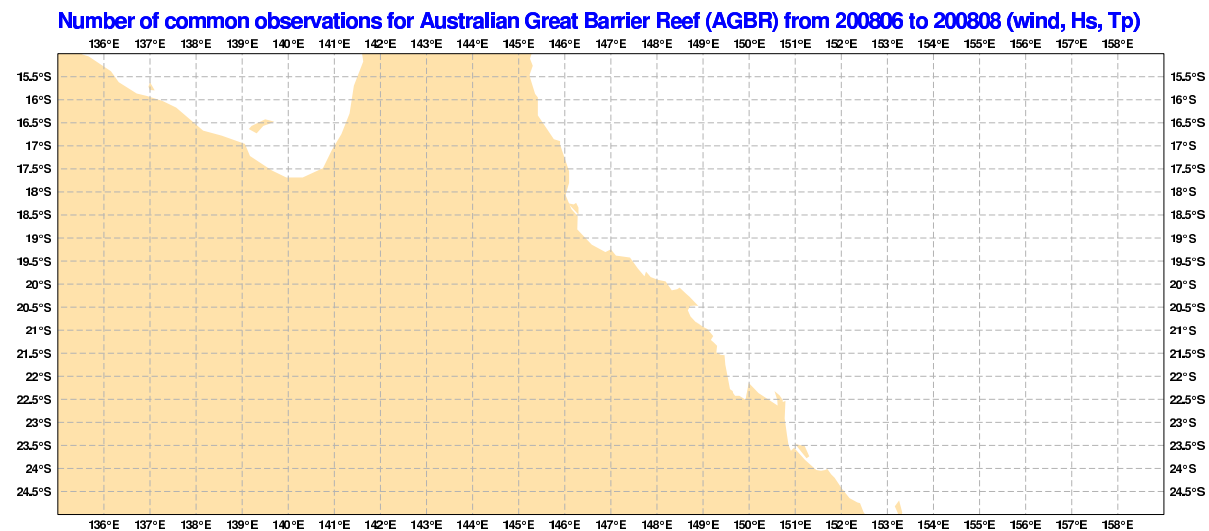
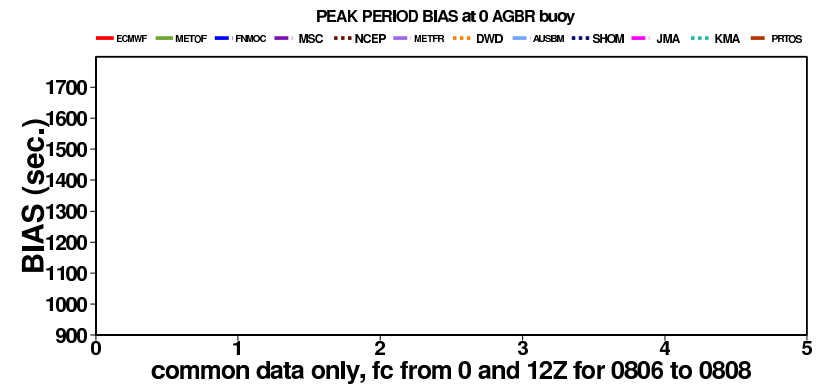
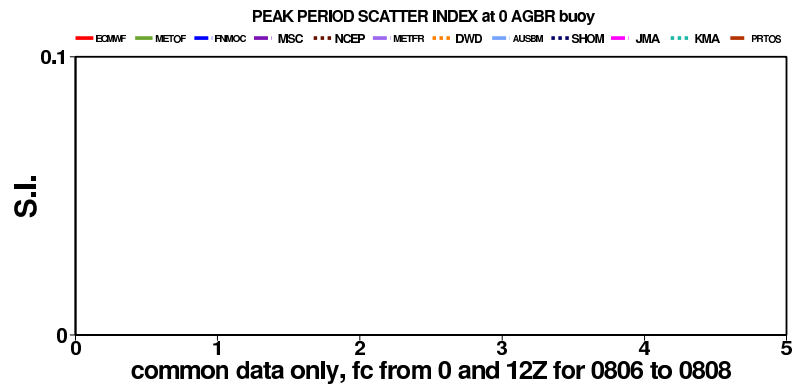
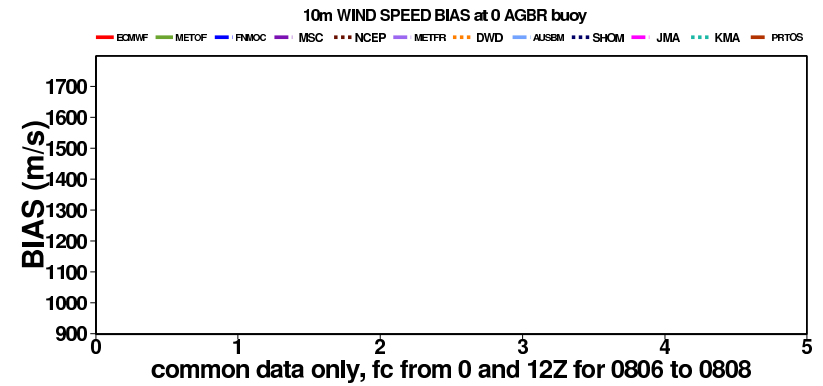
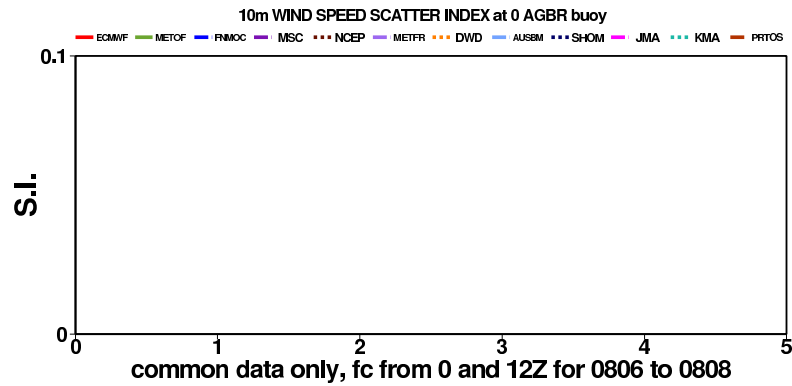
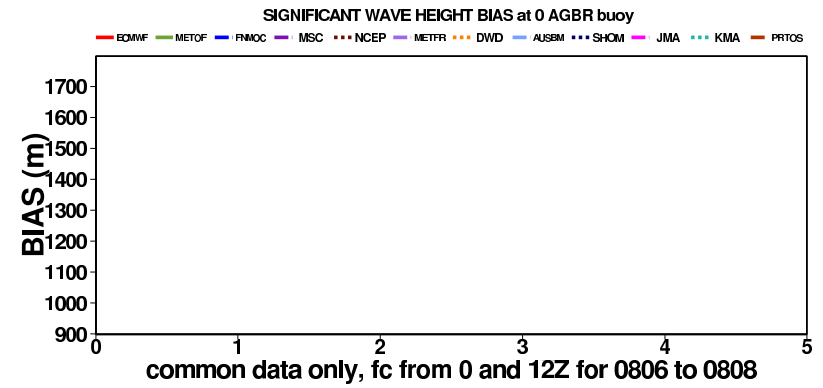
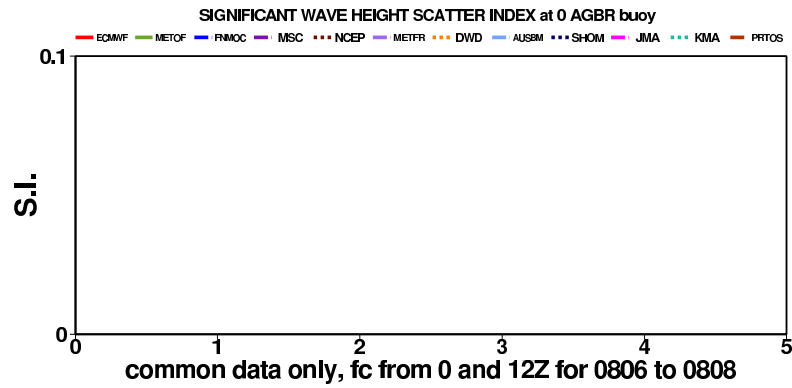


