

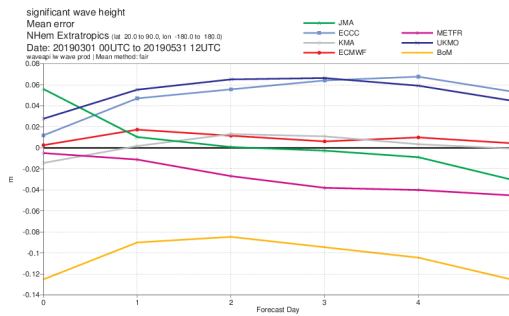
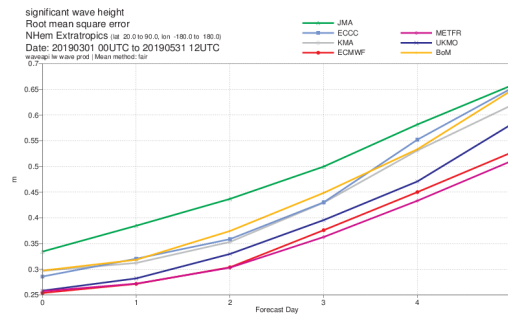
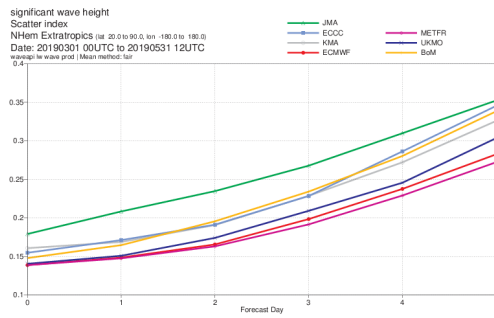
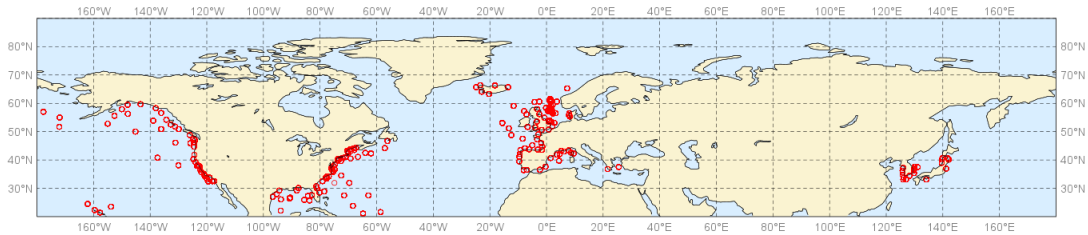
Intercomparison of operational wave forecasting systems against
in-situ observations: data from BoM, DMI, ECCO, ECMWF,
JMA, KMA, METEOAM, METFR, SHNSM, UKMO.

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

June 21, 2019

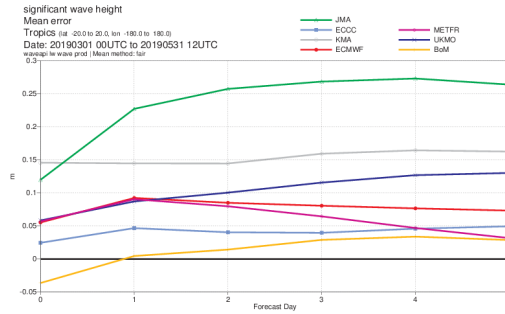
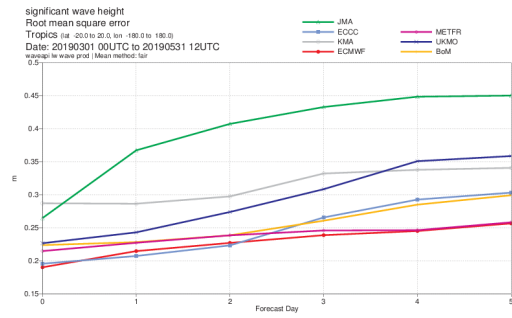
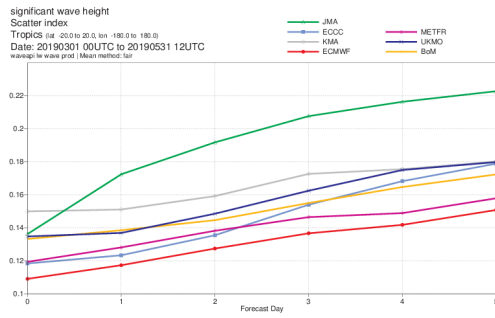
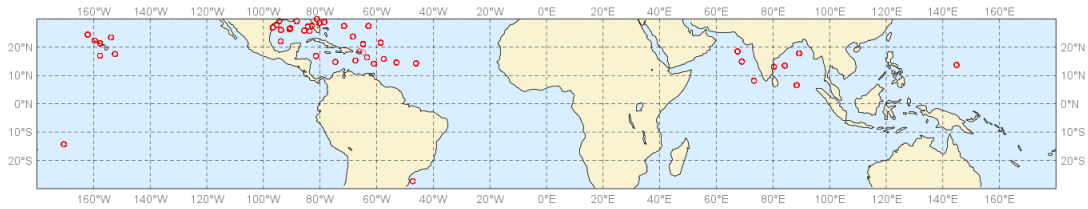
PART I: significant wave height (SWH)

