

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

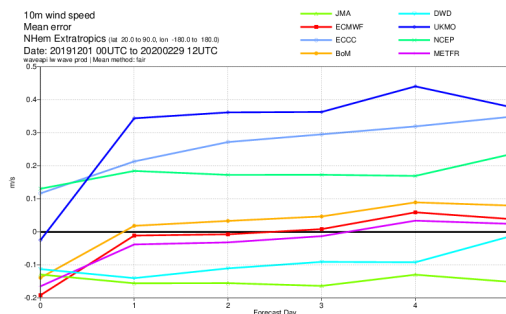
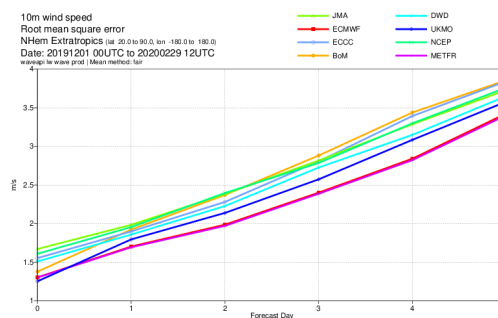
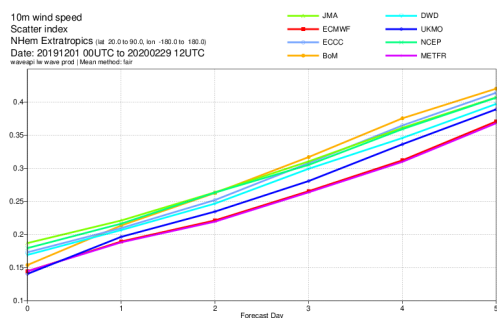
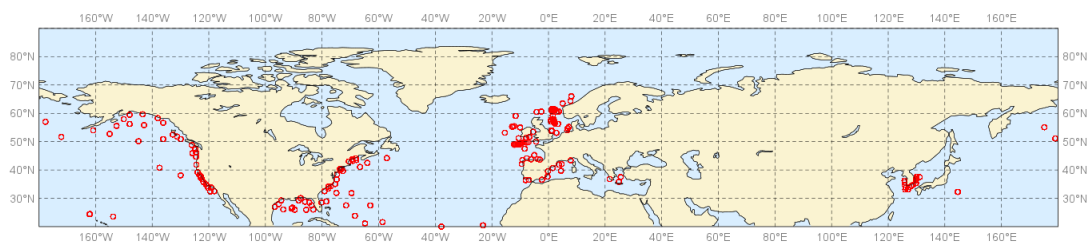
00 and 12 UTC runs

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

March 17, 2020

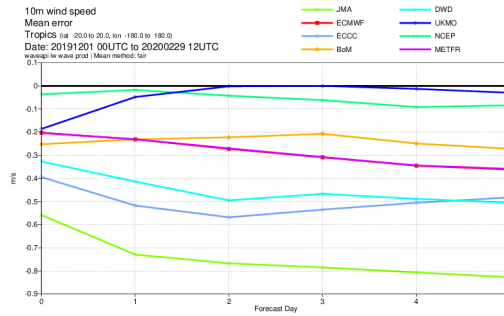
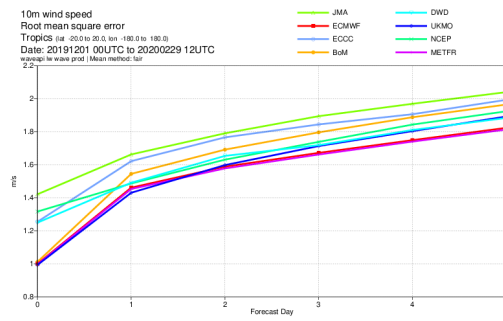
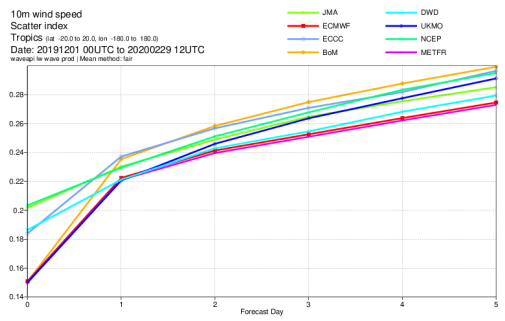
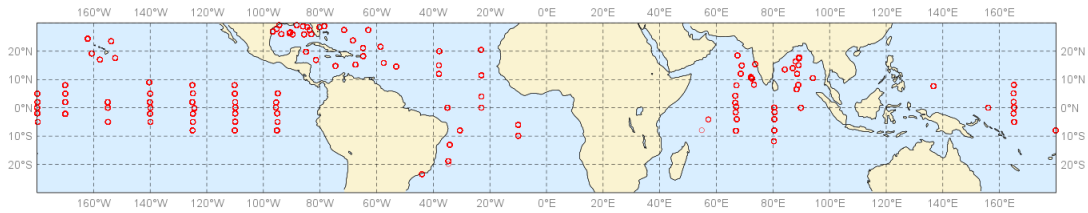
PART III: 10 meter wind speed (10ff)

Buoys observations - from 20191201 to 20200229 - (10ff)



