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Lead authors	Luis Ripollés
Contributors	Enrique Álvarez-Fanjul, Susana Pérez-Rubio, Begoña Pérez-Gómez, Marcos García-Sotillo, José María García-Valdecasas, Óscar Ballesteros, Manuel García-León, Giovanni Coppini
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## 1. Executive summary

This report presents the features and the manual for the OSPAC service (Oceanographic Services for Ports and Cities), within the framework of the EuroSea project (funded by the European Union's Horizon 2020 program, Grant Agreement 862626). OSPAC encloses a one-stop shop of met-ocean indicators and tools for the management and decision support at harbours and coastal cities. This deliverable presents its already implemented applications: (i) real time monitoring; (ii) met-ocean forecasts; (iii) floating debris; joint with the User and Administrator manuals for OSPAC.

All these applications can be managed by a common infrastructure, in which each pilot-site may have several Administrators and Users. Hence, OSPAC can be used by different types of stakeholders, each one with different requirements and access levels. These tools are added-value products from high resolution CMEMS-based forecasts (please refer to Deliverables D5.3 and D5.4), that aim to manage and control the environmental state of harbours and cities. As a demonstrator case, the Barcelona pilot-site has been successfully implemented in OSPAC. This service can be easily extended to other pilot-sites.

The OSPAC service is already available for Desktop and mobile.

## 2. OSPAC description and main features

OSPAC encloses a one-stop shop of met-ocean indicators and tools for the management and decision support at Harbours and coastal Cities. It features highly-customizable applications for the visualization and alerts of met-ocean parameters, both for real-time measurements and forecasts. This service is available for desktop and mobile.

OSPAC allows to:

- Visualize real-time met-ocean parameters (e.g. waves, sea level, wind, currents, temperature and salinity) coming from different in-situ stations (buoys, tidal stations, meteorological stations, etc.).
- Visualize met-ocean forecasts (3 days ahead) coming from high-resolution models developed within the framework of the EuroSea project (please refer to Deliverables D5.3 and D5.4).
- Create highly customizable alerts for any of the above-mentioned parameters, be it from real-time parameters or met-ocean forecasts. These alerts can be timely received by e-mail or SMS.
- Forecast floating debris lagrangian trajectories (3 days ahead), according to sources defined by the pilot-site Administrator. High resolution 3D circulation models are used as reference to estimate these lagrangian trajectories.

In addition, within the framework of the EuroSea project, the following features are also being developed:

- To forecast rip-currents (3 days ahead) with a high-resolution 3D circulation model (please refer to Deliverable D5.3).
- To forecast flushing-times maps from outcomes of a high-resolution 3D circulation model (Deliverable D5.3).
- To forecast flooding and erosion at urban beaches (3 days ahead), with outcomes from high resolution coupled wave-circulation models (Deliverable D5.3).

All these applications can be managed by a common infrastructure, in which each pilot-site may have several Administrators and Users. Hence, OSPAC can be used by different types of stakeholders, each one with different requirements and access levels. The architecture of OSPAC is divided into three main layers:

(i) *Visualization layer*: It includes the interface that Users access to view and set-up the results of the different applications (i.e. alerts, forecasts, floating debris).

(ii) *Storage layer*: It involves the database (PostgreSQL database system) that stores all the data needed to manage the app (real-time measurements, met-ocean forecasts),

(iii) *Interoperability layer*: This layer manages the connections and data transfer between the database (storage layer) and the User app (visualization layer), via a Python-based web server.

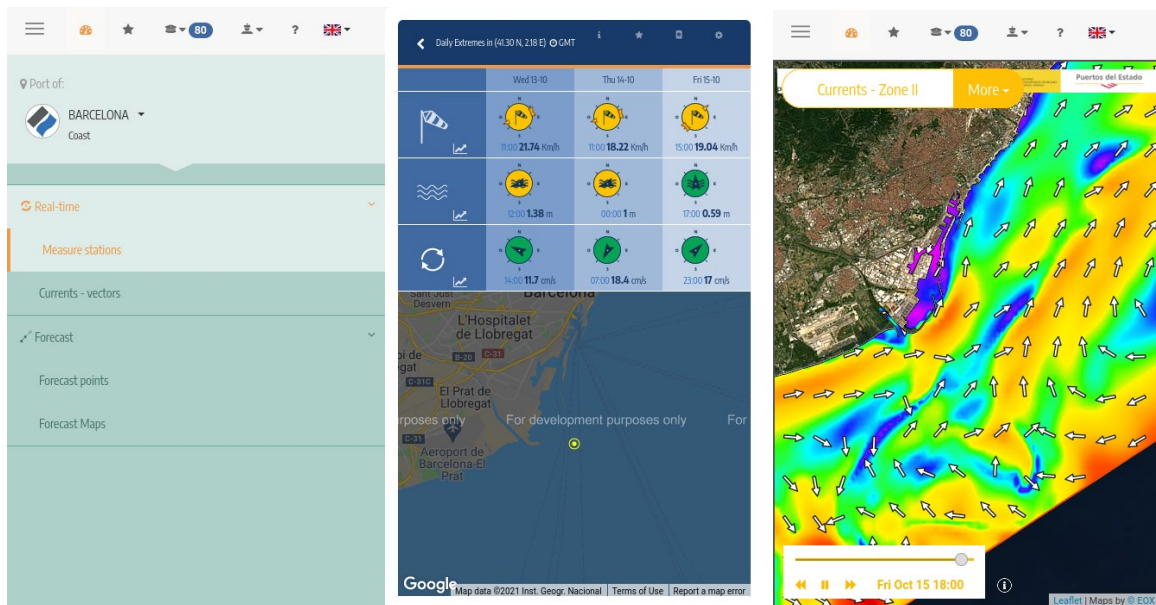


Figure 1. Screenshots of the OSPAC mobile visualization. Left: Option menu available at Barcelona harbour; Centre: Forecasts for the next 3 days for the wind (up), waves (middle) and currents (bottom); Right: Surface currents forecasts from the coastal model at Barcelona harbour (350 m horizontal resolution). The coloured areas are the surface currents and the white arrows the hourly-averaged surface current direction.

### 3. User manual

#### 3.1. Introduction

##### Previous requirements

OSPAC (Oceanographic Services for Ports and Cities) is a web app that requires Internet access for its use. The web application works on the main web browsers.

##### Supported devices

OSPAC recommends high screen resolution, since it summarises significant amount of information. The minimum tested resolution is 1024x768 pixels. It can also be used in smartphones; though not recommended, due to lack of space for map visualization.

##### Supported browsers

Please verify that you are using a supported web browser (see Table below). If your web browser is not supported, the web application may crash. Specifically, OSPAC supports the most recent versions of the following browsers and platforms:

	Chrome	Firefox	Internet Explorer	Opera	Safari
<b>Android</b>	YES	NO	-	NO	-
<b>iOS</b>	YES	-	-	NO	Partially
<b>Mac OS X</b>	YES	YES	-	YES	YES
<b>Windows</b>	YES	YES	YES	YES	NO

Internet Explorer is supported from version 9. iOS-Safari (i.e., iPad) is partially supported. In the latter case, please note that the Summary tab reloads the page to the beginning; hence, the User experience can be reduced and it may even disable the application.

##### Software requirements

Some web-browsers disable JavaScript by default. It is required to enable JavaScript for running the application.

#### 3.2. Definition

OSPAC encloses a one-stop shop of met-ocean indicators and tools for the management and decision support at harbours and coastal cities. It features a top menu, that highlights the three main blocks of the framework (*Operational Services, Administrator and User*), jointly with a lateral option menu.

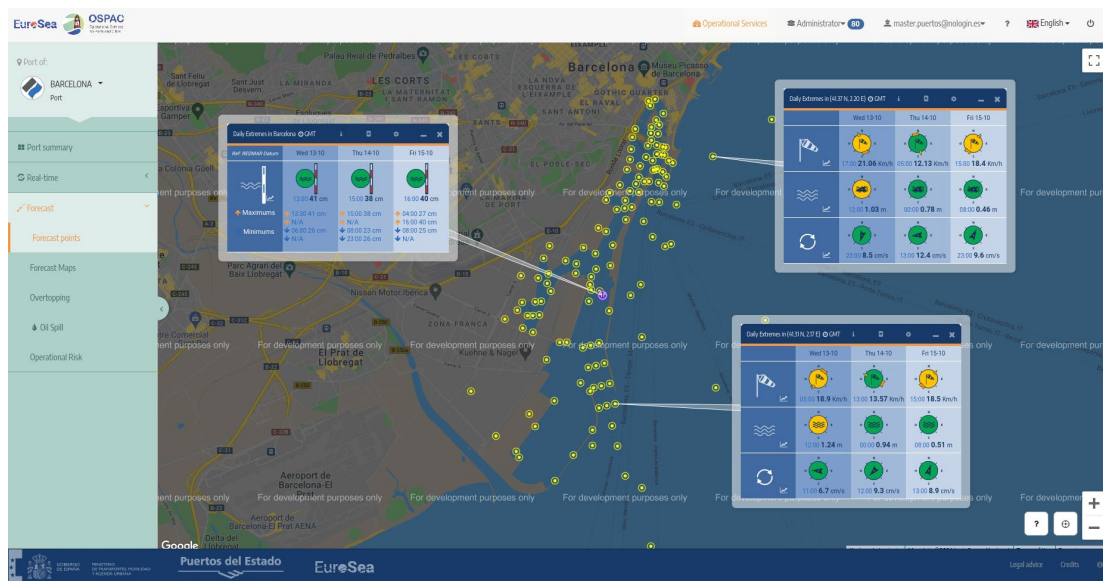


Figure 2. Screenshot of the OSPAC application (Desktop version). Forecast points at several points of the Barcelona harbour for the following met-ocean parameters: sea level (left); wind, waves and currents at the harbour entrance (center) and wind, waves and currents at the outer part of the harbour (right).

