

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

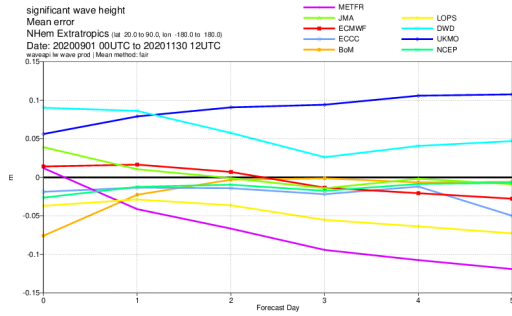
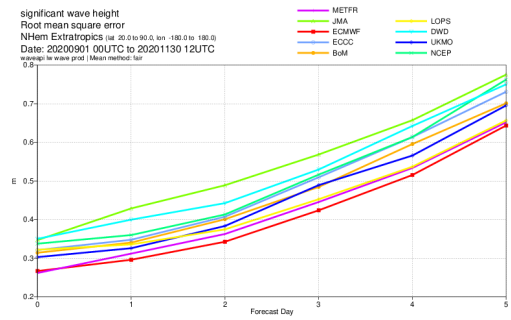
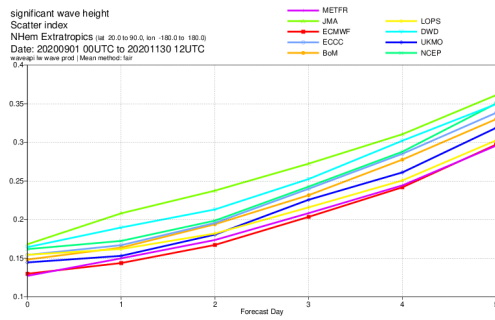
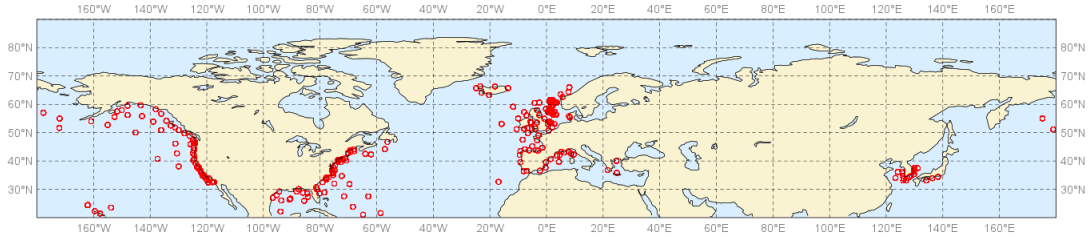
00 and 12 UTC runs

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

December 14, 2020

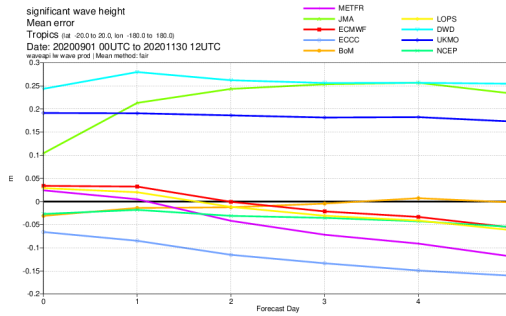
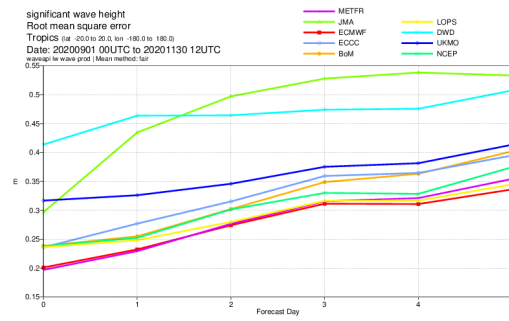
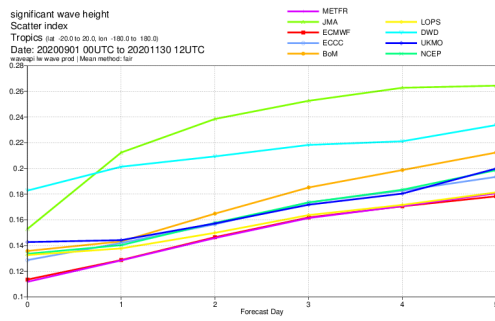
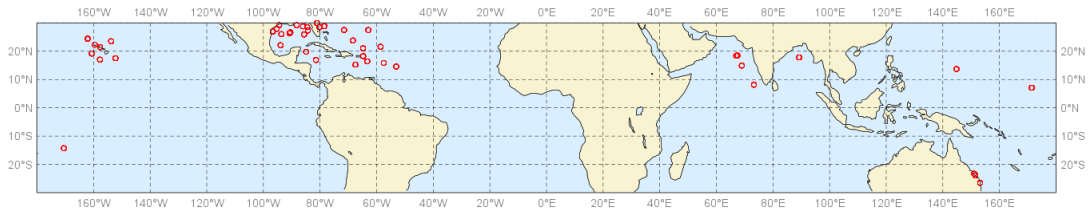
PART I: significant wave height (SWH)

Buoys observations - from 20200901 to 20201130 - (swh)



