

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

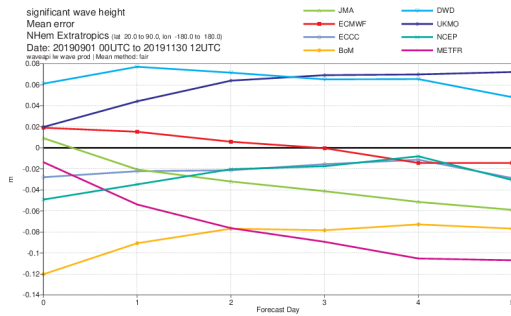
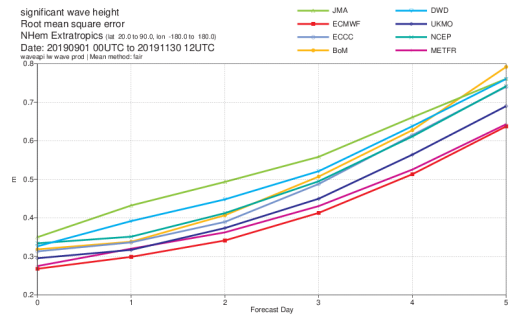
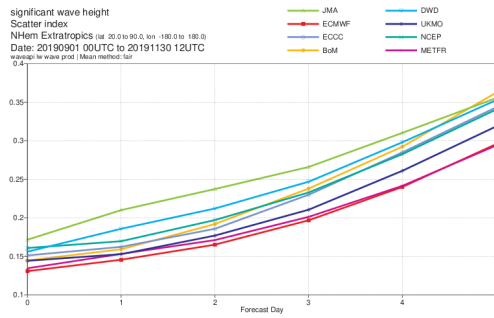
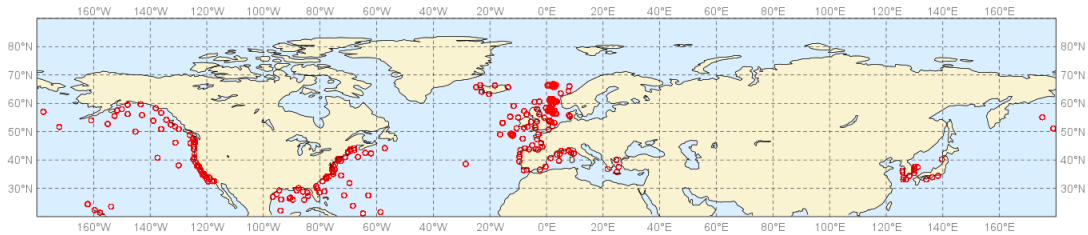
00 and 12 UTC runs

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

December 19, 2019

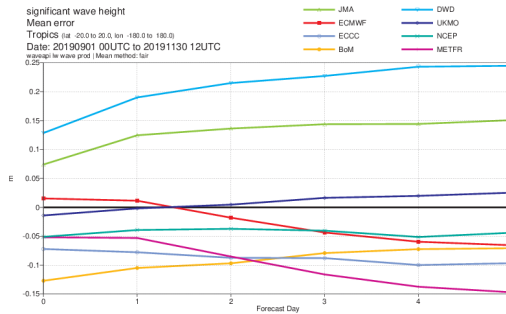
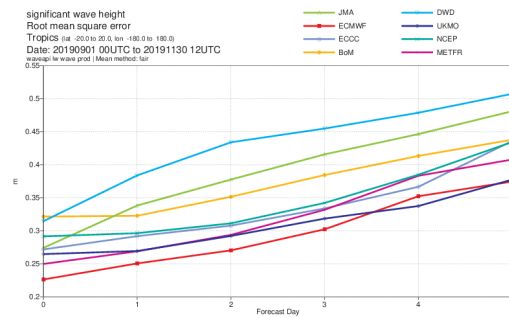
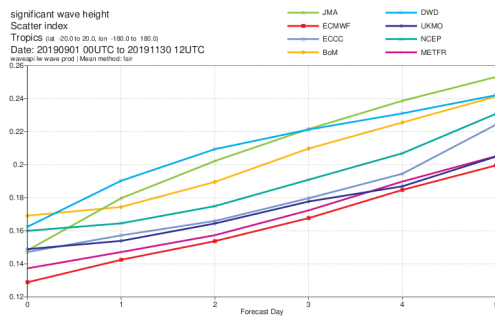
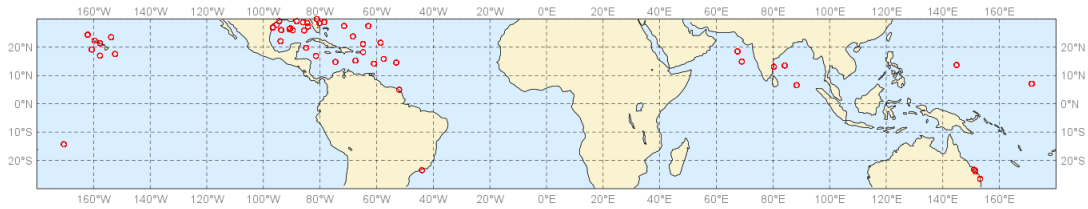
PART I: significant wave height (SWH)

Buoys observations - from 20190901 to 20191130 - (swh)



