01/06/2021

La Transformación verde y digital de una Autoridad Portuaria

Sistema de Monitorización de la Calidad del Aire
en cinco puertos de las Islas Baleares

CONAMA 2020
CONGRESO NACIONAL DEL MEDIO AMBIENTE

31 MAY 2021 / 03 JUN 2021

Centro de Convenciones
Norte / IFEMA

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Kunak Technologies tiene una misión

Ella was the first person in the UK to have **air pollution** listed as the cause of death on their death certificate

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La Calidad del Aire es una prioridad ambiental

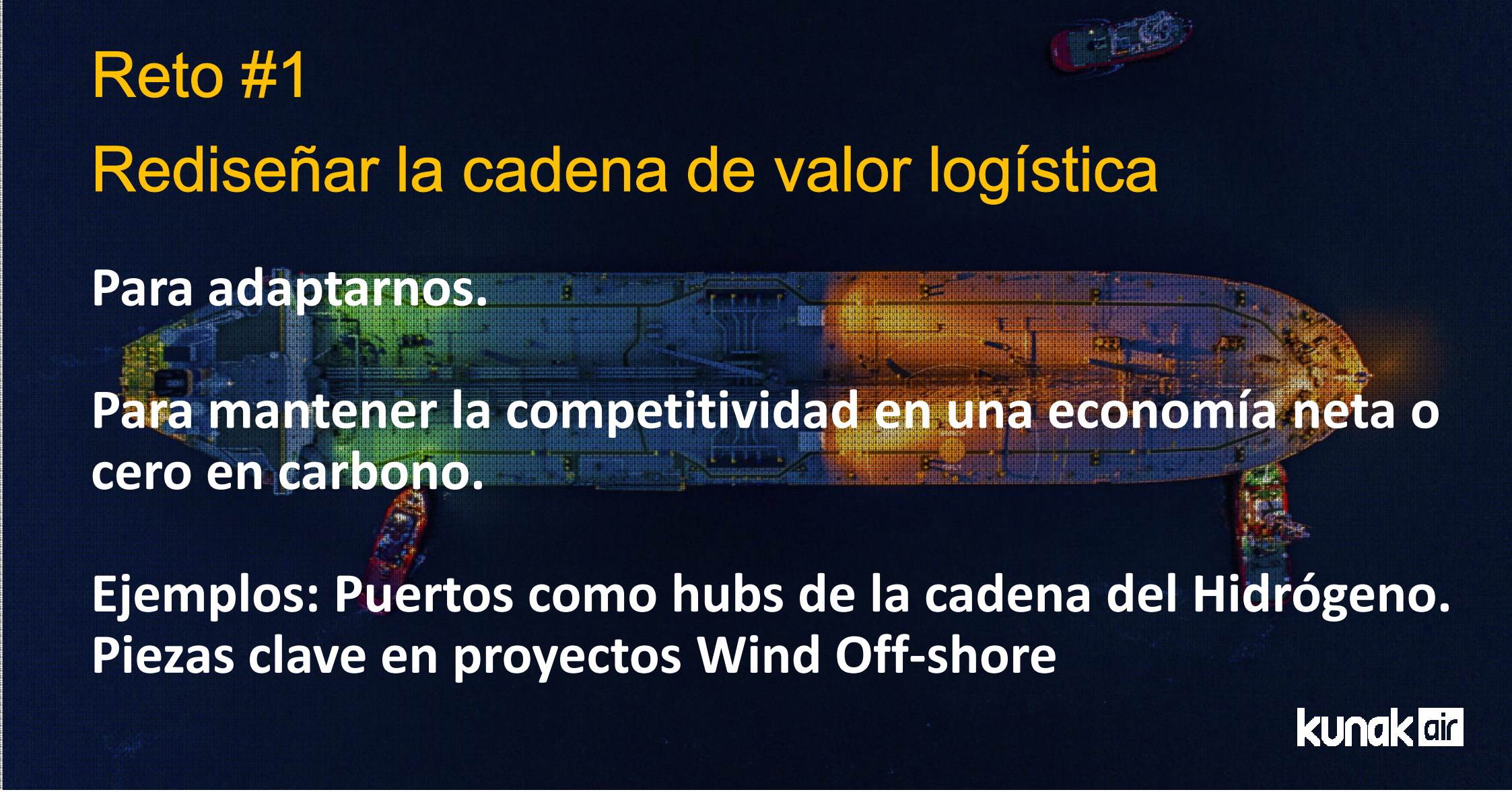
The European Sea Ports Organisation

La calidad del aire sigue siendo la máxima prioridad medioambiental para los puertos

Se ha convertido en un factor determinante de la **actividad portuaria sostenible** y su **licencia social para operar**.

Reto #1

Rediseñar la cadena de valor logística



Para adaptarnos.

Para mantener la competitividad en una economía neta o cero en carbono.

Ejemplos: Puertos como hubs de la cadena del Hidrógeno. Piezas clave en proyectos Wind Off-shore

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Reto #2

Más datos, de mayor calidad

Las actividades impactan en la Calidad del Aire.

Pero los datos oficiales son escasos.

Necesitamos redes complementarias de sensores fiables.

Reto #3

Más acceso a financiación SDG 9

Hay una desconexión entre la limitada oferta de financiación y la demanda de infraestructuras sostenibles