Buoys observations - from 20190301 to 20190531 - (swh)



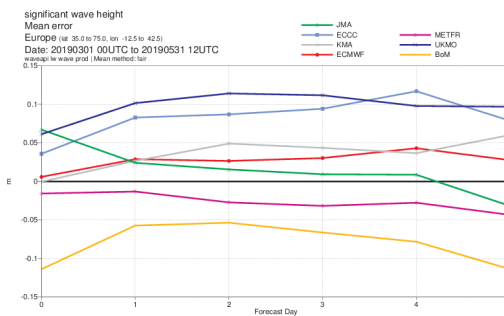
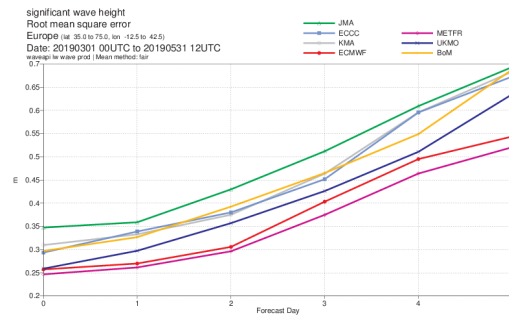
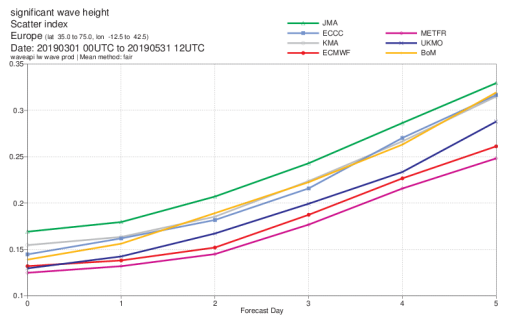
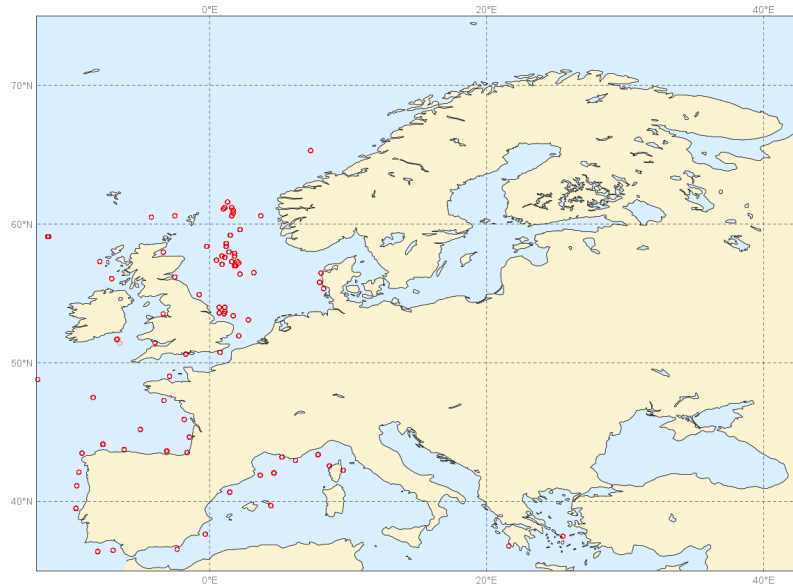
Northern Hemisphere. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)