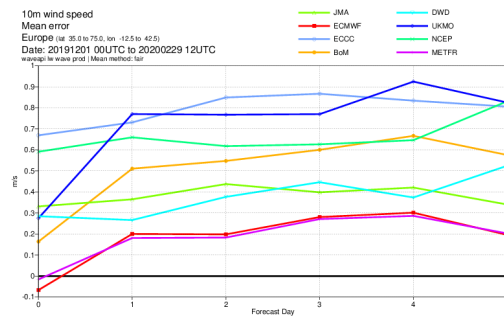
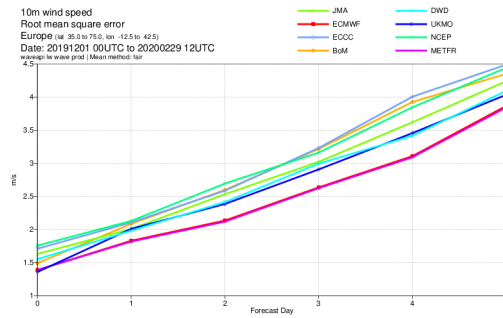
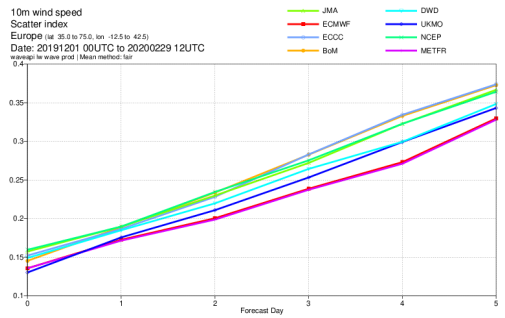
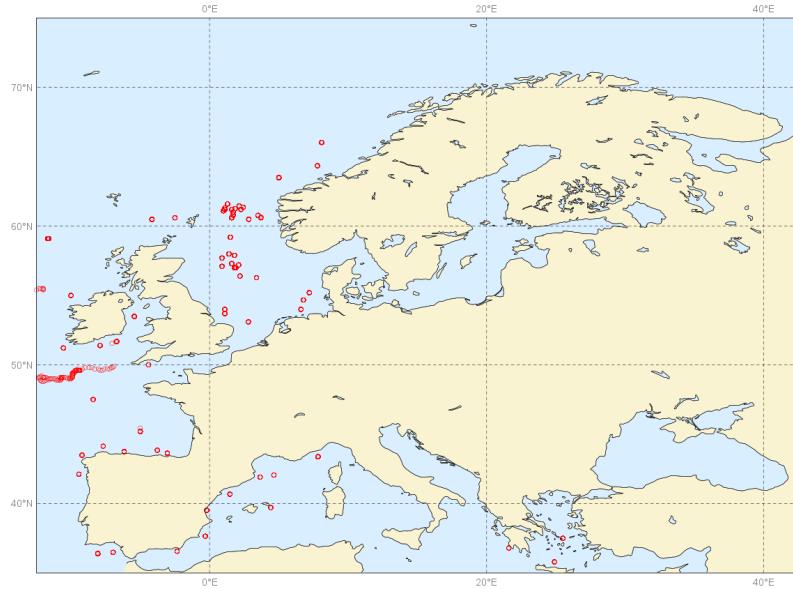
Northern Hemisphere. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



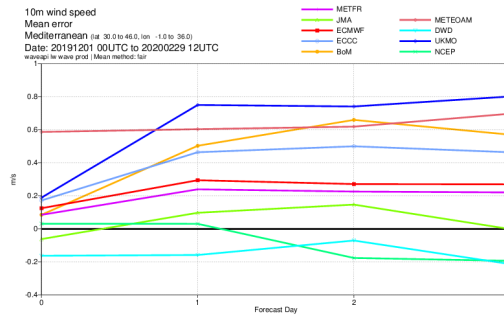
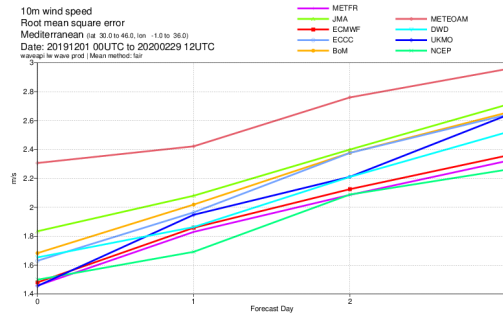
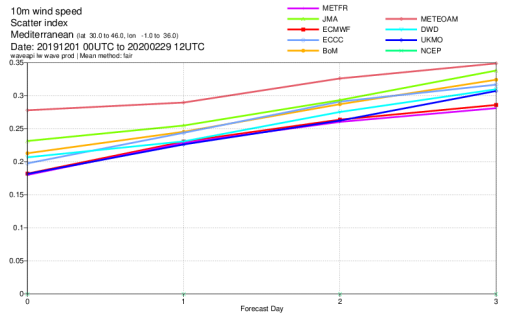
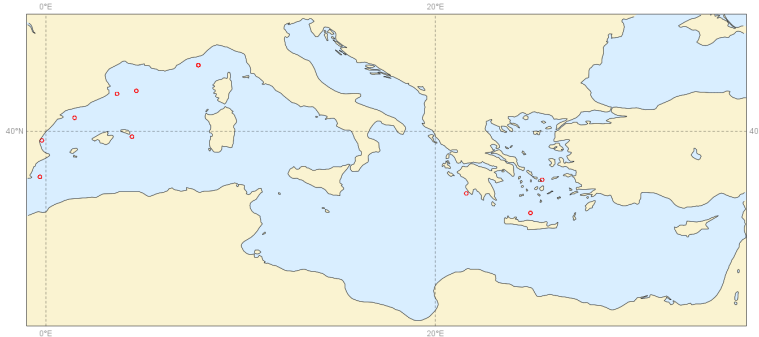
Tropics. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



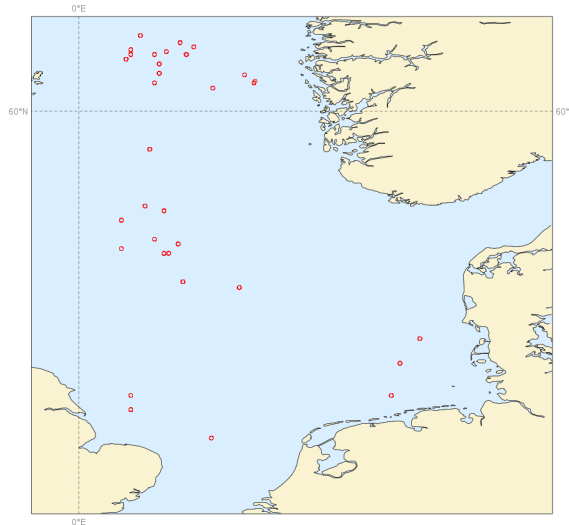
Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)