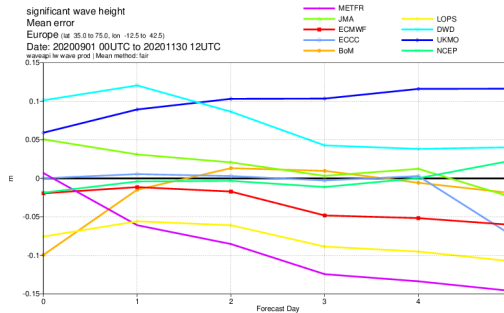
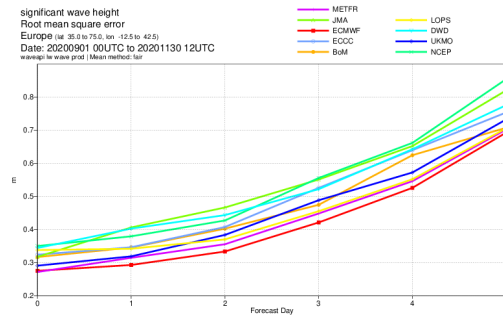
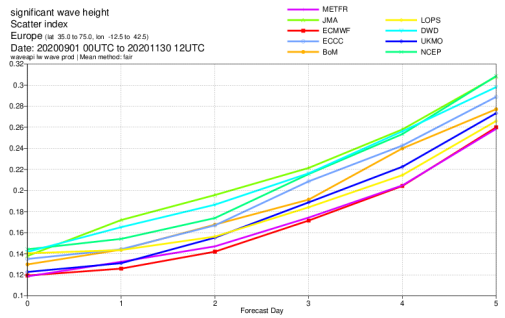
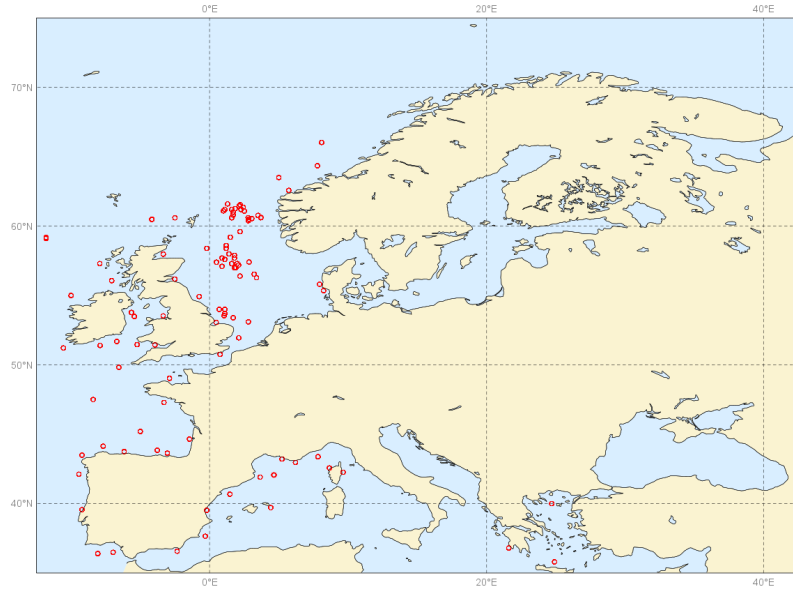
Northern Hemisphere. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



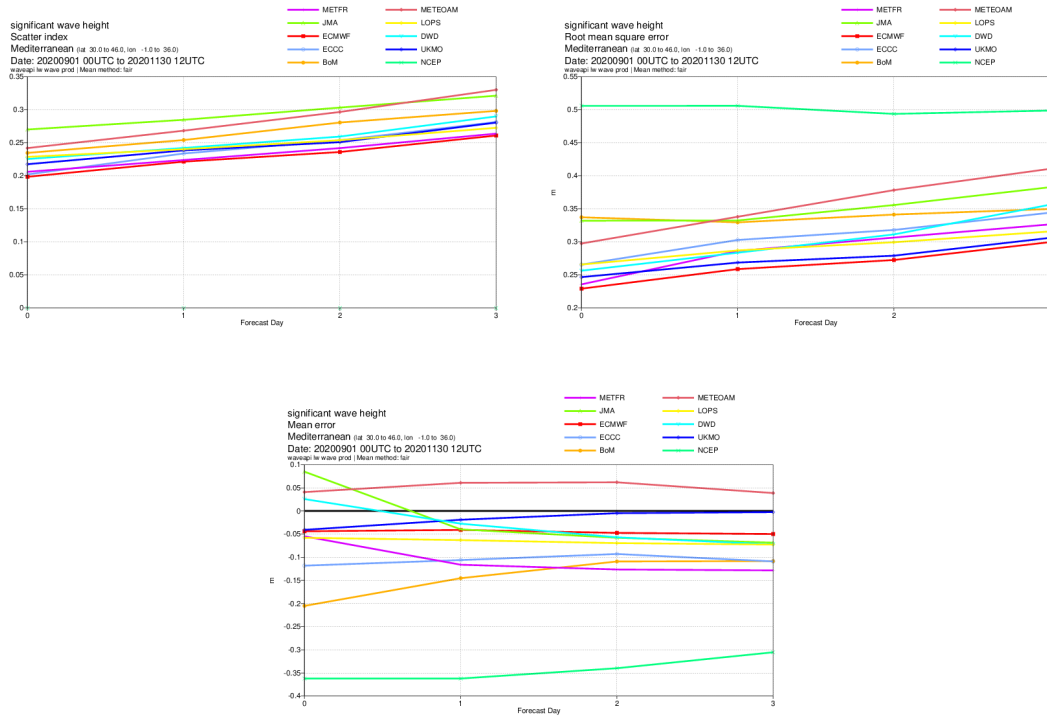
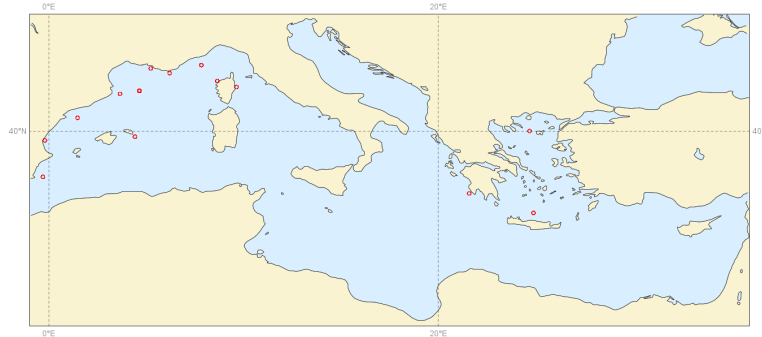
Tropics. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



