

Intercomparison of operational wave forecasting systems against  
in-situ observations: data from BoM, DMI, DWD, ECCO,  
ECMWF, JMA, METEOAM, NCEP, PRTOS, SHNSM, UKMO.

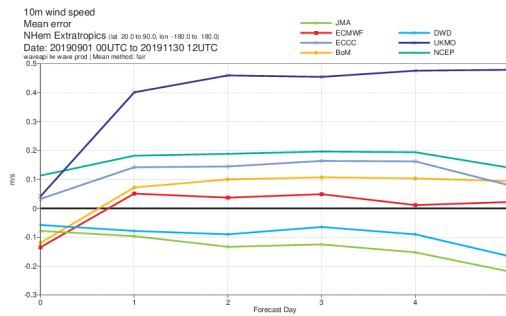
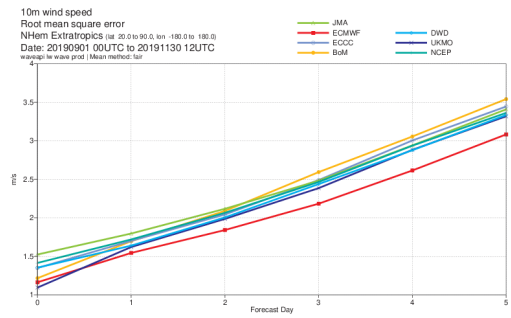
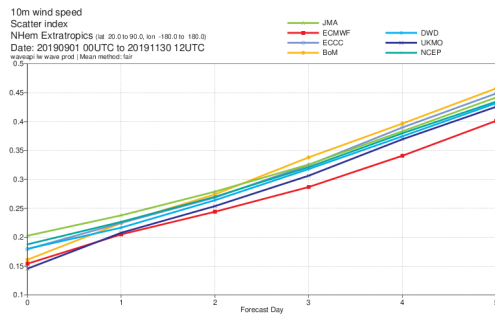
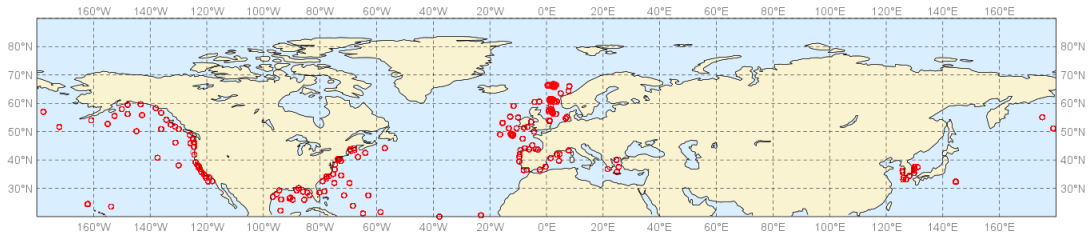
00 and 12 UTC runs

WMO Lead Centre for Wave Forecast Verification LC-WFV,  
European Centre for Medium-Range Weather Forecasts ECMWF

December 19, 2019

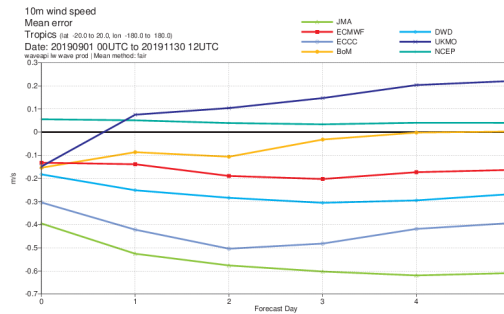
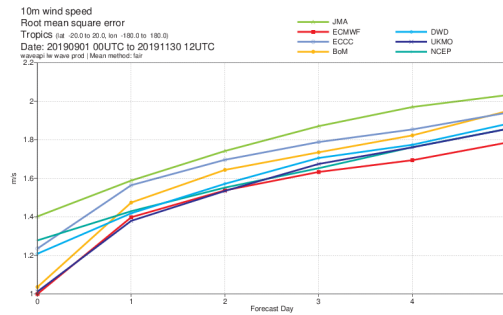
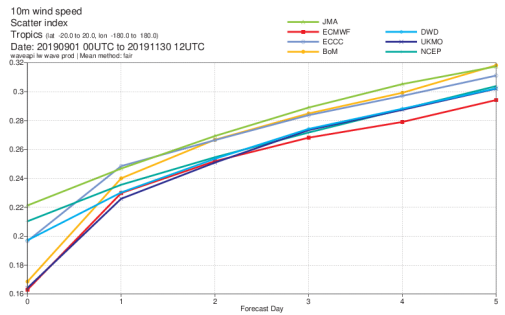
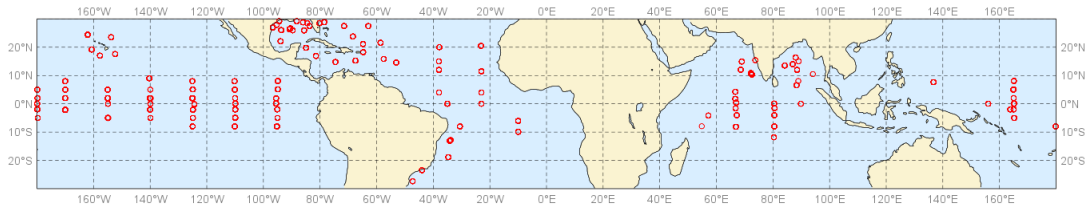
**PART III: 10 meter wind speed (10ff)**