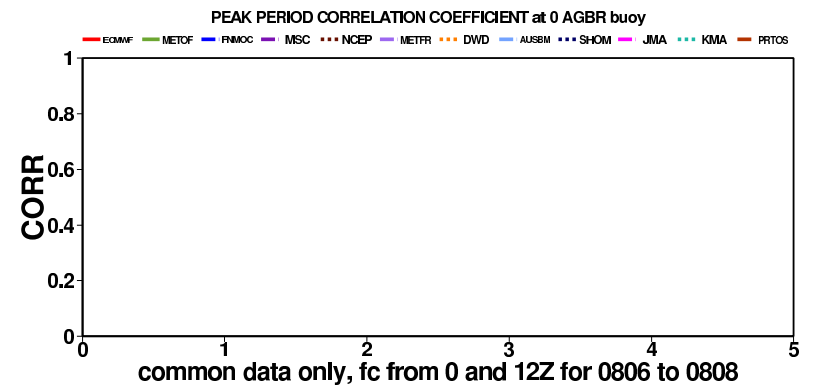
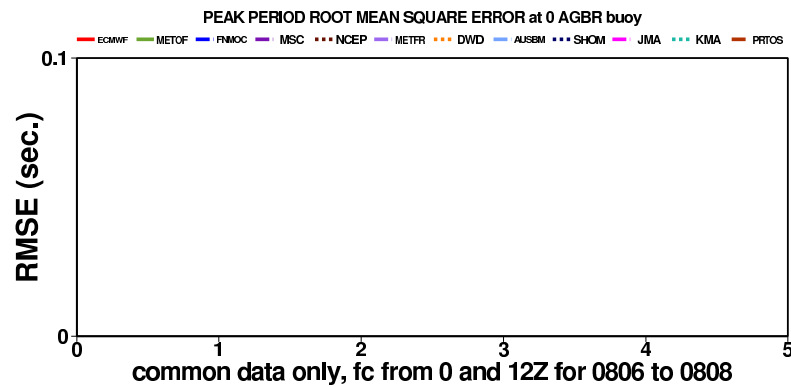
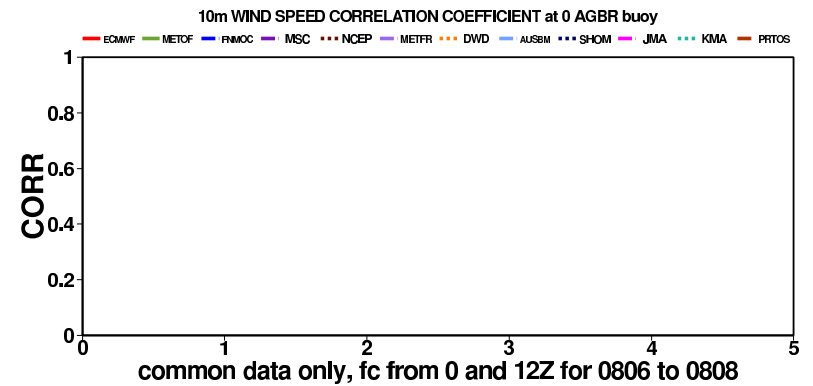
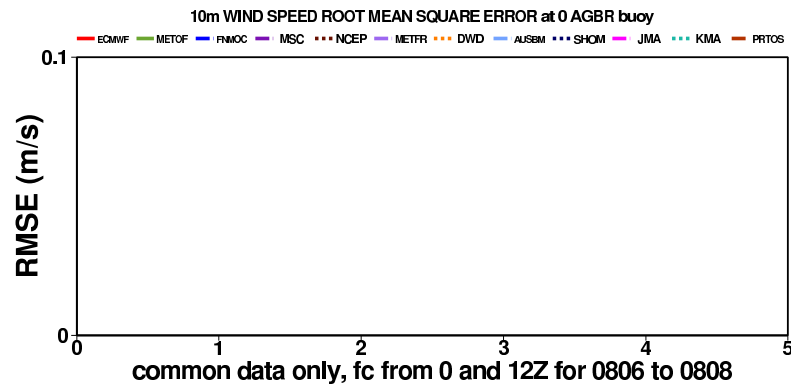
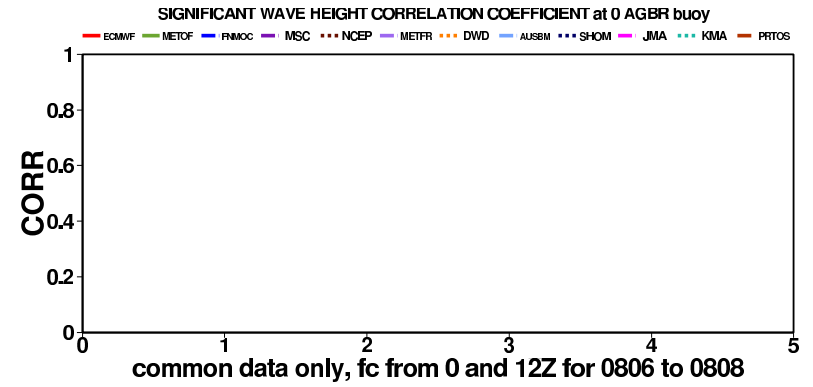
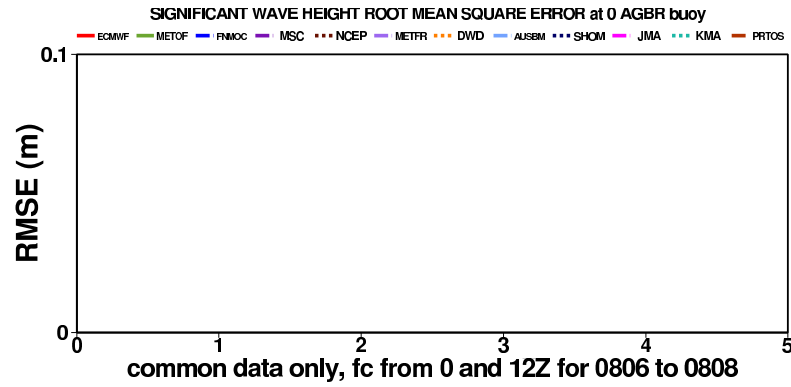
Figure 55: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 56: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Australian Great Barrier Reef buoys.