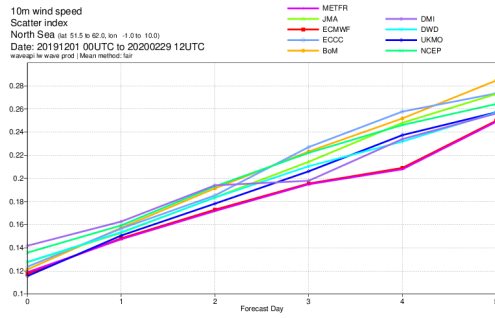


Mediterranean Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

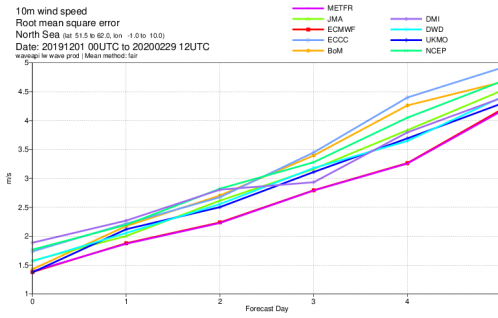
Buoys observations - from 20191201 to 20200229 - (10ff)



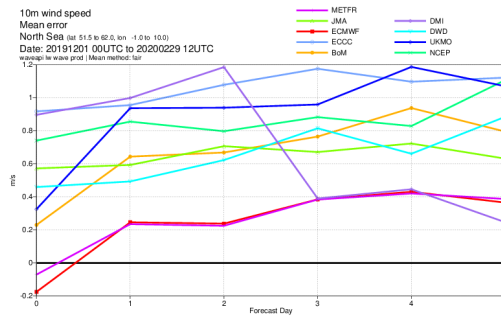
10m wind speed
Scatter index
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)
Date: 20191201 00UTC to 20200229 12UTC
wrapper: le wave prod / Mean method: tar



10m wind speed
Root mean square error
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)
Date: 20191201 00UTC to 20200229 12UTC
wrapper: le wave prod / Mean method: tar

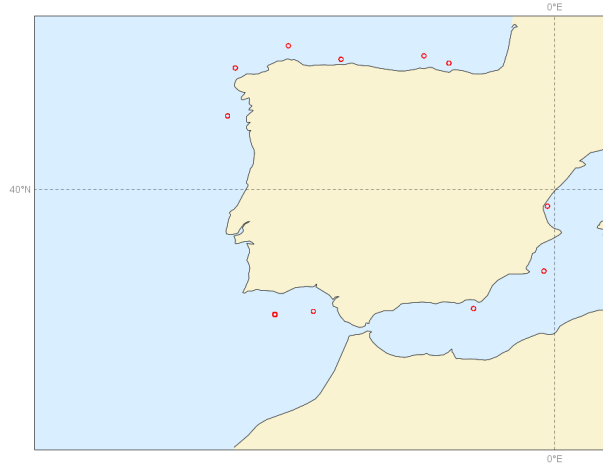


10m wind speed
Mean error
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)
Date: 20191201 00UTC to 20200229 12UTC
wrapper: le wave prod / Mean method: tar

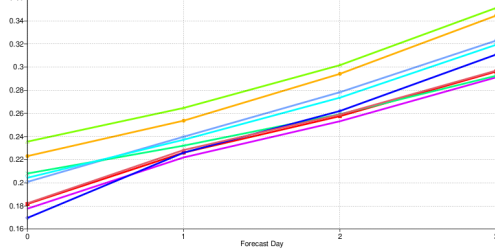


North Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

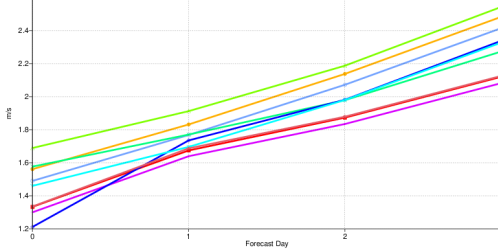
Buoys observations - from 20191201 to 20200229



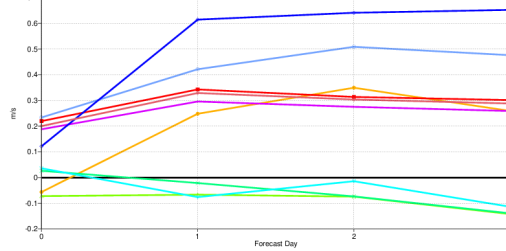
10m wind speed
Scatter index
SW Europe (lat 32.5 to 45.0, lon -15.0 to 10.0)
Date: 20191201 00UTC to 20200229 12UTC
Average for area grid. Mean method. lat



10m wind speed
Root mean square error
SW Europe (lat 32.5 to 45.0, lon -15.0 to 10.0)
Date: 20191201 00UTC to 20200229 12UTC
Average for area grid. Mean method. lat

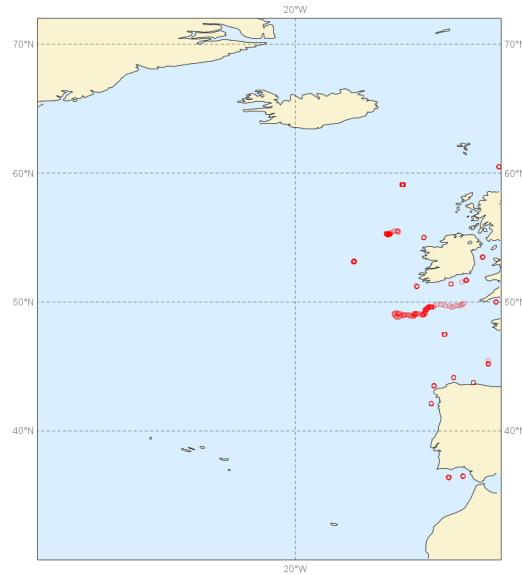


10m wind speed
Mean error
SW Europe (lat 32.5 to 45.0, lon -15.0 to 10.0)
Date: 20191201 00UTC to 20200229 12UTC
Average for area grid. Mean method. lat