Buoys observations - from 20190901 to 20191130 - (10ff)



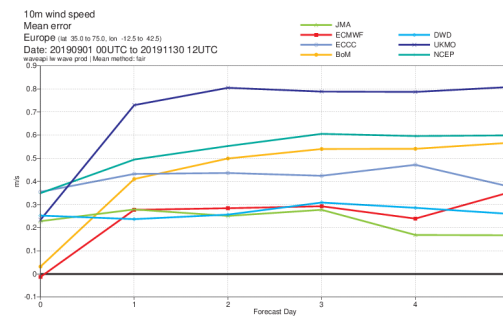
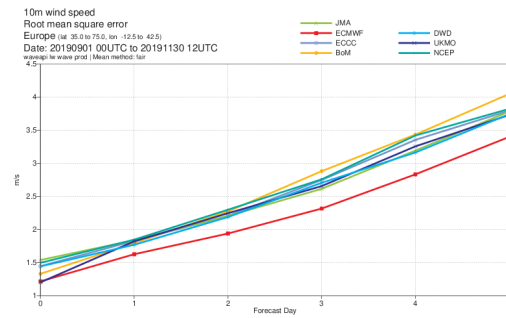
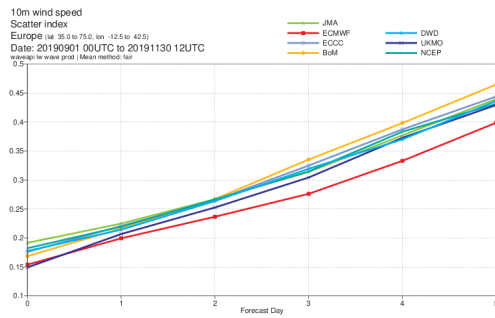
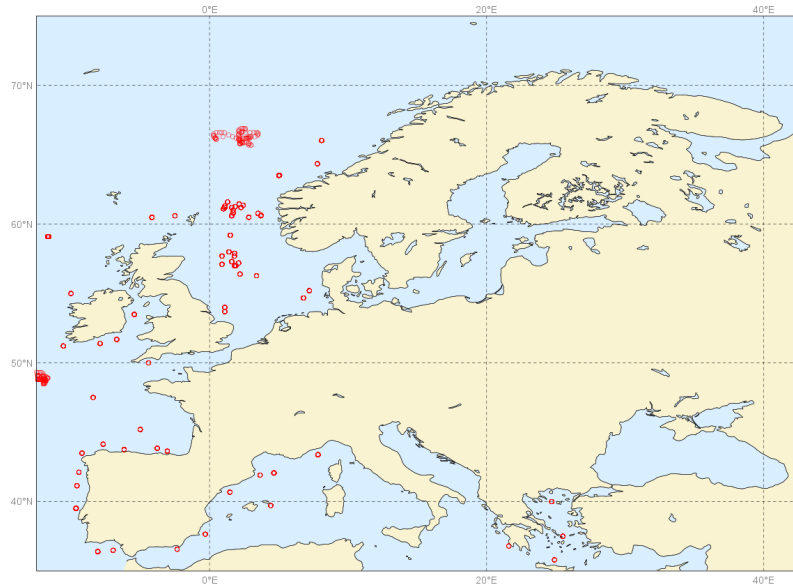
**Northern Hemisphere.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



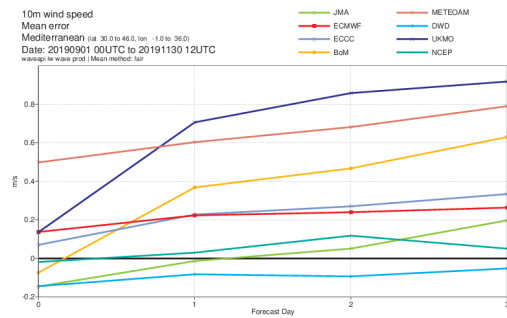
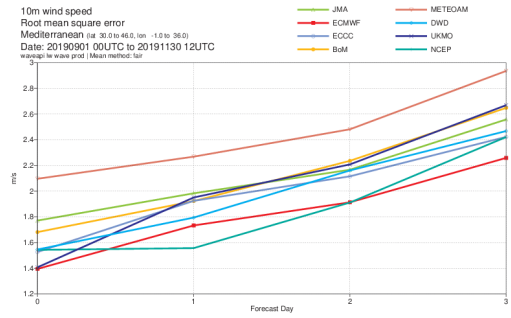
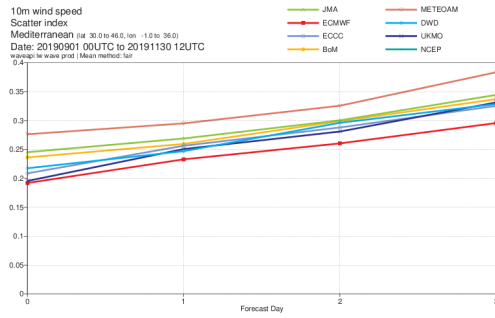
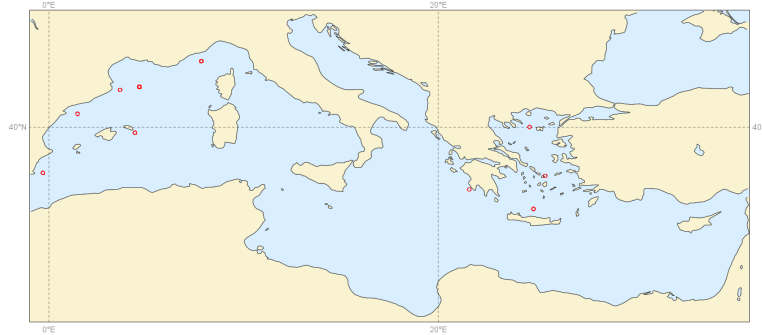
**Tropics.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