The three main blocks at the top menu not only control the main features of OSPAC, but also has a set of shortcuts, such as Help, Language, or Logging out:

## Operational Services

This block summarises the applications that display the data gathered from the different pilot-sites (in this case, demonstrators) included in the OSPAC system. These applications may vary, depending on the availability of information at each specific site. Hence, not all applications will be found at all sites. Each site may be subsetted into different views; and each view may have several applications that are listed in the lateral menu.

## Administrator

The access to this block is exclusive to the Administrator of the pilot-site application. It encloses the administration tasks of the applications at the pilot-sites subscribed to OSPAC. The Administrator can accept / deny new User requests, manage alerts, and configure site-specific threshold options.

## User

User management tasks can be carried out from this menu. The User can request access to the pilot-sites or subscribe to alerts at specific points.

## First steps

### *User registration*

A new User requires two steps prior to be fully registered:

- (i) The User data needs to be added into the system.
- (ii) The Administrator of the pilot-site needs to grant permission on at least one view.

There are two registration procedures, that will vary upon the User: (i) self-registration and (ii) administrative registration.

### *Self-registration*

It is done by Users themselves by entering their data and requesting access permissions on at least one pilot-site application.

### **Permissions types**

There are several permissions types, that are cumulative and closely linked to the pilot-site. They depend on the data availability and met-ocean sensors deployed at each pilot-site, that can strongly differ amongst sites. The available permission types are:

- (i) Basic:* It gives access to the real-time and forecasts modules.
- (ii) E-mail alerts:* It enables receiving a daily e-mail report of alerts and forecasts for a specific site.
- (iii) Alerts:* It enables receiving a daily SMS of the site forecast alerts. This SMS sending service has a cost, so it is recommended to use it exclusively when you need to receive them by SMS, and e-mail is not enough.
- (iv) Administration:* Administration and configuration of the User permissions for the pilot-site application modules. It includes all previous permissions.

### *Administrative registration*

It is carried out by a pilot-site Administrator without User intervention, entering the User's data and the sites and views that they are allowed to access.

### *Login*

Once the User has permissions for at least one pilot-site, they can enter into OSPAC by submitting their e-mail address and password. After their credentials are successfully validated, the User can access the sites and applications in which they have permissions.



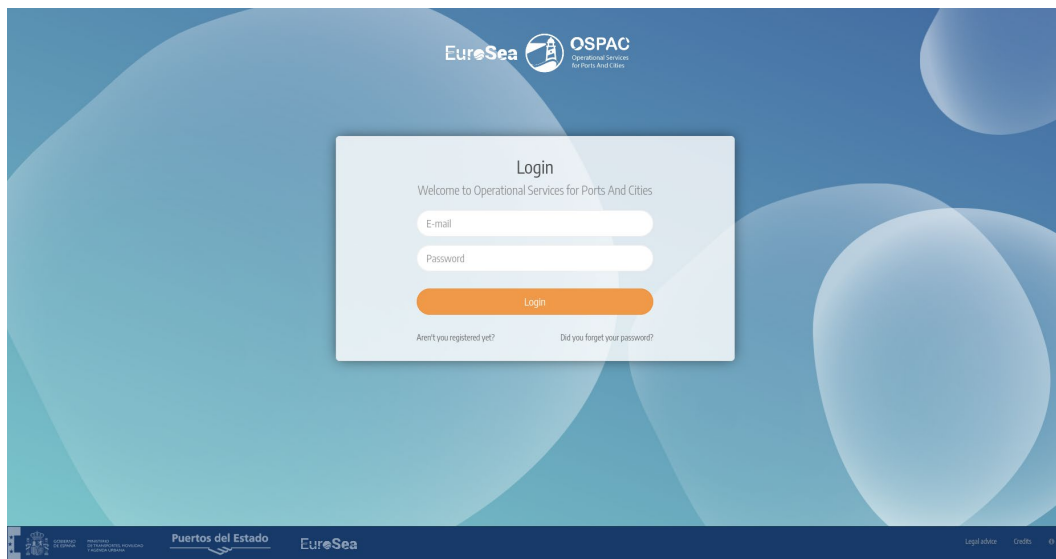


Figure 3. OSPAC Login screen

## Notifications

The notifications are found in the User menu. This feature keeps a history log with the requests made by the User. Once completed the first steps, a notification will notify the approval to the pilot-site.

The history log can be filtered by state, pilot-site and date. The items are sorted in a drop-down menu, and they can be expanded to show more information.

The procedures displayed in this screen, can be managed from the “My ports” menu.

## 3.3. My ports

### Introduction

“My ports” screen allows to modify the permission types detailed in the previous Introduction section. The system consists of a pilot-site search engine, that allows the User to filter among all the sites subscribed to OSPAC; and then, to request new permissions on the system.

### Permission request on a new pilot-site

To request permission, you just have to select the desired pilot-site and press the “request permission” button. A new window will request the confirmation of the permissions changes.

### Permission extension on an already linked pilot-site

The procedure is identical than to request permission on a new pilot: A confirmation window will be displayed detailing the requested permission extension. This window will modify the existing permissions, expanding or reducing their scope.


In both cases, the permission is not granted automatically. Permissions must be confirmed by the Administrator. Once the permission has been granted or denied by the Administrator, the User will receive the reply in the "Notifications" menu.




## 3.4. Thresholds

Users can adjust tailor-made thresholds associated with the met-ocean parameters. Please note that changes in these thresholds will modify the thresholds linked to the User, and that these are used in various parts of OSPAC, such as graphs and some types of alerts. Hence, once they are modified, that change will be also reflected in these applications.

### Default thresholds

The default thresholds are those identified with the switch on icon , which has been set-up by the Administrator. In case the switch is on, the User will see the thresholds recommended for that point by the pilot-site Administrator. In case that the Administrator does not set specific thresholds, global thresholds will be used instead.

### User thresholds

User thresholds are activated when the switch icon is off . Then, thresholds for a given point can be customized to own experience, covering the different needs of the Users.

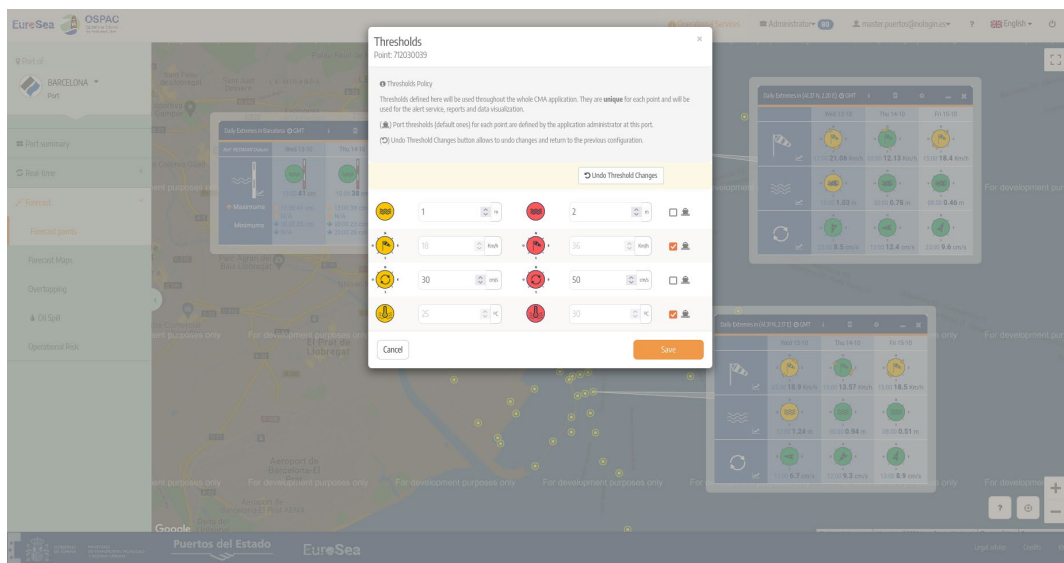


Figure 4. Option menu for changing the thresholds at a specific point

## 3.5. Alert system

One of the key features of OSPAC is the alert system, that allows to receive warning about the state of the sea, either based on real-time monitoring or based on forecasts. The main characteristics of the alert system are the following:

- The **alerts** are associated with a **monitoring station** or a **specific point** in the pilot-site.