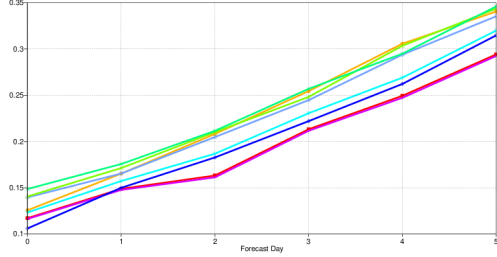


South West Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

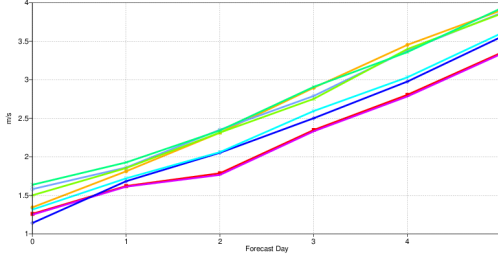
Buoys observations - from 20191201 to 20200229 - (10ff)



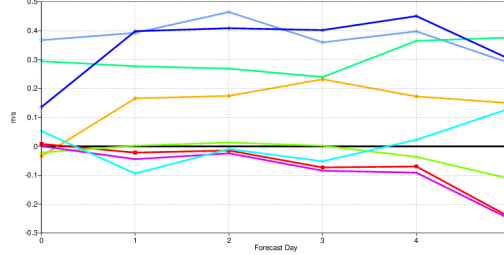
10m wind speed
Scatter index
North East Atlantic (lat 30 to 72, lon -40 to -4)
Date: 20191201 00UTC to 20200229 12UTC
average for area grid. Mean method. lat



10m wind speed
Root mean square error
North East Atlantic (lat 30 to 72, lon -40 to -4)
Date: 20191201 00UTC to 20200229 12UTC
average for area grid. Mean method. lat

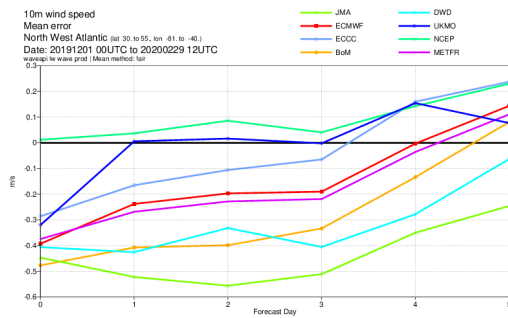
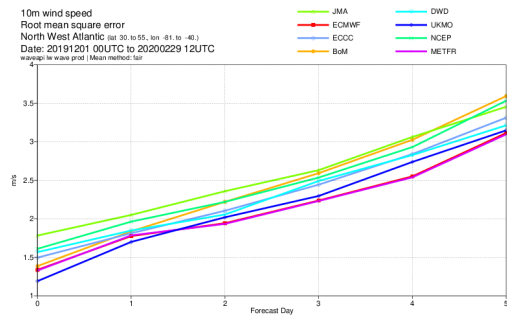
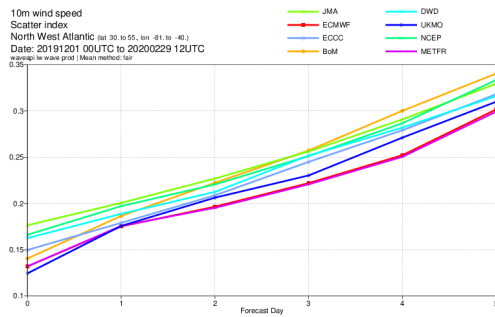
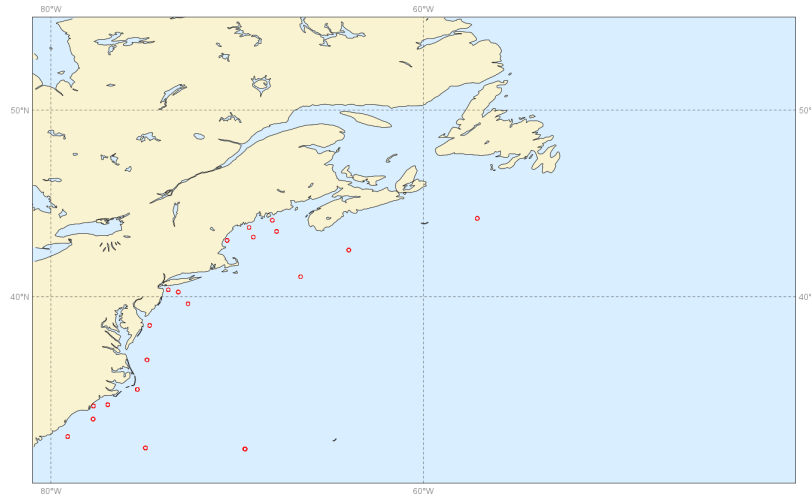


10m wind speed
Mean error
North East Atlantic (lat 30 to 72, lon -40 to -4)
Date: 20191201 00UTC to 20200229 12UTC
average for area grid. Mean method. lat