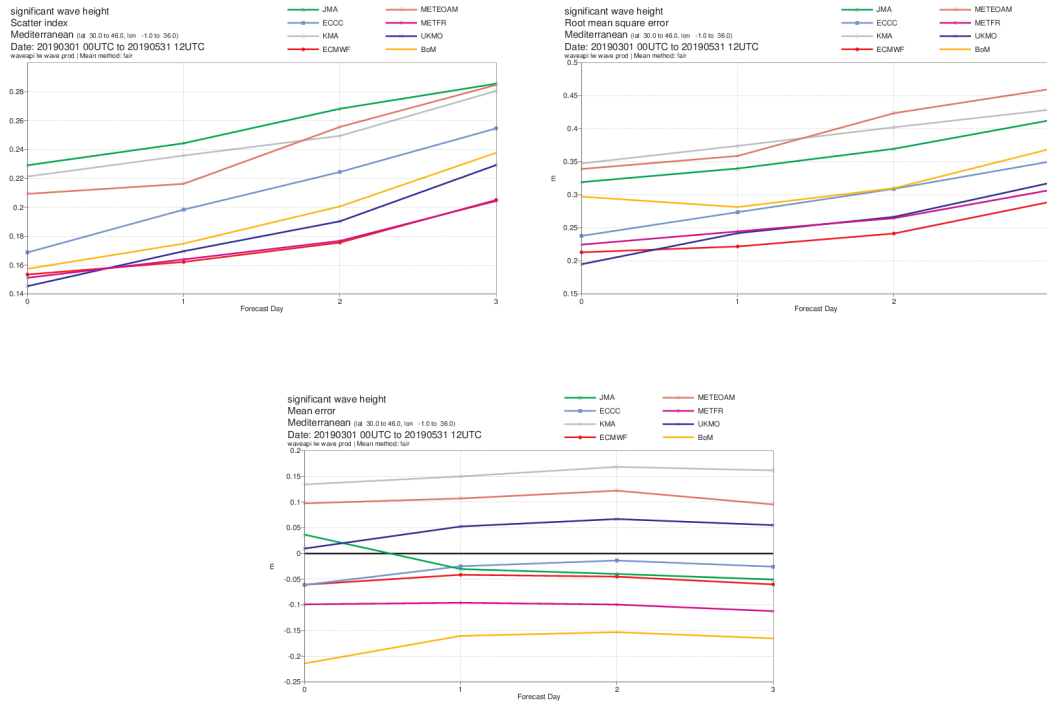
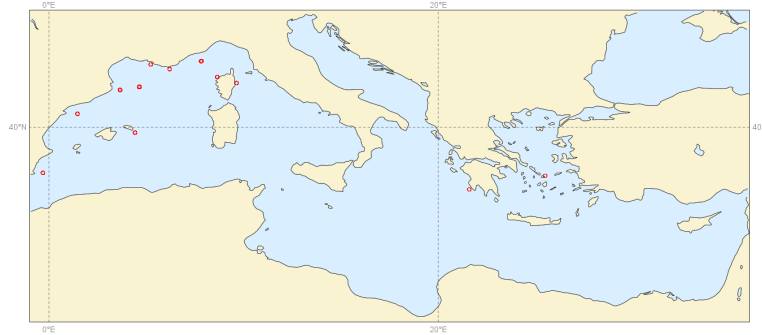
Tropics. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)



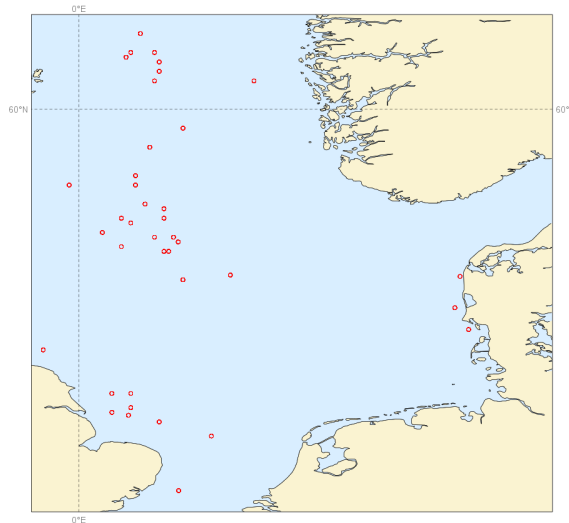
Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)

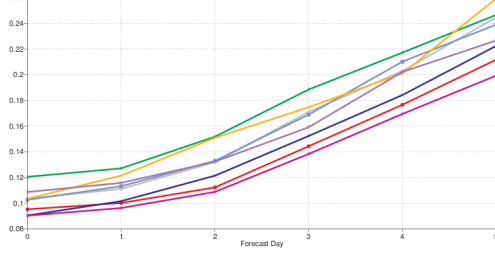


Mediterranean Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

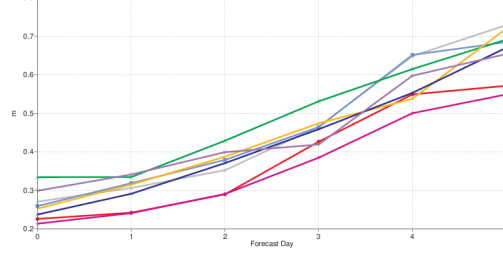
Buoys observations - from 20190301 to 20190531 - (swh)



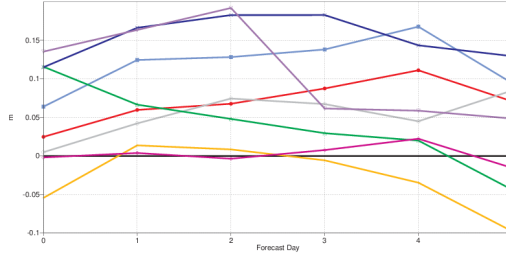
significant wave height
Scatter index
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)
Date: 20190301 00UTC to 20190531 12UTC
wavep10 le wave prod | Mean method: tar



significant wave height
Root mean square error
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)
Date: 20190301 00UTC to 20190531 12UTC
wavep10 le wave prod | Mean method: tar