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 57: Forecast root mean square error (RMSE) and linear correlation coefficient at common Australian Great Barrier Reef buoys.

### 0.3.16 Comparison for Australian South West facing Coast buoys

Number of common observations for Australian South West facing Coast (ASWC) from 200806 to 200808 (wind, Hs, Tp)

1	55026	0	182	182	Strahan	3	56004	0	177	177	Jurien
2	55040	0	182	182	Cape Du Couedic	4	56005	0	175	175	Rottnest Island

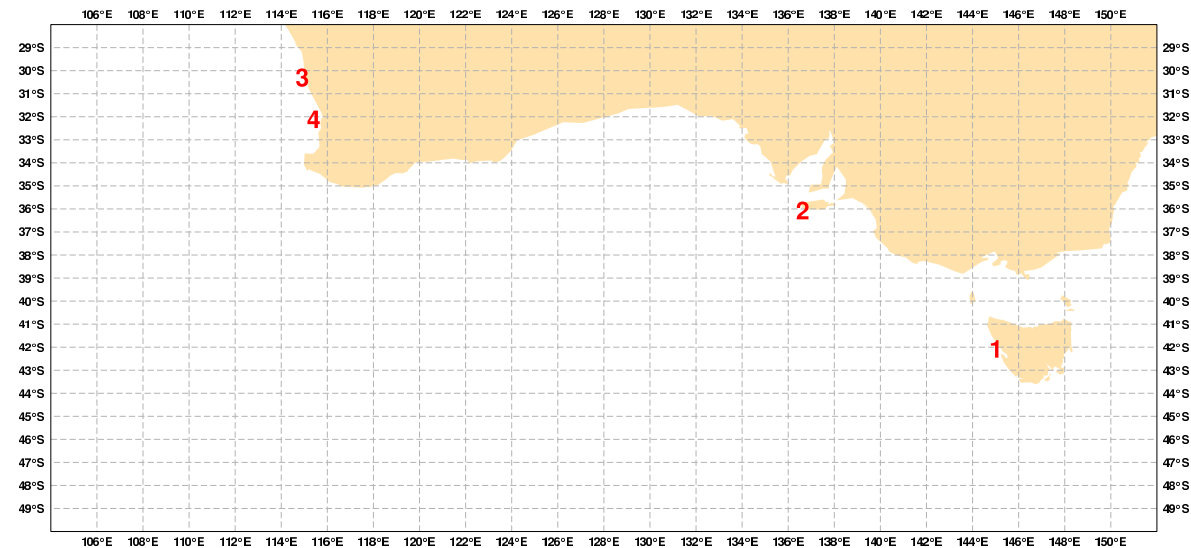
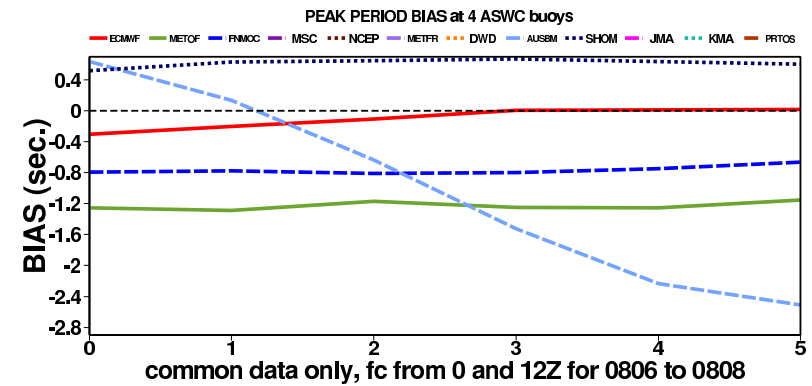
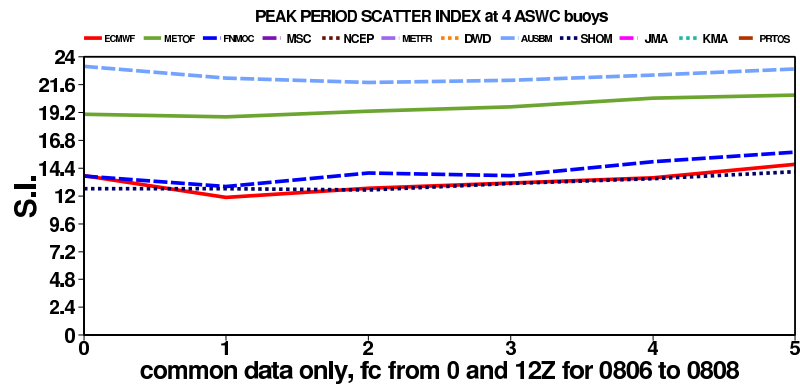
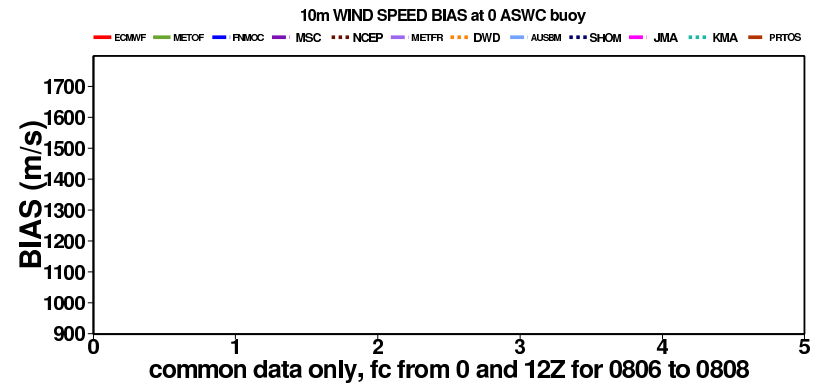
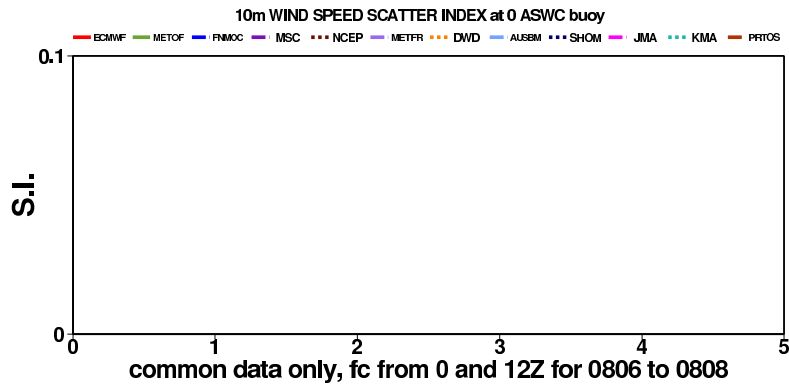
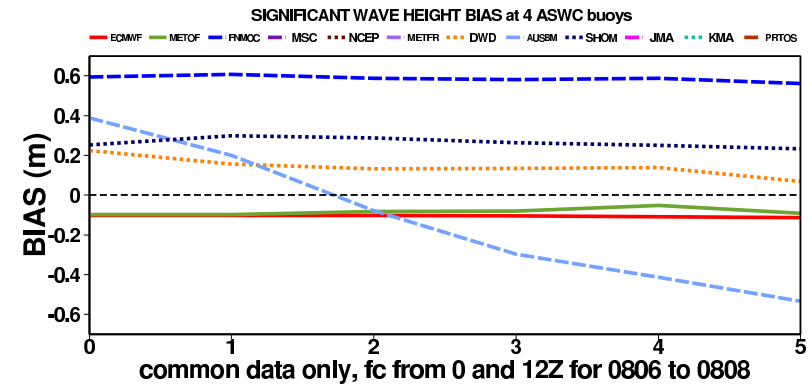
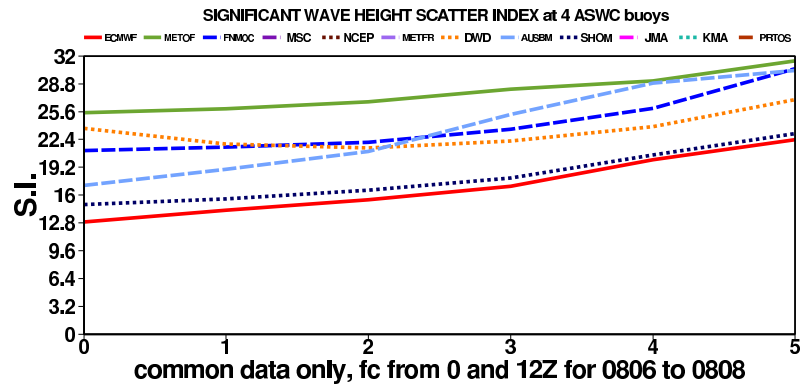


