

# WAVE OBSERVATIONS PROJECT ON THE WEST COAST OF IRELAND

COMPARING THE COLLECTED FORECASTS FROM VARIOUS MODELS TO THE ACTUAL ATMOSPHERIC AND SEA STATE CONDITIONS

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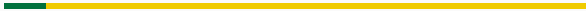
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# INTRODUCTION



- The Wave Obs project started as an alert service for the engineering team of the HIGHWAVE project located in the West of Ireland.
- The idea was to obtain the weather and sea state forecast for the next few days, so that instrument deployment and other experimental activities could be planned.

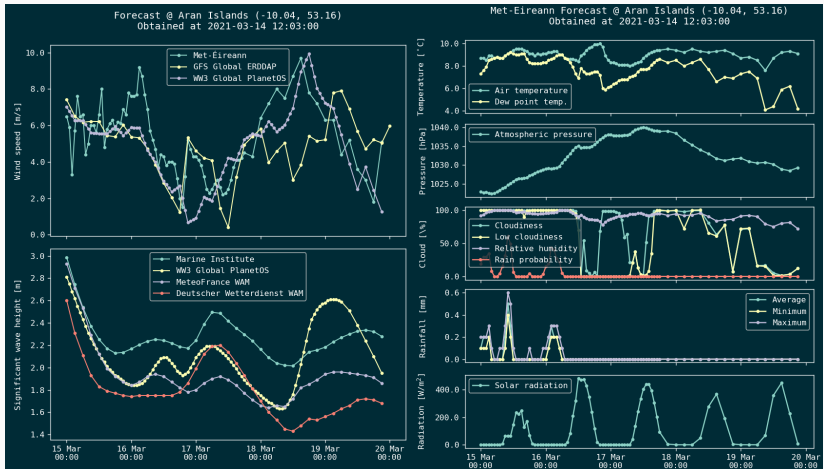
# STORY OF WAVE OBS

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- Since 12 JAN 2020 (start date) daily forecasts for meteorological and sea state variables.
- A database for storing the forecasts has been created.
- Four model forecasts have been selected for daily record.
- Since MAY 2020, atmospheric variables have been recorded.
- Forecast collection process has been automated.
- The daily forecast started appearing on [highwave-project.eu](http://highwave-project.eu)
- Spotter buoy first deployed in JUN 2020.
- Additional meteorological variables added to the forecast.
- Forecast validation/verification/training has began.

# DAILY FORECAST

Example of daily forecast available on [highwave-project.eu](http://highwave-project.eu)

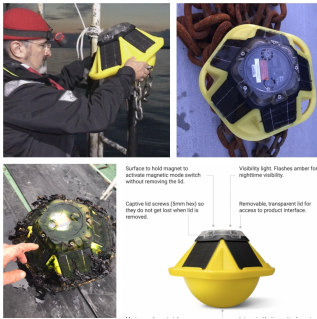


# SPOTTER BUOYS - COLLECTING SEA-STATE DATA

Two spotters, nick-named Wanderer and Explorer, manufactured by Sofar Ocean, went through two deployment campaigns each.

- 1 JUN 2020 - 19 SEP 2020 (Wanderer)
- 11 AUG 2020 - 1 OCT 2020 (Explorer)
- 7 NOV 2020 - 3 MAR 2021 (Wanderer)
- 8 DEC 2020 - 10 MAR 2021 (Explorer)

These miniature buoys have most of the features of the large met buoys. Spotters have been designed to drift across the oceans, but they can as well be anchored to the seafloor (our choice for the time being).





# WEATHER STATION - COLLECTING ATMOSPHERIC VARIABLES

- Gill MAXIMET GMX700-9 weather station positioned in Tonacrick, Co Galway, Ireland.
- Wind speed and direction, temperature, humidity, pressure, precipitation, solar radiation.
- Sea conditions to be coupled to the atmospheric conditions in our analyses.
- Future weather stations will be located on the Aran Islands.