#GREENDEAL
1.000.000.000.000 €

#NEXTGENEU
700.000.000.000 €

UNEP FINANCE INITIATIVE

PORTS 4.0
Ports of Spain **Tradetech** Fund

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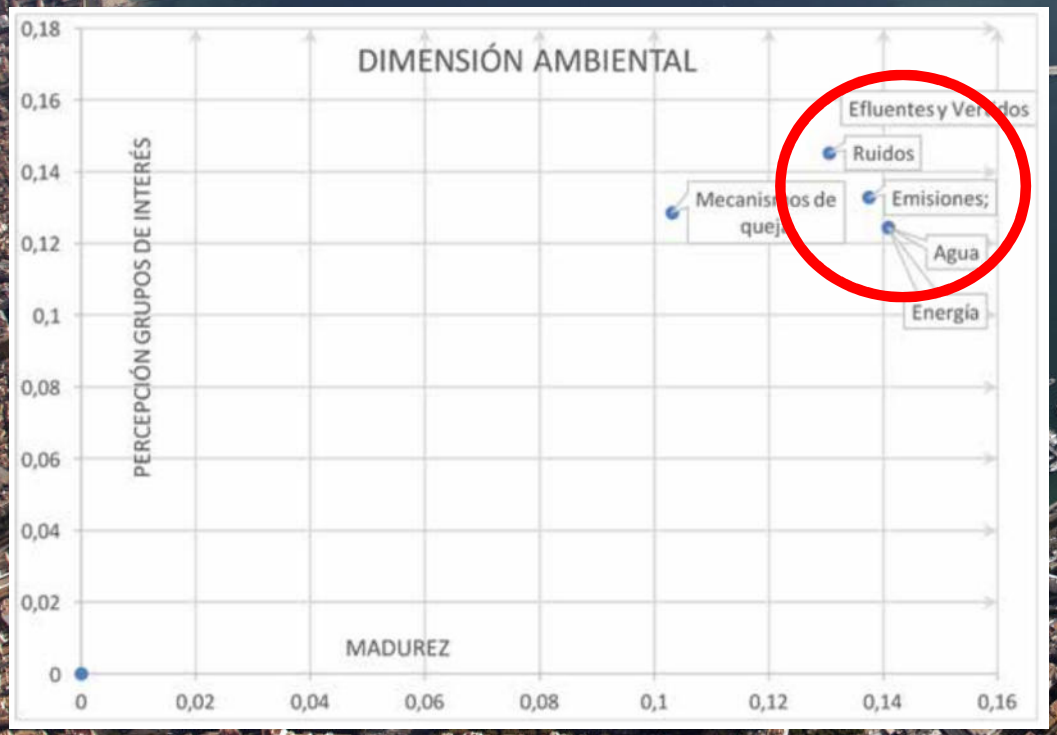
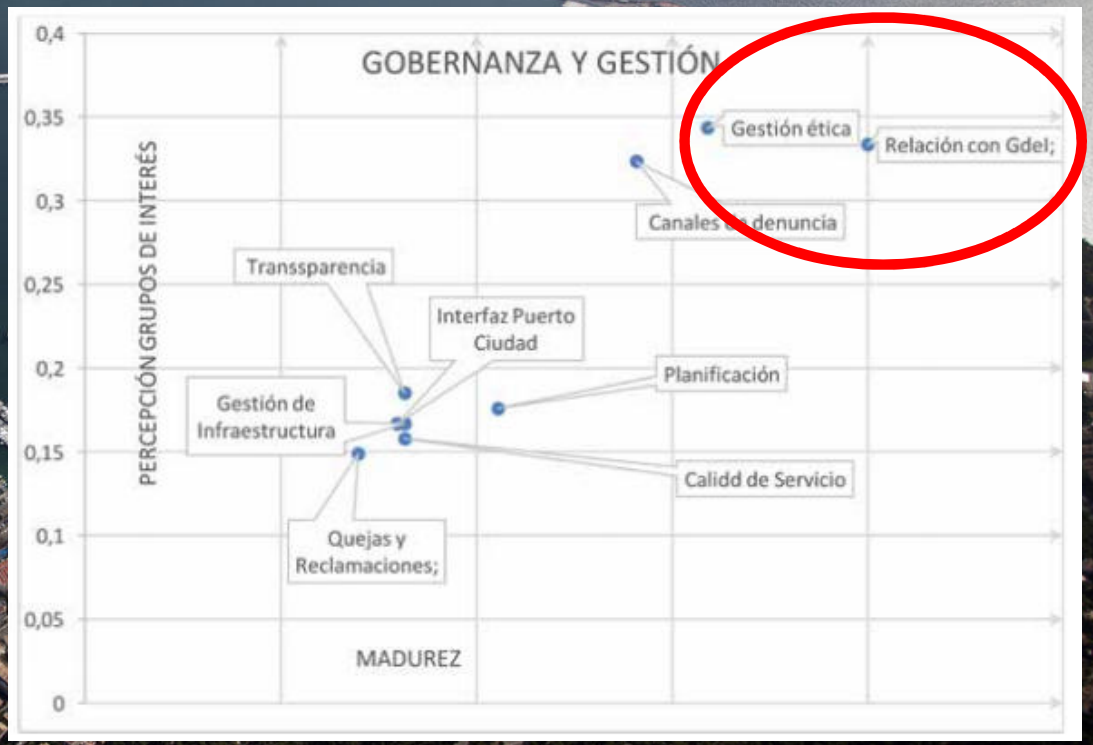
2018 Sustainability Report - Materiality Matrix

Ports de Balears

Autoritat Portuària de Balears





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2018 Sustainability Report -
APB Green Port Strategy
Ports de Balears
Autoritat Portuària de Balears
Green Port
=
Equilibrio entre un ECOSISTEMA SOSTENIBLE & ALTA EFICIENCIA ECONOMICA
Medioambiental
• Reducir el impacto de las actividades en la Calidad del Aire
Social
• Mejorar la percepción sobre la sostenibilidad de los puertos
Gobernanza
• Ofrecer los datos de manera abierta y transparente
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UTE Kunak – Labaqua
Reshaping Air Quality Management