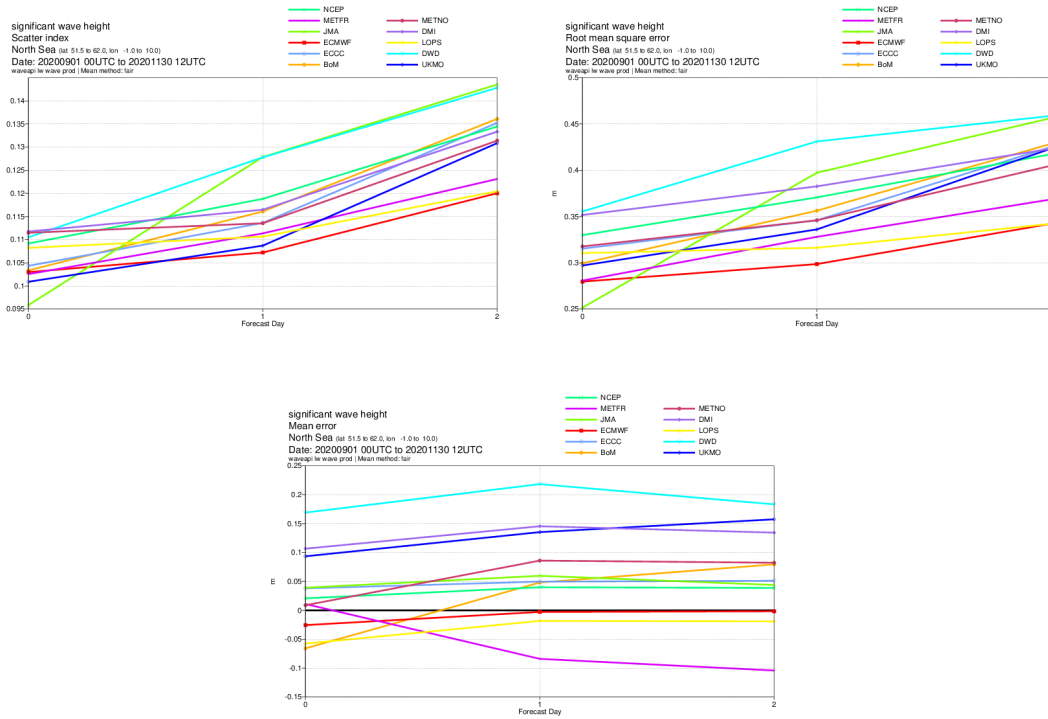
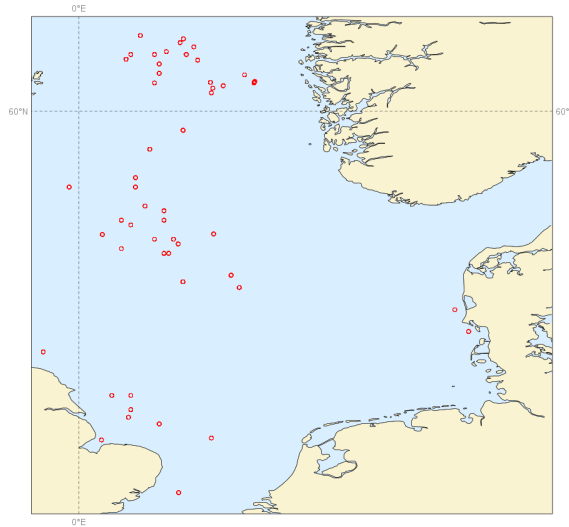
Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



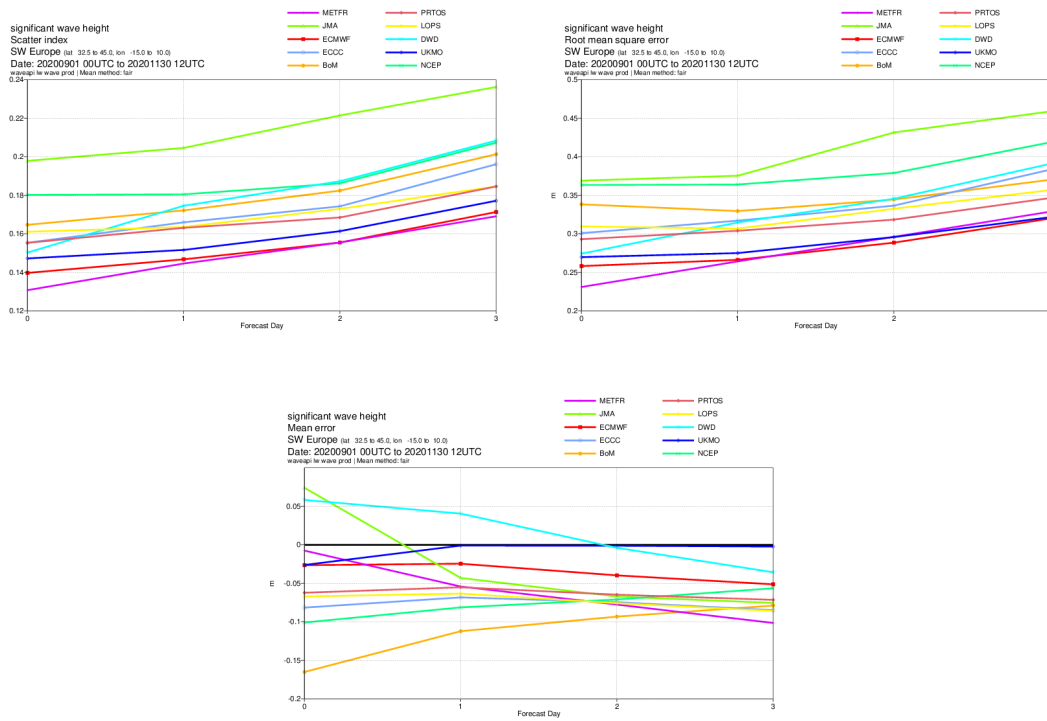
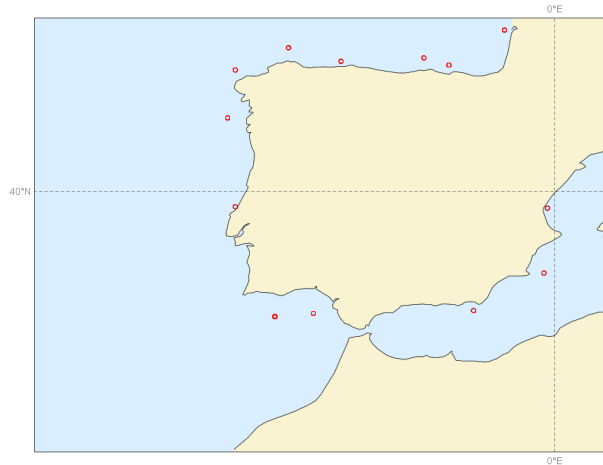
Mediterranean Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