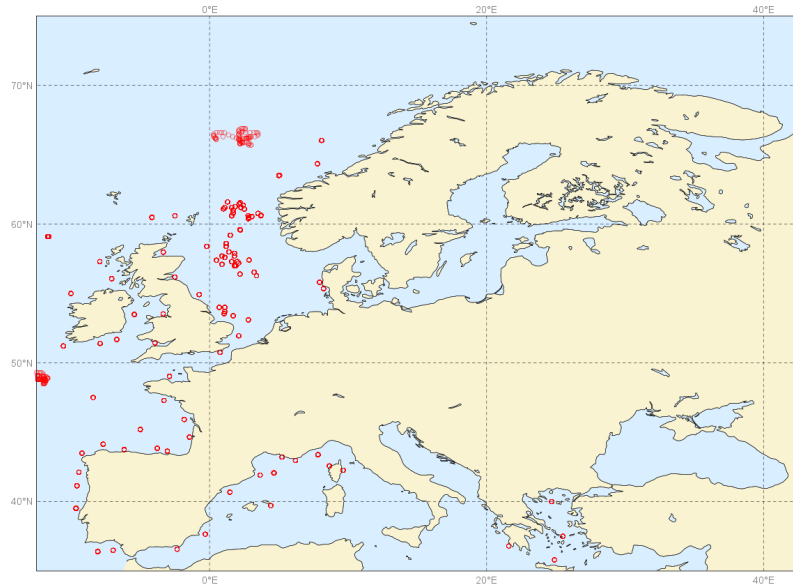
Northern Hemisphere. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swh)

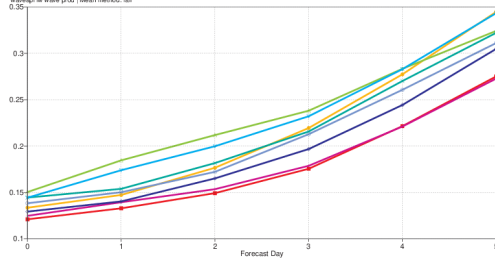


Tropics. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

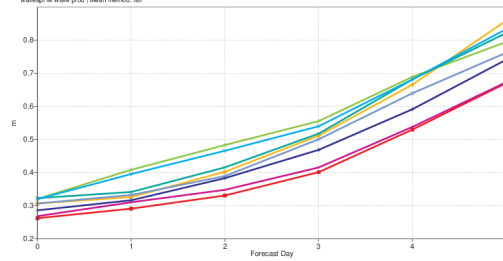
Buoys observations - from 20190901 to 20191130 - (swH)



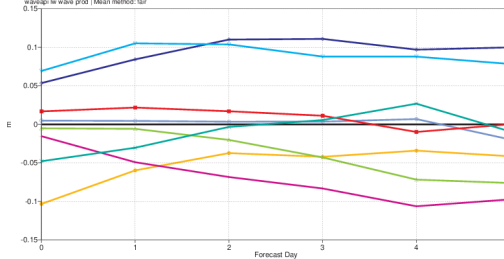
significant wave height
Scatter index
Europe (lat. 35.0 to 75.0, lon. -12.5 to 42.5)
Date: 20190901 00UTC to 20191130 12UTC
Average for wave prod. (Mean method, lat)



significant wave height
Root mean square error
Europe (lat. 35.0 to 75.0, lon. -12.5 to 42.5)
Date: 20190901 00UTC to 20191130 12UTC
Average for wave prod. (Mean method, lat)

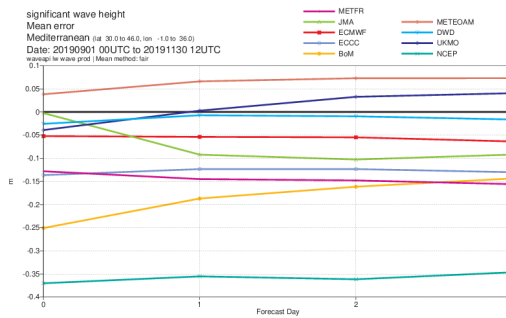
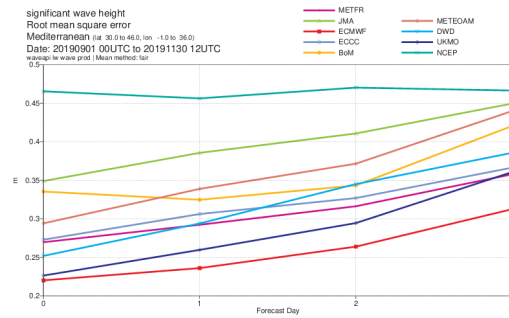
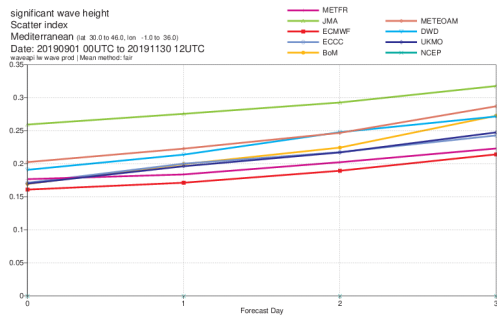
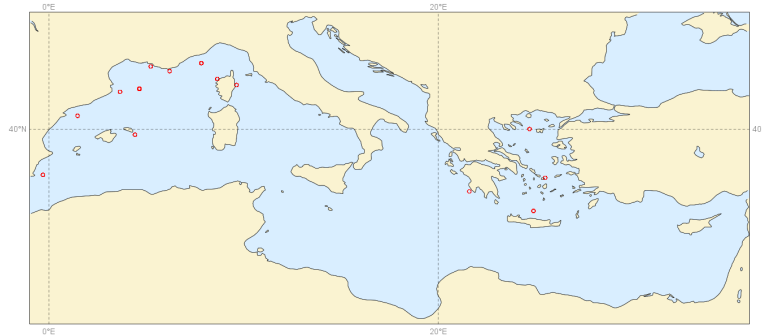


significant wave height
Mean error
Europe (lat. 35.0 to 75.0, lon. -12.5 to 42.5)
Date: 20190901 00UTC to 20191130 12UTC
Average for wave prod. (Mean method, lat)