5
Ports

25
Monitoring Locations

>1,5million
Datapoint each month

UIB Universitat de les Illes Balears

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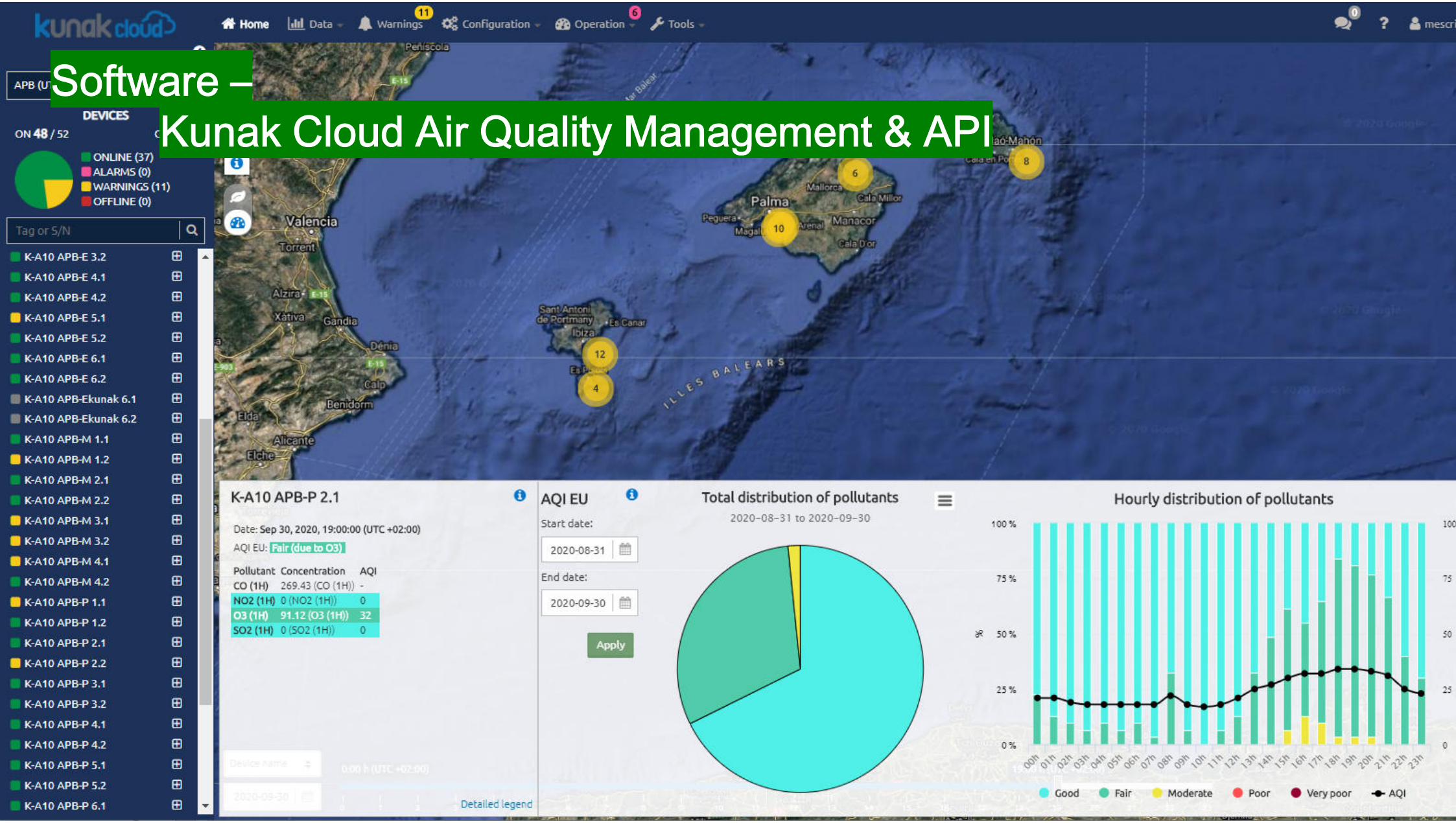
Hardware –
50 Kunak Air Quality Stations

5 gases
CO, SO_2, NO, NO_2, O_3

particles
PM_{10}, $PM_{2,5}$, PM_1

noise
LAeq

meteo
Veloc. y direc. del viento, Temp. Humedad relativa, presión atmos.


Software –
Kunak Cloud Air Quality Management & API
kunak cloud
Home
Data
Warnings
Configuration
Operation
Tools
DEVICES
ON 48 / 52
ONLINE (37)
ALARMS (0)
WARNINGS (11)
OFFLINE (0)
Tag or S/N
K-A10 APB-E 3.2
K-A10 APB-E 4.1
K-A10 APB-E 4.2
K-A10 APB-E 5.1
K-A10 APB-E 5.2
K-A10 APB-E 6.1
K-A10 APB-E 6.2
K-A10 APB-Ekunak 6.1
K-A10 APB-Ekunak 6.2
K-A10 APB-M 1.1
K-A10 APB-M 1.2
K-A10 APB-M 2.1
K-A10 APB-M 2.2
K-A10 APB-M 3.1
K-A10 APB-M 3.2
K-A10 APB-M 4.1
K-A10 APB-M 4.2
K-A10 APB-P 1.1
K-A10 APB-P 1.2
K-A10 APB-P 2.1
K-A10 APB-P 2.2
K-A10 APB-P 3.1
K-A10 APB-P 3.2
K-A10 APB-P 4.1
K-A10 APB-P 4.2
K-A10 APB-P 5.1
K-A10 APB-P 5.2
K-A10 APB-P 6.1
Valencia
Palma
Ibiza
Mallorca
Menorca
Alicante
Elche
Benidorm
Dénia
Xàtiva
Alzira
Torrent
Gandia
ILLES BALEARS
K-A10 APB-P 2.1
Date: Sep 30, 2020, 19:00:00 (UTC +02:00)
AQI EU: Fair (due to O3)
Pollutant Concentration AQI
CO (1H) 269.43 (CO (1H)) -
NO2 (1H) 0 (NO2 (1H)) 0
O3 (1H) 91.12 (O3 (1H)) 32
SO2 (1H) 0 (SO2 (1H)) 0
Detailed legend
AQI EU
Start date:
2020-08-31
End date:
2020-09-30
Apply
Total distribution of pollutants
2020-08-31 to 2020-09-30
Hourly distribution of pollutants
100 %
75 %
50 %
25 %
0 %
Good
Fair
Moderate
Poor
Very poor
AQI

