European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

WGs Meeting, Belgrade, 13 - 14 October 2015

CHALLENGES OF AN AIR QUALITY AND NOISE SENSOR NETWORK ON A MARITIME PORT

Carlos Borrego

MC Member

Ana Margarida, Clara Ribeiro and João Ginja

IDAD - Institute of Environment and Development / Portugal

COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

Environmental impacts at urban ports

Urban ports are seen as the origin of both negative and positive externalities affecting the public wellbeing

Several impacts from ports on the environment:

- Air quality
- Noise
- Waste
- Water and sediment quality
- Biodiversity
- Soil quality
- Traffic
- Energy consumption
- …

Environmental impacts at urban ports

The movement of dry bulk cargo, ships and road vehicles are the main port activities with possible impacts on **air quality** through the emission of atmospheric pollutants

Ship operations and cargo handling in ports cause problems with disturbing **noise** in nearby dwellings.

The impact of air quality and noise are particularly relevant in ports situated adjacent to urban areas, being the most common cause of complaints from the nearby residents

Case study on a Portuguese port

Air quality monitoring

AQ stations at the Port and AQ stations from the national air quality network

Case study on a Portuguese port

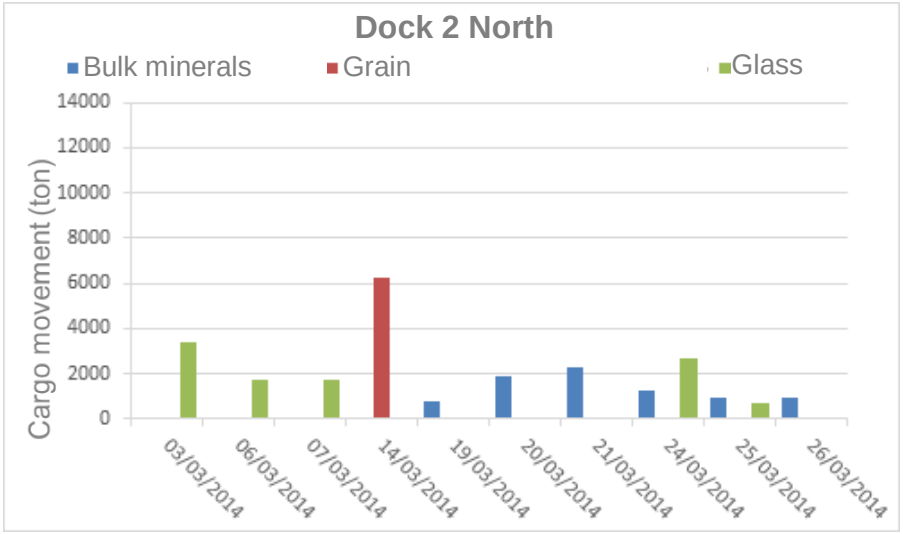
Air quality monitoring

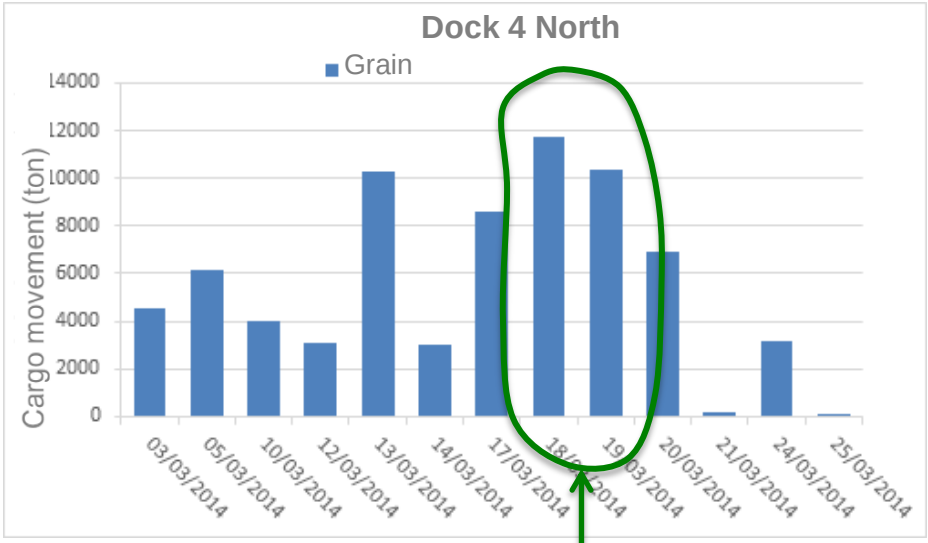
PTS and PM10 analyser

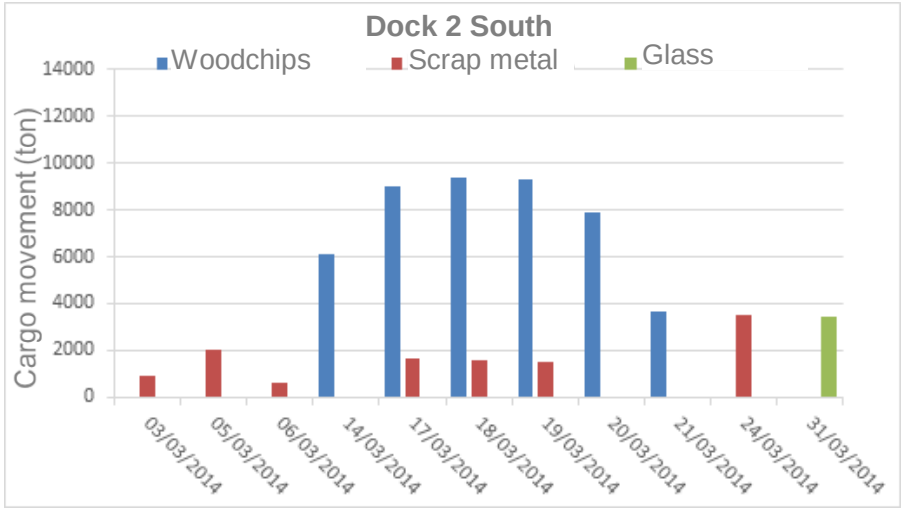
- 2 air quality stations with continuous measurements of TSP (Total Suspended Particulates) and PM10 (daily averages with beta attenuation monitoring)
- 2 meteorological stations (wind direction and velocity, precipitation)