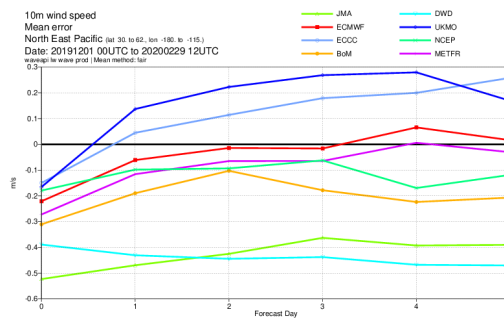
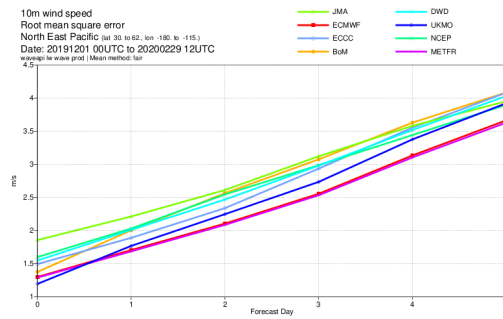
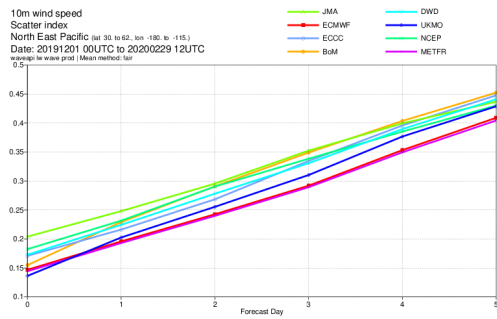
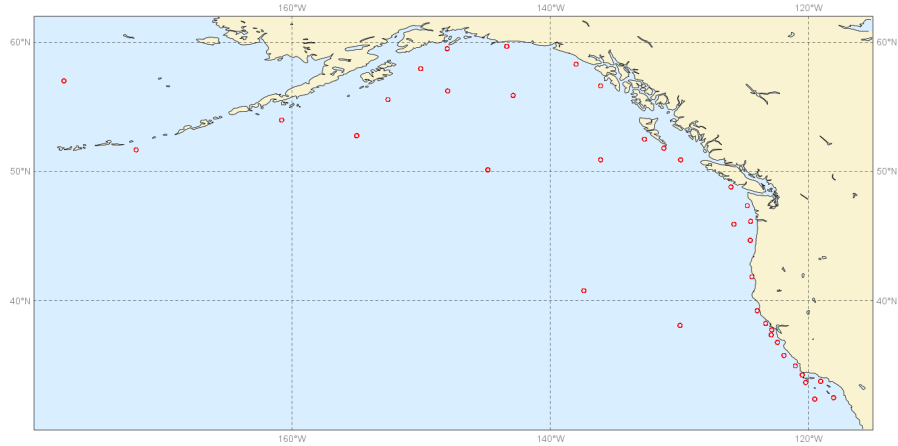
North East Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



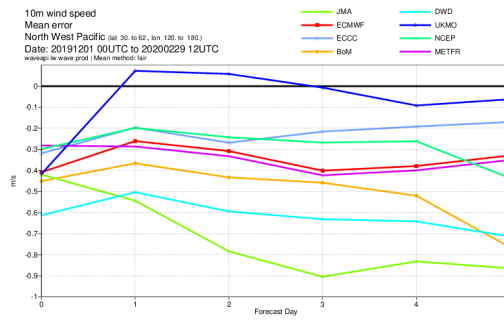
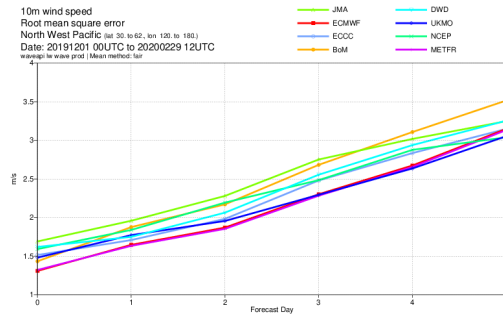
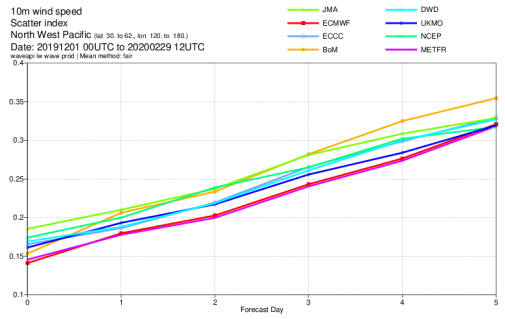
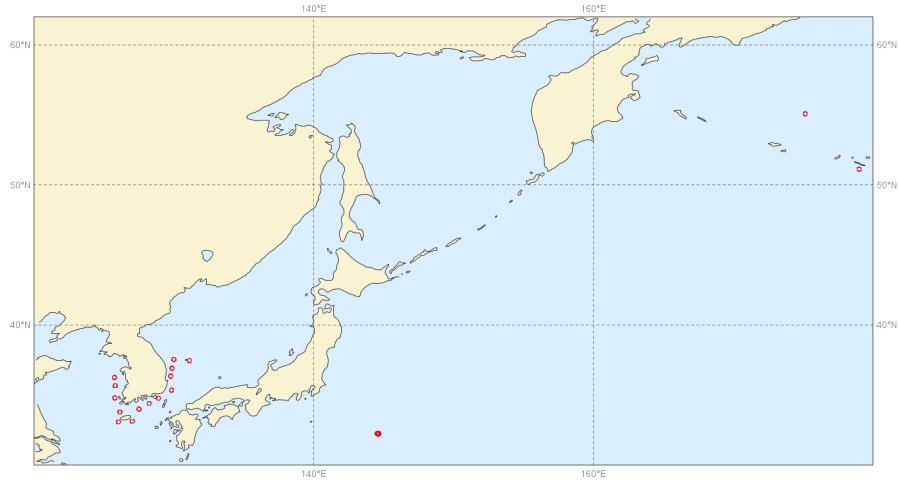
North West Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