Open Data – Website Real Time Dashboard

nexMACHINA
THE COMING TECHNOLOGY

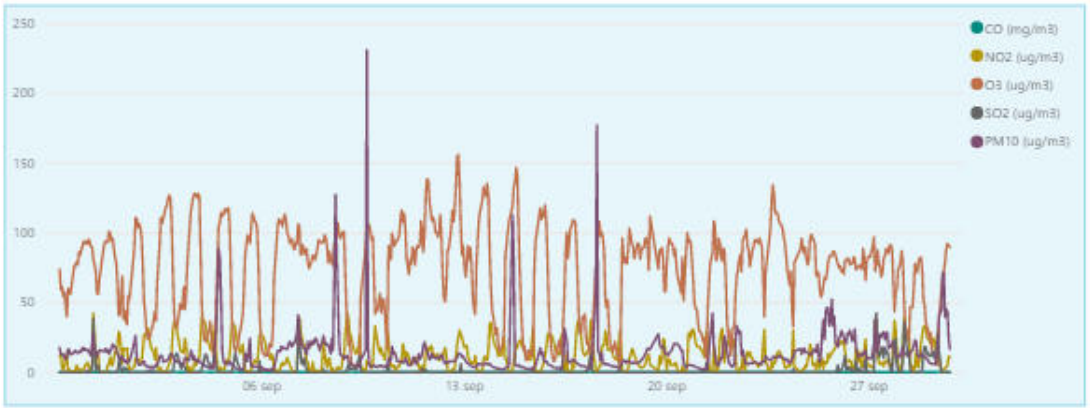
Puerto de Maó

Índices de calidad del aire (última media horaria calificada*):

CO Monóxido de Carbono	NO2 Dióxido de Nitrógeno	O3 Ozono	SO2 Dióxido de Azufre	PM10 Particulas 10	LAeq Ruido
0.29	10.99	89.93	0.00	16.71	50.53
mg/m3	ug/m3	ug/m3	ug/m3	ug/m3	dB(A)
Excelente	Excelente	Bien	Excelente	Excelente	---

* Fuente página web http://www.caib.es/sacmicrofront/archivopub.do?ctrl=MCRST145ZI84843&id=84843 del Govern Balear

Índices de calidad del aire (medias horarias del último mes):



Último cálculo media horaria*:

29-09-2020 19:00

*Aviso: Los datos utilizados para el cálculo de los índices de calidad del aire son temporales, sin validar.

Ports de Balears
Autoritat Portuària de Balears

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LABAQUA

UIB Universitat de les Illes Balears

nexMACHINA

Airadvance
Real Time Supervision

Integración datos monitorización

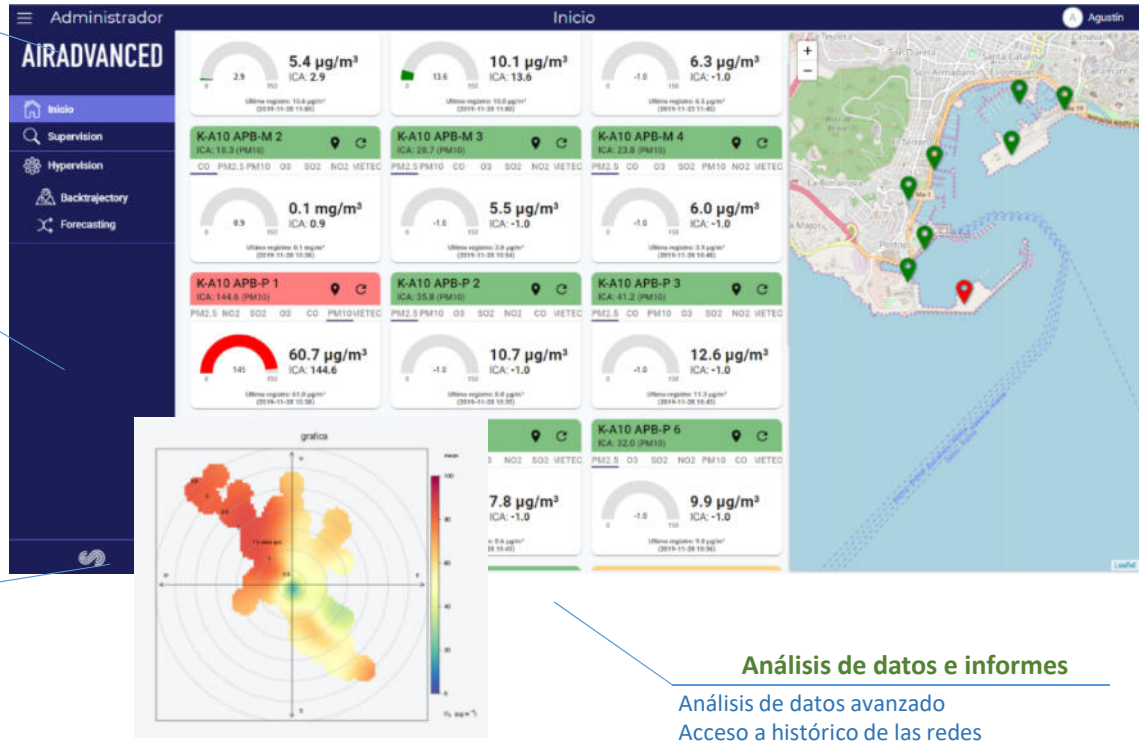
Redes oficiales y redes propias
- Meteorología
- Calidad del aire
- Olores
- ruido

Índices de calidad del aire

Agregación de datos en índices de calidad del aire (AQI)
Escalas de colores y alertas