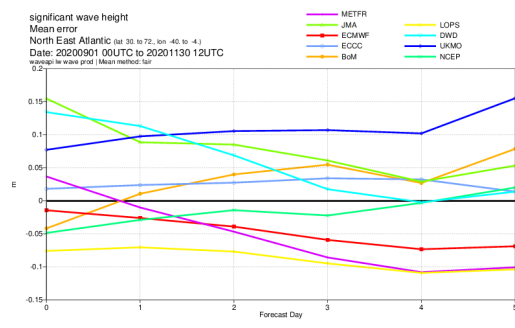
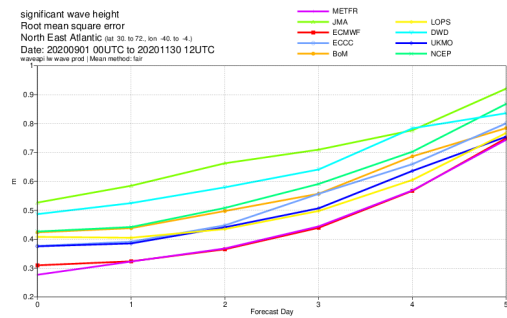
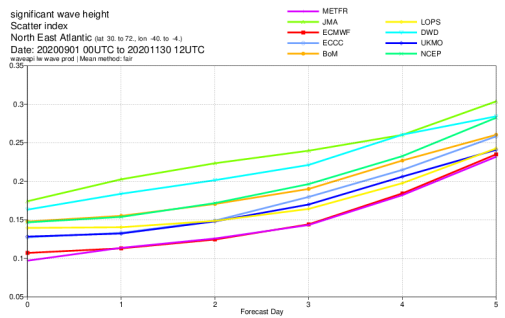
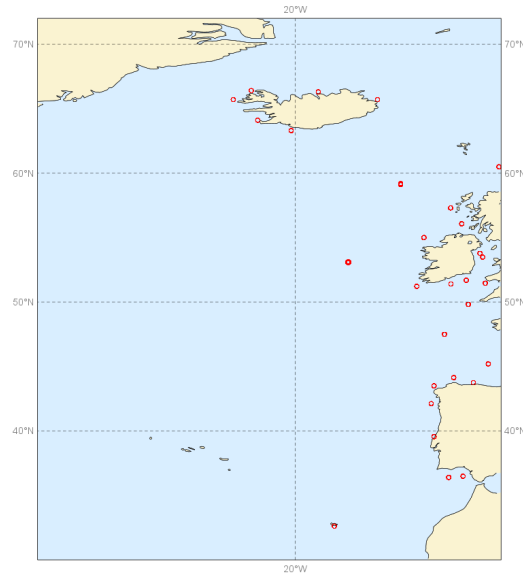
North Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 2020



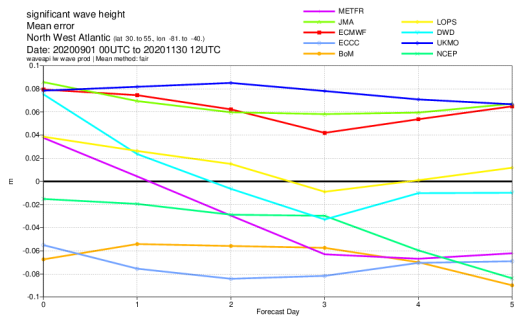
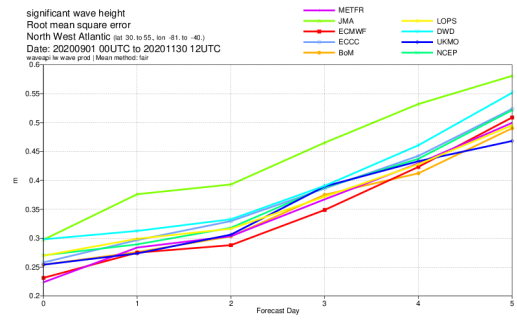
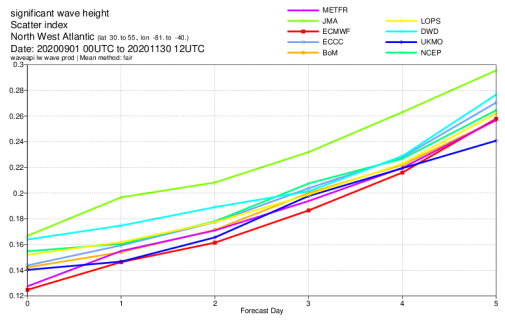
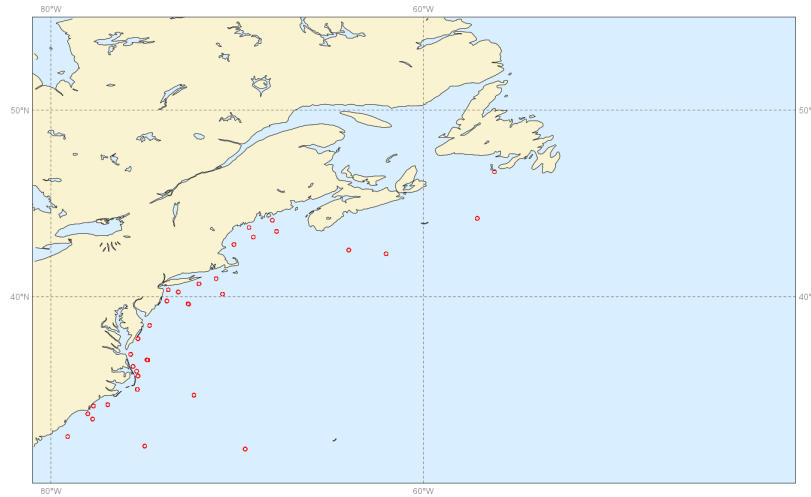
South West Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