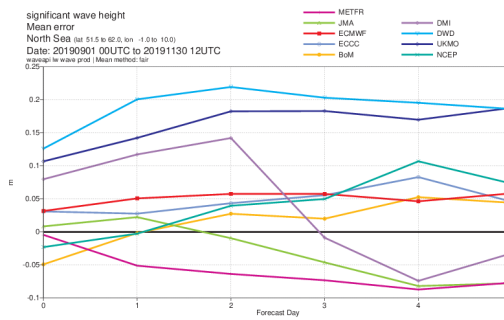
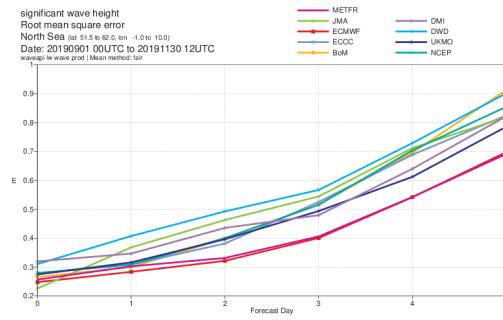
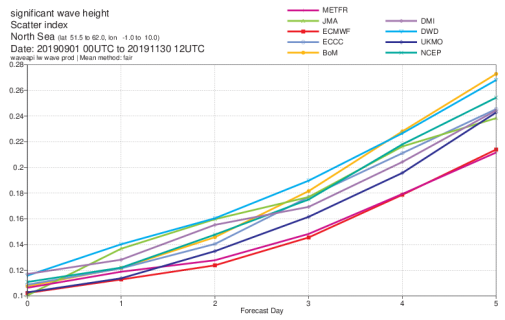
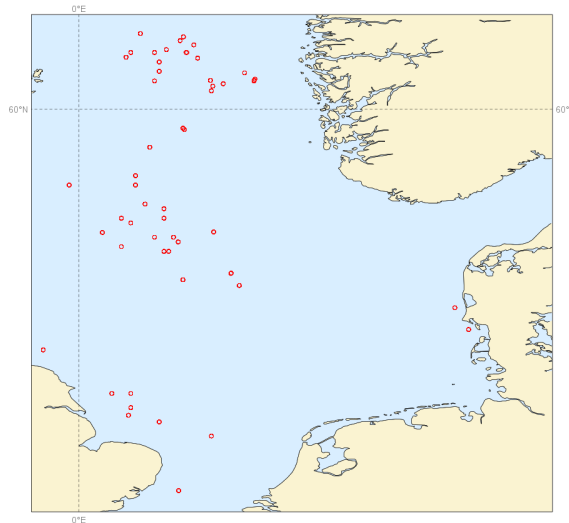
Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swh)



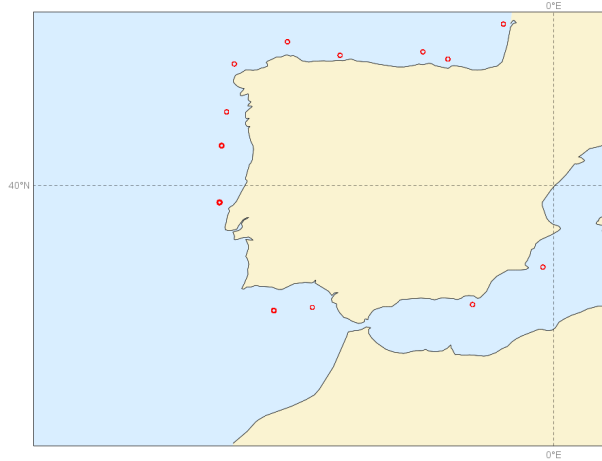
Mediterranean Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swh)

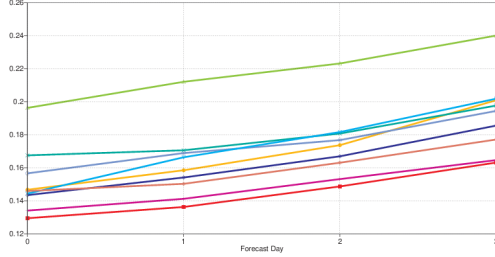


North Sea. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

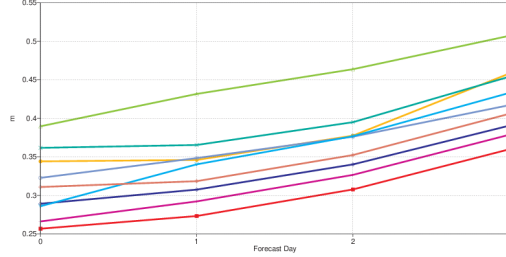
Buoys observations - from 20190901 to 2019