## WHY IS WAVE OBS IMPORTANT?

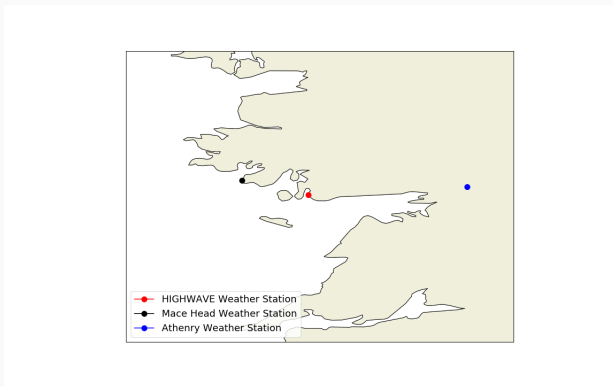
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- Successful completion of the open ocean experiments.
- The local community on the Aran Islands heavily depends on the weather and sea.
- Numerical models formulation and validation.
- One of the main goals of HIGHWAVE is to develop a more accurate coupled sea state and ocean weather forecasting model.

# INTERIM RESULTS

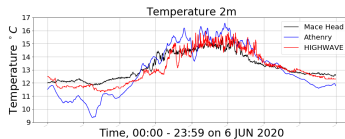
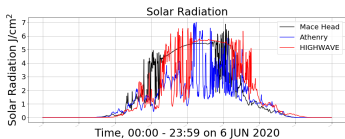
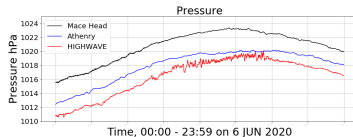
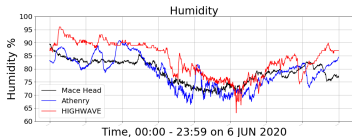


Map of the HIGHWAVE weather station and two Met Eireann stations

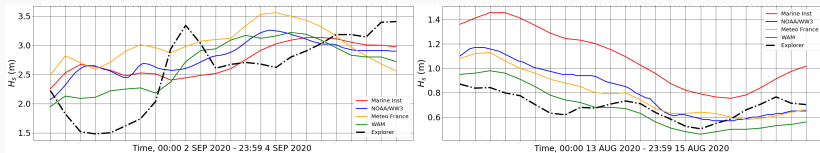


**Figure 1:** Location of the three weather stations. Tonacrick is where the HIGHWAVE weather station (in red) is located at 53.26N 9.56W, Mace Head (in black) at 53.20N 9.54W, and Athenry (in blue) at 53.30N 8.74W

# VALIDATION OF METEOROLOGICAL VARIABLES

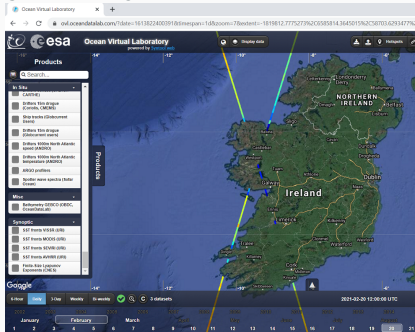


# VALIDATION OF SEA-STATE VARIABLES



- The significant wave height forecast from the models versus the actual real ocean significant wave height.
- This data will be used together with the Bayesian Model Averaging (BMA) software to 'train' the forecasts.

## SENTINEL-3B



Ocean Virtual Laboratory

- Passes the area of interest (Aran Islands)
- Keep the records since JAN 2020
- Use the data to spot check collected data and the forecast
- Example - storm of 27/28 OCT 2020