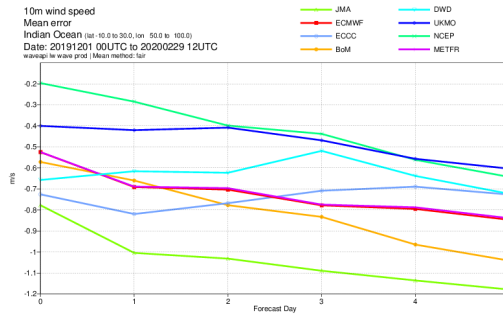
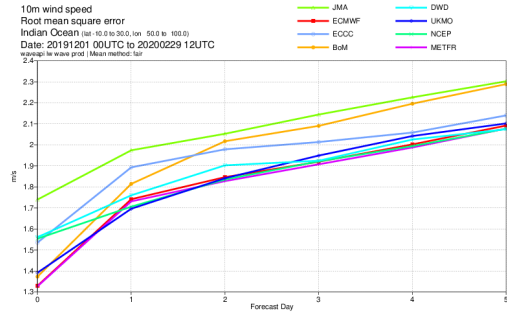
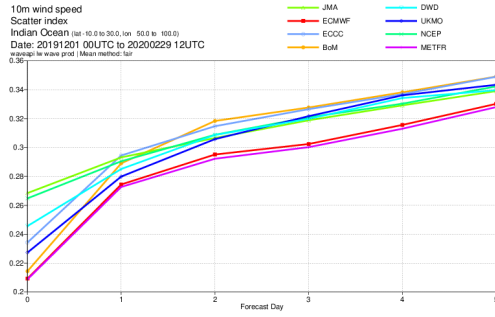
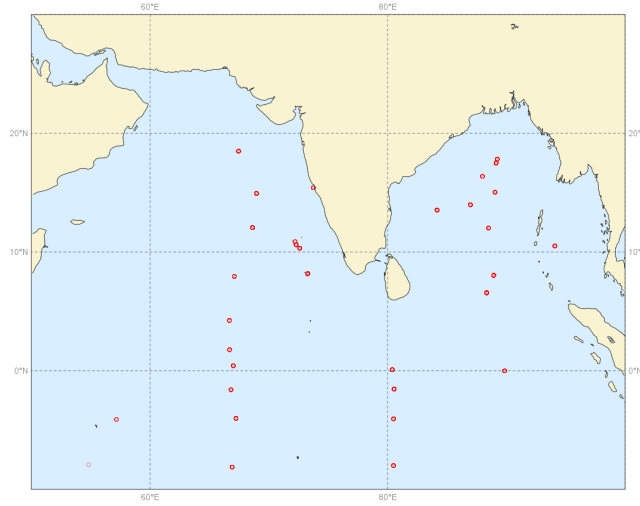
North East Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



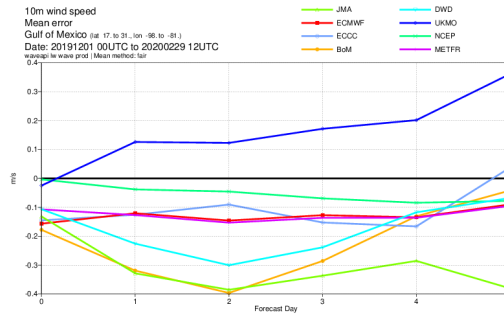
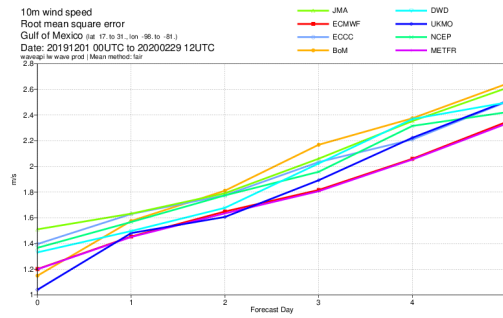
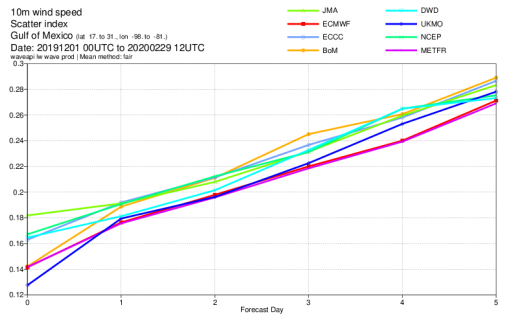
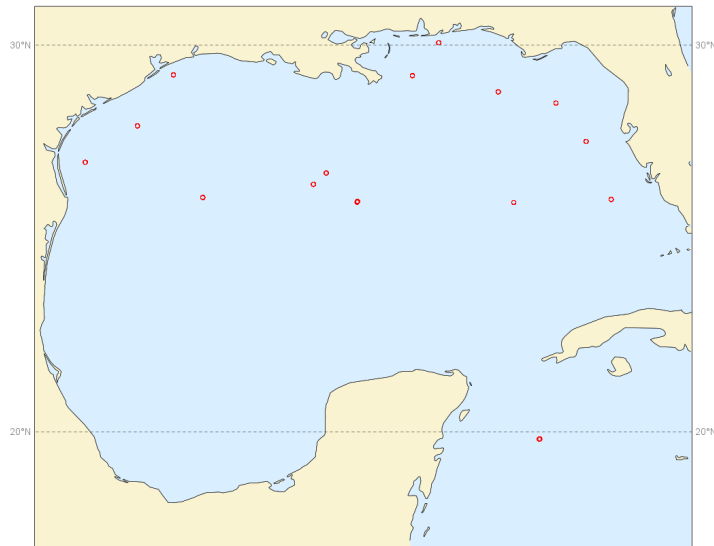
North West Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