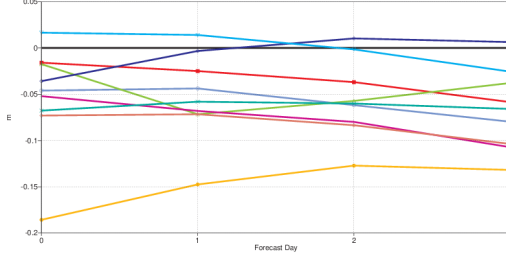
significant wave height
Scatter index
SW Europe (lat: 32.5 to 45.0, lon: -15.0 to 10.0)
Date: 20190901 00UTC to 20191130 12UTC
average for wave grid (Mean method: last)



significant wave height
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 wave grid (Mean method: last)

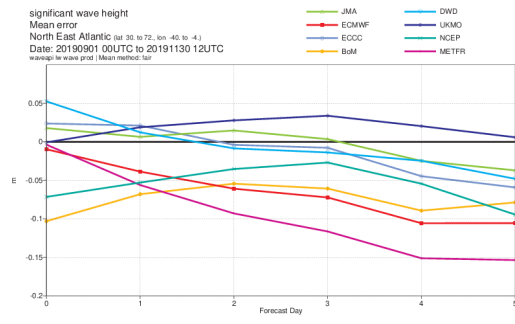
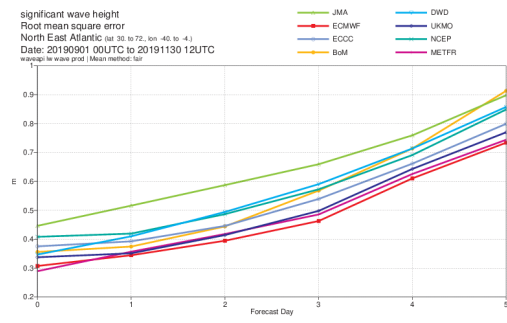
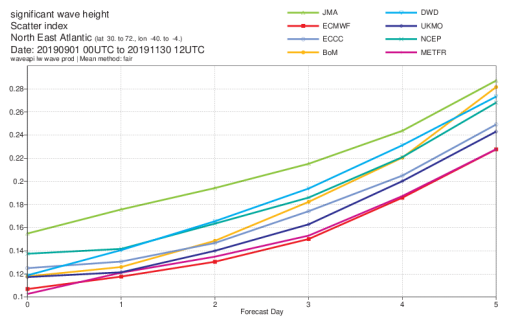
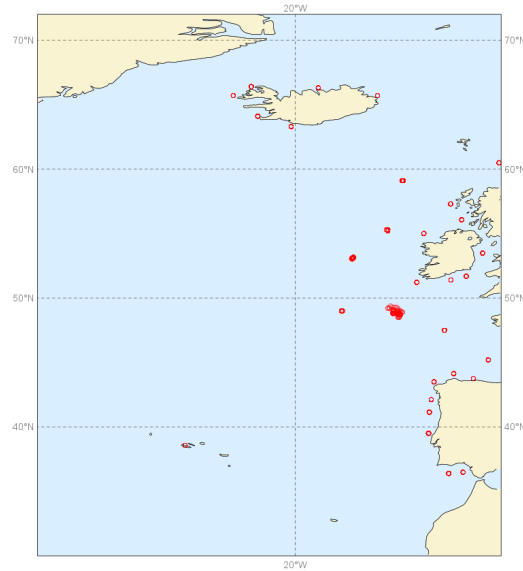


significant wave height
Mean error
SW Europe (lat: 32.5 to 45.0, lon: -15.0 to 10.0)
Date: 20190901 00UTC to 20191130 12UTC
average for wave grid (Mean method: last)



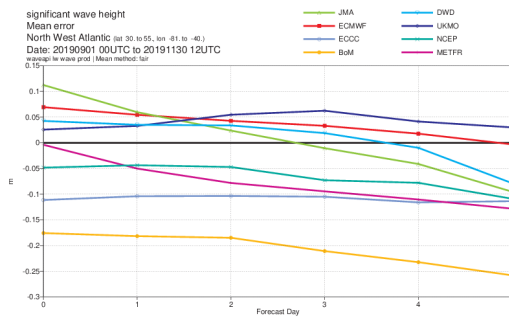
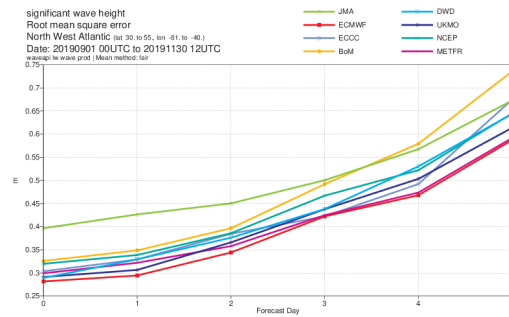
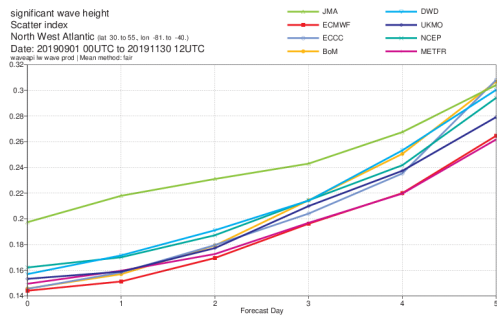
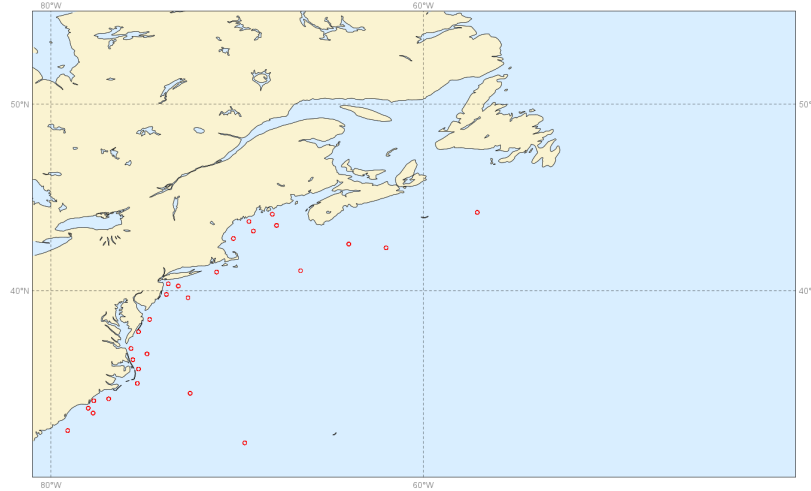
South West Europe. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swh)