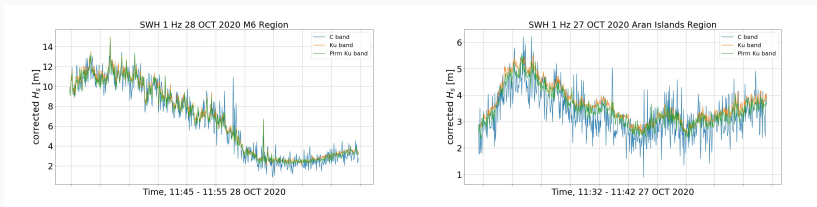


## EXAMPLE - THE REMNANTS OF HURRICANE EPSILON

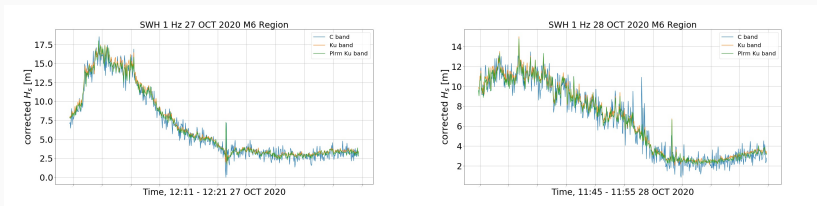
- Media reporting waves from 18 m to 30 m.
- M6 buoy recorded a maximum individual wave height of 21.7 m between 27 and 28 OCT, with significant wave height being 15.7 m and 17.5 m accordingly.
- 27 OCT 2020 the vicinity of the Aran Islands. The values recorded go slightly over 6 m. Confirmed by live observations on the Aran Islands.
- Extreme weather events recorded by more than one sensor.
- New concepts in wave measurement using real-time instrumentation.

# EXAMPLE - THE REMNANTS OF HURRICANE EPSILON

Record of the  $H_s$  from Sentinel-3A and Sentinel-3B on 27 and 28 OCT 2020.



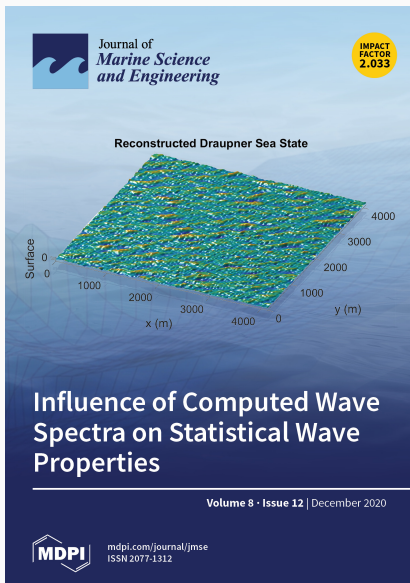
Met Eireann and the Marine Institute M6 buoy reported  $H_s$  of 15.7 m.



## FUTURE PLAN

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- Continue collecting forecasts
- Continue collecting real – ocean observations and weather observation
- Forecast verification/validation to continue
- Forecast training using BMA
- Produce improved forecasts
- Improved forecast verification/validation



## Influence of Computed Wave Spectra on Statistical Wave Properties,

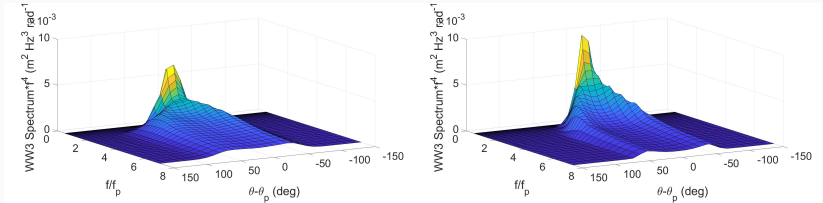
T. Kokina, F. Dias,

J. Mar. Sci. Eng. 2020, 8(12), 1023;

Published: 15 DEC 2020

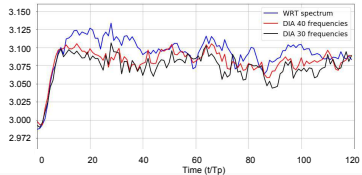
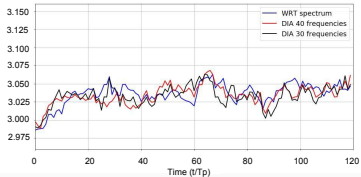
Special Issue: Extreme Waves.

# SHORT DESCRIPTION OF THE PAPER

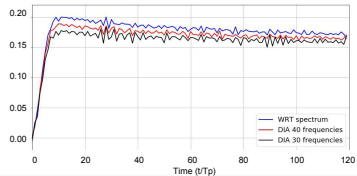
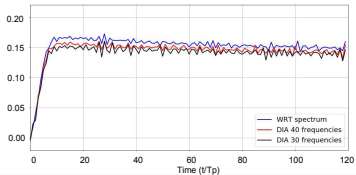


- Two different algorithms (DIA vs WRT) for computing wave spectrum.
- Are the statistical properties affected?
- A minimum domain size of at least 10 times the wavelength.
- The greatest effect was due to energy dissipation filter applied.

# RESULTS



Kurtosis (top) and skewness (bottom) averages with strong and weak filters



# ACKNOWLEDGMENTS

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