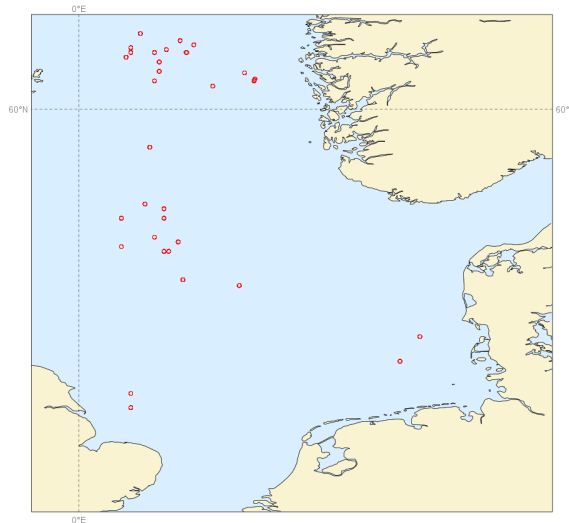
**Europe.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)

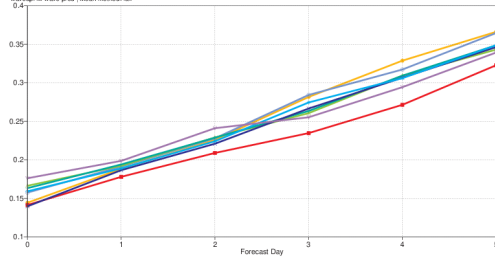


**Mediterranean Sea.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

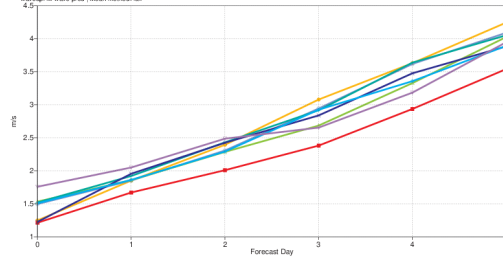
Buoys observations - from 20190901 to 20191130 - (10f)



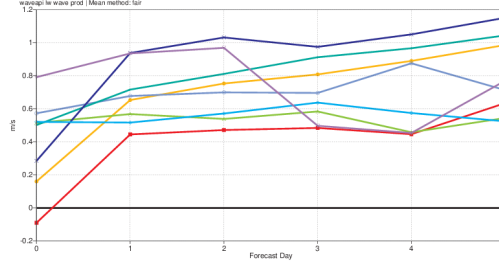
10m wind speed  
Scatter Index  
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)  
Date: 20190901 00UTC to 20191130 12UTC  
wrapup: le wave prod | Mean method: tar



10m wind speed  
Root mean square error  
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)  
Date: 20190901 00UTC to 20191130 12UTC  
wrapup: le wave prod | Mean method: tar

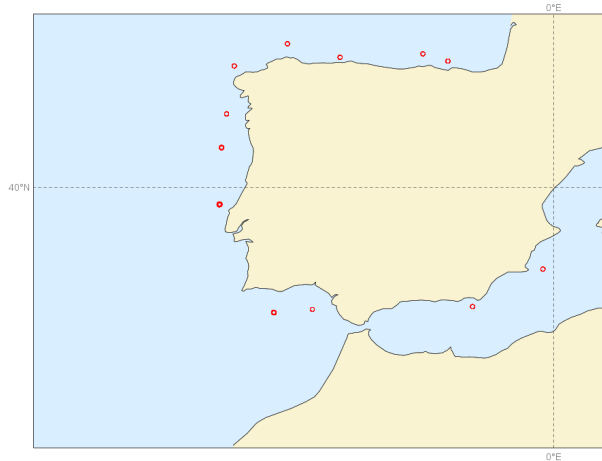


10m wind speed  
Mean error  
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)  
Date: 20190901 00UTC to 20191130 12UTC  
wrapup: le wave prod | Mean method: tar

