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**The Environmental Observation Web and its Service
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D3.4.2 (MAST) Prototype Software and Manual II

Guidelines document

MI - Intune

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1 Introduction

The Marine Asset Management Decision Support Tool (MAST) is a web portal developed from the analysis of a number of use cases developed by the marine work package of ENVIROFI. The principle driver is the use case of Ocean Energy Asset Management. This use case contained cross functionality with the other use cases which were based on different thematic areas within the Marine area (fisheries, tourism etc.). The role of the portal is to create a tool that promotes situational awareness of Galway Bay among offshore enterprise managers. In this particular case the principal actor is an Offshore Energy Manager.

As part of the ENVIROFI project, the team responsible for the MAST have been following the design principles:

- **REST** (Representational State Transfer) is a style of software architecture for distributed systems and is a Web service design model. Key to REST is the existence of resources which are referenced by global identifiers (e.g. an URI in HTTP) and that the set of operations supported by the web service use HTTP methods (e.g., GET, PUT, POST, or DELETE).
- **ROA** (Resource Orientated Architecture) is a specific set of guidelines of a RESTful architecture. It is only applicable to the Web, where published content is regarded as a resource. Specifically, for the purposes of the MAST system, it recommends that applications should expose many URIs, one for each resource. The strategic resources which exist on the Marine Institute servers are never touched; instead various representations of those strategic resources are made available via ERDDAP web services. This is the case with ERDDAP data broker (a web service) that is being accessed by MAST.
- **SOA** (Service Orientated Architecture) is a set of principles in developing software in the form of interoperable services. These services are business functions that are built as software components that can be reused. Web implementation of SOA (web services) can be implemented using a service based technology, for example CORBA or REST.
- **OpenData** is the principle that data should be freely available for everyone to reuse and republish.
- **MASHUP**, in web development, is a web page or web application that combines web resources (data, presentation or functionality) from two or more sources to create new services.

In doing so the team aims to illustrate that powerful and publically useful web based applications are possible through the loose coupling of functionality and data from disparate domains on the Internet. This in essence is the concept of the MASHUP in action.

The OpenData element to the project has been supplied by the Marine Institutes data web services, which publish data that can be accessed and queried via simple HTTP links. Gaps in the data requirements have been filled by free third party data aggregators of ship identification data (AIS) and personal weather station data. MAST is a first Beta version. During the next development stage other functionality will be added via web services being produced by FI-WARE (Generic Enablers) and ENVIROFI (Specific Enablers).

2 Background to the Prototype

Wave Energy farm operators will be required to routinely make well informed operational decisions on how the arrays of energy generating devices will operate based on current and forecast conditions.

Advance knowledge of changes in weather and wave conditions mean that the devices can be re-orientated to maximise the extraction of energy. In the event of severe conditions the facility may also be required to shut down assets or components of the asset remotely.

Intelligent integration of the real-time data coupled with model predictions will be an essential tool in identifying weather windows of opportunity to schedule essential operational maintenance and repairs. The application of an intelligent responsive decision based management tool has been identified by the marine renewable energy industry as highly desirable in the operational management of these assets. The predicted weather and sea state data will also be of use to utility companies in preparing the electricity grid for peaks and troughs of electricity production.

A weather window occurs when a weather forecast indicates that a given set of marine operations can be performed within their maximum limits of their appropriate constraint: i.e. wave height in this case study. Weather windows are dependant:

- Time needed: e.g. 6 hours etc
- Wave height for Access: 1m

Monitoring of the sea state and marine traffic is also important. Fortunately this type of information is published by other marine users. When these data feeds/observation are published in a open and un-restrictive format, it is possible to combine these feeds to address the asset management needs of the hypothetical wave farm manager.

Many of the concerns of our hypothetical wave farm manager are common to other marine users from numerous different fields (Aquaculture, Leisure, Fishing etc.). The MAST systems functionality spans multiple sectors and illustrates what can be achieved with OpenData and cutting Internet architectures.

3 Links to prototype

3.1 Online version

The online version of the application is provided to those people that want to test the application. This is a beta version of the system that demonstrates the data access functionality.

Mast Web Portal: <http://apps.marine.ie/enviro-fi/realtime.html>



NOTE: The Online application works with all modern web browsers and requires Adobe Flash Player. MAST has been designed to work on smart phones, tablets, desktop computers and laptops.

3.2 Hardware Requirements

MAST is not particular demanding of hardware or network bandwidth. The following of Restful and Service Orientated architecture means that a lot of processing happens remotely before resources are delivered to the browser.