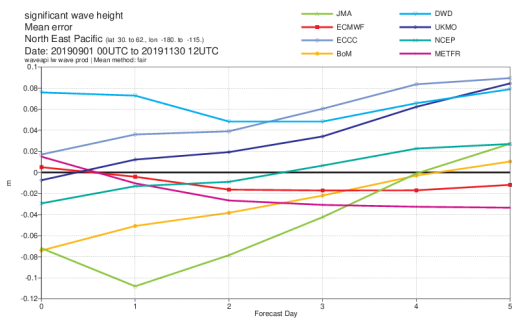
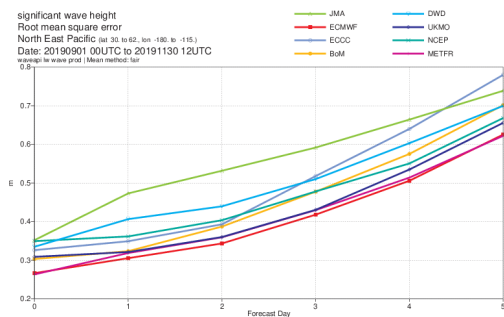
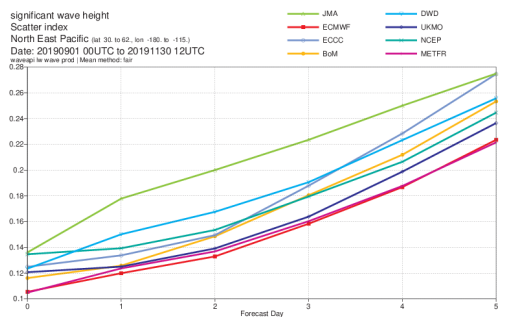
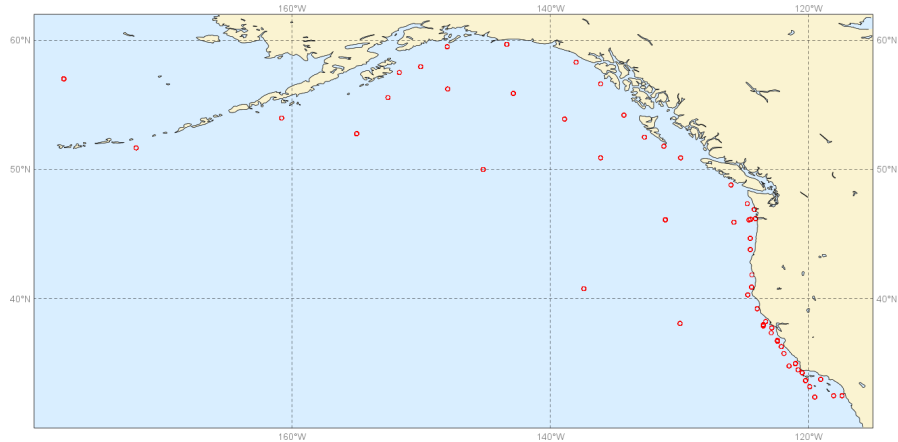
North East Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swH)



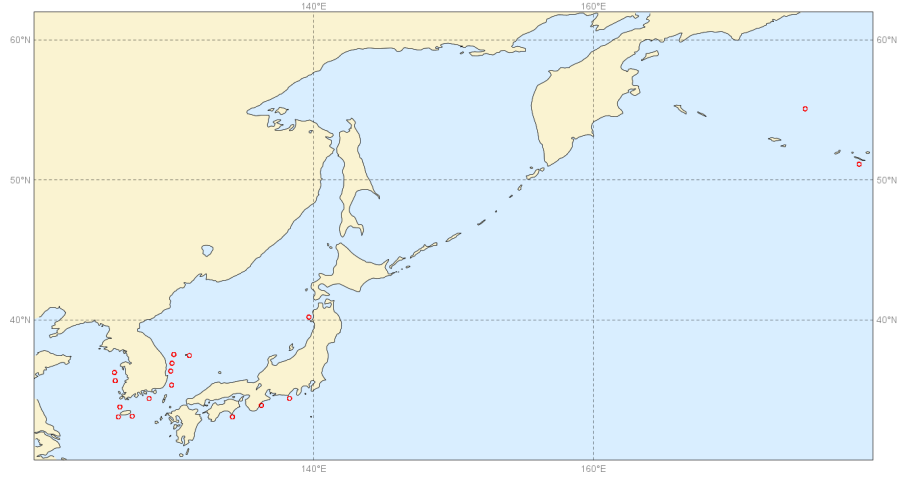
North West Atlantic. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swh)