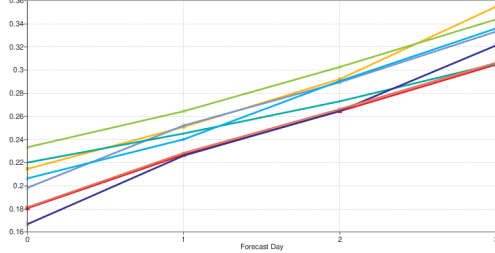


**North Sea.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

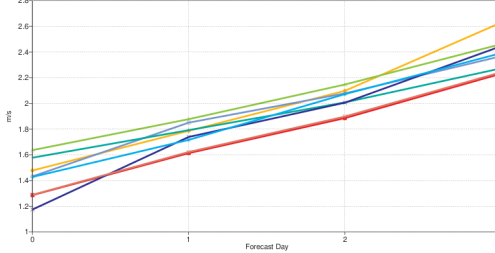
Buoys observations - from 20190901 to 20191130



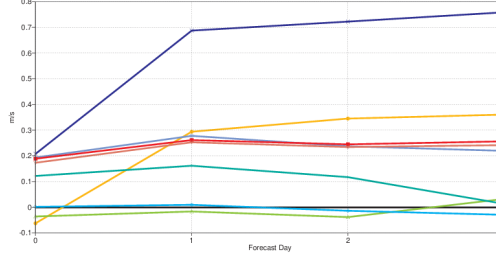
10m wind speed  
Scatter index  
SW Europe (lat: 32.5 to 45.0, lon: -15.0 to 10.0)  
Date: 20190901 00UTC to 20191130 12UTC  
Average for every grid (Mean method: last)



10m wind speed  
Root mean square error  
SW Europe (lat: 32.5 to 45.0, lon: -15.0 to 10.0)  
Date: 20190901 00UTC to 20191130 12UTC  
Average for every grid (Mean method: last)

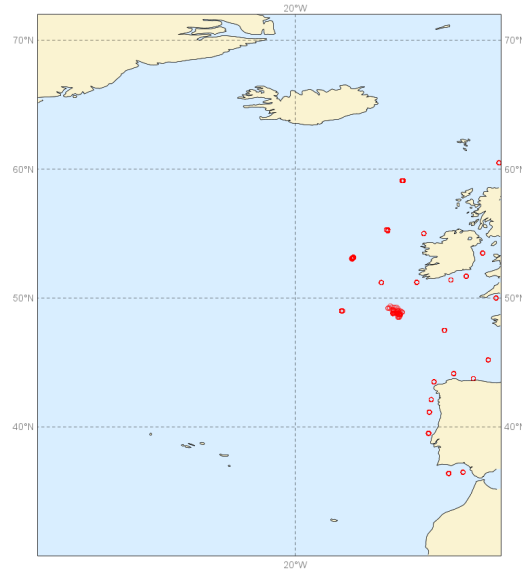


10m wind speed  
Mean error  
SW Europe (lat: 32.5 to 45.0, lon: -15.0 to 10.0)  
Date: 20190901 00UTC to 20191130 12UTC  
Average for every grid (Mean method: last)

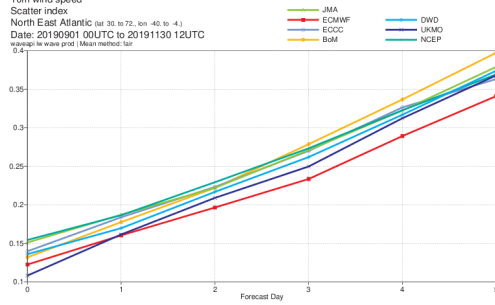


**South West Europe.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

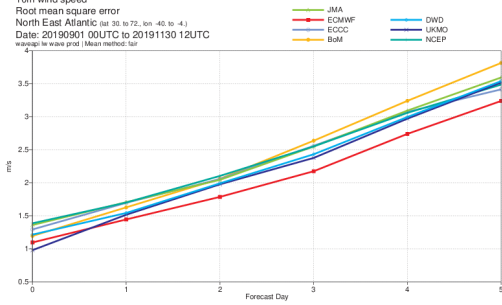
Buoys observations - from 20190901 to 20191130 - (10ff)



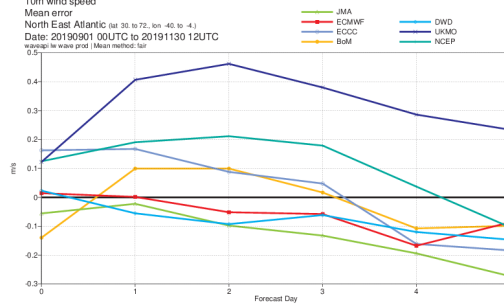
10m wind speed  
Scatter index  
North East Atlantic (lat 30 to 72, lon -40 to -4)  
Date: 20190901 00UTC to 20191130 12UTC  
average for area grid. Mean method: last



10m wind speed  
Root mean square error  
North East Atlantic (lat 30 to 72, lon -40 to -4)  
Date: 20190901 00UTC to 20191130 12UTC  
average for area grid. Mean method: last