- Alerts may include a set of **filters**: (i) by directions in the case of directional variables (wind, currents, ocean waves); and/or (ii) by parameters related to the wave period.
- Notices can be received **by e-mail or SMS**. Please note that e-mail alerts send more detailed information than those ones sent by SMS.
- There are two options to define the alerts: (i) by User-defined thresholds for specific points/stations (please refer to Section 3.4.), (ii) by thresholds specifically defined for that alert. Please note that if the User-defined thresholds option is activated, any change in the thresholds will affect the result of that alert. However, in case that the thresholds are specific for the alert, these thresholds will not be modified unless specific modifications on the alert configuration.

## Alert types

There are two alert types, that depend on the two main sources of information: (i) real time (monitoring stations) and (ii) forecasts (from numerical models).

**Real time alerts:** They are generated from the measurements received from the **monitoring stations** in real time. If the data sent by the monitoring station matches the criteria set in the alert, a warning is issued.



**Forecast alerts:** They are generated from the available **forecasts** at a specific point for the **next 72 hours**. Regardless there is an alert or not, the User receives a daily report that informs about the state of the sea in the forthcoming 3 days.

Given the potential wide range of needs that Users may have, OSPAC includes three types of alerts according to their origin of creation: (i) Global alerts; (ii) from the Administrator (Pilot-site alerts); (ii) from Users (Private alerts).

The **Global alerts** are those alerts that have thresholds by default in OSPAC. Global thresholds are superseded by thresholds defined by the Administrator or by the Users.

The **Pilot-site alerts** are defined by the Administrator who can also subscribe these alerts to specific Users. In addition, any User can subscribe to these alerts. In the application these alerts are associated with the icon



The **Private alerts** are User-defined and any other User can subscribe to them. If the particular alert has been defined by the User themselves, the icon  will be associated in the application. However, if the User is not the owner (they have subscribed to an existing particular alert), the associated icon will be .

## Thresholds

When an alert is created at a forecast point or measurement station, it is required to define two thresholds for assessing the state of the alert.

Then, Users can choose between two options by using a sliding button:

**User thresholds:** These are User-defined in OSPAC for a given point or station. They are the same that are used in the visualization of the data. Please note that any modification in these thresholds will affect the result of the alert. If the User does not have customised thresholds for that point or station, those defined by the Administrator will be used instead. In the latter case, the associated icon will appear as marked.

**Fixed thresholds:** The User can select this type of threshold to define values specifically for that alert. Once defined, these thresholds will be fixed and can only be edited by the User who owns the alert.

### Real-time alerts

If the User subscribes to an alert, they will **receive e-mails and/or SMS messages** with the state of the alert, denoting any relevant changes in its status. Six types of messages can be received:

**(i) Alert activation:** It will imply that the alert activation criteria for a given threshold (red, yellow) have been exceeded.

**(ii) Alert deactivation:** It will imply that the alert activation criteria for the given threshold (red, yellow) are no longer exceeded. Consequently, the alert period is considered as finished.

**(iii) Increase in the alert level:** In case that the yellow alert is active, the met-ocean parameter has exceeded the red threshold and the alert changes from yellow to red.

**(iv) Decrease in the alert level:** In case that the red alert is active, the met-ocean parameter no longer exceeds the red level threshold after a certain period of time, but the value is still above yellow. Hence, the level is updated from red to yellow.

**(v) No Data:** No data is being received from the station. Therefore, the alert level cannot be calculated.

**(vi) No alert:** Data is available, but no threshold is exceeded (green level). This message will be received after a period where no data is available.

### *Communication sending frequency*

Alerts are **checked every 5-20 minutes**, depending on the sampling period of the associated sensor. The sending frequency severely depends on how the alert evolves throughout time.



Once an alert is activated and notified, **no further communication** will be received until either its **alert level is updated**, or it is **completely deactivated**.

With the aim of minimising the number of messages to Users, that can lead to ineffective action, both the deactivation of the alert and the decrease in its level are not immediately communicated to the User. Instead, in these specific cases, **the system uses latency times as reference**, that may vary in a range from 1h to 4h (depending on the sensor sampling). Hence, the system checks that the met-ocean parameter remains in the same range during its latency time, prior to sending a message to the User.

In the following table, it can be found data related to the evaluation frequency, latency time and the time interval that must have passed prior to be considered that there is no data for the assessment of the alert. Please note that all these parameters depend on the sensor sampling period.

Sensor sampling frequency (min)	Frequency of the alert evaluation (every X min)	Latency (min)	Time interval for determining the state "without data" (min)
<b>T ≤ 1</b>	5	60	60
<b>1 &lt; T &lt; 20</b>	10	60	60
<b>T &gt; 20</b>	20	240	240

### Subscription to an existing alert: Pilot-site or Private alert

The User can subscribe to an existing alert, be it Pilot-site specific or Private. Pilot-site alerts are those defined by the Administrator, and they have associated the following icon . Private alerts are those created by other Users, and they have associated the icon .

The User can subscribe by following 4 steps: (i) select the pilot-site, (ii) select a given point, (iii) select the alert and (iv) its delivery type. In the case of sending by e-mail, please select what additional information is to be sent.

Please note that if the subscribed alert has been defined according to the User's thresholds, any change made to these thresholds will modify the evaluation of the alert. For further information on thresholds, please refer to Section 3.4..

### Creation of a Private alert




The creation of a Private alert differs from subscribing to a Pilot-site alert from the second step in the previous menu. The User has to select at that moment: *Unable to find the alert you need? Create a new customized alert*. Once selected, the User will be able to access the configuration of the Private alert.

Private alerts allow the User to set-up the alert with suitable criteria and filters. For instance, a criterion for the alert can be the significant wave height, and the peak period as a filter. The existing criteria and filters depend on the station and the available sensors.

When creating a Private alert, it is needed to define two thresholds to compute its status. The types of thresholds and their configuration can be referred in Section 3.4..

### Further operations with the alerts

Additionally, from the initial alert menu, it can be performed several operations, such as Unsubscribe / Delete, Modify / View and Mute. In those alerts created by third parties, only the Unsubscribe and View options will be displayed.

There are two types of third-party alerts: (i) those created by the Administrator (Pilot-site alerts), with the icon ; and (ii) those from other Users (Private alerts), associated with the icon . Hence, the Delete and Modify options will only be shown in those alerts owned by the User (icon ). In all cases, from the alert menu, the User can:

- Mute the alert, in case the User wants to temporarily stop receiving notifications.

- Modify the sending method (e-mail / SMS).

## Forecast alerts



Forecast alerts are those based on the forecast data available at the selected point for the next 72 hours (3 days). In this alert type, the notification with the result of the evaluation of the alert is always done, at a specific time, regardless of whether the thresholds are exceeded.

If the User subscribes to an alert, they will receive e-mails and/or SMS messages, at least with daily frequency. Three types of messages can be received:

- (i) If there is no data, the User will receive in a message that forecasts are not available.
- (ii) If there is data but the alert activation criteria have not been exceeded, the User will receive in a message that there is no alert.
- (iii) If there is data and the alert activation criteria have been exceeded, the User will receive a message about the activation times and alert levels.

The OSPAC system is able to notify daily alerts every 12 hours, at 8 in the morning and at 8 in the evening. Users are able to subscribe to both alerts, or to just one of them. In case of the implemented coastal circulation system (be it currents, salinity or water temperature), the subscription will be only delivered once per day, in the early afternoon.

### *Subscription to an existing alert: Pilot-site or Private alert*

The User can subscribe to an existing alert, be it Pilot-site specific or Private. Pilot-site alerts are those defined by the Administrator, and they have associated the following icon . Private alerts are those created by other Users, and they have associated the icon .

The User can subscribe by following 4 steps: (i) select the pilot-site, (ii) select a given point, (iii) select the alert and (iv) its delivery type. In the last step, the Users must choose the sending method (SMS or e-mail) and the delivery time slot (be it early morning and/or afternoon).