3.3 Demonstration Presentation

A Power Point demonstration of the portal has been created in case there are any problems with the portal itself.

The online Webcast demonstrating the background to the application and a walkthrough of its functionality can be viewed here:

<http://catalogue.envirofi.eu/applications/future-internet-collaborative-usage-of-marine-environmental-assets>

3.4 Paper Documentation - Guidelines document

Information on the prototype is available in the following formats and from the following locations:

This document in PDF Format can be downloaded from:

<http://catalogue.envirofi.eu/applications/future-internet-collaborative-usage-of-marine-environmental-assets>

4 Guidelines to Users

4.1 Getting started

Simply open a web browser and navigate to the following address.

Mast Web Portal: <http://apps.marine.ie/enviro-fi/realtime.html>

The website contains three tabs that that can be navigate via a navigation menu (figure 1).

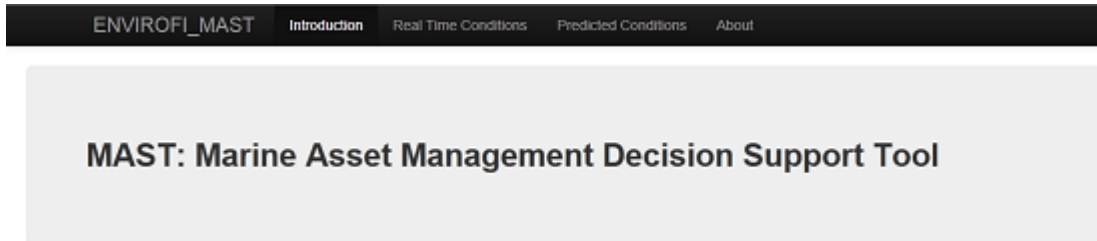


Figure 1: Navigation menu

The tabs are:

- Introduction: Executive summary of portal
- Real Time Conditions: The current activity in Galway Bay. Ship Traffic and Weather Sensor via third party. Tidal gauge at Galway harbour via Marine Institute
- Predicted Conditions: Model outputs and tide predictions from Marine Institute

The various forecasts and sensors feeds in the portal take the current date show the latest data for that date. All forecast are made from the current date.

4.2 Real Time Conditions

The home page of the MAST portal is the Real Time Conditions tab (figure 2 and figure 3). The page contains the data feeds that are necessary to get a snapshot of activity in Galway Bay. A live web cam of the bay is first data feed. The weather and the ships map feeds (top right and second row of figure 2) are third party data feeds (widgets) and update at regular intervals.

Below the Ship Map widget is the outputs from the various sensors located in or near bay (figure 3). The sensors displayed here were selected because they indicate the sea conditions in and outside the bay.

There is functionality provided by the third party widgets (figure 2). By clicking on the weather widget the user is taken to a third party website that contains the weather history for that personal weather station. It is possible to interact with the mapping functionality of the Ships Map widget; these functions are provided by via the third party servers.