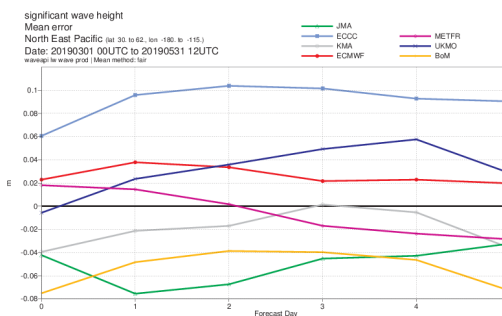
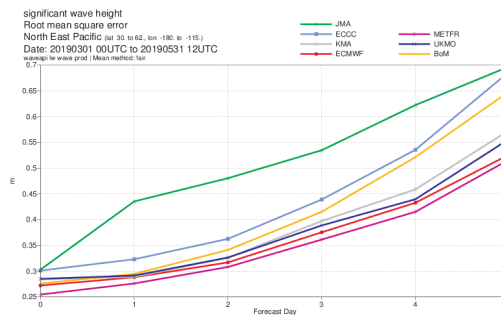
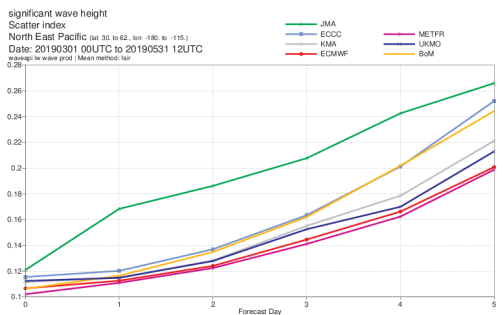
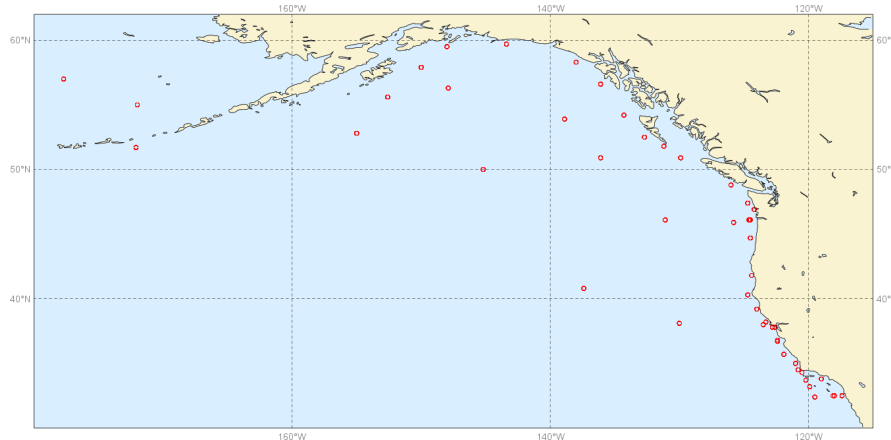


significant wave height
Mean error
North Sea (lat 51.5 to 62.0, lon -1.0 to 10.0)
Date: 20190301 00UTC to 20190531 12UTC
wavep10 le wave prod | Mean method: tar



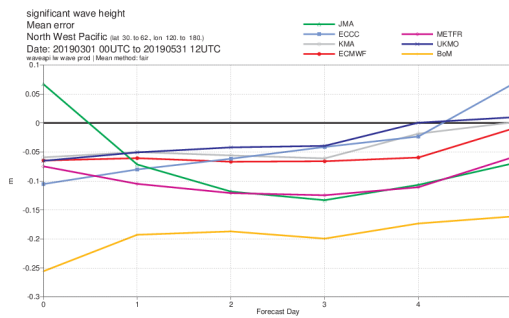
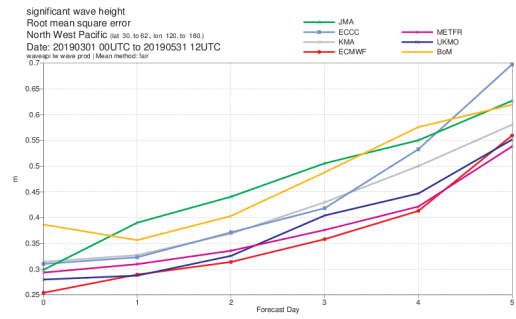
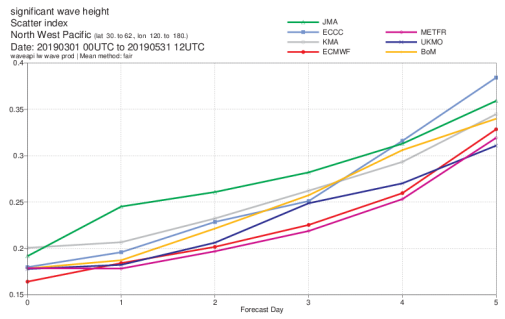
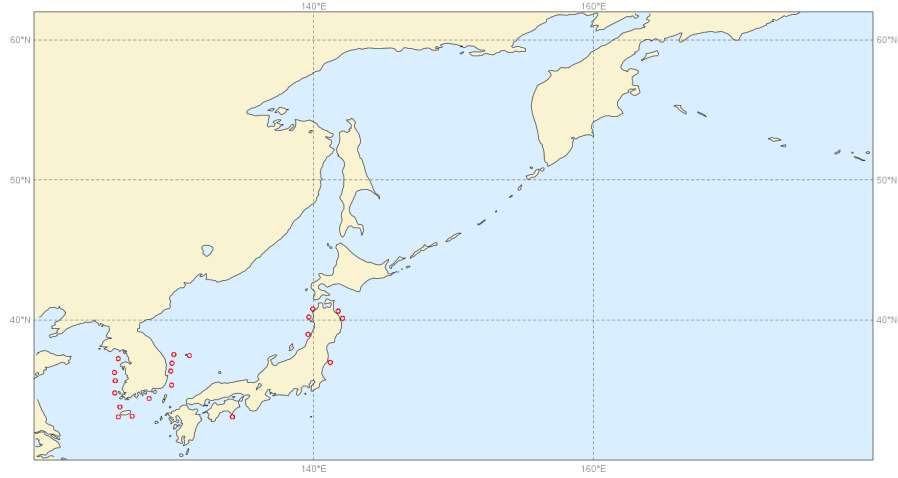
North Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)