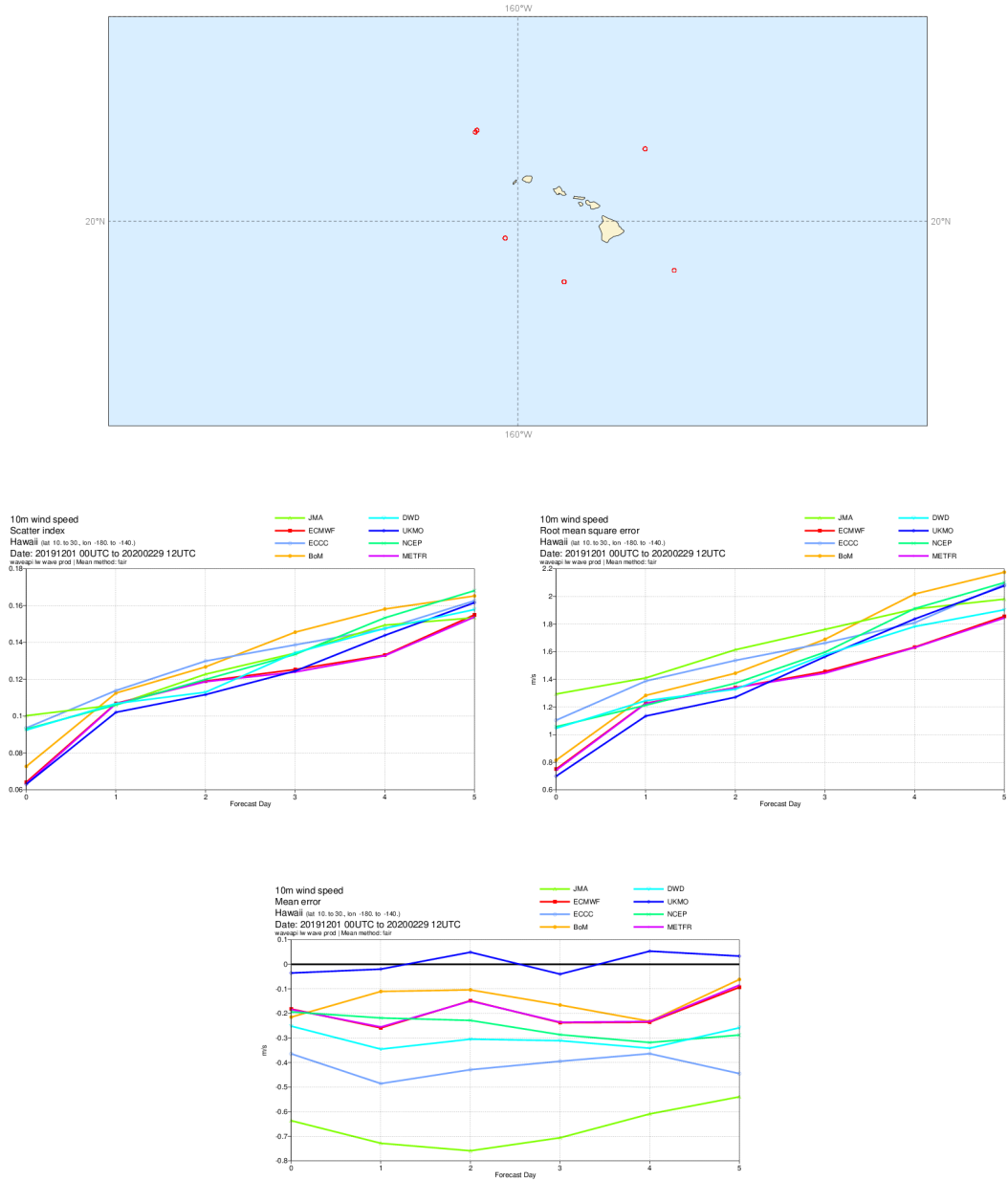
Indian Ocean. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



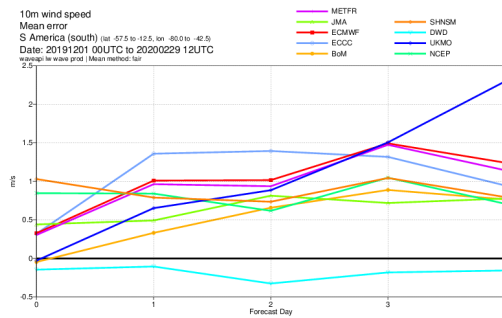
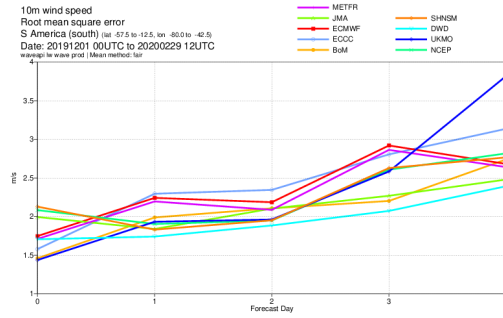
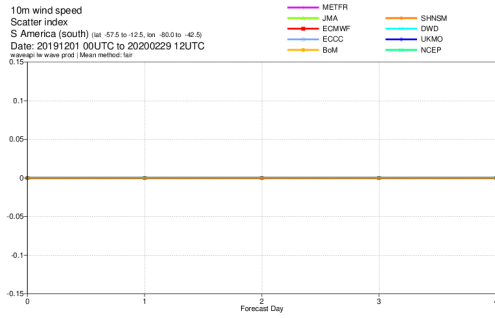
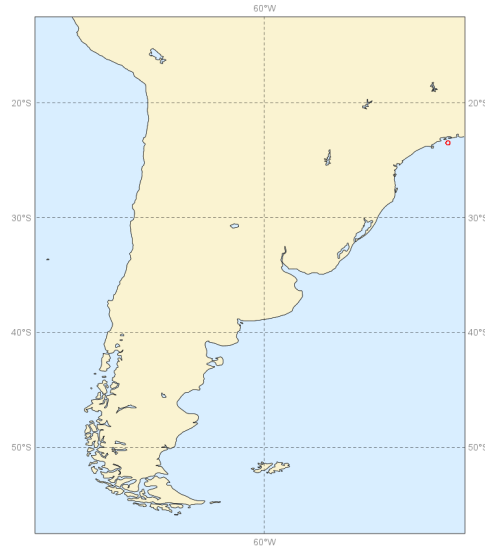
Gulf of Mexico. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



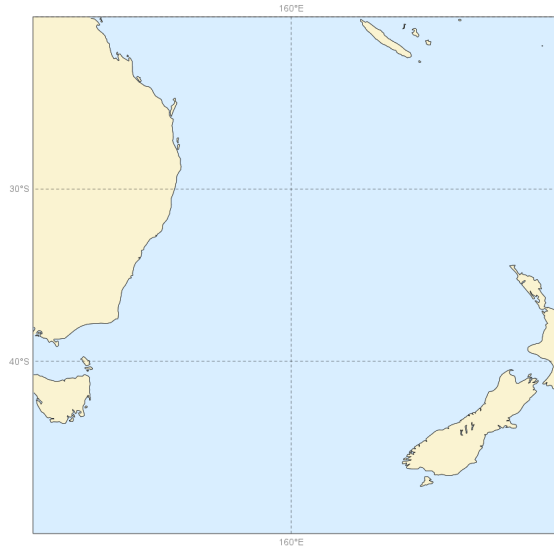
Hawaii. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (10ff)