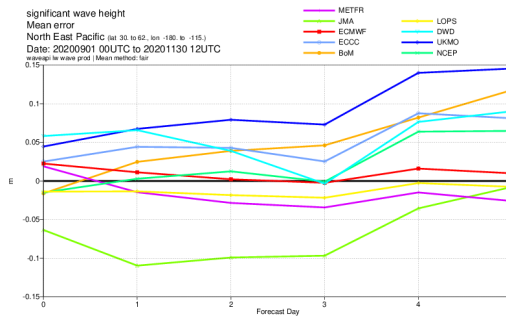
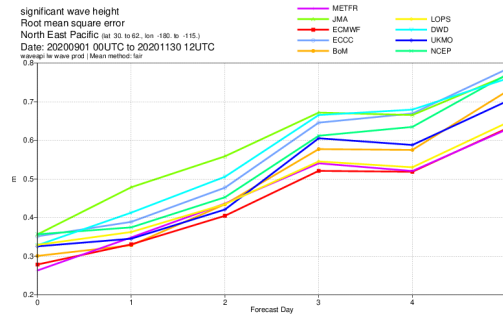
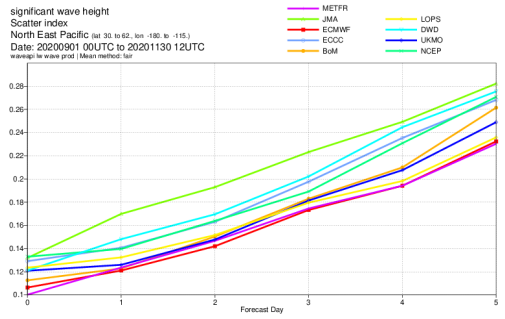
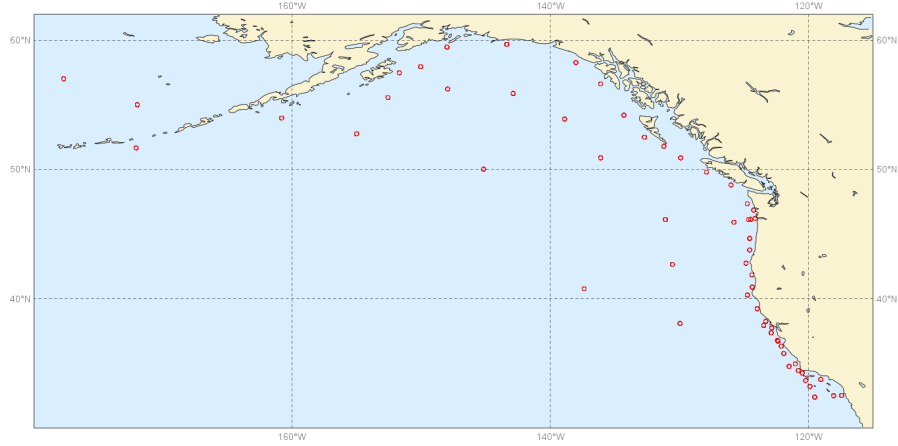
North East Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



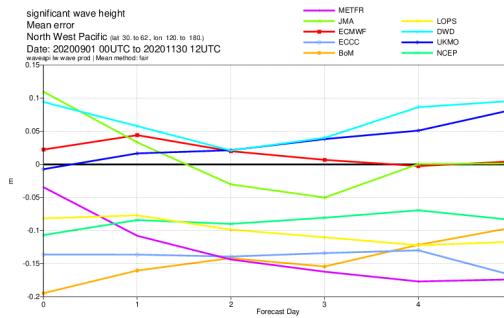
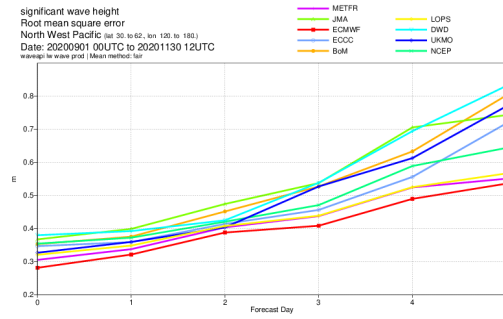
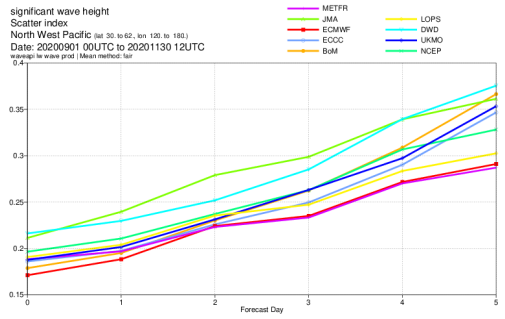
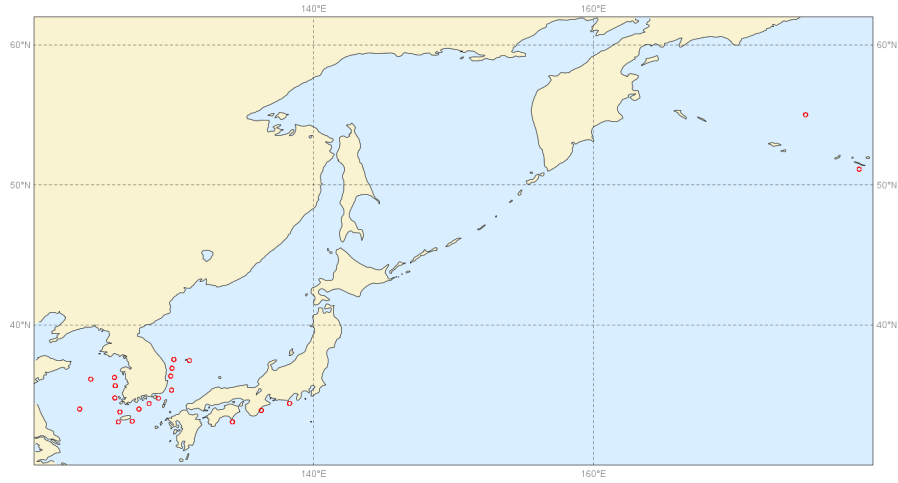
North West Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