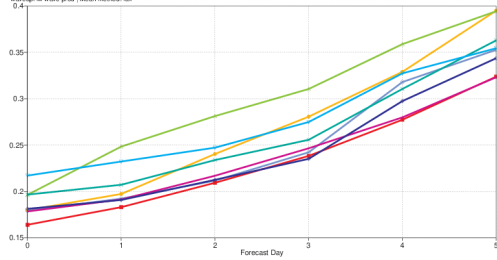


North East Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

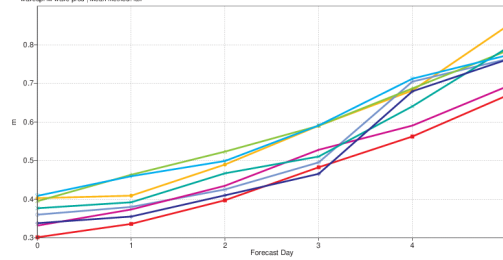
Buoys observations - from 20190901 to 20191130 - (swh)



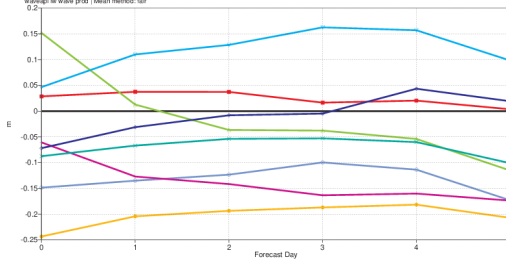
significant wave height
Scatter index
North West Pacific (lat 30 to 62, lon 120 to 180)
Date: 20190901 00UTC to 20191130 12UTC
average for wave grid (Mean method, lat)



significant wave height
Root mean square error
North West Pacific (lat 30 to 62, lon 120 to 180)
Date: 20190901 00UTC to 20191130 12UTC
average for wave grid (Mean method, lat)

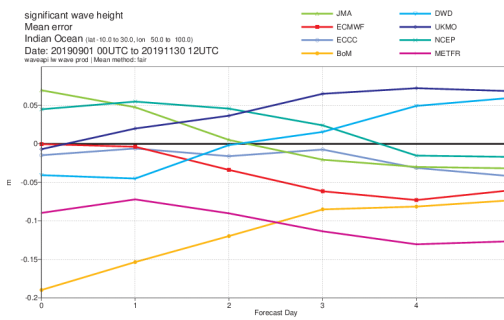
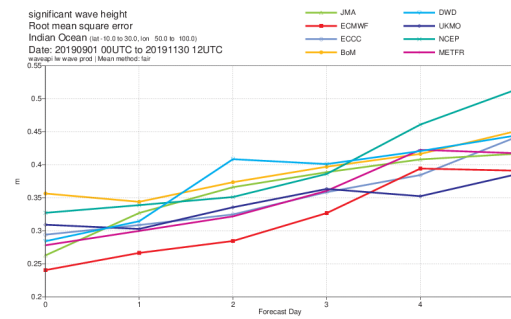
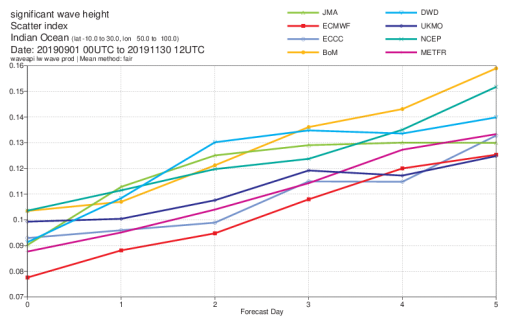
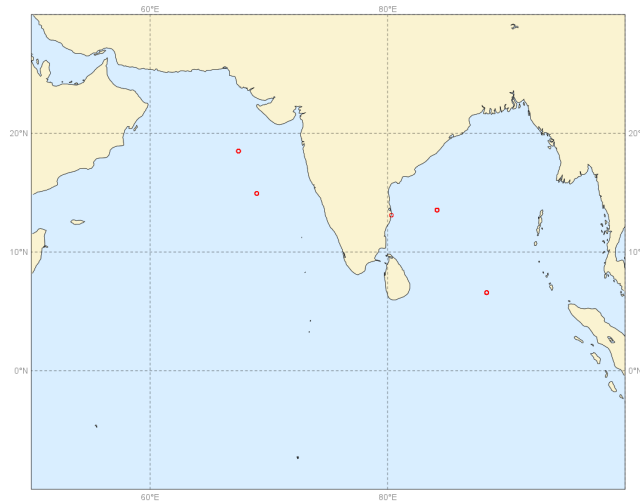


significant wave height
Mean error
North West Pacific (lat 30 to 62, lon 120 to 180)
Date: 20190901 00UTC to 20191130 12UTC
average for wave grid (Mean method, lat)