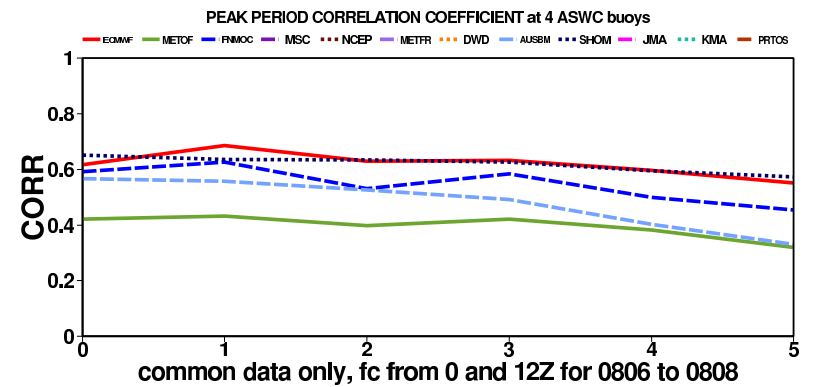
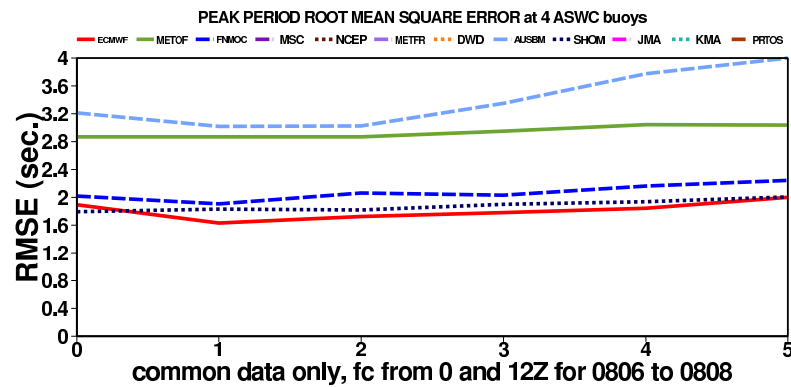
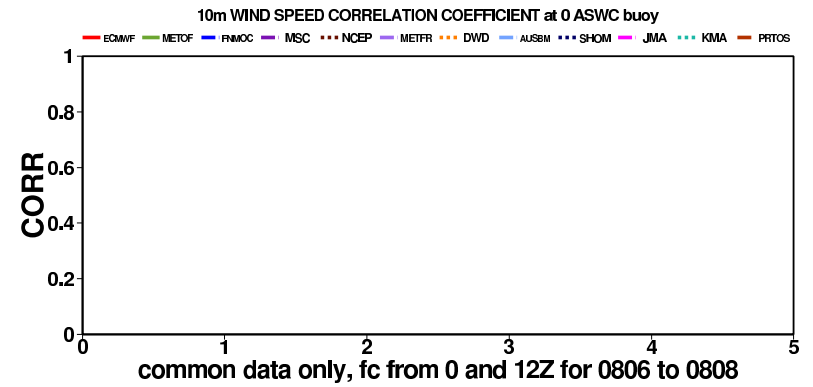
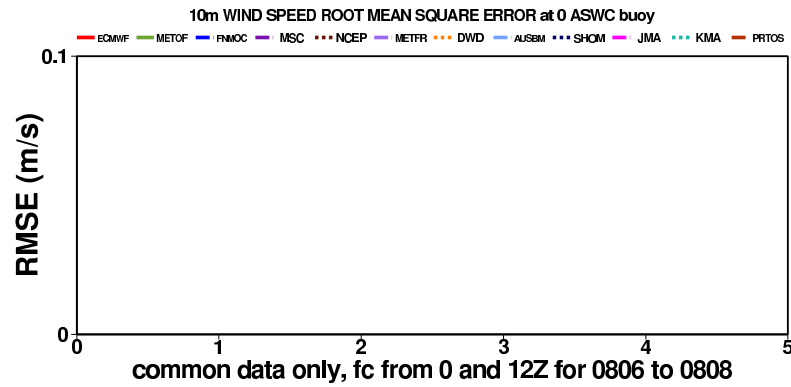
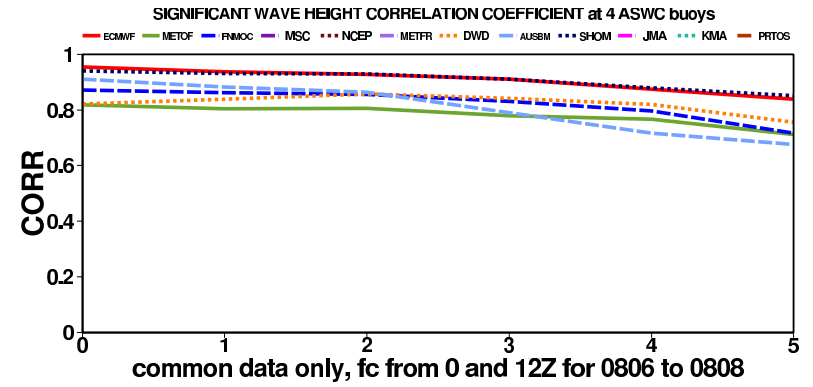
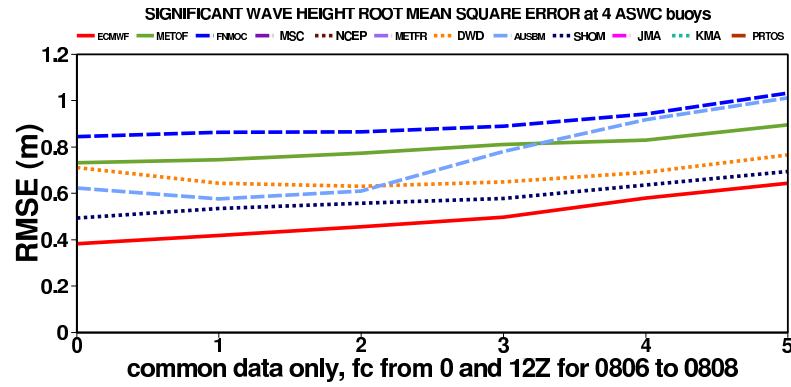
Figure 58: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.