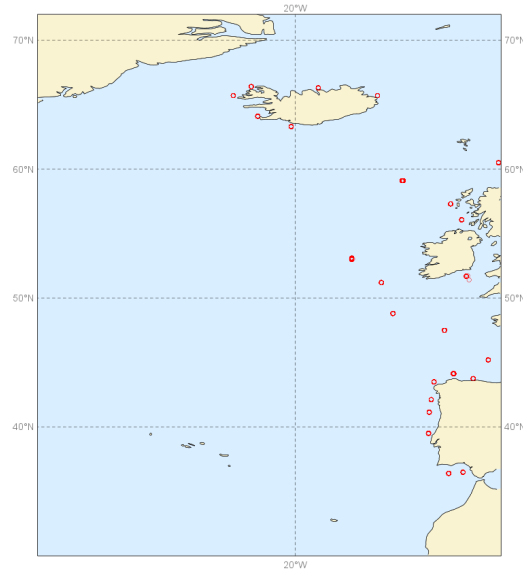
North East Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)

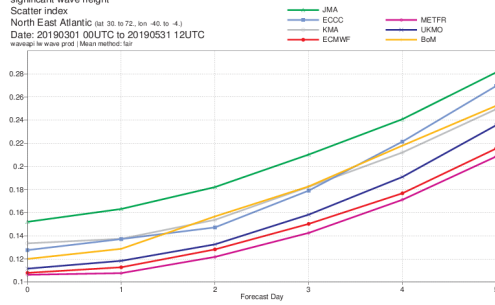


North West Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

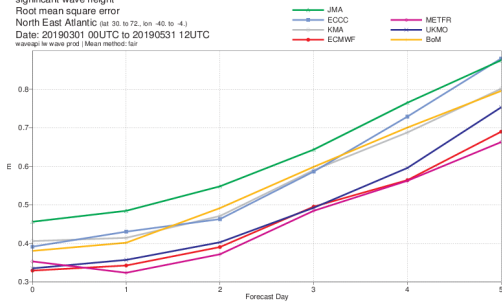
Buoys observations - from 20190301 to 20190531 - (swh)



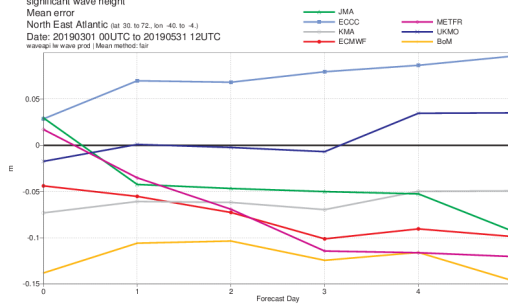
significant wave height
Scatter index
North East Atlantic (lat 30 to 72, lon -40 to -4)
Date: 20190301 00UTC to 20190531 12UTC
wavenp10-waveprod_MeanMethodC_test



significant wave height
Root mean square error
North East Atlantic (lat 30 to 72, lon -40 to -4)
Date: 20190301 00UTC to 20190531 12UTC
wavenp10-waveprod_MeanMethodC_test