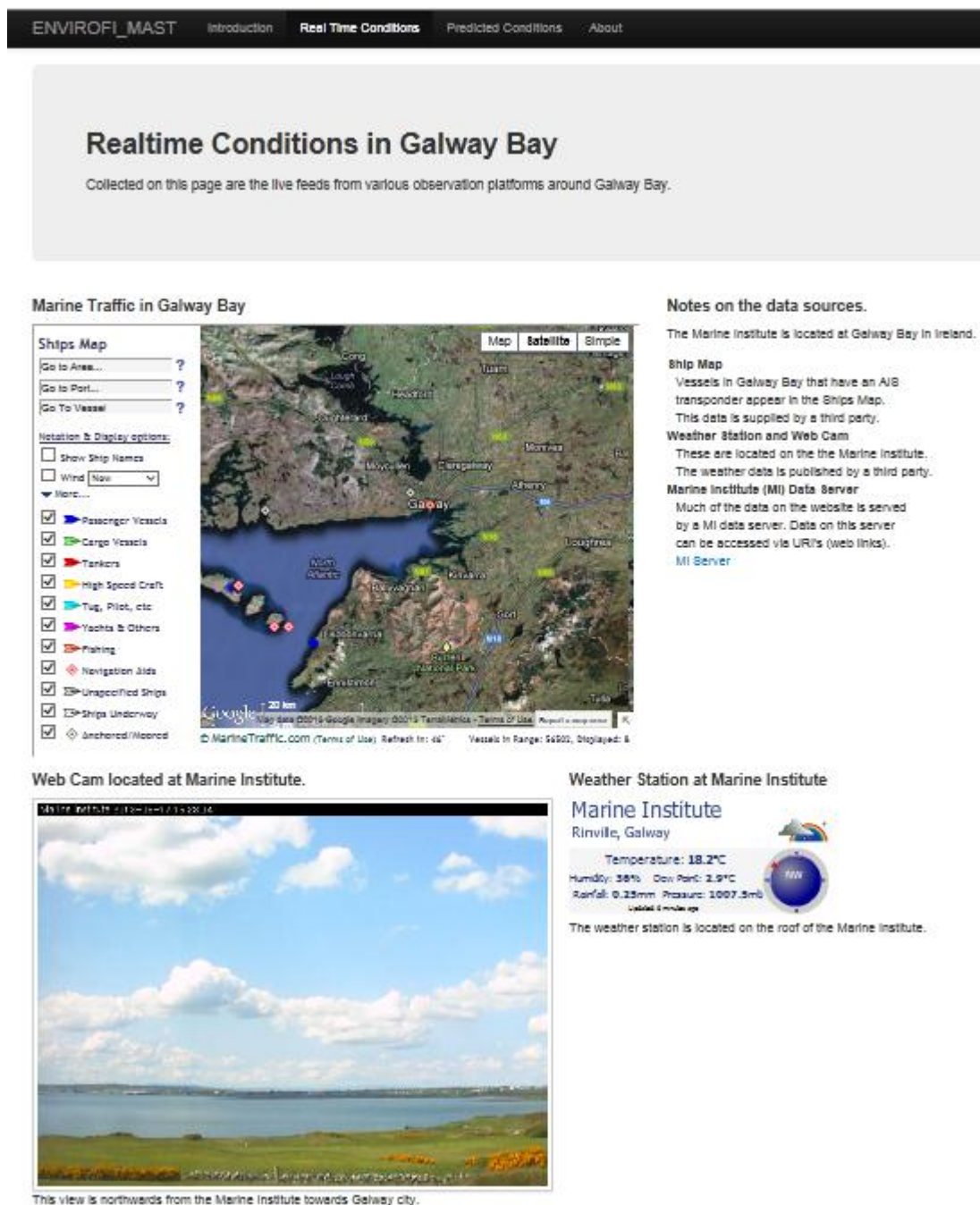


Figure 2: The Real Time Conditions tab of the MAST portal. This is the top half of the page

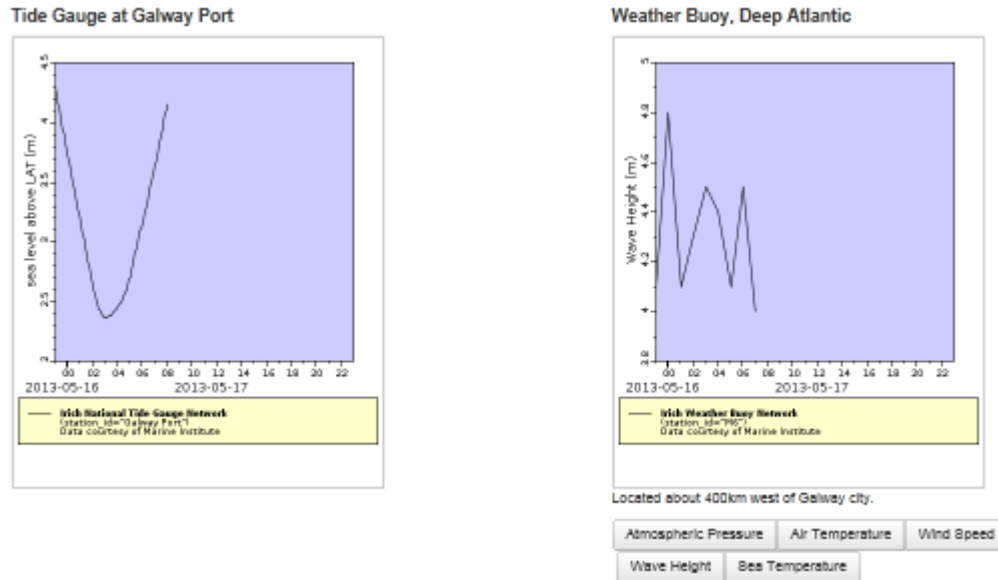


Figure 3: The Real Time Conditions tab of the MAST portal. This is the bottom half of the page

Weather Widget

This widget is displaying current weather conditions as observed close to the Marine Institute. The data is coming from a personal weather station and is being harvested by a USA based company called the Weather Underground. The widget is displaying the following data feeds:

- Temperature.
- Pressure.
- Humidity.
- Rainfall.
- Dew Point.
- Wind Speed.
- Wind Direction.