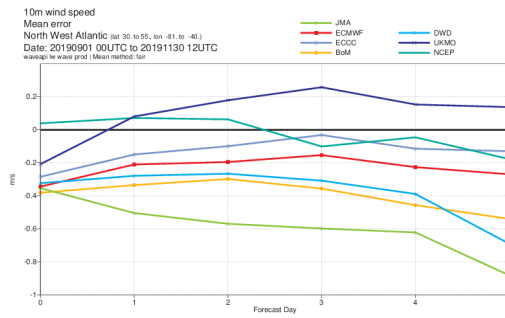
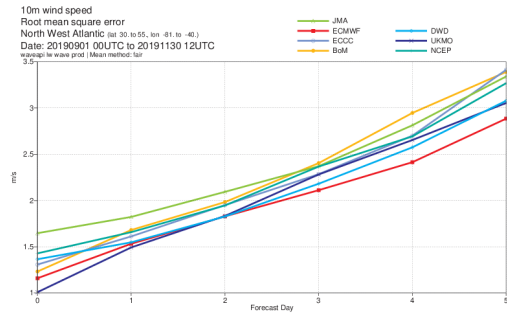
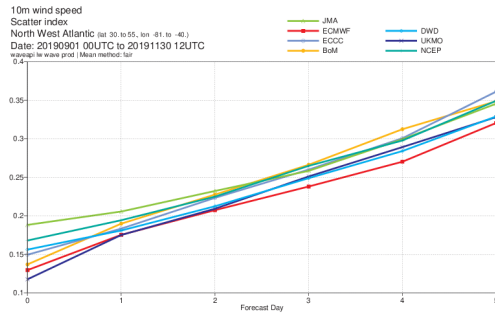
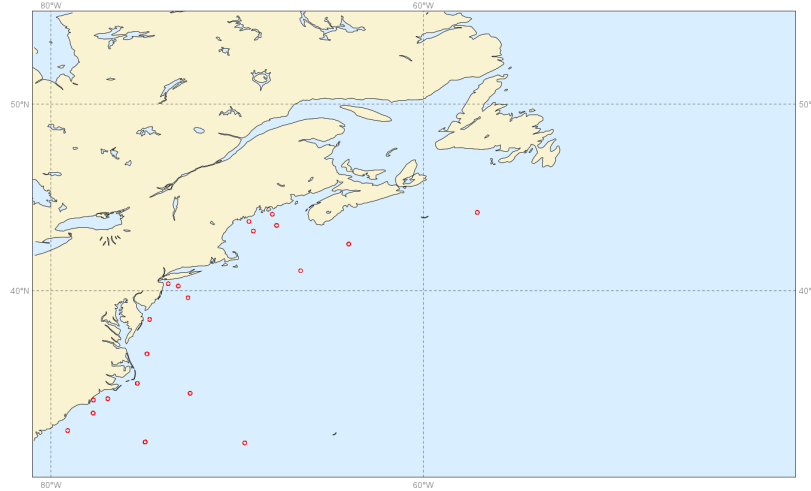
10m wind speed  
Mean error  
North East Atlantic (lat 30 to 72, lon -40 to -4)  
Date: 20190901 00UTC to 20191130 12UTC  
average for area grid. Mean method: last



**North East Atlantic.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

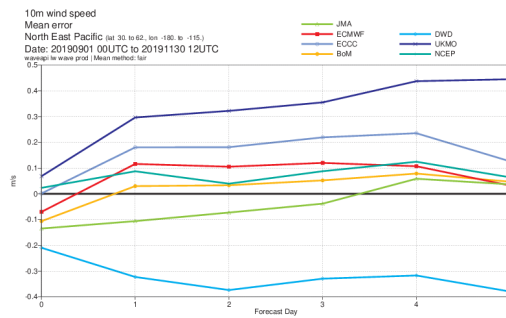
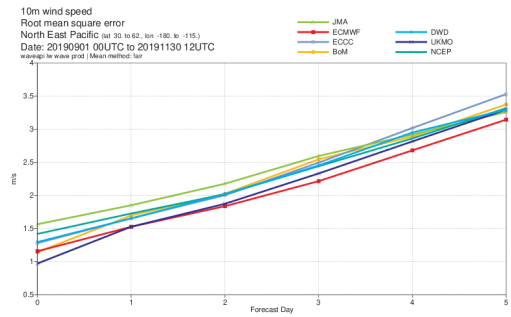
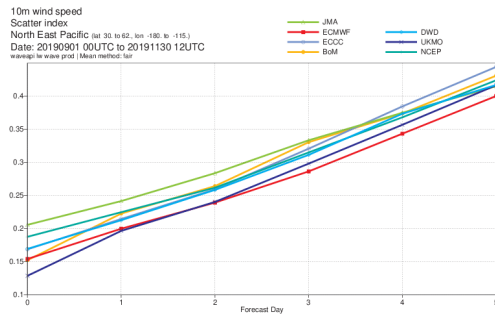
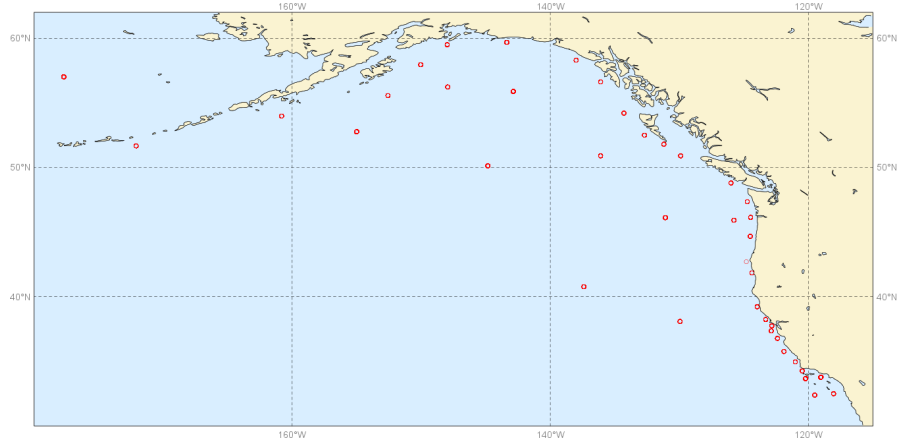