Validación de datos

Supervisión y validación de datos de monitorización
Aseguramiento de calidad



Análisis de datos e informes

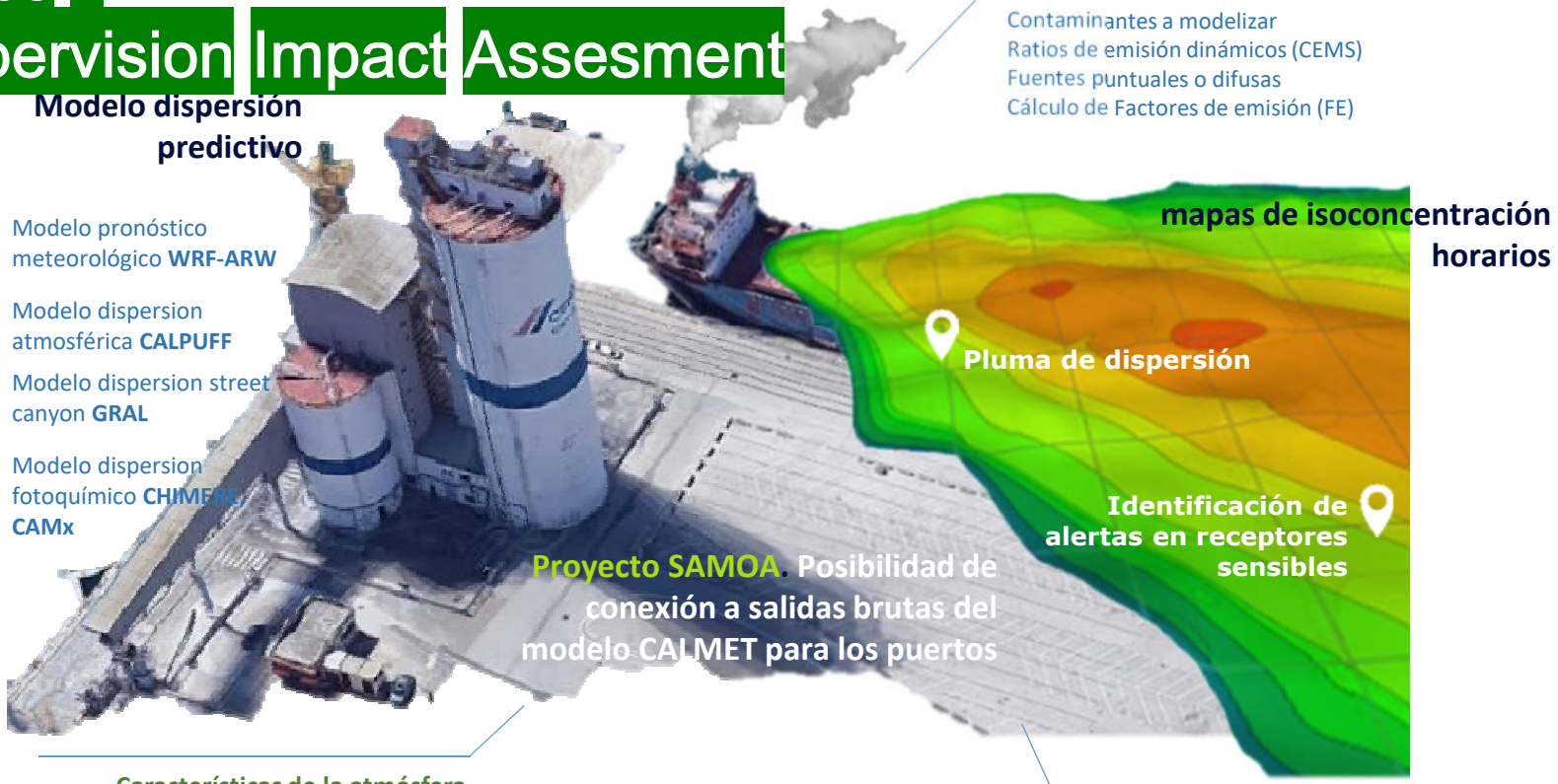
Análisis de datos avanzado
Acceso a histórico de las redes
Generación automática de informes
Generación de archivos de intercambio

Display de visualización de datos de monitorización de la calidad del aire

Airadvance – Hypervision Impact Assesment

Modelo dispersión predictivo

- Modelo pronóstico meteorológico **WRF-ARW**
- Modelo dispersion atmosférica **CALPUFF**
- Modelo dispersion street canyon **GRAL**
- Modelo dispersion fotoquímico **CHIMERE, CAMx**



Características de la emisión

Caracterización de fuentes de emisión
Contaminantes a modelizar
Ratios de emisión dinámicos (CEMS)
Fuentes puntuales o difusas
Cálculo de Factores de emisión (FE)

mapas de isoconcentración horarios

Características de la atmósfera

Modelo pronóstico meteorológico (WRF)
Horizonte temporal de 24-48-72 h
Downscaling hasta área de 4km^2

Características del terreno

Modelo digital del terreno
Usos del suelo
Receptores sensibles

- Pronóstico del impacto en la calidad del aire

Airadvance

Predictive Dispersion Models

Análisis de receptores

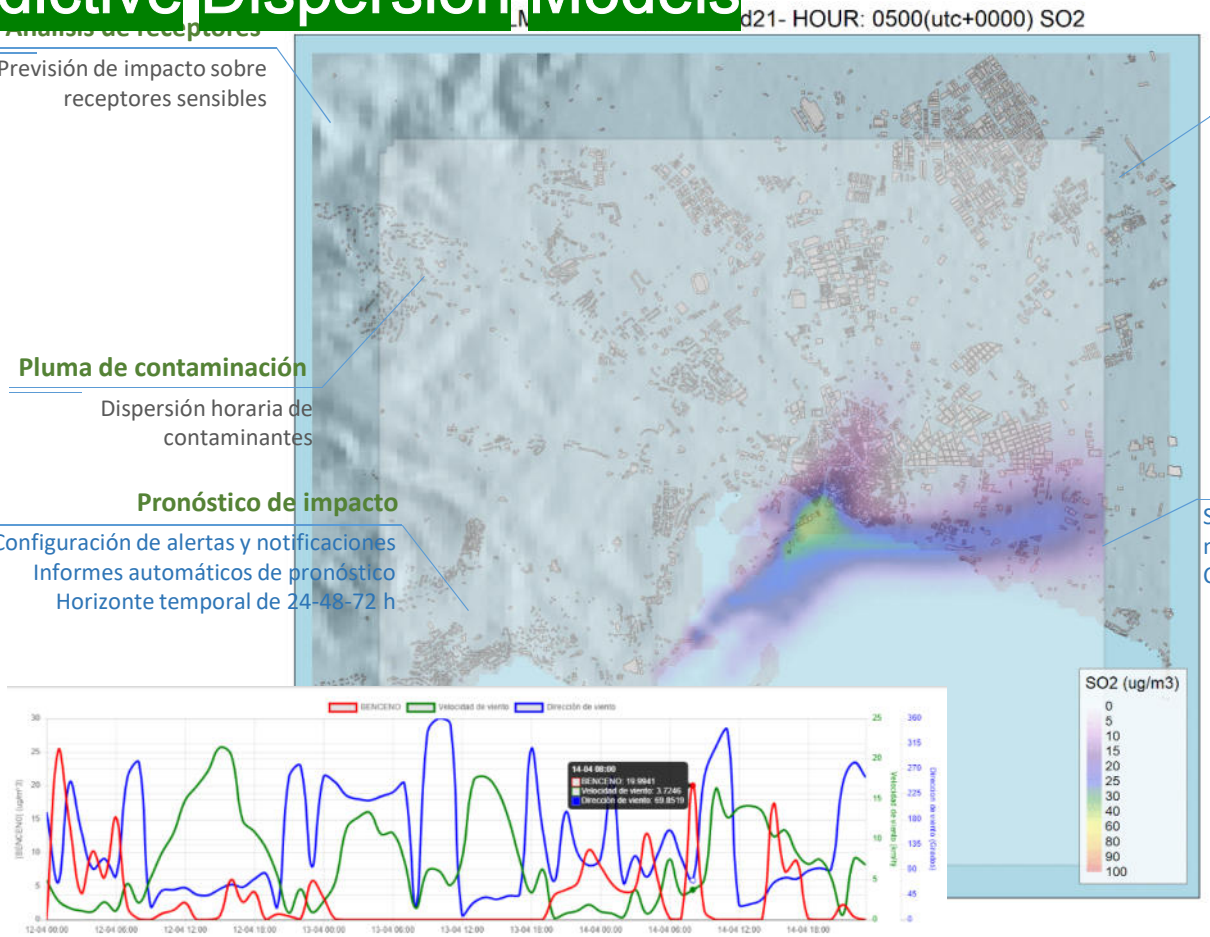
Previsión de impacto sobre receptores sensibles