Ships Map

Ship Maps is a free third party feed of marine traffic in Galway Bay that mashes data from various sources to provide them as a “situation report” of activity in Galway Bay. The data that is being aggregated and republished in this feed are:

- Automatic Identification System (AIS): AIS is an automatic tracking system used by ships and vessel traffic services for the identifying and locating of vessels by electronically exchanging data with other nearby ships and base stations. AIS report the vessel identification, position, course and speed. These are available in the AIS data feed by clicking on the vessel icon.
- Wind forecast: The wind forecast is available by clicking on the wind forecast checkbox.
- Geospatial data is provided by Google mapping services.

This AIS data feed reports on any marine traffic that has an AIS sensor and which appear in the region of interest (Galway bay) shortly after they enter the bay, including (for example) the Irish Coast Guard helicopter.

Tide Gauge

This is a feed of the height of the tide from the tidal sensor located at Galway Port.

Atlantic Weather Buoy

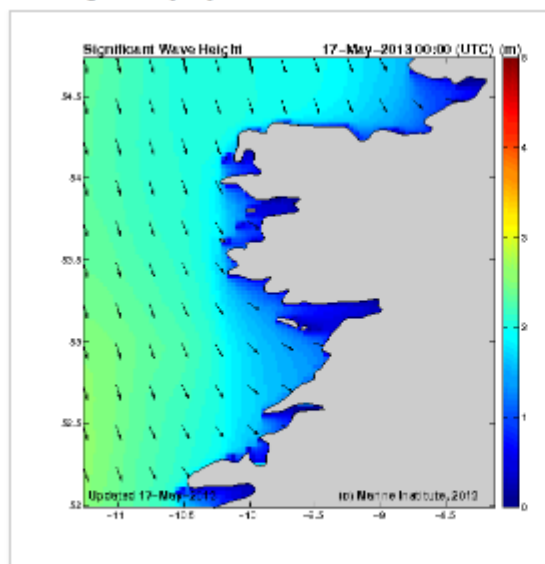
The weather buoy panel displays the latest observations from the Irish Weather Services (Met Eireann) Atlantic Ocean weather buoy. The user can choose from a number of parameters by selecting the appropriate radio button.

4.3 Predicted Conditions

The Forecast of the Sea State tab provides information that would be useful for making plans for putting to sea. Data for the widgets on the page come from;

- A fluid dynamic model of the ocean of the west coast of Ireland. The model is run on a high performance computer once a day. This model is used to drive a wave forecast model.
- The Global Forecast System weather model. This is used to provide the wind forecast.
- The predicted tide for Galway Port. This is an astronomical model of the tide.
- The twitter feed from the national weather service (Met Eireann) and from the Galway Port harbour master.