(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 59: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Australian South West facing Coast buoys.



(a) R.M.S.E.

(b) Correlation Coefficient

Figure 60: Forecast root mean square error (RMSE) and linear correlation coefficient at common Australian South West facing Coast buoys.

### 0.3.17 Comparison for Australian North West Coast buoys

Number of common observations for Australian North West Coast (ANWC) from 200806 to 200808 (wind, Hs, Tp)

1	56002	35	35	0	North Rankin
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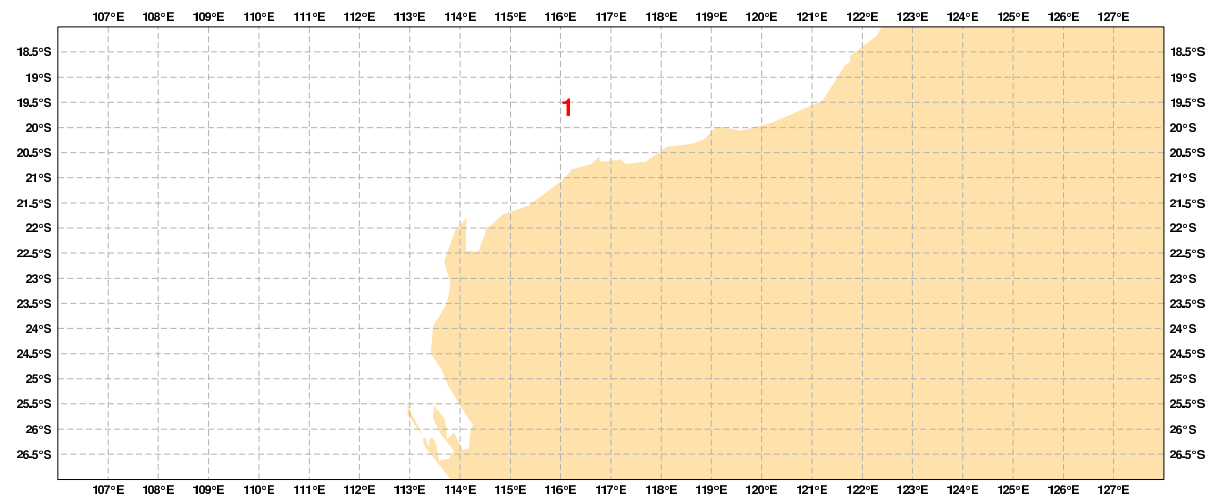
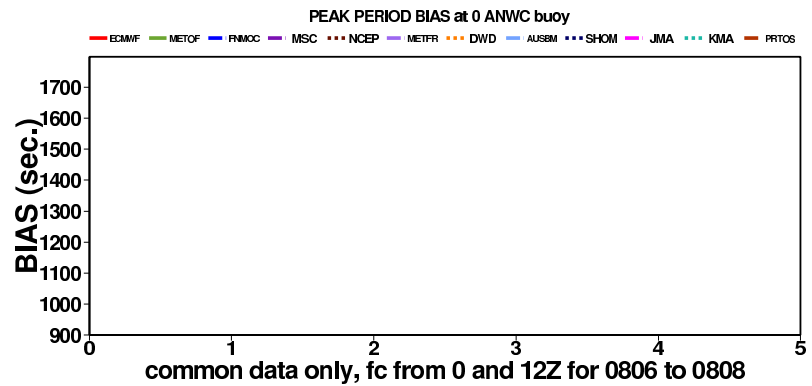
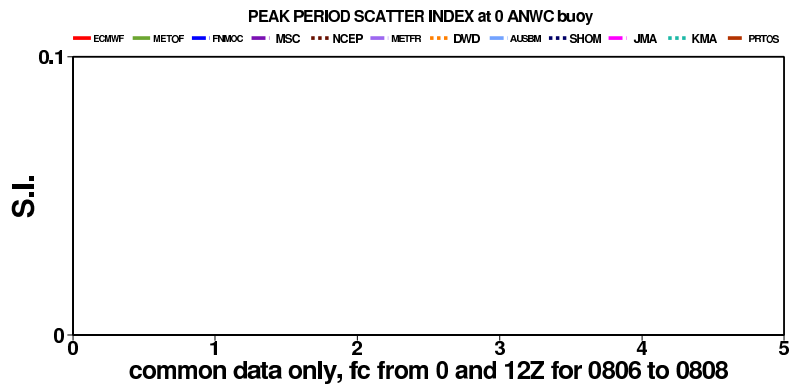
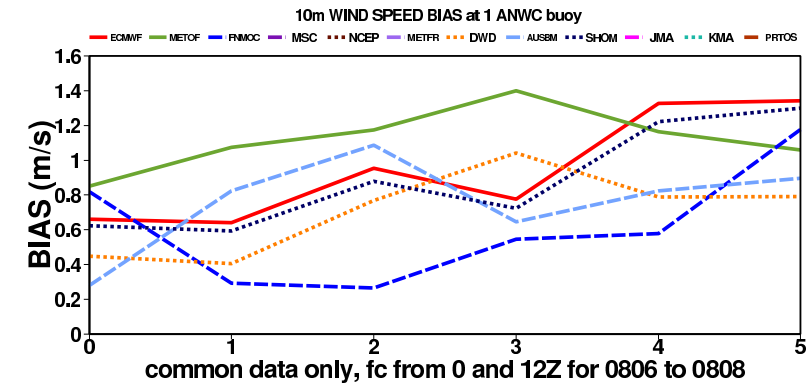
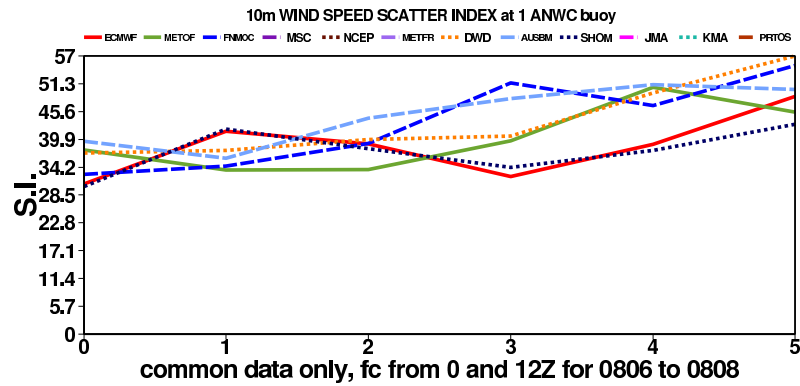
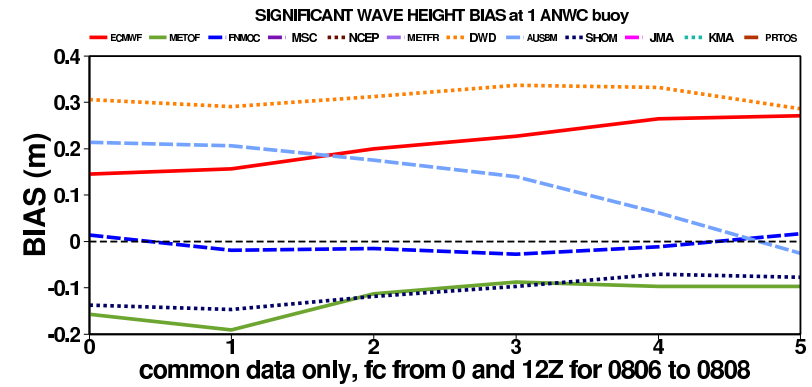
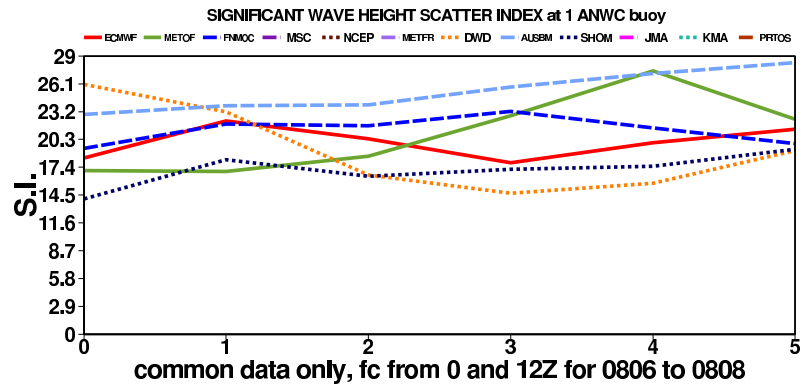


Figure 61: Buoy locations. The numbers in the table following each buoy identifier are the number of collocations between models and buoy wind speed, wave height and peak period.