Buoys observations - from 20190901 to 20191130 - (10ff)



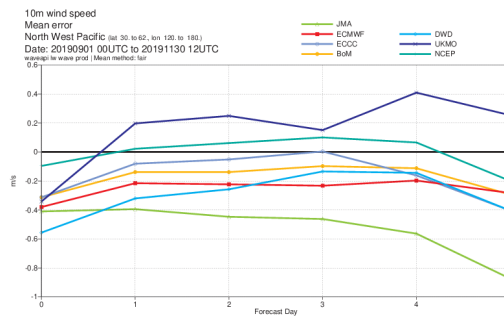
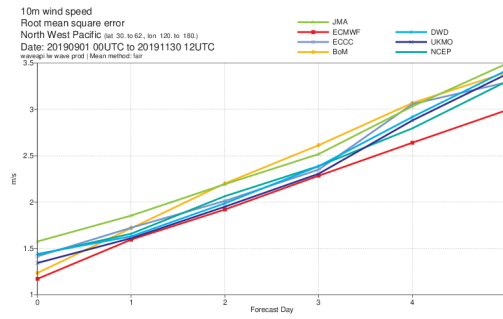
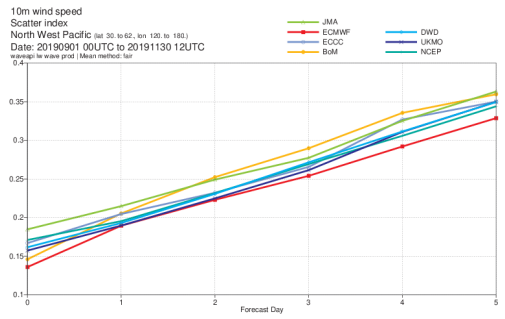
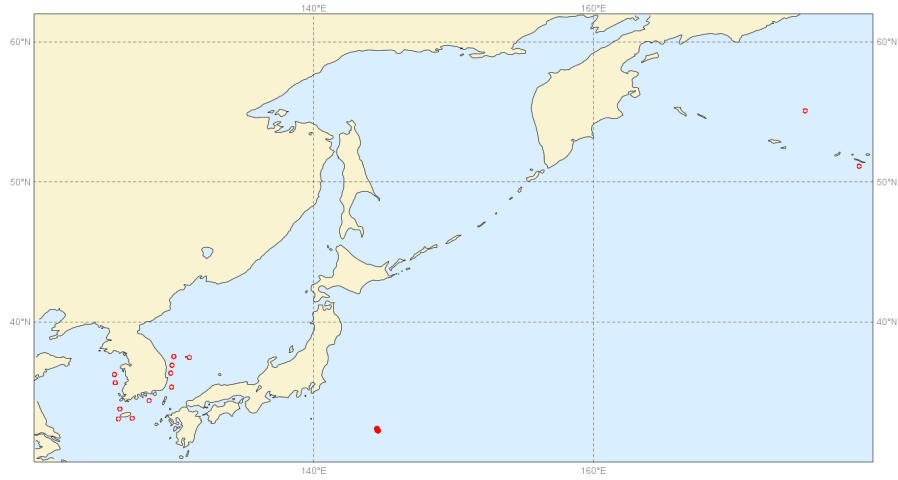
**North West Atlantic.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