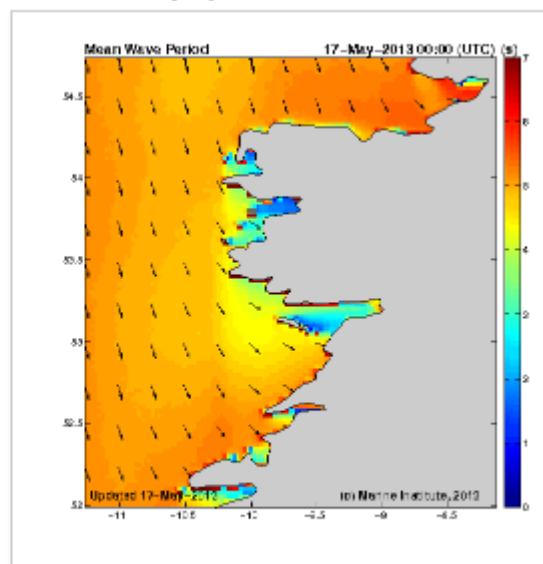
Wave Height Galway Bay



Click Next to advance forecast on by 3 hours

Previous Next

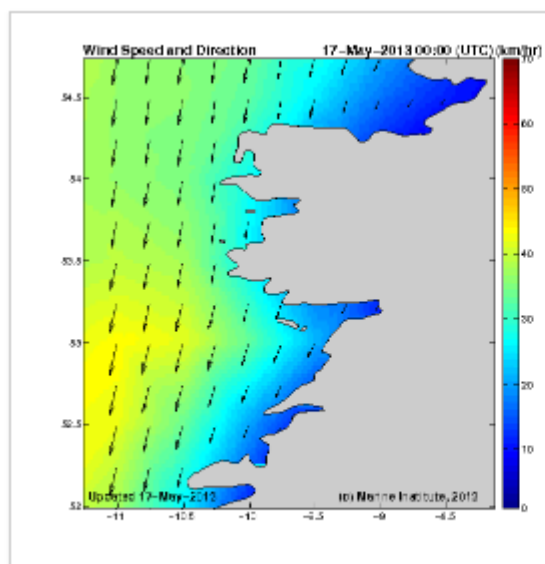
Wave Period Galway Bay



Click Next to advance forecast on by 3 hours

Previous Next

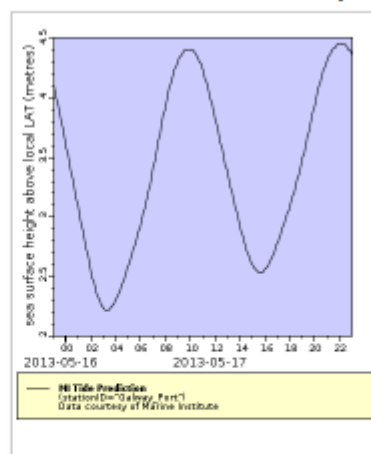
Wind Forecast



Click Next to advance forecast on by 3 hours

Previous Next

Astronomical Tide Prediction for Galway Port



Click Next to advance forecast on by 24 hours

Previous Next

Figure 4: Forecast of Sea State

Wave and Wind Vector Forecast

The wave forecast panel allows the user to choose between the forecast of the wave height or the wave period. This is done by selecting the appropriate radio button (left panel of Figure 5). By clicking on the “Next” button the forecast is increased by 3 hours up to a maximum of 3 days in advance. The wave period and height forecasts are iterated in tandem.

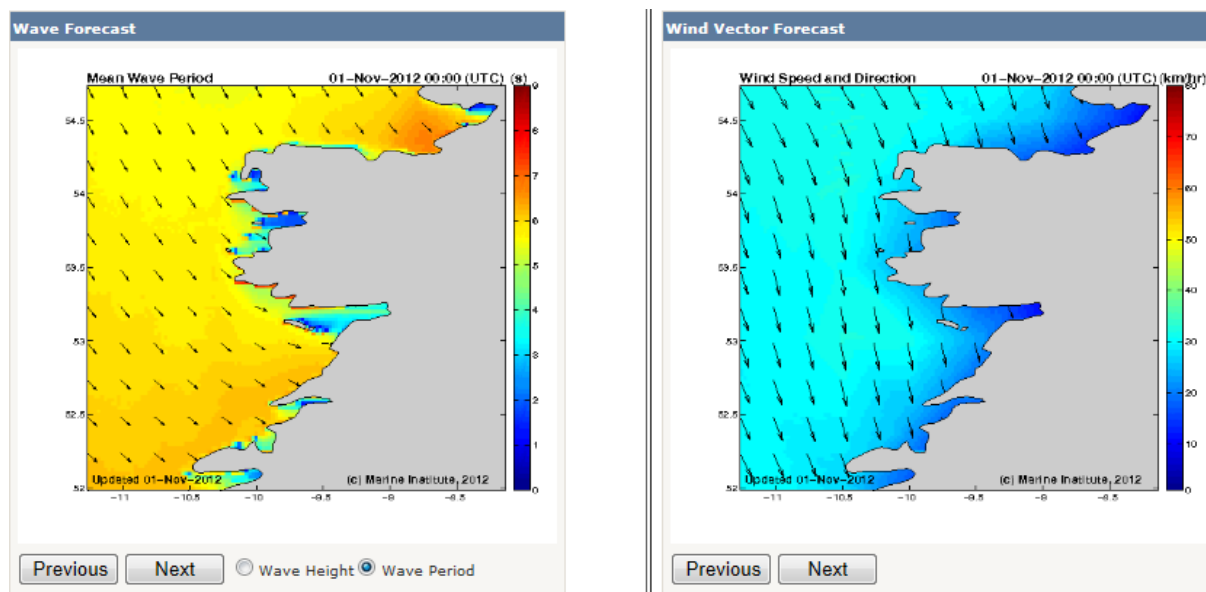


Figure 5: The wave and wind forecast

Similarly for the wind forecast the user can click the “Next” button to advance the forecast by 3 hours up to 3 days in advance.