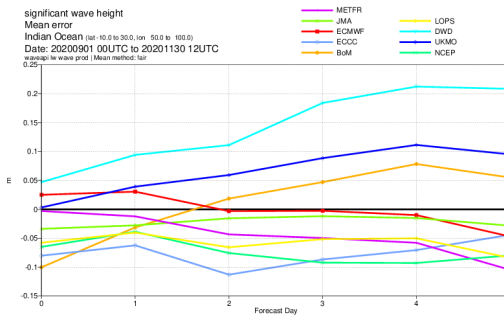
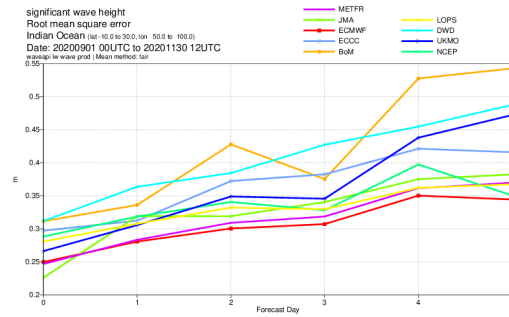
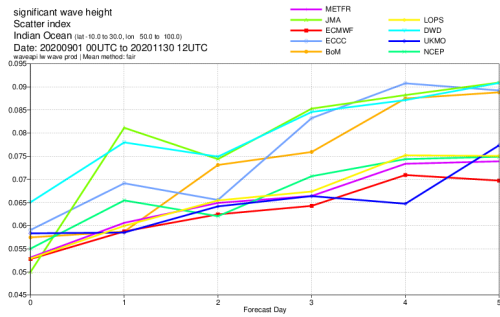
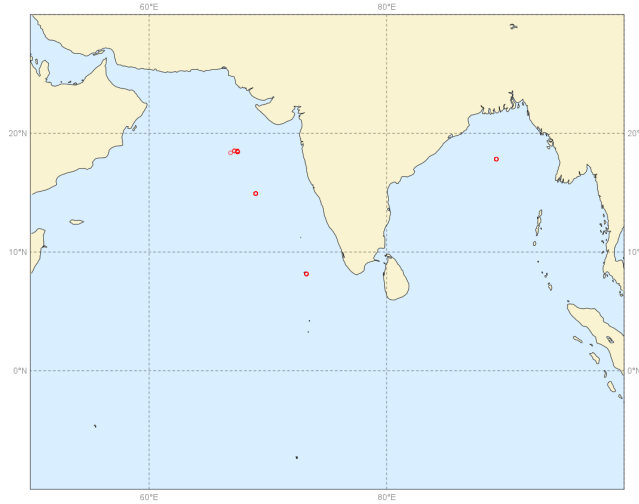
North East Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



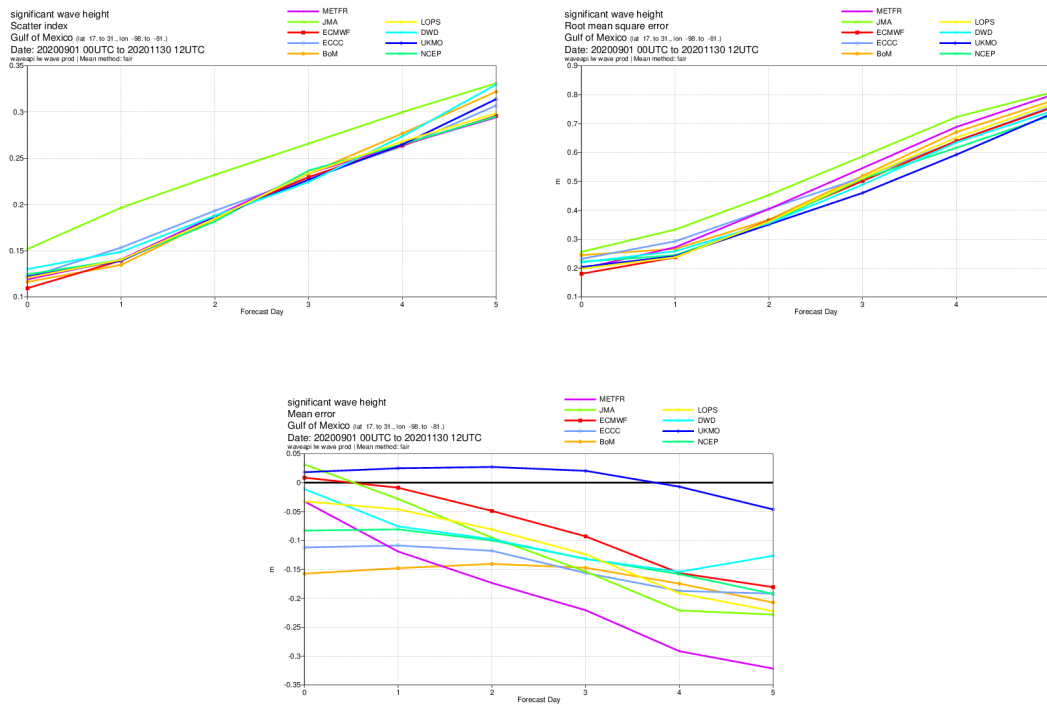
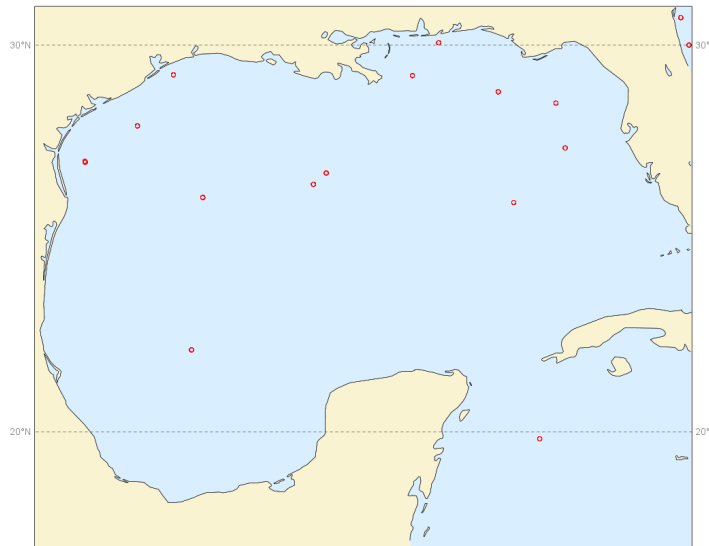
North West Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