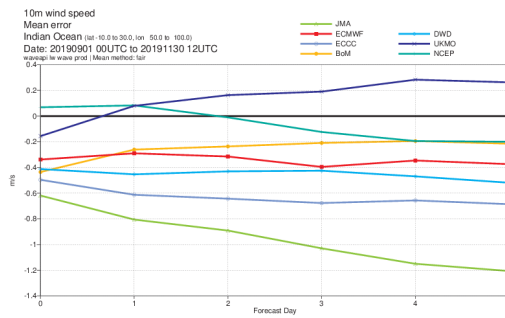
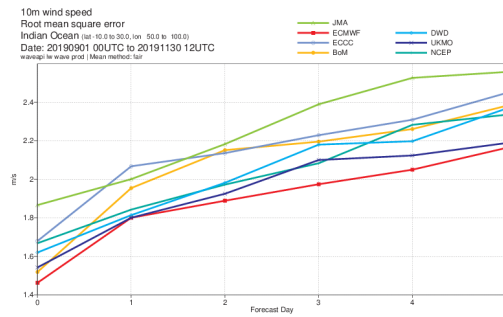
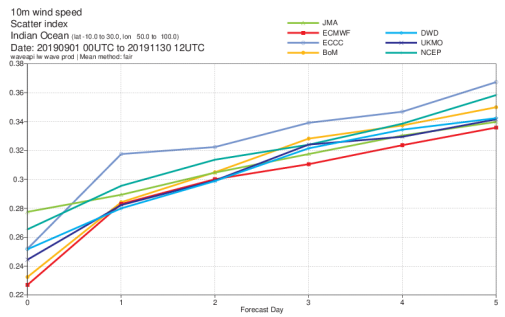
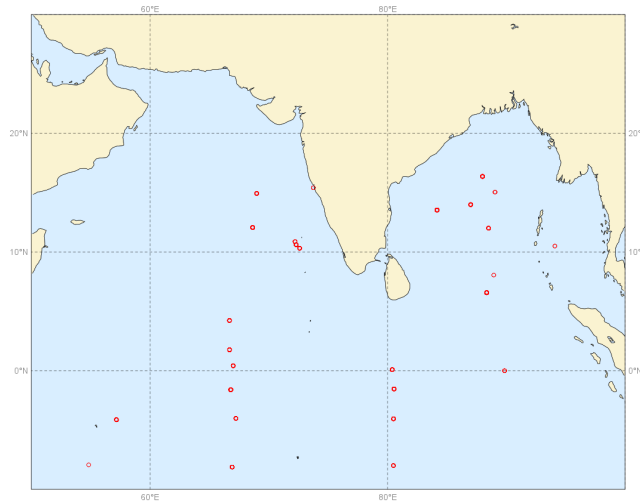
**North East Pacific.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



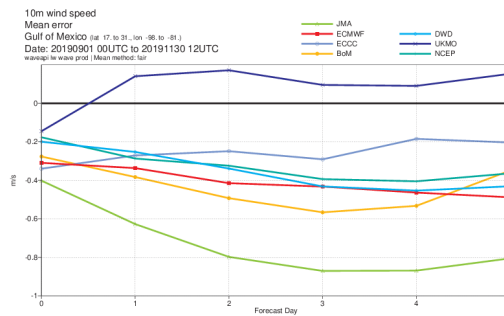
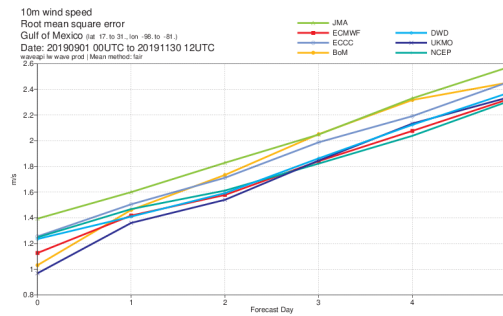
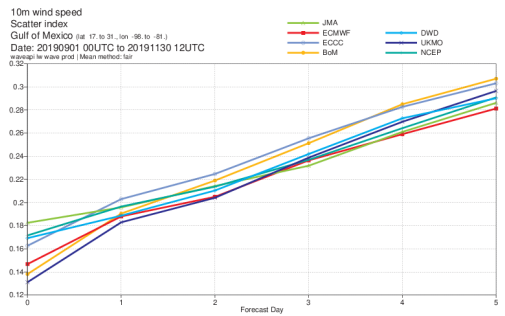
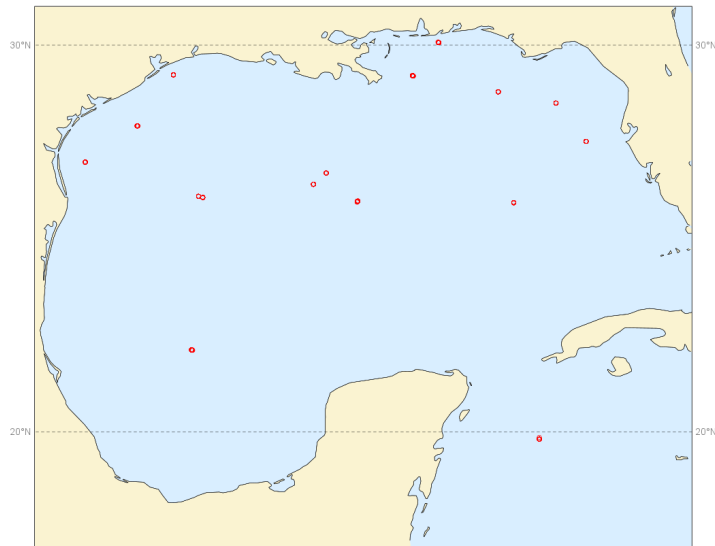
**North West Pacific.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