Predicted Tide

In figure 6 are the widgets for the Galway wave buoy and the astronomical model of the tide in the Galway Bay. In the predicted tide widget the user can advance the prediction by 24 hours by clicking the “Next” button. A forecast up 3 years in advance is available.

Twitter Feed

Also illustrated in the figure 6 are the twitter feeds from the national weather service (Met Eireann) and from the Galway Port harbour master.

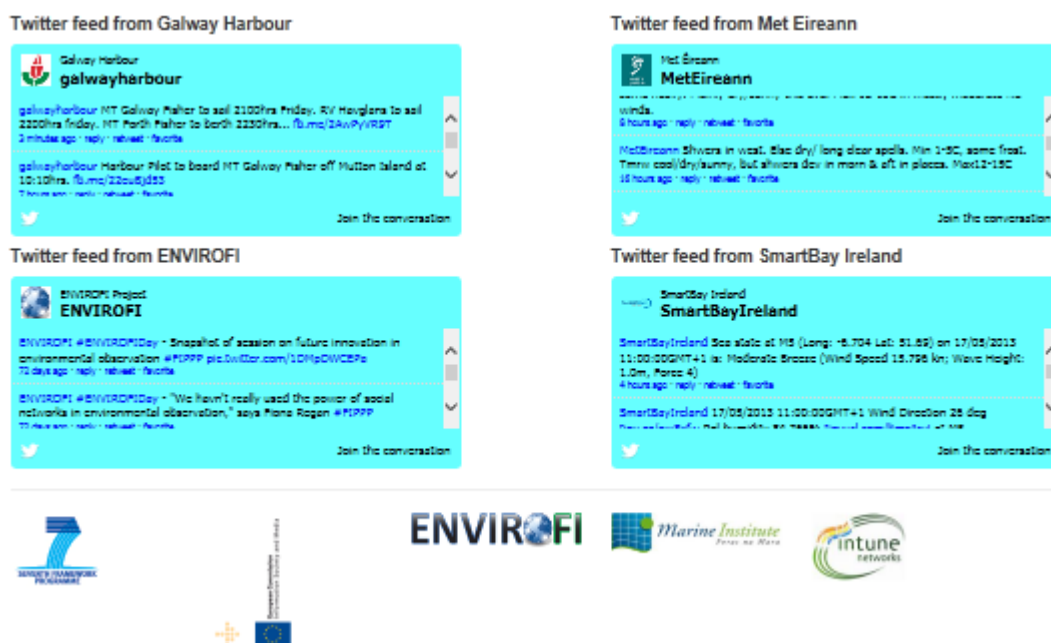


Figure 6: The twitter feed and predicted tide

5 Feedback page

The feedback form is designed to capture responses from users and stakeholders with regards to the app's functionality, usability and usefulness. It also enables the user to provide input on suggestions for improvements as well as additional features. This data will be captured during the development and testing phases of the project with the results making up part of the final deliverable documentation. This data can then be used to improve the system in any future phases. This form will be available online from the ENVIROFI Products page.

6 Release Data

The following information details the development of the ENVIROFI App and includes basic functional updates for each version so far.

Name	Date	Release Type	Technology	Data Streams	Notes
Mast Beta 1	13/10/2012	Internal	ASP.Net, C#, AJAX	<u>ERDDAP</u> : Tide Gauge, Wave Forecast, Wind Forecast, Tide Forecast, Galway Wave Buoy. <u>Third Party</u> : Weather Buoy, Weather Station, Ship Tracking.	First release
MastBeta 2	1/11/2012	Internal		Added Web Cam Feed	Service release
Mast	2/11/2012	Internal			Service release
MAST v1	6/11/2012	Production			Website Redesign
MAST v1.1	7/11/2012	Production			Service Release
MAST 1.2	13/11/2012	Production		Added Twitter feeds	Website redesign
MAST 1.3	17/11/2012	Production			Service Release
MAST 1.4	15/03/2013	Production	BootStrap, JQuery, Ajax, HTML	Removed Wave buoy added another webcam	Website redesign and move to new framework
MAST 1.5	19/03/2013	Production			Service Release
MAST 1.7	27/03/2013	Production			Release to make compatible with older browsers
MAST 1.8	2/04/2013	Production		Removed unreliable web cam feed	Service Release
MAST 1.9	09/04/2013	Production			Service Release
MAST 2.0	15/04/2013	Production			Service Release

Table: The release log for MAST (releases of Type 'Production' include and internal test release)