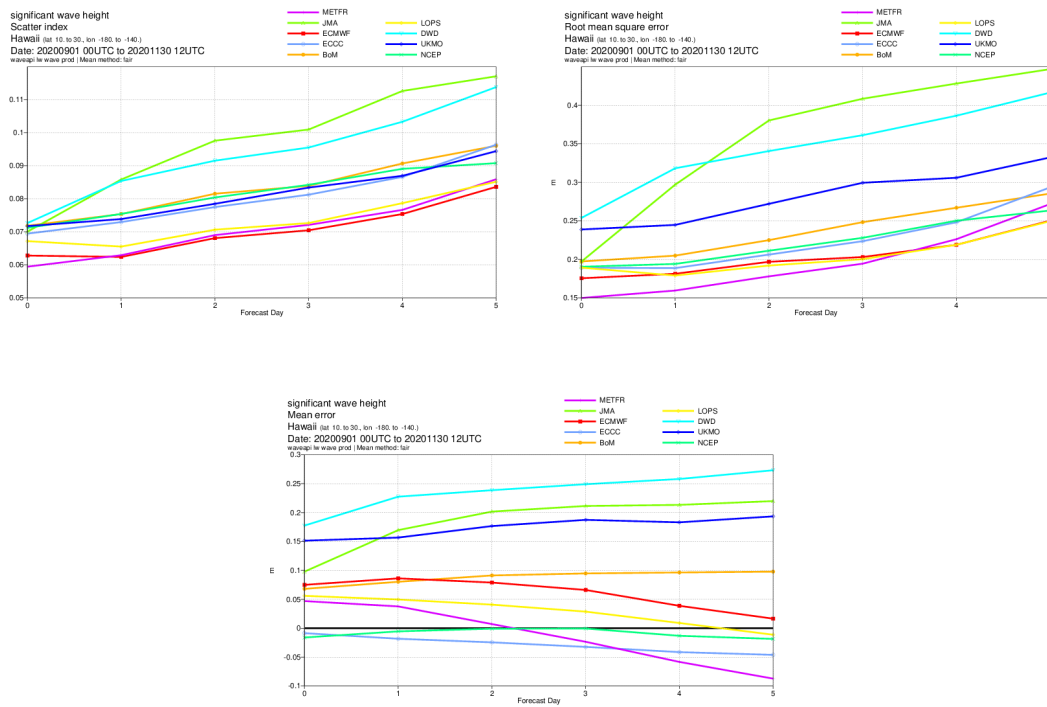
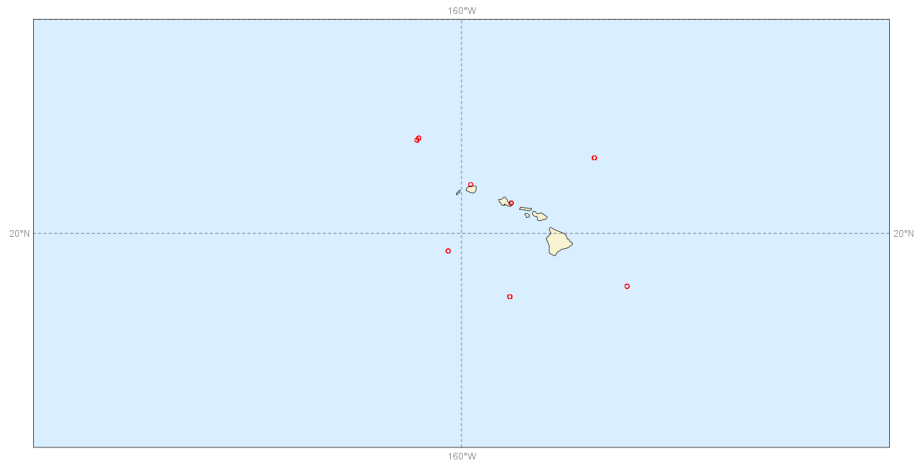
Indian Ocean. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)



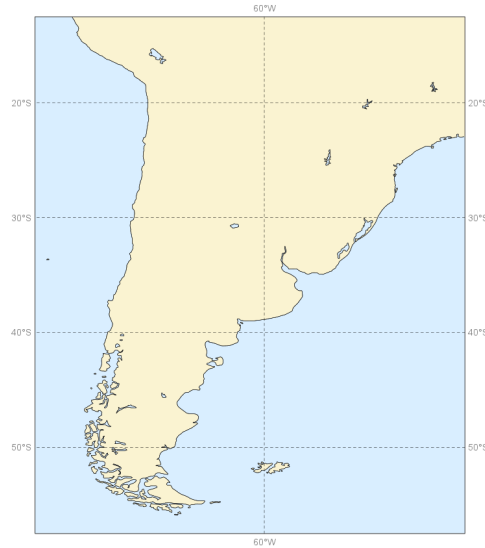
Gulf of Mexico. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)

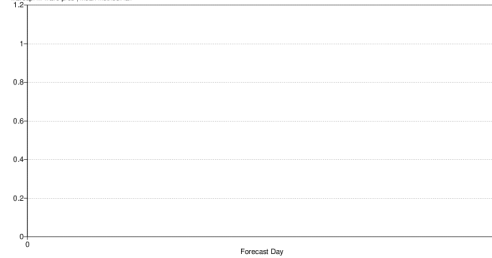


Hawaii. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20200901 to 20201130 - (swh)

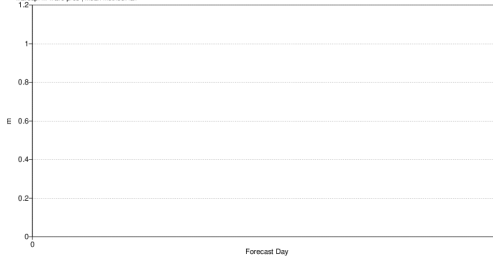


significant wave height
Scatter index
S America (south) (lat: 57.5 to 12.5, lon: -80.0 to -42.5)
Date: 20200901 00UTC to 20201130 12UTC
averaged by wave period (Mean method: lat)



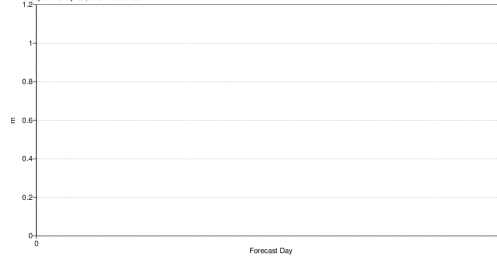
METFR SHNSM
JMA LOPS
ECMWF DWD
ECCC UKMO
BoM NCEP

significant wave height
Root mean square error
S America (south) (lat: 57.5 to 12.5, lon: -80.0 to -42.5)
Date: 20200901 00UTC to 20201130 12UTC
averaged by wave period (Mean method: lat)