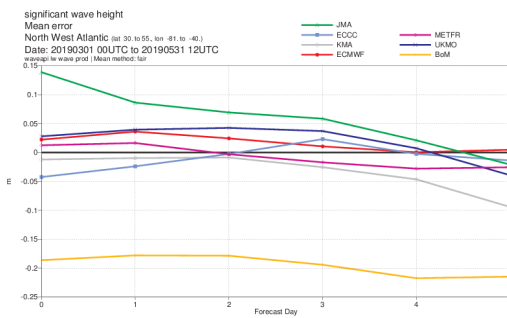
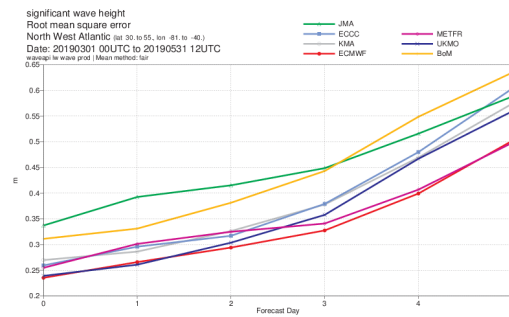
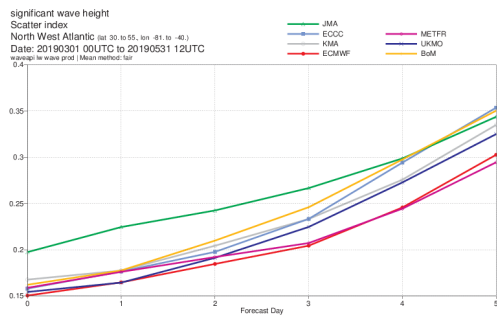
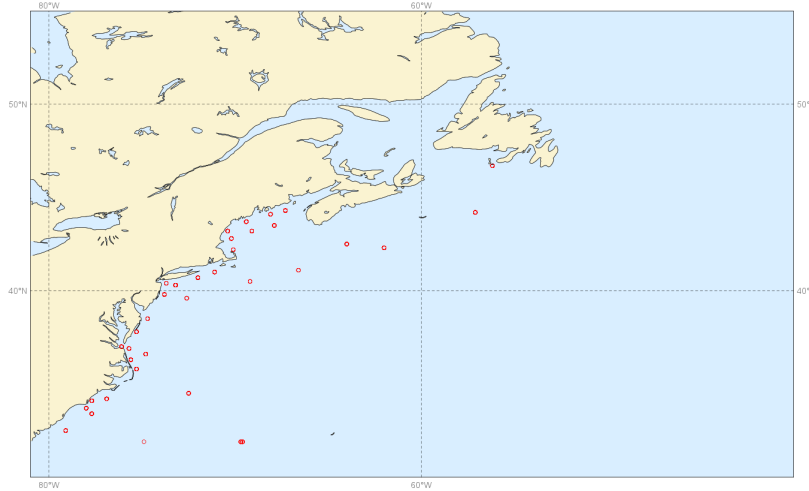


significant wave height
Mean error
North East Atlantic (lat 30 to 72, lon -40 to -4)
Date: 20190301 00UTC to 20190531 12UTC
wavenp10-waveprod_MeanMethodC_test



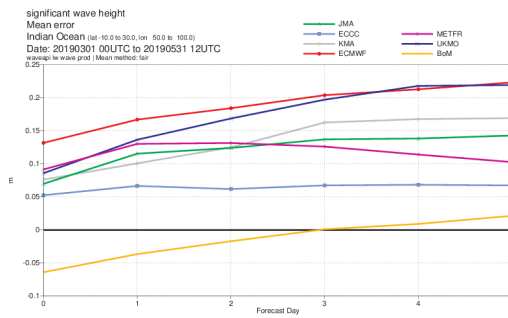
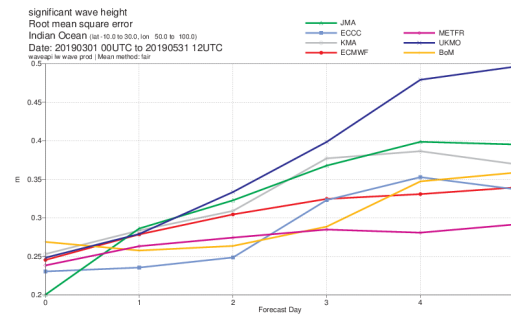
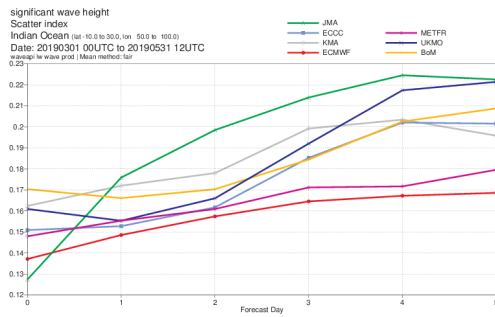
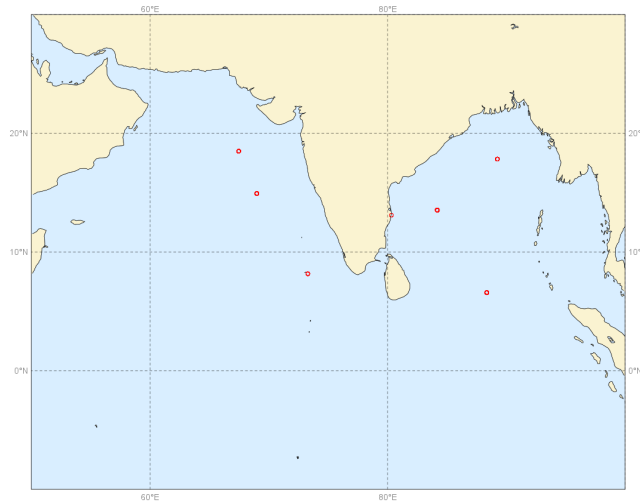
North East Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)