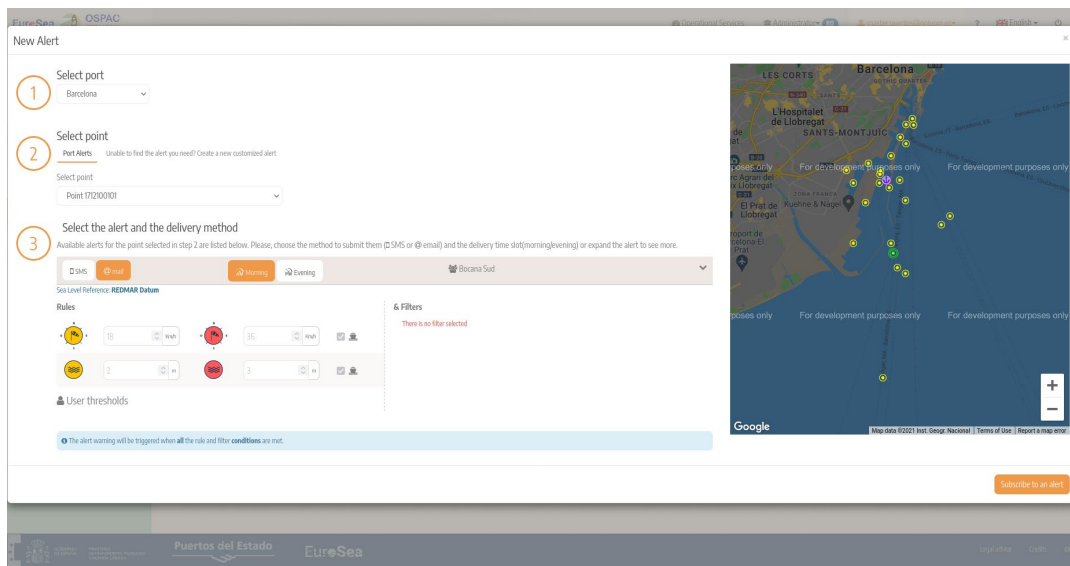


Figure 5. Option menu for creating a new Forecast alert

### Creation of a Private alert




The creation of a Private alert differs from subscribing to a Pilot-site alert from the second step in the previous menu. The User has to select at that moment: *Unable to find the alert you need? Create a new customized alert*. Once selected, the User will be able to access the configuration of the Private alert.

Private alerts allow the User to set-up the alert with suitable criteria and filters. For instance, a criterion for the alert can be the significant wave height, and the peak period as a filter. The existing criteria and filters depend on the chosen point, and the forecast available at that point.

When creating a Private alert, it is needed to define two thresholds to compute its status. These thresholds can be global or User-defined. In the User-defined option, please note that any change in the thresholds will modify the evaluation and result of the alert. The types of thresholds and their configuration can be referred in Section 3.4..

### Further operations with the alerts

Additionally, from the initial alert menu, it can be performed several operations, such as Unsubscribe / Delete, Modify / View and Mute. In those alerts created by third parties, only the Unsubscribe and View options will be displayed.

There are two types of third-party alerts: (i) those created by the Administrator (Pilot-site alerts), with the icon ; and (ii) those from other Users (Private alerts), associated with the icon . Hence, the Delete and Modify options will only be shown in those alerts owned by the User (icon ). In all cases, from the alert menu, the User can:

- Mute the alert, in case the User wants to temporarily stop receiving notifications.

- Modify the sending method (e-mail / SMS).
- Modify the time slot for the alert delivery (except from those alerts that include currents, salinity or water temperature; in these specific parameters, the delivery is only available for the afternoon).

## 3.6. Settings

### Introduction

In this section the User can set the OSPAC options, such as the language, the home page, etc. It can also be defined the units in which the OSPAC parameters will be displayed.

### OSPAC Home Page Settings

The configuration of the OSPAC home page requires three parameters: (i) the pilot-site, (ii) the view and (iii) the application that the User wants to open by default.

### Preferred Language Settings

The preferred language setting is the language in which OSPAC will load by default. Note that the User can occasionally change the language momentarily from the top menu language option. On the next reload of OSPAC, though, the application will return to the default language.

### Map Display Type Settings

OSPAC uses the Google Maps library, which allows two views: (i) vector view and (ii) satellite view. The vector view is recommended for slow Internet connections or low-performance computing devices, since it is much lighter than the satellite view.

### Setting the General Units of Measure

The main application parameters and their corresponding measure units are displayed.

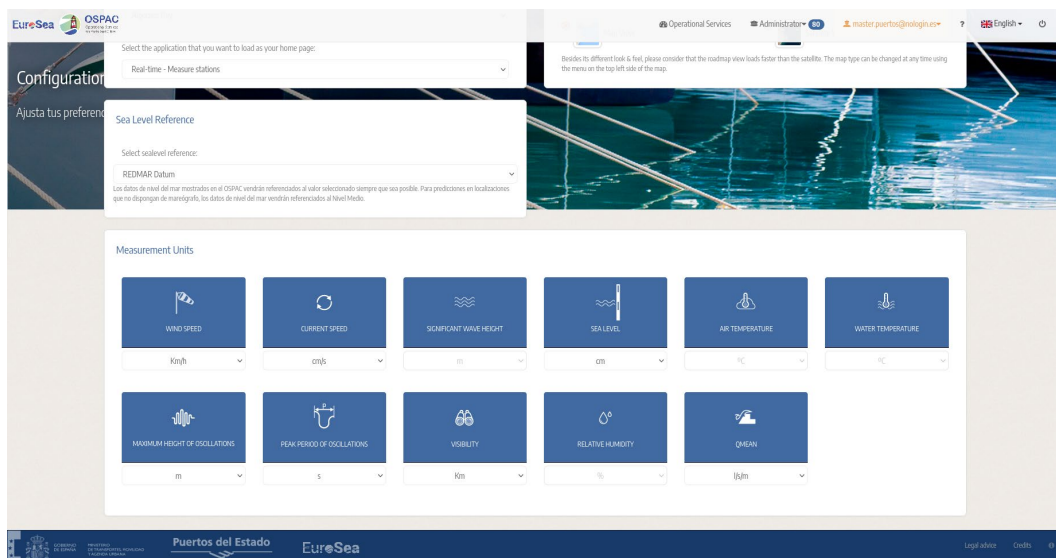


Figure 6. Settings screen for changing the General Units of Measure



### 3.7. Profile

#### **Introduction**

The User can configure their User profile at any time through the User profile menu.

#### **Change of personal data**

Personal data such as Name, Last Name, Organization or Position, can be changed at any time. However, there are restrictions on changing the e-mail. Once an e-mail has been registered, the User cannot change it again.

#### **User password change**

The User's password can be changed from this screen. The User only needs to know the old password and type twice - to confirm - the new password.

## 4. Administrator manual

### 4.1. Introduction

#### Previous requirements

OSPAC (Oceanographic Services for Ports and Cities) is a web app that requires Internet access for its use. The web application works on the main web browsers.

#### Supported devices

OSPAC recommends high screen resolution, since it summarises significant amount of information. The minimum tested resolution is 1024x768 pixels. It can also be used in smartphones; though not recommended, due to lack of space for map visualization.

#### Supported browsers

Please verify that you are using a supported web browser (see Table below). If your web browser is not supported, the web application may crash. Specifically, OSPAC supports the most recent versions of the following browsers and platforms:

	Chrome	Firefox	Internet Explorer	Opera	Safari
<b>Android</b>	YES	NO	-	NO	-
<b>iOS</b>	YES	-	-	NO	Partially
<b>Mac OS X</b>	YES	YES	-	YES	YES
<b>Windows</b>	YES	YES	YES	YES	NO

Internet Explorer is supported from version 9. iOS-Safari (i.e. iPad) is partially supported. In the latter case, please note that the Summary tab reloads the page to the beginning; hence, the User experience can be reduced and even it may disable the application.

#### Software requirements

Some web-browsers disable JavaScript by default. It is required to enable JavaScript for running the application.

### 4.2. Definition

OSPAC encloses a one-stop shop of met-ocean indicators and tools for the management and decision support at harbours and coastal cities. It features a top menu, that highlights the three main blocks of the framework (*Operational Services, Administrator and User*), jointly with a lateral option menu.

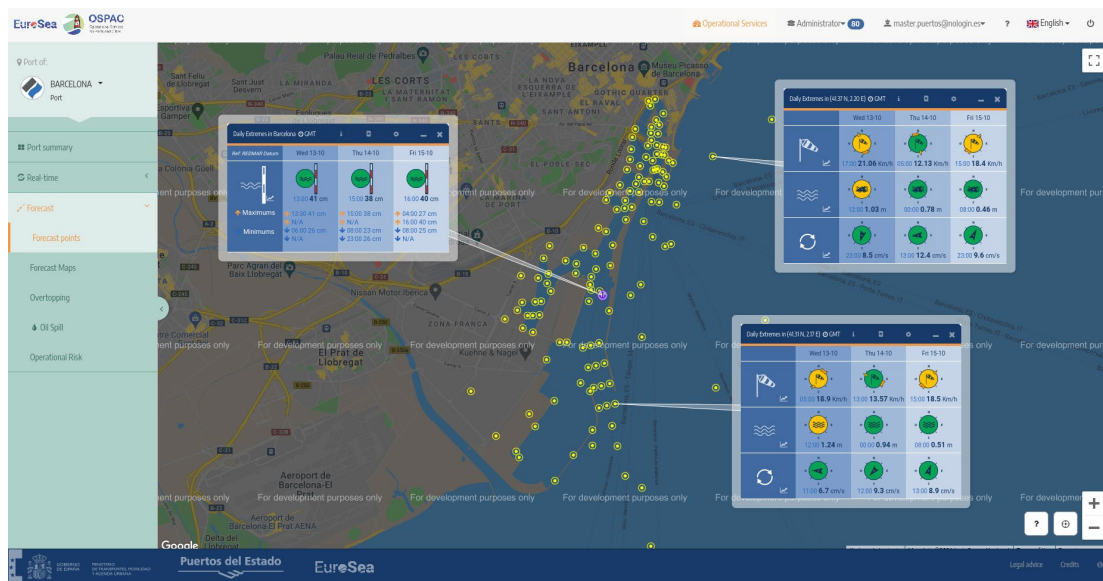


Figure 7. Screenshot of the OSPAC application (Desktop version). Forecast points at several points of the Barcelona harbour for the following met-ocean parameters: sea level (left); wind, waves and currents at the harbour entrance (center) and wind, waves and currents at the outer part of the harbour (right).