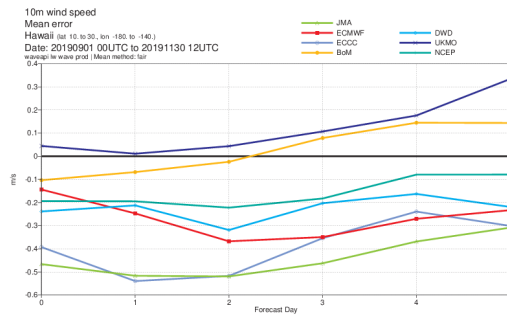
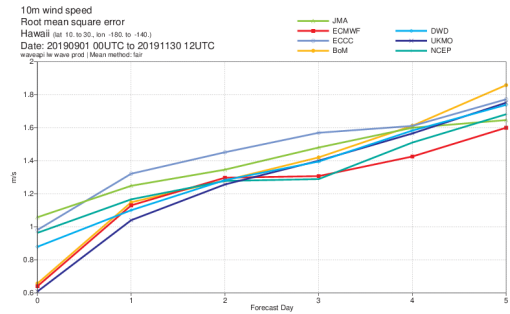
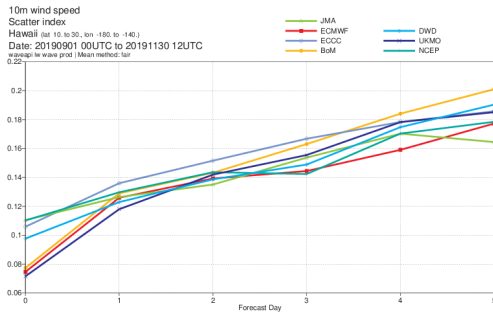
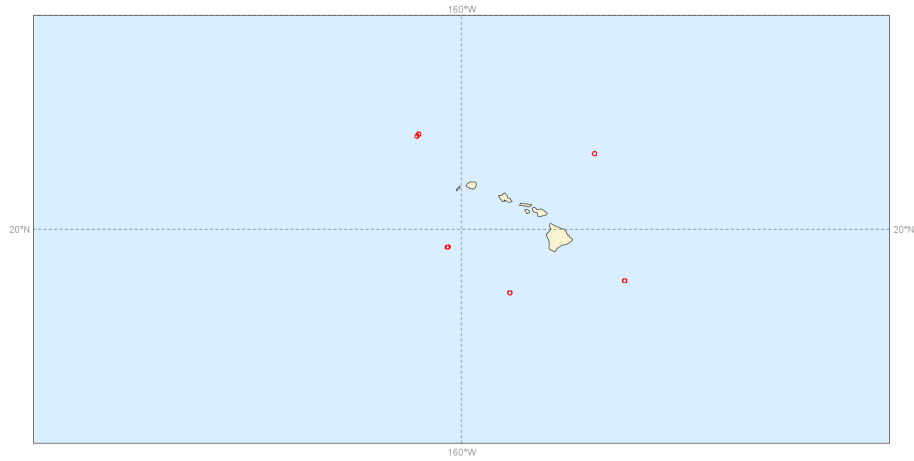
**Indian Ocean.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



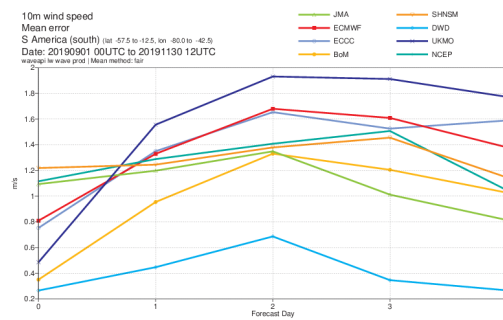
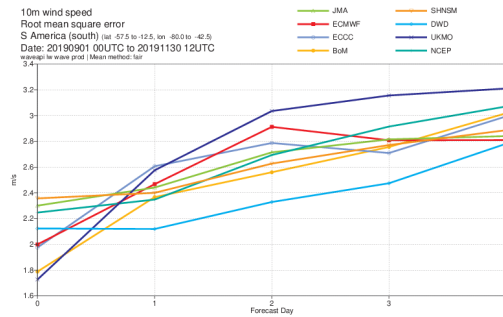
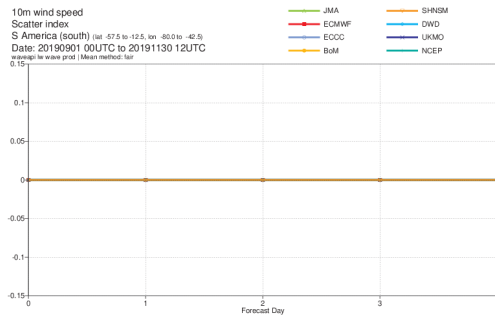
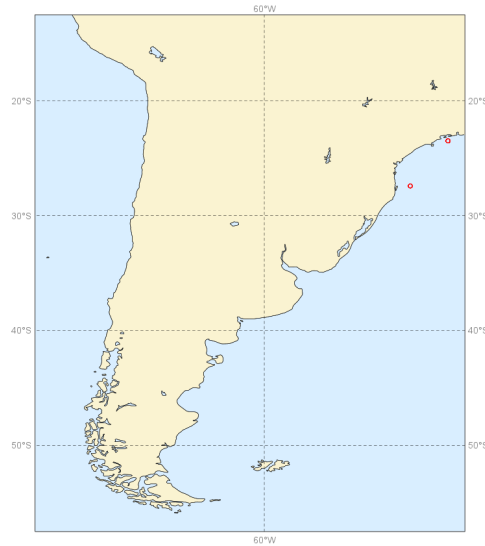
**Gulf of Mexico.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



**Hawaii.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (10ff)



**South of South America.** Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).