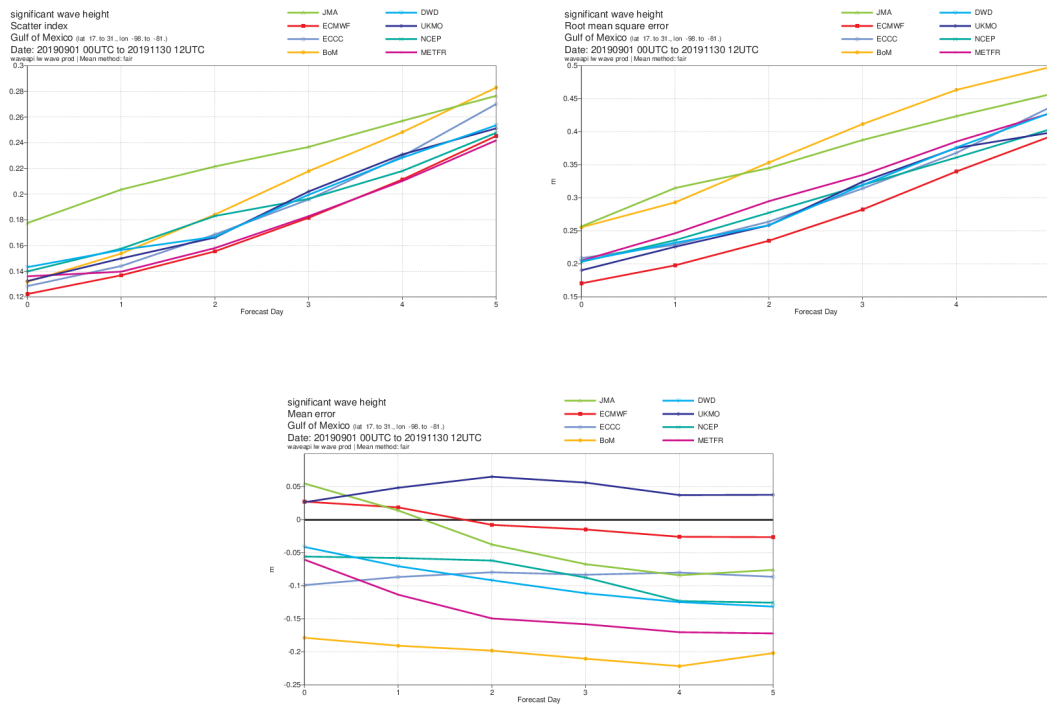
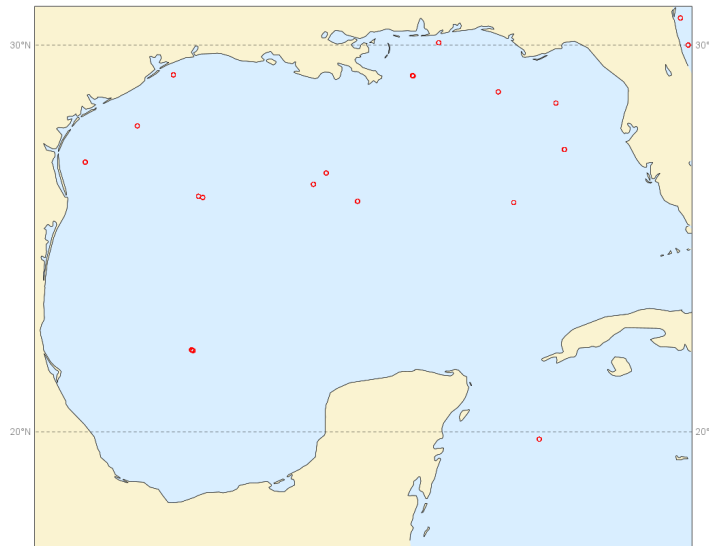
North West Pacific. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swh)