The three main blocks at the top menu not only control the main features of OSPAC, but also has a set of shortcuts, such as Help, Language, or Logging out:

## Operational Services

This block summarises the applications that display the data gathered from the different pilot-sites (in this case, demonstrators) included in the OSPAC system. These applications may vary, depending on the availability of information at each specific site. Hence, not all applications will be found at all sites. Each site may be subsetting into different views; and each view may have several applications that are listed in the lateral menu.

## Administrator

The access to this block is exclusive to the Administrator of the pilot-site application. It encloses the administration tasks of the applications at the pilot-sites subscribed to OSPAC. The Administrator can accept / deny new User requests, manage alerts, and configure site-specific threshold options.

## User

User management tasks can be carried out from this menu. The User can request access to the pilot-sites or subscribe to alerts at specific points.

## First steps

### *Administrator registration*

A new Administrator requires two steps prior to be fully registered:

- (i) The User data needs to be added into the system.
- (ii) Admin permission granted on at least one pilot-site by the pilot-site manager.

There are two registration procedures: self-registration and administrative registration.

### *Self-registration*

It is done by Users themselves by entering their data and requesting access permissions on at least one pilot-site application.

### *Permissions types*

There are several permissions types, that are cumulative and closely linked to the pilot-site. They depend on the data availability and met-ocean sensors deployed at each pilot-site, that can strongly differ amongst sites. The available permission types are:

- (i) *Basic*: It gives access to the real-time and forecasts modules.
- (ii) *E-mail alerts*: It enables receiving a daily e-mail report of alerts and forecasts for a specific site.
- (iii) *Alerts*: It enables receiving a daily SMS of the site forecast alerts. This SMS sending service has a cost, so it is recommended to use it exclusively when you need to receive them by SMS, and e-mail is not enough.
- (iv) *Administration*: Administration and configuration of the User permissions for the pilot-site application modules. It includes all previous permissions.

## **Converting an existing User into an Administrator User**

It can be done either (i) by an existing Administrator that upgrades the User's permissions or (ii) by the User requesting new permissions on the pilot-site.

### *Administration menu*

Once the Administrator has permissions to manage a pilot-site, they can enter the portal by entering their e-mail address and password, as another User. Please note that the upper menu shows an administration screen that the rest of the Users do not have access. The Administrator menu is in charge of User management and administration. The administrative sub-menus are the following:

- (i) *Requests*: Allows the Administrator to manage (list / approve / deny) the different requests for access permissions to pilot-sites and User registrations.
- (ii) *Users*: Allows the Administrator to manage the Users of the pilot-sites.
- (iii) *Alerts*: Allows the Administrator to manage and configure alerts.

(iv) *Configuration*: Allows the Administrator to set-up the general parameters of the pilot-site, as well as each of the module or applications within OSPAC.

## 4.3. Requests

### Introduction

This screen allows accepting or denying requests for User registration in new pilot-sites or modification of permissions on a pilot-site. Requests can be filtered by Status (Pending, Denied, Accepted), User, Pilot-site, or Date. Items are drop down and expand to show more information.

### Accept / Deny a request

To accept or deny a request, simply fill in the comments field, and press the “Grant Permissions” or “Reject all Permissions” button. Prior to press the “Grant Permissions” button, the Administrator can modify any request done by the User.

## 4.4. Users

### Introduction


The User screen aims to manage all the Users that are administered at a given pilot-site.

### New User


A new User can be created through the request/notifications system that was previously explained, or the Administrator can create new Users associated with their pilot-site without the need for User intervention. In the latter case, the Administrator has to press the “New User” button located at the bottom right of the screen and fill in the form with the requested data.

### Delete User


In the interface there are two ways to delete a User: (i) in massive operations (several Users at once), by pressing the “delete” button located at the bottom right of the interface; (ii) individually (one User at once),

by pressing the icon .

### Modify User

The icon  allows to increase the permissions or roles granted on the pilot-site. All data except e-mail can be changed. If the User runs out of roles activated in the pilot-site, it will be automatically deleted from that pilot-site, but not from the system. The User will not be completely deleted from the system until they run out of roles at all the pilot-sites included in OSPAC.

### Password change

A User password can be changed in the icon . A pop-up will request the following:

- (i) The password of the Administrator who will change the User password.
- (ii) The new User password.
- (iii) Confirmation of the new User password.

## 4.5. Alert system

One of the key features of OSPAC is the alert system, that allows to receive warning about the state of the sea, either based on real-time monitoring or based on forecasts. The main characteristics of the alert system are the following:

- The **alerts** are associated with a **monitoring station** or a **specific point** in the pilot-site.
- Alerts may include a set of **filters**: (i) by directions in the case of directional variables (wind, currents, ocean waves); and/or (ii) by parameters related to the wave period.
- Notices can be received **by e-mail or SMS**. Please note that e-mail alerts send more detailed information than those ones sent by SMS.
- There are two options to define the alerts: (i) by User-defined thresholds for specific points/stations, (ii) by thresholds specifically defined for that alert. Please note that if the User-defined thresholds option is activated, any change in the thresholds will affect the result of that alert. However, in case that the thresholds are specific for the alert, these thresholds will not be modified unless specific modifications on the alert configuration.

The Administrator can set-up Pilot-site alerts and User-specific alerts. If the Administrator manages several pilot-sites, a first screen will summarise a selection list with the pilot-sites. In case that the Administrator only manages one pilot-site, the screen will move directly to the administration page of the alerts.

### Alert types

There are two alert types, that depend on the two main sources of information: (i) real time (monitoring stations) and (ii) forecasts (from numerical models).

**Real time alerts:** They are generated from the measurements received from the **monitoring stations** in real time. If the data sent by the monitoring station matches the criteria set in the alert, a warning is issued.



**Forecast alerts:** They are generated from the available **forecasts** at a specific point for the **next 72 hours**. Regardless there is an alert on not, the User receives a daily report that informs about the state of the sea in the forthcoming 3 days.

Given the potential wide range of needs that Users may have, OSPAC includes three types of alerts according to their origin of creation: (i) Global alerts; (ii) from the Administrator (Pilot-site alerts); (ii) from Users (Private alerts).

The **Global alerts** are those alerts that have thresholds by default in OSPAC. Global thresholds are superseded by thresholds defined by the Administrator or by the Users.

The **Pilot-site alerts** are defined by the Administrator who can also subscribe these alerts to specific Users. In addition, any User can subscribe to these alerts. In the application these alerts are associated with the icon



The **Private alerts** are User-defined and any other User can subscribe to them. If the particular alert has been defined by the User themselves, the icon  will be associated in the application. However, if the User is not the owner (they have subscribed to an existing particular alert), the associated icon will be .

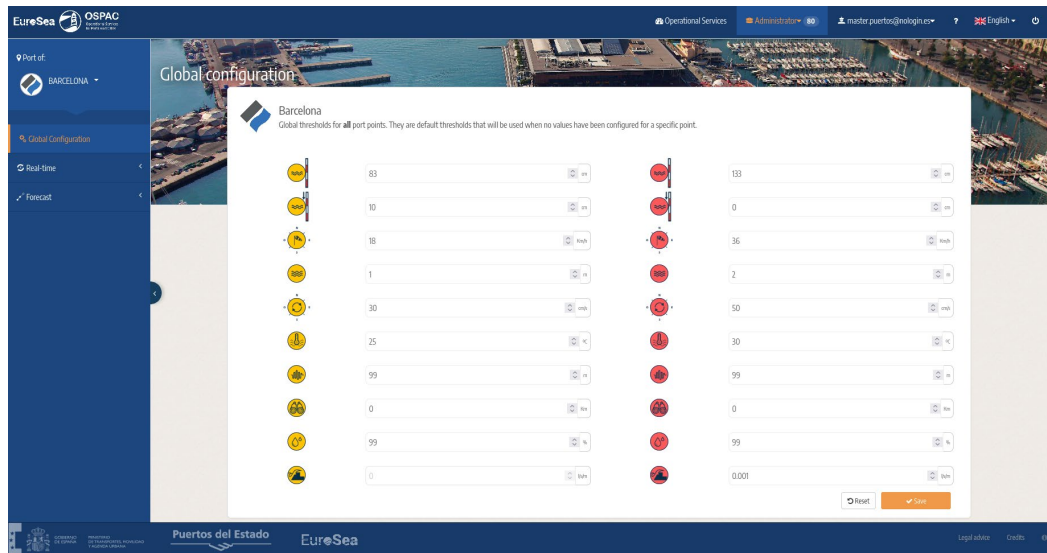


Figure 8. Option menu for defining the global thresholds for all points

## Real time alerts

If the User subscribes to an alert, they will **receive e-mails and/or SMS messages** with the state of the alert, denoting any relevant changes in its status. Six types of messages can be received:

- (i) **Alert activation:** It will imply that the alert activation criteria for a given threshold (red, yellow) have been exceeded.
- (ii) **Alert deactivation:** It will imply that the alert activation criteria for the given threshold (red, yellow) are no longer exceeded. Consequently, the alert period is considered as finished.
- (iii) **Increase in the alert level:** In case that the yellow alert is active, the met-ocean parameter has exceeded the red threshold and the alert changes from yellow to red.
- (iv) **Decrease in the alert level:** In case that the red alert is active, the met-ocean parameter no longer exceeds the red level threshold after a certain period of time, but the value is still above yellow. Hence, the level is updated from red to yellow.
- (v) **No Data:** No data is being received from the station. Therefore, the alert level cannot be calculated.
- (vi) **No alert:** Data is available, but no threshold is exceeded (green level). This message will be received after a period where no data is available.