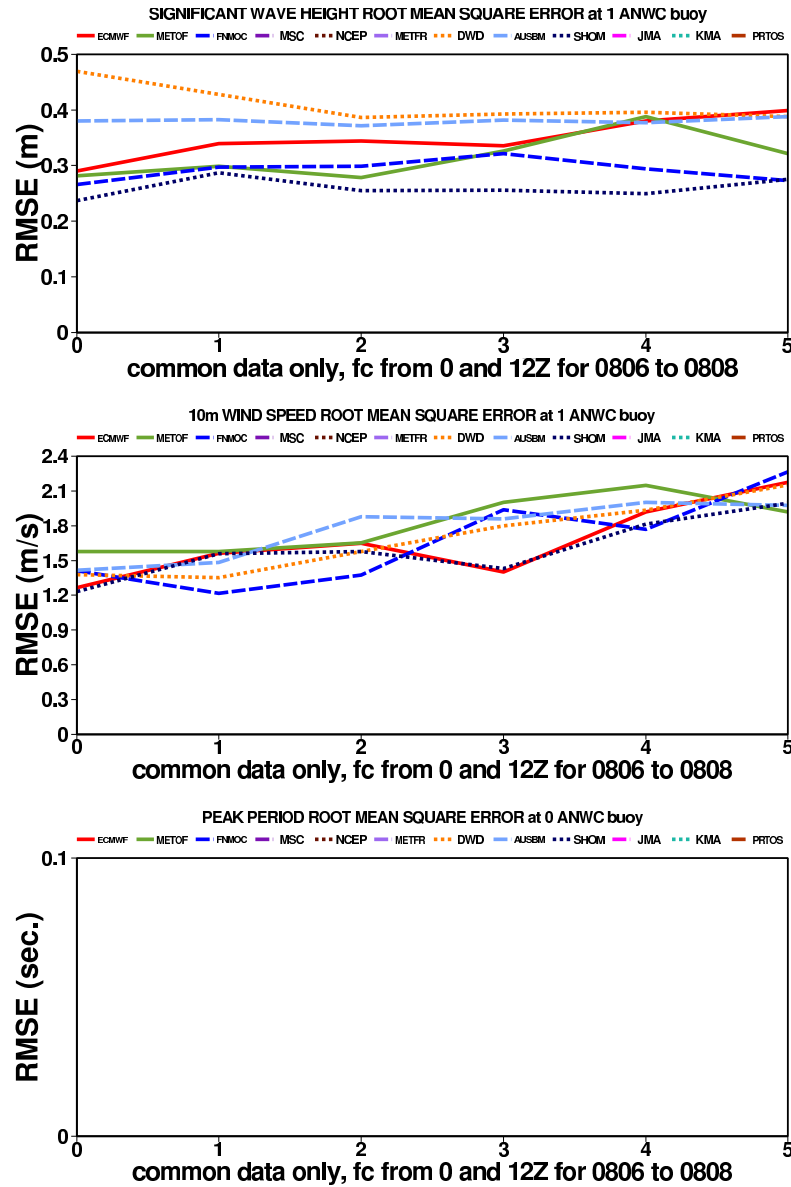




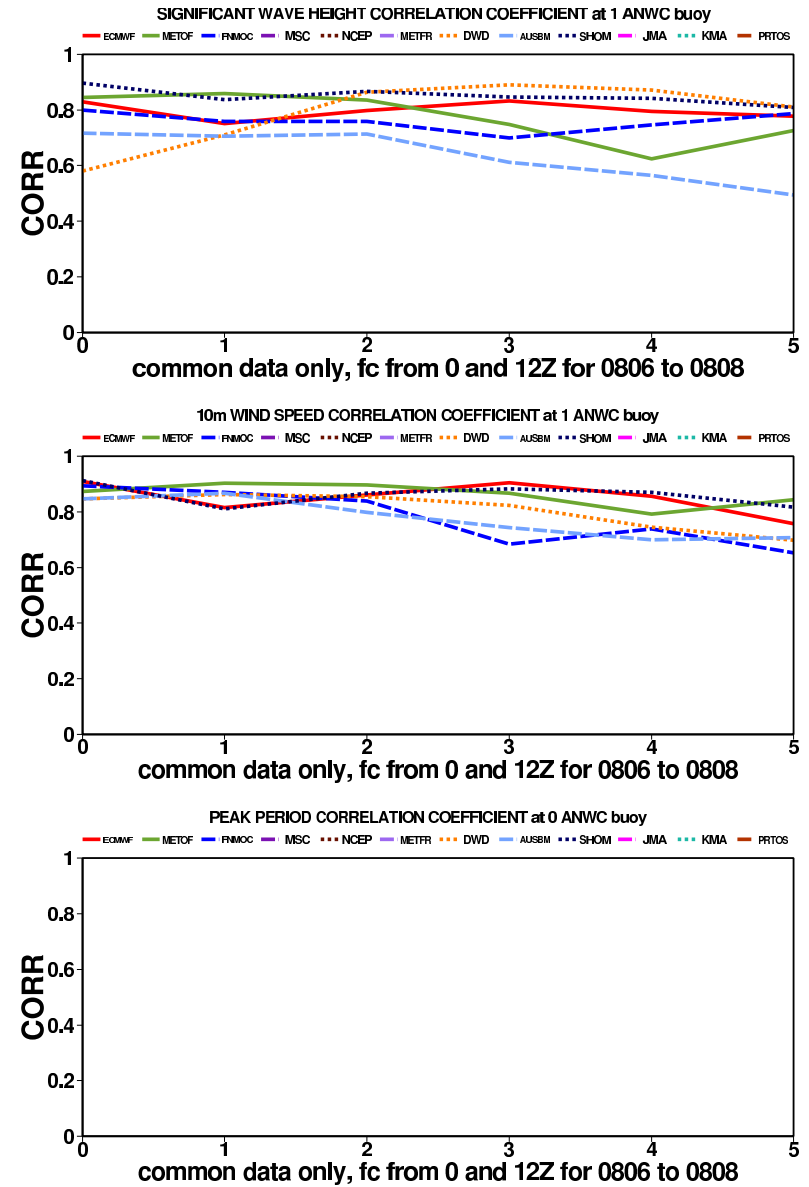
(a) Scatter Index (%)

(b) Bias (model-buoy)

Figure 62: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations) and bias (model-buoy) at common Australian North West Coast buoys.



(a) R.M.S.E.



(b) Correlation Coefficient

Figure 63: Forecast root mean square error (RMSE) and linear correlation coefficient at common Australian North West Coast buoys.