METFR SHNSM
JMA LOPS
ECMWF DWD
ECCC UKMO
BoM NCEP

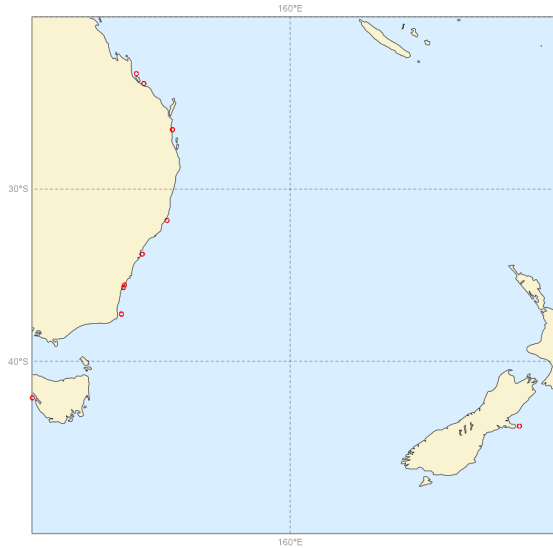
significant wave height
Mean error
S America (south) (lat: 57.5 to 12.5, lon: -80.0 to -42.5)
Date: 20200901 00UTC to 20201130 12UTC
averaged by wave period (Mean method: lat)



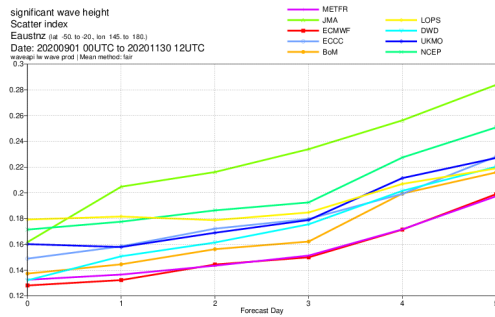
METFR SHNSM
JMA LOPS
ECMWF DWD
ECCC UKMO
BoM NCEP

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).

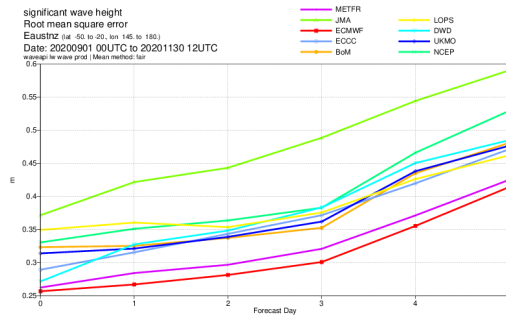
Buoys observations - from 20200901 to 20201130 - (sw)



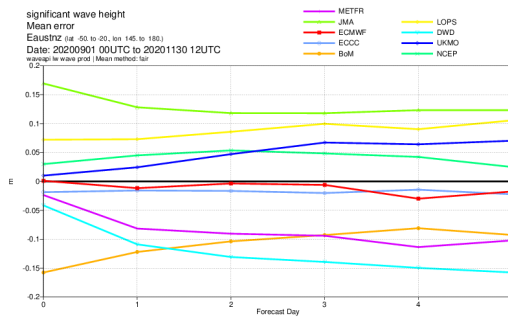
significant wave height
Scatter index
Eaustnz (lat: 50 to 20, lon: 145 to 185)
Date: 20200901 00UTC to 20201130 12UTC
averaged by wave period (Mean method: lat)



significant wave height
Root mean square error
Eaustnz (lat: 50 to 20, lon: 145 to 185)
Date: 20200901 00UTC to 20201130 12UTC
averaged by wave period (Mean method: lat)

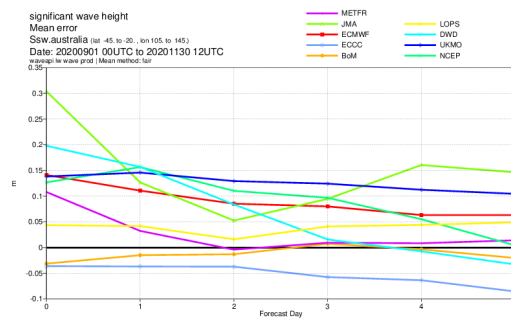
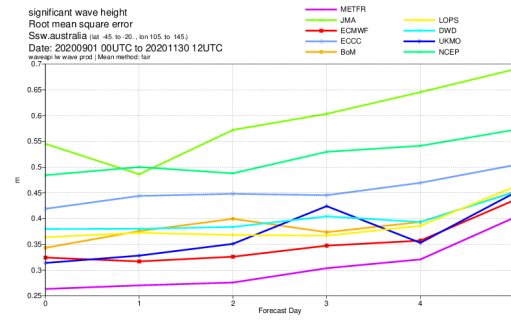
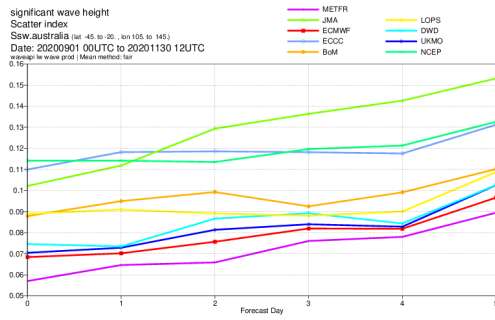
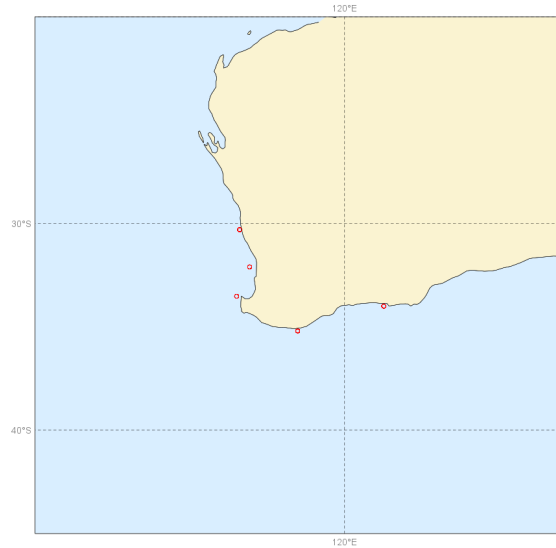


significant wave height
Mean error
Eaustnz (lat: 50 to 20, lon: 145 to 185)
Date: 20200901 00UTC to 20201130 12UTC
averaged by wave period (Mean method: lat)



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 20200901 to 20



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).