## Communication sending frequency

Alerts are **checked every 5-20 minutes**, depending on the sampling period of the associated sensor. The sending frequency severely depends on how the alert evolves throughout time.

Once an alert is activated and notified, **no further communication** will be received until either its **alert level is updated**, or it is **completely deactivated**.

With the aim of minimising the number of messages to Users, that can lead to ineffective action, both the deactivation of the alert and the decrease in its level are not immediately communicated to the User. Instead, in these specific cases, **the system uses latency times as reference**, that may vary in a range from 1h to 4h (depending on the sensor sampling). Hence, the system checks that the met-ocean parameter remains in the same range during its latency time, prior to sending a message to the User.

In the following table, it can be found data related to the evaluation frequency, latency time and the time interval that must have passed prior to be considered that there is no data for the assessment of the alert. Please note that all these parameters depend on the sensor sampling period.


Sensor sampling frequency (min)	Frequency of the alert evaluation (every X min)	Latency (min)	Time interval for determining the state "without data" (min)
<b>T ≤ 1</b>	5	60	60
<b>1 &lt; T &lt; 20</b>	10	60	60
<b>T &gt; 20</b>	20	240	240

## Pilot-site alert


### Creation of a Pilot-site alert

To create a new Pilot-site alert in which Users can subscribe, please go to the Pilot-site alerts tab and set-up the new alert parameters.

### Add Users to a Pilot-site alert

To add Users to a Pilot-site alert, the Administrator has to click . A list with all the Users that have the alerts permission active will be shown. Then, the Administrator has to select the Users that will receive the Pilot-site alerts.

### Mute a Pilot-site alert for all the Users

There exists an option that allows you to temporarily unsubscribe an alert, to make it inactive, without needing to delete it from the list of alerts. The mute mode can be activated/deactivated with the icon .

### Delete a Pilot-site alert

To remove the alert from the list, please press the icon .

## *Private alert*

### **Creation of a Private alert**


The most usual way to create a Private alert is from the own User alerts menu, in order to allow the User to create a tailor-made alert, as indicated in the OSPAC User Manual. It is recommended to use this approach. However, there is an additional option that lets the Administrator to control third-party alerts. In this latter case, the Administrator will be able to construct the criteria and alert filters, and also, they will be able to select the following threshold parameters:

**-User thresholds:** For the evaluation of the Private alert, the User's own thresholds for the station in the OSPAC application will be used; regardless of what the Administrator puts in that section.

**-Fixed thresholds:** These are specific thresholds for the Private alert. Once defined, the thresholds will be fixed and can only be modified by editing the alert.

To create a particular alert, click on the New Alert button, located at the bottom of the screen.


### **Mute a Private alert**

The mute mode for a Private alert can be activated/deactivated with the icon .

### **Mute all Private alerts at a point**

In order to mute all Private alerts at a point, it is needed to filter by Place, writing the point code, selecting all the elements on the lateral side of the table, and press the Mute Alert button at the left area of the screen.

### **Delete a Private alert**

To remove a Private alert from the list, please press the icon . Several alerts can be removed at once, by using the button at the bottom left of the screen.

## Forecast alerts

Forecast alerts are those based on the forecast data available at the selected point for the next 72 hours (3 days). In this alert type, the notification with the result of the evaluation of the alert is always done, at a specific time, regardless of whether the thresholds are exceeded.

If the User subscribes to an alert, they will receive e-mails and/or SMS messages, at least with daily frequency. Three types of messages can be received:

- (i) If there is no data, the User will receive in a message that the forecasts are not available.
- (ii) If there is data but the alert activation criteria have not been exceeded, the User will receive in a message that there is no alert.
- (iii) If there is data and the alert activation criteria have been exceeded, the User will receive a message about the activation times and alert levels.

The OSPAC system is able to notify daily alerts every 12 hours, at 8 in the morning and at 8 in the evening. Users are able to subscribe to both alerts, or to just one of them. In case of the implemented coastal circulation system (be it currents, salinity or water temperature), the subscription will be only delivered once per day, in the early afternoon.

## *Pilot-site alert*


### **Creation of a Pilot-site alert**

To create a new Pilot-site alert in which Users can subscribe, please go to the Pilot-site alerts tab and set up the new alert parameters. It is required to define two thresholds for assessing the state of the alert. Then, the Administrator can choose between two options by using a sliding button:


**Pilot-site thresholds:** These are determined by the Administrator for the point or station in the OSPAC application. Please note that any modification of these thresholds will affect the result of that alert, because such changes will be considered for the level computations.

**Fixed thresholds:** The Administrator can select these types of thresholds to define values specific for that alert. Once defined, these will be fixed and can only be modified by the Administrator editing the alert.


### **Add Users to a Pilot-site alert**

To add Users to a Pilot-site alert, the Administrator has to click . A list with all the Users that have the alerts permission active will be shown. Then, the Administrator has to select the Users that will receive the Pilot-site alerts.

### **Mute a Pilot-site alert for all the Users**

There exists an option that allows you to temporarily unsubscribe an alert, to make it inactive, without needing to delete it from the list of alerts. The mute mode can be activated/deactivated with the icon .

### **Delete a Pilot-site alert**

To remove the alert from the list, please press the icon .

## *Private alert*

### **Creation of a Private alert**


The most usual way to create a Private alert is from the own User alerts menu, in order to allow the User to create a tailor-made alert, as indicated in the OSPAC User Manual. It is recommended to use this approach. However, there is an additional option that lets the Administrator to control third-party alerts. In this latter case, the Administrator will be able to construct the criteria and alert filters, and also, they will be able to select the following threshold parameters:

**-User thresholds:** For the evaluation of the Private alert, the User's own thresholds for the station in the OSPAC application will be used; regardless of what the Administrator puts in that section.

**-Fixed thresholds:** These are specific thresholds for the Private alert. Once defined, the thresholds will be fixed and can only be modified by editing the alert.

To create a particular alert, click on the New Alert button, located at the bottom of the screen.


## Mute a Private alert

The mute mode for a Private alert can be activated/deactivated with the icon .

## Mute all Private alerts at a point

In order to mute all Private alerts at a point, it is needed to filter by Place, writing the point code, selecting all the elements on the lateral side of the table, and press the Mute Alert button at the left area of the screen.

## Delete a Private alert

To remove a Private alert from the list, please press the icon . Several alerts can be removed at once, by using the button at the bottom left of the screen.

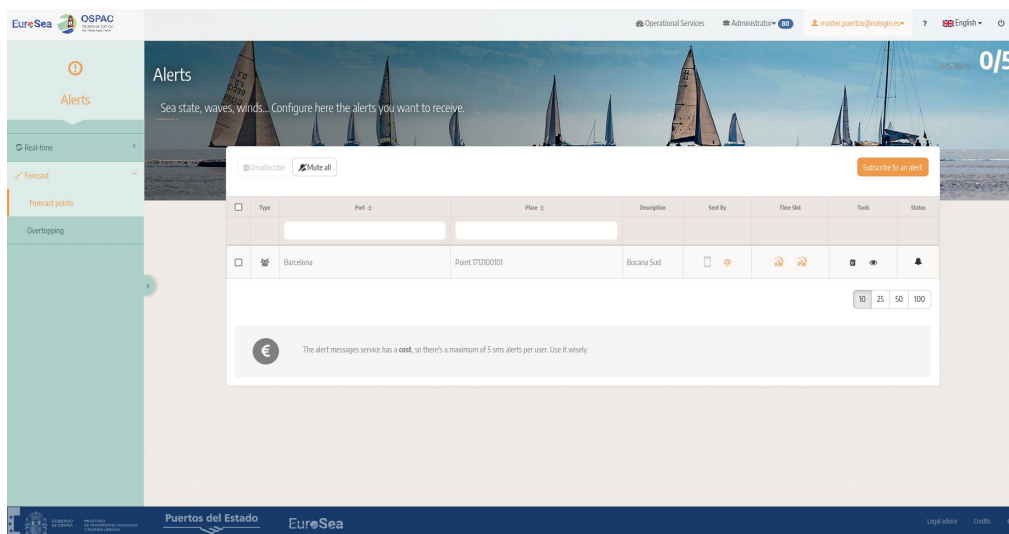


Figure 9. Alert management screen. This screen summarises the available alerts and shows their properties/actions (edit, time slots, mute, etc.).