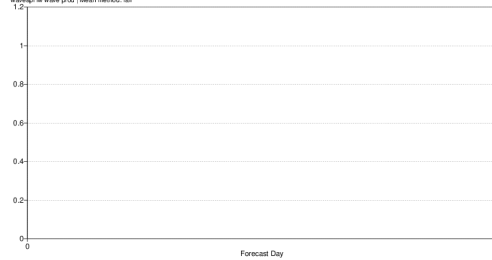
South of South America. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 20200229 - (1C)



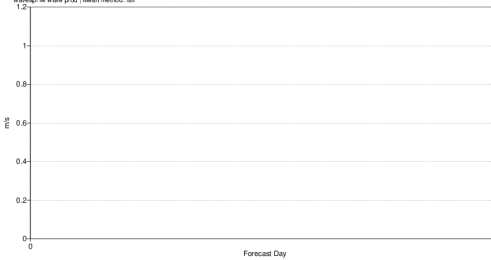
10m wind speed
Scatter index
Eaustnz (lat: 50 to 20, lon: 145 to 185)
Date: 20191201 00UTC to 20200229 12UTC
Average for every grid (Mean method: lat)

- JMA
- ECMWF
- ECCC
- BolM
- DWD
- UKMO
- NCEP
- METFR



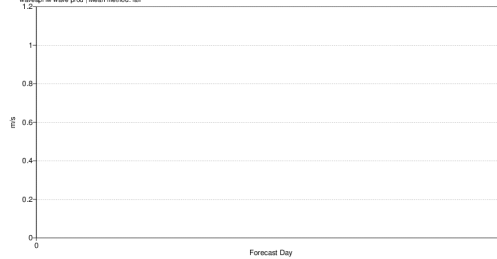
10m wind speed
Root mean square error
Eaustnz (lat: 50 to 20, lon: 145 to 185)
Date: 20191201 00UTC to 20200229 12UTC
Average for every grid (Mean method: lat)

- JMA
- ECMWF
- ECCC
- BolM
- DWD
- UKMO
- NCEP
- METFR



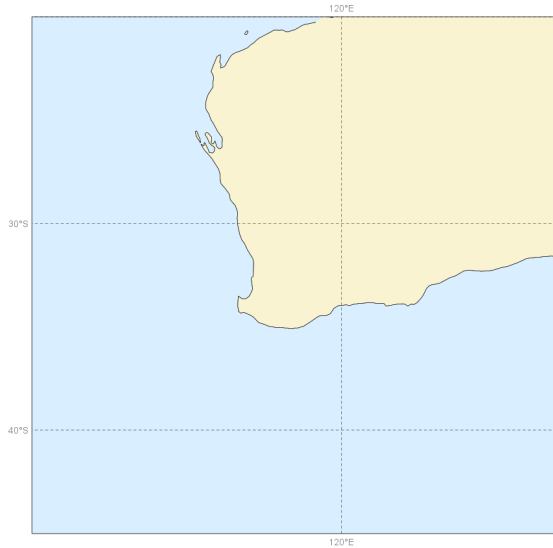
10m wind speed
Mean error
Eaustnz (lat: 50 to 20, lon: 145 to 185)
Date: 20191201 00UTC to 20200229 12UTC
Average for every grid (Mean method: lat)

- JMA
- ECMWF
- ECCC
- BolM
- DWD
- UKMO
- NCEP
- METFR

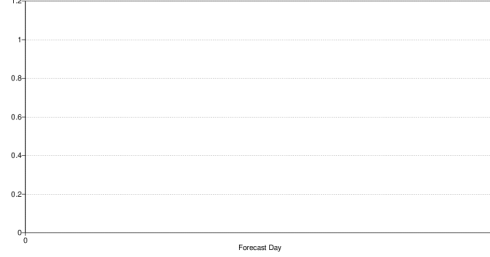


East Australia - New Zealand. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20191201 to 2C

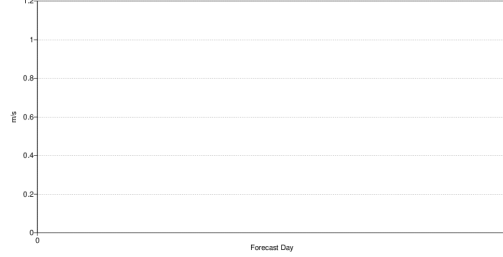


10m wind speed
Scatter index
Sw.australia (lat -45 to -20, lon 105 to 145)
Date: 20191201 00UTC to 20200229 12UTC
Average for every grid (Mean method: lat)



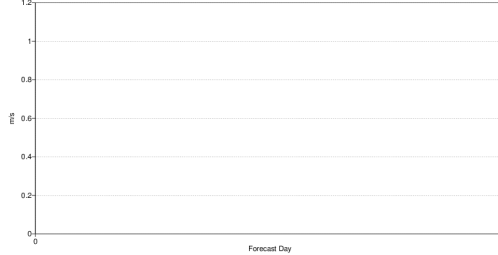
JMA DWD
ECMWF UKMO
ECCC NCEP
BoM METFR

10m wind speed
Root mean square error
Sw.australia (lat -45 to -20, lon 105 to 145)
Date: 20191201 00UTC to 20200229 12UTC
Average for every grid (Mean method: lat)



JMA DWD
ECMWF UKMO
ECCC NCEP
BoM METFR

10m wind speed
Mean error
Sw.australia (lat -45 to -20, lon 105 to 145)
Date: 20191201 00UTC to 20200229 12UTC
Average for every grid (Mean method: lat)



JMA DWD
ECMWF UKMO
ECCC NCEP
BoM METFR

South South West Australia. 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).