Pluma de contaminación

Dispersión horaria de contaminantes

Pronóstico de impacto

Configuración de alertas y notificaciones
Informes automáticos de pronóstico
Horizonte temporal de 24-48-72 h



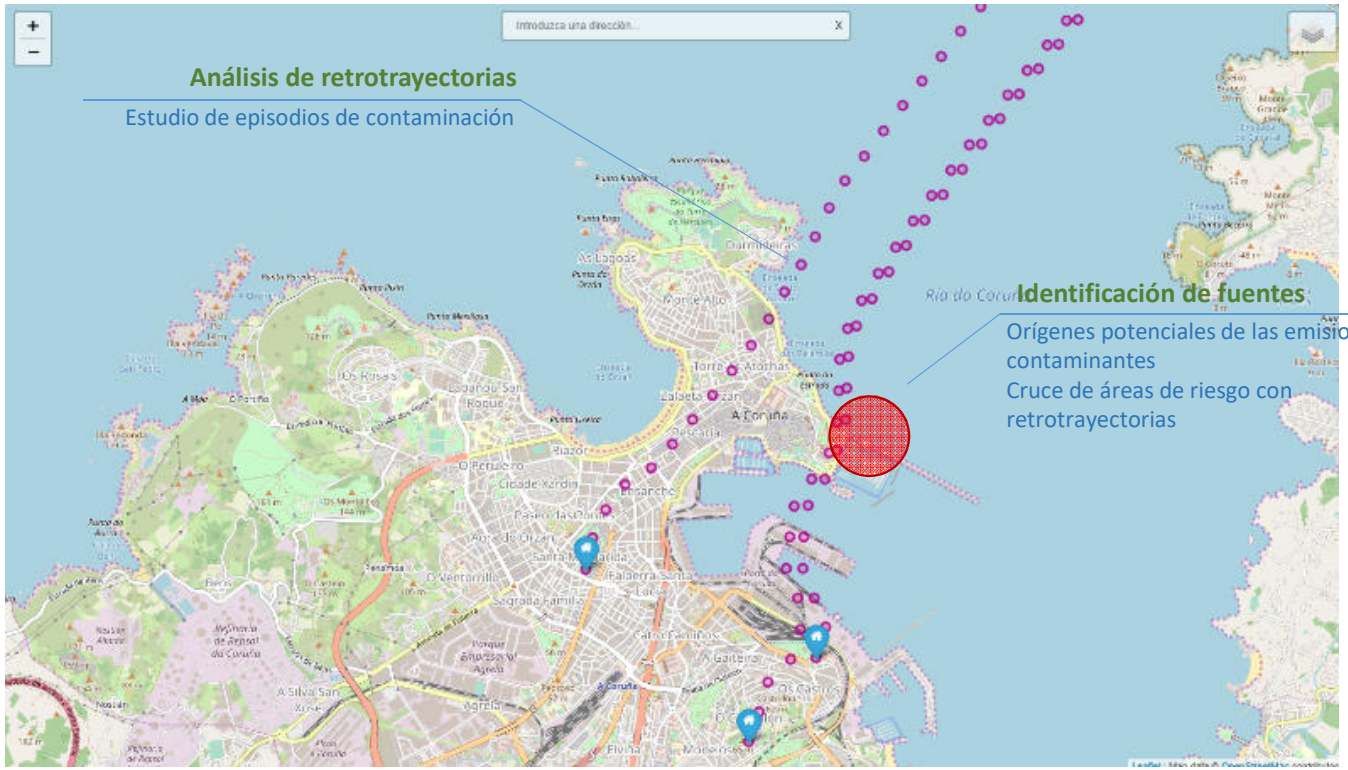
Predicción horaria

Programación de la ventana temporal de predicción
Horizonte temporal de 24, 48 o 72 horas.