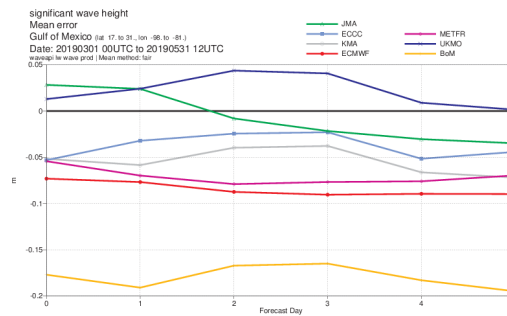
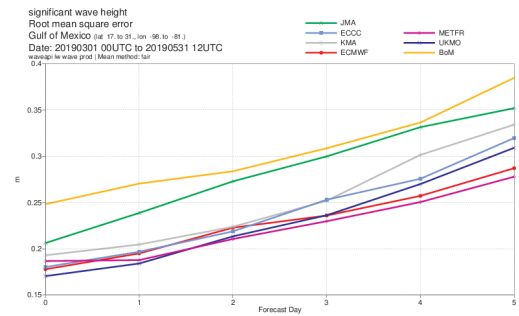
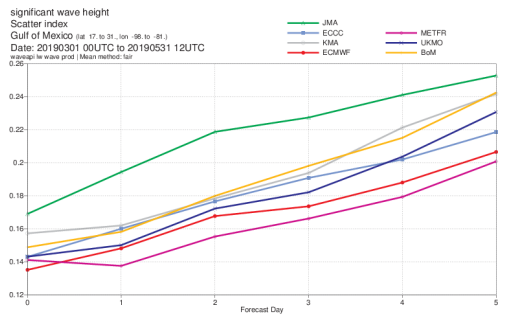
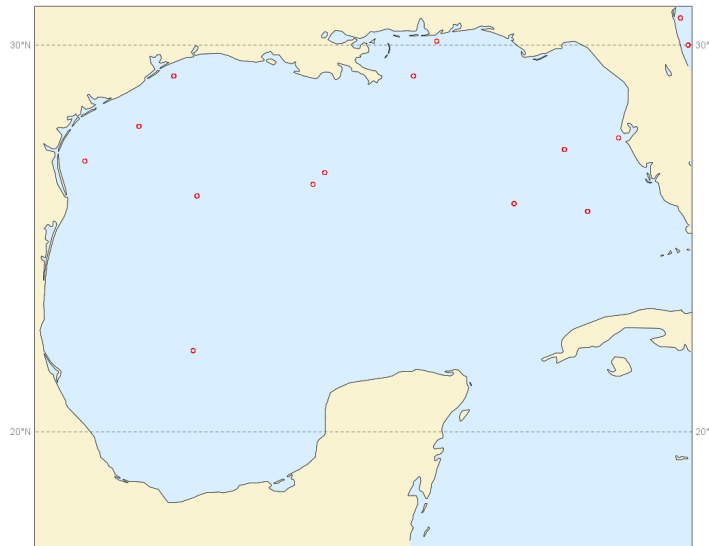
North West Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)