## 4.6. Settings

### Introduction

The configuration screen can be accessed through a side menu with a pilot-site selector. From this screen, it can be controlled the specific configuration of each OSPAC application.

### **General thresholds settings**

Thresholds are critical for the OSPAC applications. Hence, generic default settings have been reserved for all the points, in case that there is no one defined. The restore button restores the ones prior to any changes made.

### **Thresholds settings at each application**



OSPAC has been designed as each application has its own settings space. Consequently, in case of further details about its settings, please check the corresponding manual of the application.

## 5. Applications

This section will present three applications of OSPAC, already implemented and fully operational: (i) Real-time monitoring; (ii) Forecast points and (iii) Floating debris.

### 5.1. Real time monitoring

#### Introduction

This application displays the met-ocean monitoring data of a port/city in real time. It has two help options: (i) the Help button , which shows the map legend, and (ii) a button  to recover the centered view on the selected port/city. The windows with the information of each station are designed to be opened, closed, dragged and placed at any screen position. The last used screen layout is saved, then customising the view to the User's needs.

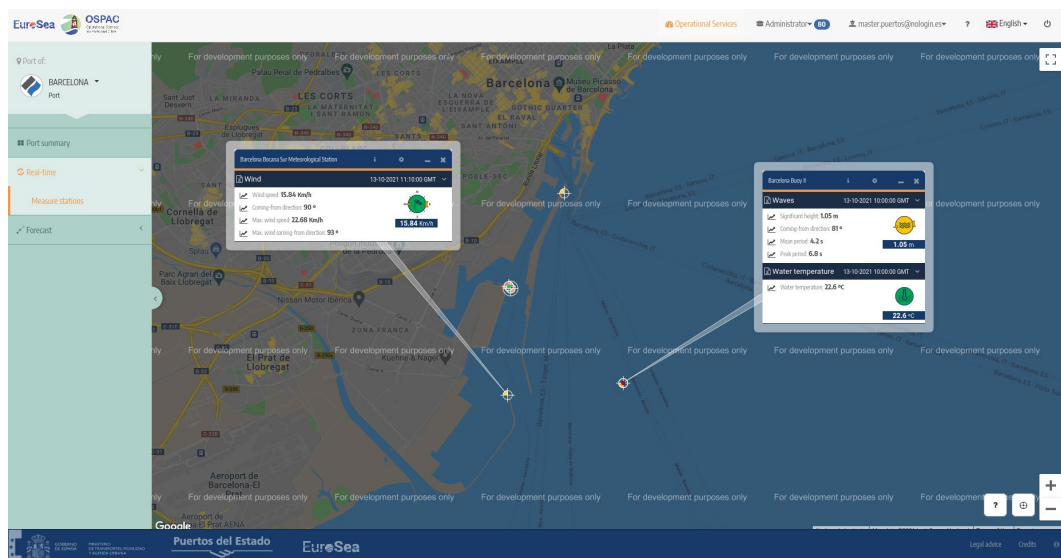



Figure 10. Real-time monitoring windows for the Barcelona meteorological station (left, near the entrance of the harbour) and its coastal buoy from Puertos del Estado (right, at the outer part of the harbour). Please note that the wind and temperature are in safe level (green) but waves are in moderate level (yellow). Note also that each station icon shows their available parameters.


#### Met-ocean parameters

The windows show the variables that are recorded in each of the stations. A set of icons help to identify these variables, showing the latest data received in real time. The date and time (GMT) of the latest available data is also indicated.


Each measuring station is identified by an icon built by superimposing others, thus indicating the available parameters for that station. The icon elements corresponding to each parameter are summarised below:

- **Wave** (


## Metadata of the monitoring station

Depending on the monitoring station, there will be available different met-ocean parameters. In the header of the information window (click on  icon), it will be shown the data sources and metadata from the measurement station. The metadata includes: station name, point code, location, type of sensors, data sampling, first record date, etc.

## Point threshold settings


The icons change its colour according to the established thresholds (yellow and red for exceeding the lower and upper threshold, respectively). By default, the station uses the same threshold as the pilot-site. However, they can be modified to tailor-made in the header icon .

## Download data from the last 72h

The User can download the measurement data from the last 72 hours in CSV format, by clicking on the icon  (next to the title of the met-ocean parameter). CSV format can be opened and modified by a spreadsheet data management program (Microsoft Excel, LibreOffice, OnlyOffice, etc.).

## Detailed met-ocean graphs for the last 7 days



In the station window, any met-ocean parameter can generate a time series graph for the last 7 days, by clicking on the icon  .

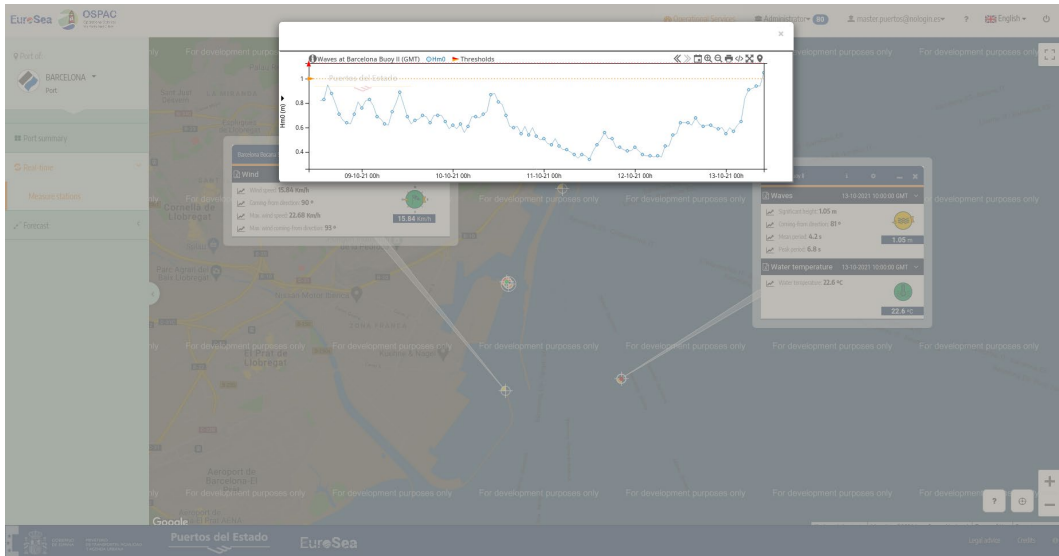


Figure 11. Real-time monitoring time-series graph for the Barcelona coastal buoy (Puertos del Estado). The blue dotted line shows the significant wave height and the discontinuous yellow line, the threshold for the same variable.

## Application settings (Administrator role)

To set-up the application in a general way for all the Users, it is required to have administrator permissions for the pilot-site. The settings menu can be found in Administrator > Settings > Measurement Stations. If the Administrator clicks on any point, a new window will show the threshold settings for each point.

## 5.2. Forecast points

### Introduction

This application allows the User to check the met-ocean forecast for the next 72 hours at a pilot-site. The data comes from numerical models and can be assessed at a set of points that have been considered as relevant. As in real time monitoring, it has two help options for the User, located in the lower right area of the map: (i) the Help button ( ? ) that shows the legend of the map; and (ii) a button ( ⊕ ) to recover the view centered on the port/city. The windows with the information of each station are designed to be opened, closed, dragged and placed at any screen position. The last used screen layout is saved, then customising the view to the User's needs.

### Point types

Specific information can be accessed at the following types of points:

- **Model point** (📍): They correspond to forecast points in the computational domains. In these points, the User will be able to check wind, waves and currents forecasts for the next 72 hours.
- **Town** (📍): These points are associated with a specific town (e.g. Barcelona). In these points, the User will be able to check the sea-level forecast for the next 72 hours.