Variables modelizadas

Selección de parámetros y variables meteorológicas
Configuración de la visualziación

Airadvance – Retrotrajectories & Source Aportion Analysis

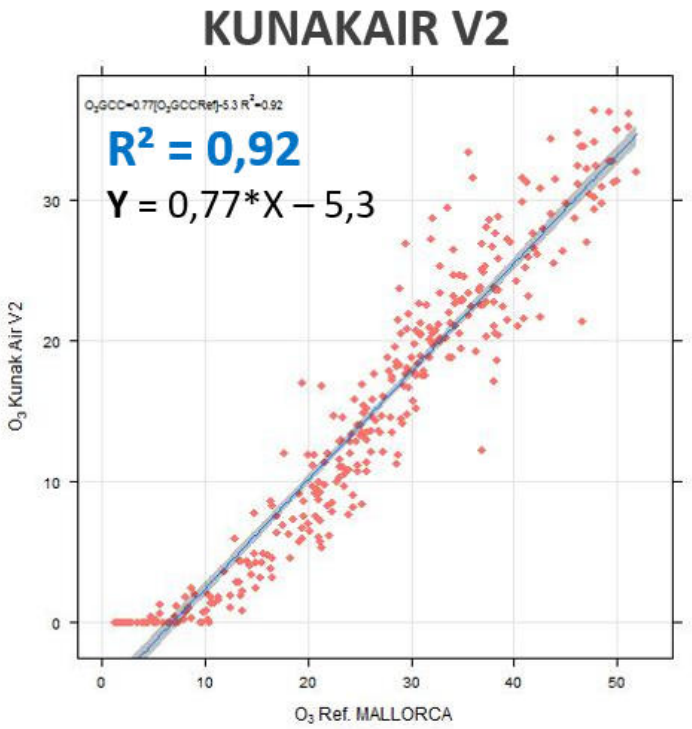


- Herramienta de identificación de fuentes potenciales de contaminación

Data Accuracy & Reliability - Government Intercomparisons

GOVERN ILLES BALEARS

Calle Foners (Palma)



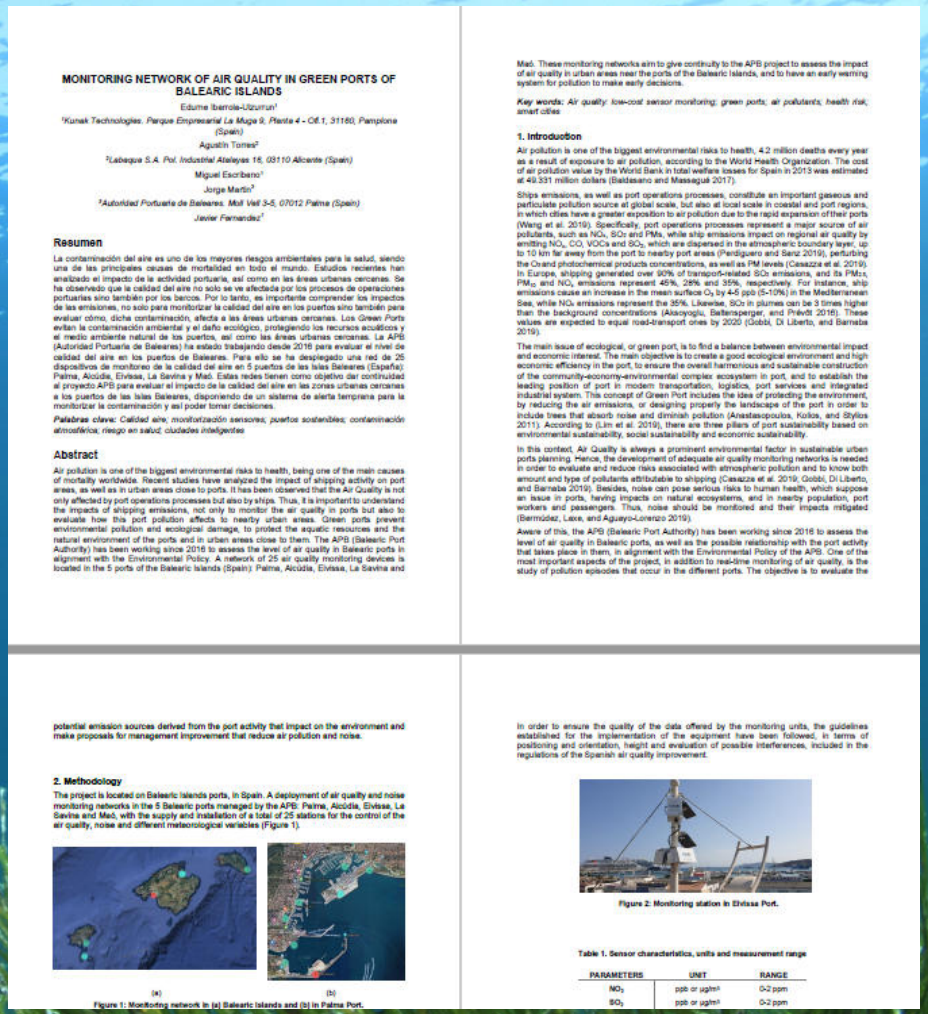
South Coast AQMD
AQ-SPEC
Air Quality Sensor Performance Evaluation Center

EPA
United States Environmental Protection Agency

AIRLAB
SOLUTIONS POUR NOTRE AIR

Visit www.kunak.es for the Article.

By Kunak, Labaqua & APB.



MONITORING NETWORK OF AIR QUALITY IN GREEN PORTS OF BALEARIC ISLANDS

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Resumen

La contaminación del aire es uno de los mayores riesgos ambientales para la salud, siendo una de las principales causas de mortalidad en todo el mundo. Estudios recientes han analizado el impacto de la actividad portuaria, así como en las áreas urbanas cercanas. Se ha observado que la calidad del aire no solo se ve afectada por los procesos de operaciones portuarias sino también por los barcos. Por lo tanto, es importante comprender los impactos de las emisiones, no solo para monitorizar la calidad del aire en los puertos sino también para evaluar cómo, dicha contaminación, afecta a las áreas urbanas cercanas. Los Green Ports evitan la contaminación ambiental y el daño ecológico, protegiendo los recursos acuáticos y el medio ambiente natural de los puertos, así como las áreas urbanas cercanas. La APB (Autoridad Portuaria de Baleares) ha estado trabajando desde 2018 para evaluar el nivel de calidad del aire en los puertos de Baleares. Para ello se ha desplegado una red de 25 dispositivos de monitoreo de la calidad del aire en 5 puertos de las Islas Baleares (España): Palma, Alcúdia, Eivissa, La Savina y Maó. Estas redes tienen como objetivo dar continuidad al proyecto APB para evaluar el impacto de la calidad del aire en las zonas urbanas cercanas a los puertos de las Islas Baleares, disponiendo de un sistema de alerta temprana para la monitorizar la contaminación y así poder tomar decisiones.