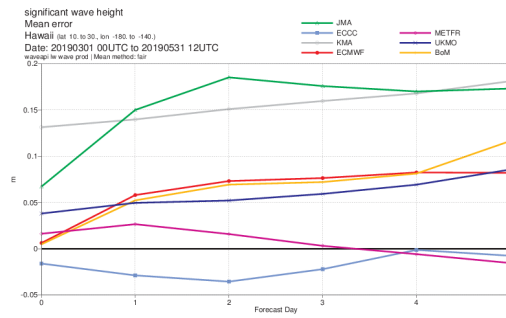
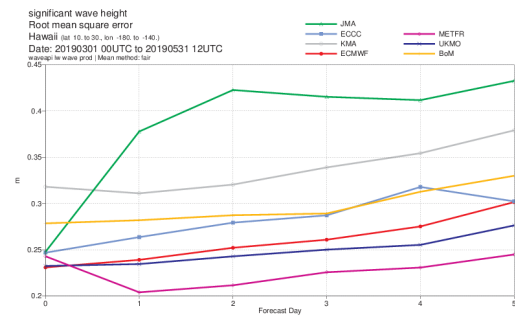
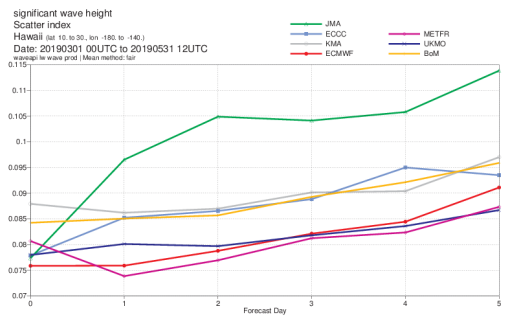
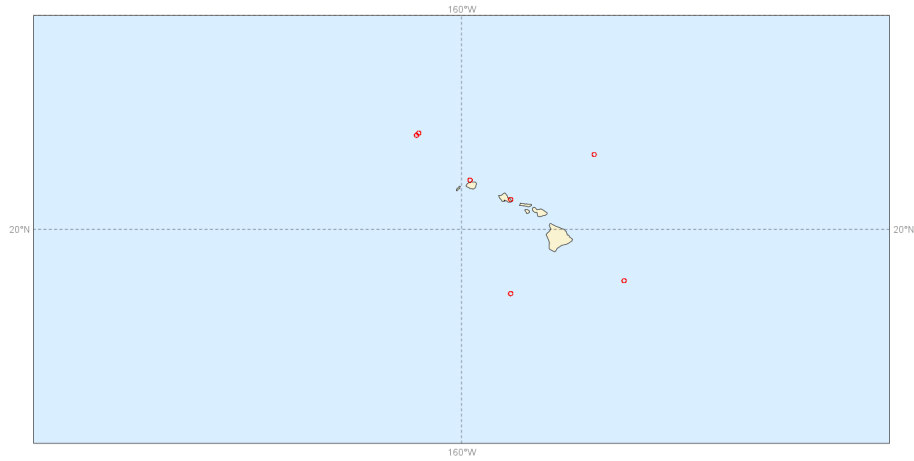
Indian Ocean. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)



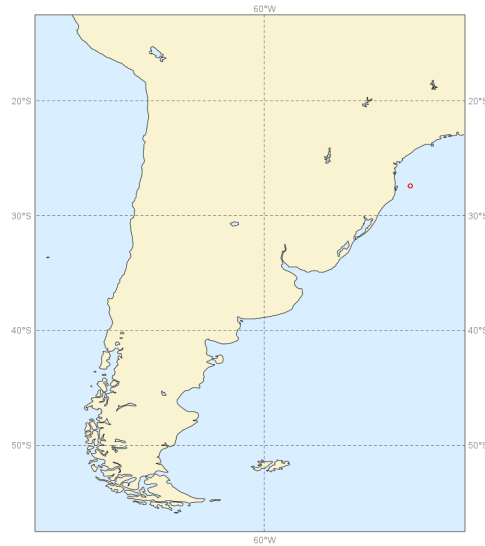
Gulf of Mexico. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190301 to 20190531 - (swh)

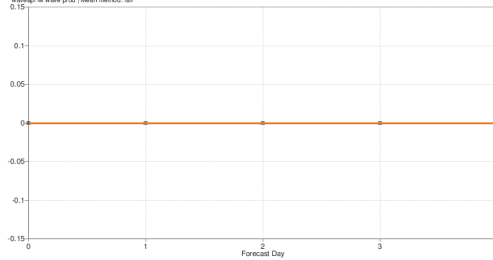


Hawaii. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

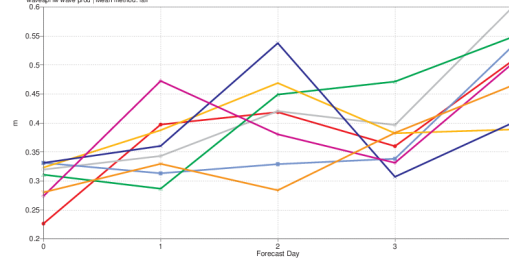
Buoys observations - from 20190301 to 20190531 - (swh)



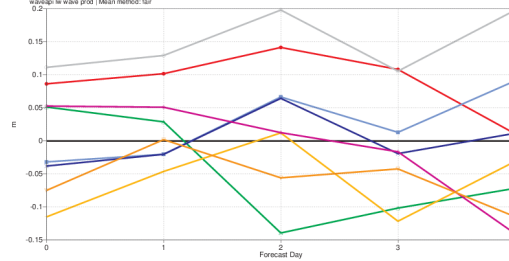
significant wave height
Scatter index
S America (south) (lat: 57.5 to 42.5, lon: -80.0 to -42.5)
Date: 20190301 00UTC to 20190531 12UTC
weights for wave prod. (Mean method, lat)



significant wave height
Root mean square error
S America (south) (lat: 57.5 to 42.5, lon: -80.0 to -42.5)
Date: 20190301 00UTC to 20190531 12UTC
weights for wave prod. (Mean method, lat)



significant wave height
Mean error
S America (south) (lat: 57.5 to 42.5, lon: -80.0 to -42.5)
Date: 20190301 00UTC to 20190531 12UTC
weights for wave prod. (Mean method, lat)



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).