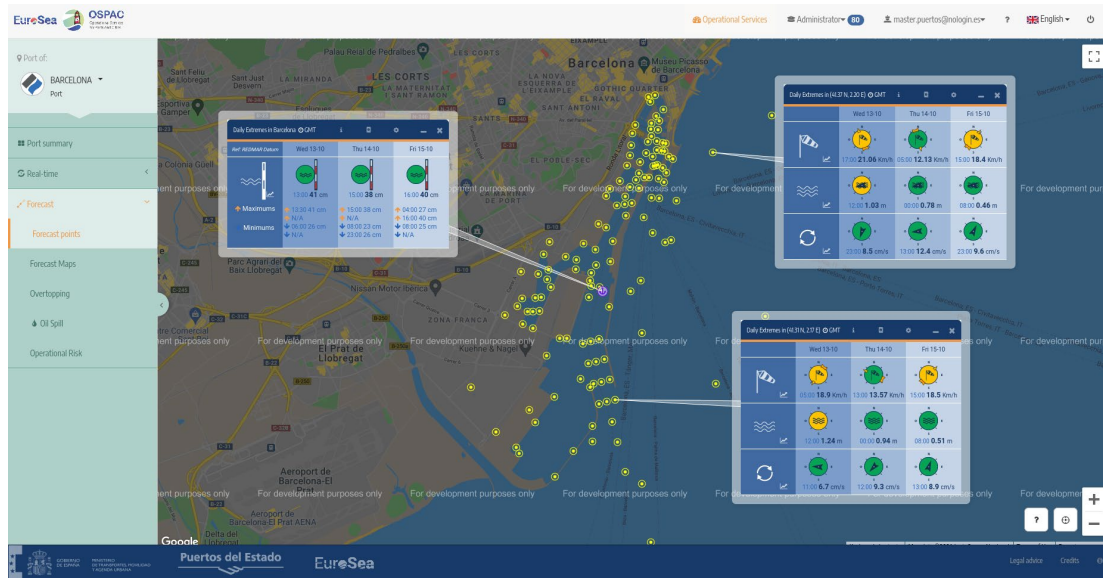


Figure 12. Forecast points at several points of the Barcelona harbour for the following met-ocean parameters: sea level (left); wind, waves and currents at the harbour entrance (center) and wind, waves and currents at the outer part of the harbour (right).


## Met-ocean parameters that have available forecasts

Each forecast point displays a window with the three-days ahead forecasts for a set of met-ocean parameters. The date and time (GMT) of the latest available data is indicated. The parameters that have forecasts are the following:


- **Wind:** The maximum values of the mean wind speed and its corresponding directions for the next 72 hours are shown. The icons are associated with the colour of the defined thresholds.
- **Waves:** The maximum forecast values of the significant wave height and its corresponding wave direction for the next 72 hours are shown. The icons are associated with the colour of the defined thresholds.
- **Currents:** The maximum forecasts values of the average surface currents and their corresponding direction for the next 72 hours are shown. The icons are associated with the colour of the defined thresholds.
- **Sea level:** The expected maximum and minimum values of the sea-level for the next 72 hours are shown in the most relevant harbours, towns and cities in the area. The data uses a reference level of the model. The icons are associated with the colour of the defined thresholds.

If the User clicks on the 📈 icon, time-series graphs for the forecasted met-ocean parameters can be assessed.

## Metadata of the forecasts

The forecasts at each point are obtained from different numerical models. To find out these sources, the User can click on the  icon, located at the top of the draggable window.

## Point threshold settings

The icons change its colour according to the established thresholds (yellow and red for exceeding the lower and upper threshold, respectively). By default, the forecast point uses the same threshold as the pilot-site. However, they can be modified to tailor-made in the header icon . These User-defined thresholds will be used throughout the OSPAC service (i.e. alerts and data visualization), as they will be unique to that specific point.

## Application settings (Administrator role)

To set-up the application in a general way for all the Users, it is required to have administrator permissions for the pilot-site. The settings menu can be found in Administrator > Settings > Forecast points. If the Administrator clicks on any point, a new window will show the threshold settings for each point.

## 5.3. Floating debris

### Introduction

The aim of this application is to forecast floating debris trajectories derived from (i) high resolution 3D circulation models and (ii) and specific source points defined by the pilot-site Administrator. Trajectories will be daily updated. New trajectories will be available at the same time that new circulation forecasts are available.

### Implementation

The trajectories need to be defined at each coastal circulation model. In the case of the Barcelona demonstrator, it is encouraged to use the local resolution model (70 m horizontal resolution) within the harbour.

*Recommendation:* In order to avoid problems with the domain limits, please do not locate origin source points near the boundary domain. Otherwise, the trajectories may be unrealistic, in case that the flow goes out the domain. In these specific cases, it is encouraged to use the coarse resolution model (350 m horizontal resolution). Hence, the floating debris trajectories will be constrained within the computational domain.

The application has two screens: (i) a settings menu, to which only the Administrator has access; (ii) the visualization screen, to which Users have access.

- **Settings menu:** Please note that only the Administrator can select the source points. The following steps must be followed: (i) to define source points for the floating debris trajectories, by adding an identification and the coordinates (lat,lon); (ii) to select a high resolution circulation domain (i.e., coastal (350 m) or local (70 m)).
- **Visualization screen:** The visualization screen can show, superimposed, (i) the floating debris trajectories (marked as white continuous solid line in Figure 14) and (ii) their associated high-

resolution surface currents. The surface currents can be viewed as an animation with a control menu for play/stop and rewind/advance the timestep shown at the moment.



Figure 13. Forecasted surface currents at the Barcelona harbour, derived from a numerical model. The coloured areas denote the hourly-averaged surface current at the computational domain (70 m horizontal resolution).

Once the Administrator defines a set of source points of floating debris (settings menu), the lagrangian trajectories will be computed at the next forecast cycle onwards (unless they are modified or deleted). Each source point will have four lagrangian trajectories. All four trajectories will share the same origin point, but they will differ in the starting time and total duration. Note also, that each trajectory is set to start at the 00:00h. As an example, please consider that the reference date of the forecast cycle is 2021-10-01:

(i) *Hindcast trajectory*: The trajectory will start 24 hours before the reference date of the forecast cycle and it will have a duration of 96 hours (i.e., 24 hours of hindcast circulation fields and 72 hours of forecast circulation fields). Hence, the starting time will be 2021-09-30 00:00h, and it will be finished on 2021-10-04 00:00h.

(ii) *Forecast Day 1 trajectory*: The trajectory will start at the reference date of the forecast cycle, and it will have a duration of 72 hours (i.e., 72 hours of forecast circulation fields). Hence, the starting time will be 2021-10-01 00:00h, and it will be finished on 2021-10-04 00:00h.

(ii) *Forecast Day 2 trajectory*: The trajectory will start 24 hours after the reference date of the forecast cycle, and it will have a duration of 48 hours (i.e., 48 hours of forecast circulation fields). Hence, the starting time will be 2021-10-02 00:00h, and it will be finished on 2021-10-04 00:00h.

(ii) *Forecast Day 3 trajectory*: The trajectory will start 48 hours after at the reference date of the forecast cycle, and it will have a duration of 24 hours (i.e., 24 hours of forecast circulation fields). Hence, the starting time will be 2021-10-03 00:00h, and it will be finished on 2021-10-04 00:00h.

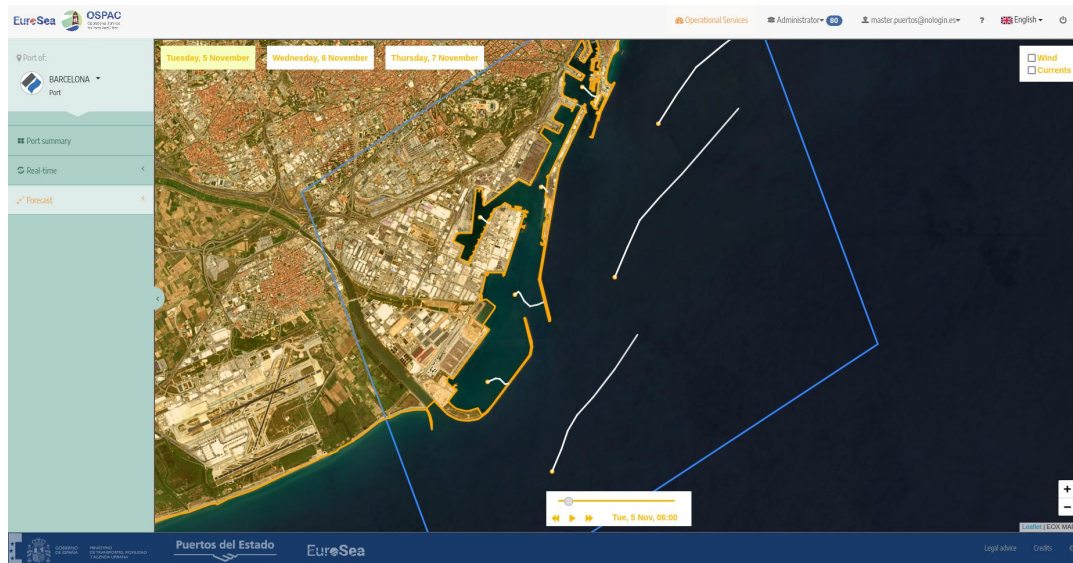


Figure 14. Forecasted floating debris trajectories at the Barcelona harbour, derived from the currents from the same system shown in Figure 13. The orange dots represent the source origin of the floating debris (defined by the Administrator). The solid white lines are the lagrangian trajectories at different points inside/outside the Barcelona harbour.

## Current limitations

- Wind-induced currents are included, but not floating debris advection due to the wind stress.
- For the sake of simplicity, there is still no option for selecting floating debris parameters, such as volume, density, debris type, etc.