Palabras clave: *Calidad aire; monitorización sensores; puertos sostenibles; contaminación atmosférica; riesgo en salud; ciudades inteligentes*

Abstract

Air pollution is one of the biggest environmental risks to health, being one of the main causes of mortality worldwide. Recent studies have analyzed the impact of shipping activity on port areas, as well as in urban areas close to ports. It has been observed that the Air Quality is not only affected by port operations processes but also by ships. Thus, it is important to understand the impacts of shipping emissions, not only to monitor the air quality in ports but also to evaluate how this port pollution affects to nearby urban areas. Green ports prevent environmental pollution and ecological damage, to protect the aquatic resources and the natural environment of the ports and in urban areas close to them. The APB (Balearic Port Authority) has been working since 2018 to assess the level of air quality in Balearic ports in alignment with the Environmental Policy. A network of 25 air quality monitoring devices is located in the 5 ports of the Balearic Islands (Spain): Palma, Alcúdia, Eivissa, La Savina and Maó. These monitoring networks aim to give continuity to the APB project to assess the impact of air quality in urban areas near the ports of the Balearic Islands, and to have an early warning system for pollution to make early decisions.

Key words: *Air quality; low-cost sensor monitoring; green ports; air pollutants; health risk; smart cities*

1. Introduction

Air pollution is one of the biggest environmental risks to health, 4.2 million deaths every year as a result of exposure to air pollution, according to the World Health Organization. The cost of air pollution value by the World Bank in total welfare losses for Spain in 2013 was estimated at 49.331 million dollars (Baldasano and Massagué 2017).

Ships emissions, as well as port operations processes, constitute an important gaseous and particulate pollution source at global scale, but also at local scale in coastal and port regions, in which cities have a greater exposition to air pollution due to the rapid expansion of their ports (Weng et al. 2019). Specifically, port operations processes represent a major source of air pollutants, such as NO_x, SO_2 and PMs, while ship emissions impact on regional air quality by emitting NO_x, CO, VOCs and SO_2, which are dispersed in the atmospheric boundary layer, up to 10 km far away from the port to nearby port areas (Perdiguero and Sanz 2019), perturbing the O3 and photochemical products concentrations, as well as PM levels (Cesazze et al. 2019). In Europe, shipping generated over 90% of transport-related SO_2 emissions, and its PM_{10}, $PM_{2.5}$ and NO_x emissions represent 45%, 28% and 35%, respectively. For instance, ship emissions cause an increase in the mean surface O_3 by 4-8 ppb (5-10%) in the Mediterranean Sea, while NO_2 emissions represent the 35%. Likewise, SO_2 in plumes can be 3 times higher than the background concentrations (Akacyoglu, Beltensperger, and Prévôt 2016). These values are expected to equal road-transport ones by 2020 (Gobbi, Di Liberto, and Barnaba 2019).

The main issue of ecological, or green port, is to find a balance between environmental impact and economic interest. The main objective is to create a good ecological environment and high economic efficiency in the port, to ensure the overall harmonious and sustainable construction of the community-economy-environmental complex ecosystem in port, and to establish the leading position of port in modern transportation, logistics, port services and integrated industrial system. This concept of Green Port includes the idea of protecting the environment, by reducing the air emissions, or designing properly the landscape of the port in order to include trees that absorb noise and diminish pollution (Anastascopoulos, Kotkis, and Stylios 2011). According to (Lim et al. 2019), there are three pillars of port sustainability based on environmental sustainability, social sustainability and economic sustainability.

In this context, Air Quality is always a prominent environmental factor in sustainable urban ports planning. Hence, the development of adequate air quality monitoring networks is needed in order to evaluate and reduce risks associated with atmospheric pollution and to know both amount and type of pollutants attributable to shipping (Cesazze et al. 2019, Gobbi, Di Liberto, and Barnaba 2019). Besides, noise can pose serious risks to human health, which suppose an issue in ports, having impacts on natural ecosystems, and in nearby population, port workers and passengers. Thus, noise should be monitored and their impacts mitigated (Bermúdez, Laxe, and Aguayo-Lorenzo 2019).

Aware of this, the APB (Balearic Port Authority) has been working since 2018 to assess the level of air quality in Balearic ports, as well as the possible relationship with the port activity that takes place in them, in alignment with the Environmental Policy of the APB. One of the most important aspects of the project, in addition to real-time monitoring of air quality, is the study of pollution episodes that occur in the different ports. The objective is to evaluate the potential emission sources derived from the port activity that impact on the environment and make proposals for management improvement that reduce air pollution and noise.

2. Methodology

The project is located on Balearic Islands ports, in Spain. A deployment of air quality and noise monitoring networks in the 5 Balearic ports managed by the APB: Palma, Alcúdia, Eivissa, La Savina and Maó, with the supply and installation of a total of 25 stations for the control of the air quality, noise and different meteorological variables (Figure 1).

(a) (b)

Figure 1: Monitoring network in (a) Balearic Islands and (b) in Palma Port.

In order to ensure the quality of the data offered by the monitoring units, the guidelines established for the implementation of the equipment have been followed, in terms of positioning and orientation, height and evaluation of possible interferences, included in the regulations of the Spanish air quality improvement.

Figure 2: Monitoring station in Eivissa Port.

Table 1. Sensor characteristics, units and measurement range

PARAMETERS	UNIT	RANGE
NO_2	ppb or µg/m³	0-2 ppm
SO_2	ppb or µg/m³	0-2 ppm

Bilbao PORT

Puerto de la Bahía de Cádiz

Autoridad Portuaria de la Bahía de Cádiz

tecnalia

emetel

Red de partículas en suspensión

Parte del Plan Director de Tecnología – 4,2M€

Gracias

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Large data is the goal. But accurate data is the key.

kunak air