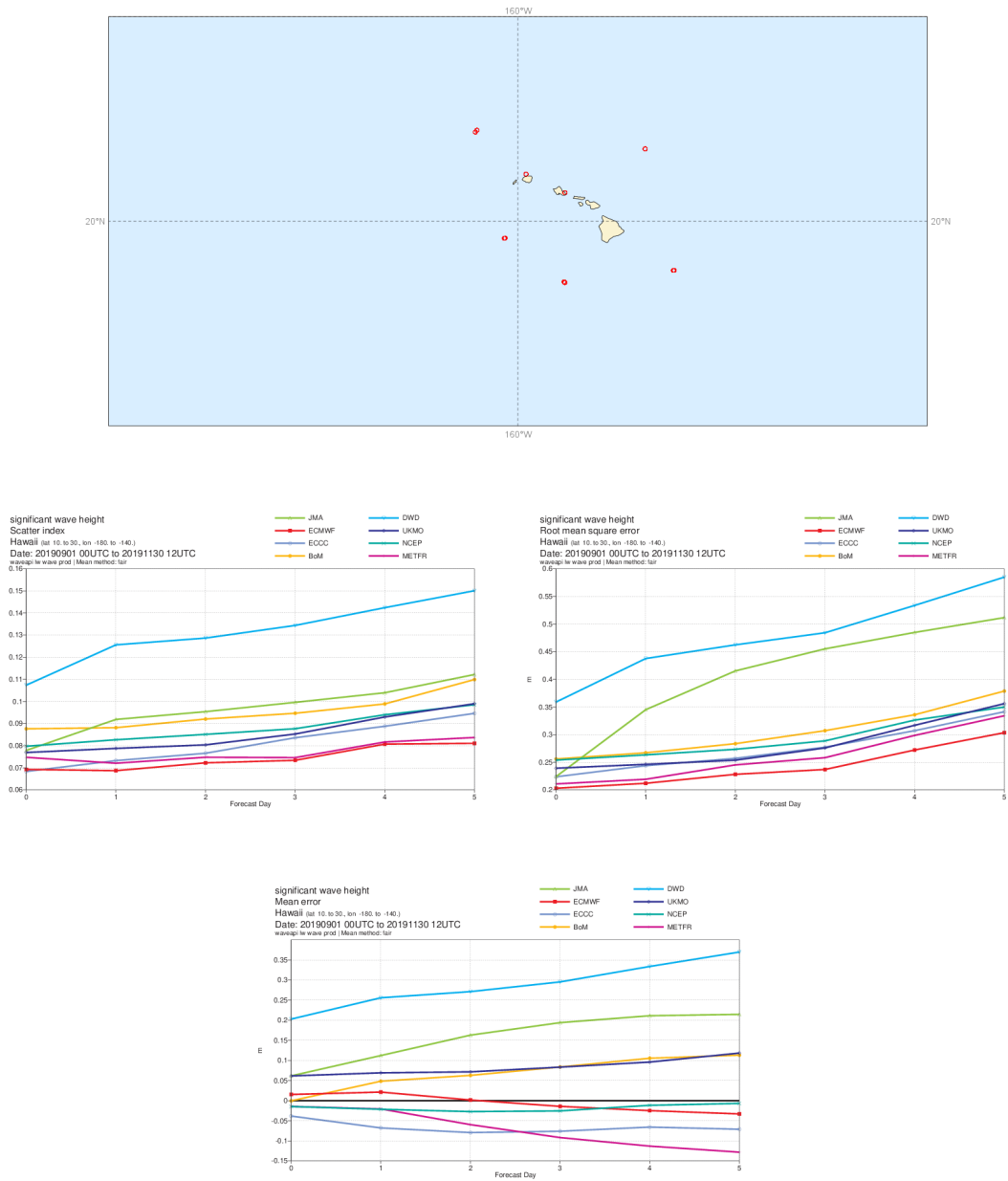
Indian Ocean. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (swH)



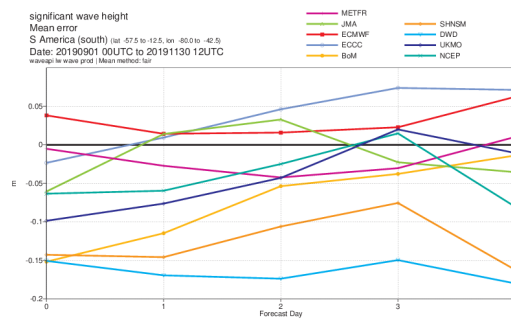
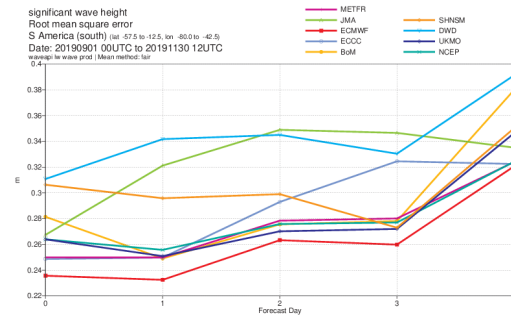
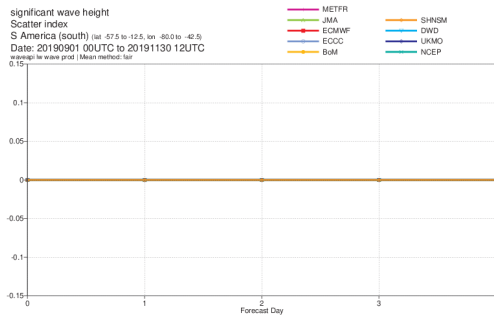
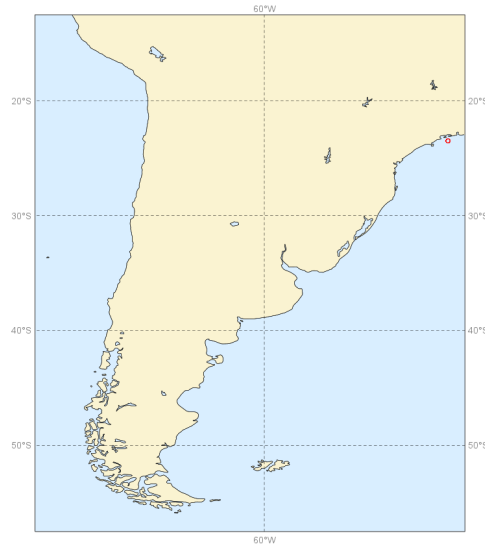
Gulf of Mexico. Top panel: observation distribution. Middle left panel: Forecast scatter index (standard deviation of the difference normalised by the mean of the observations). Middle right panel: Forecast root mean square error (RMSE). Bottom panel: forecast mean error (bias).

Buoys observations - from 20190901 to 20191130 - (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 20190901 to 20191130 - (swh)



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).