Case study on a Portuguese port

Dry bulk discharge



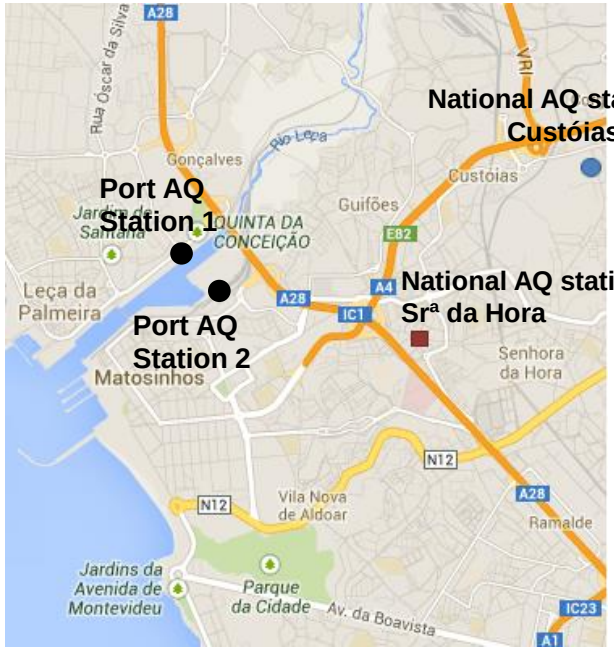




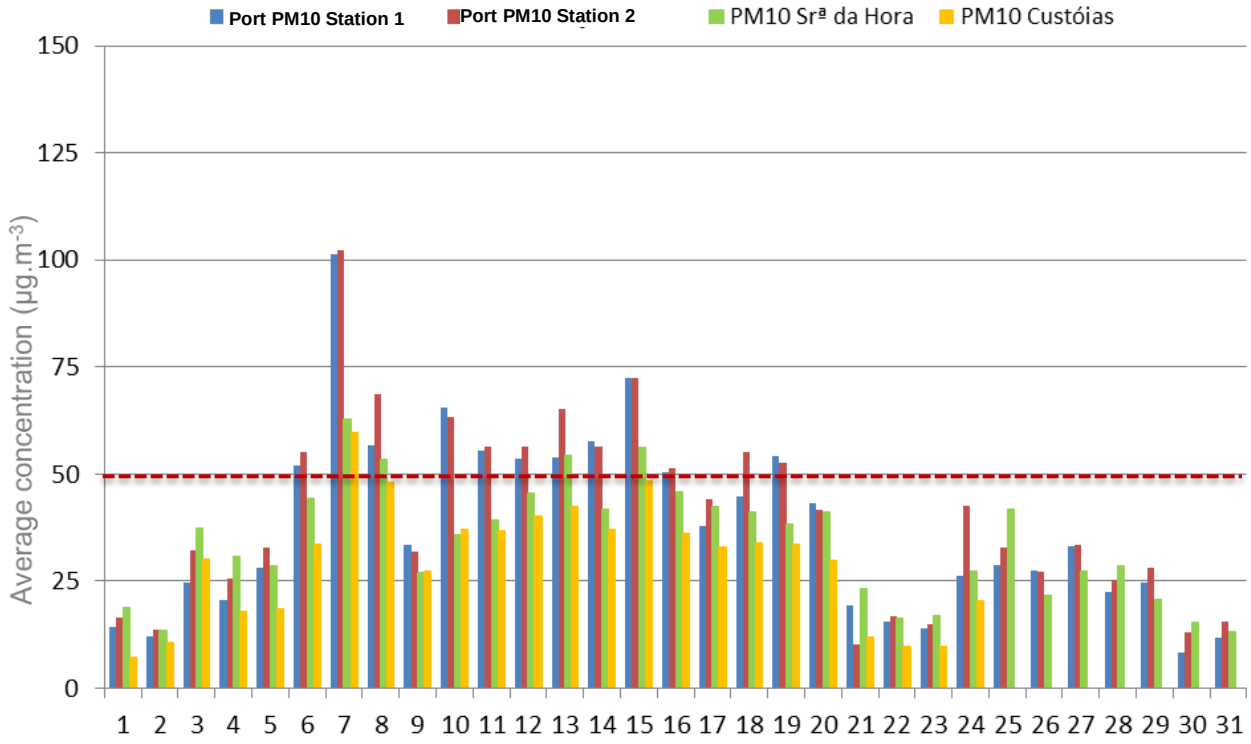
Large discharge of grain, followed by woodchips, glass and scrap metal

Case study on a Portuguese port

National AQ network vs Port AQ monitoring



Custóias AQ station (urban background) and Srª da Hora station (traffic) from the National AQ network



- Increase of PM10 concentrations in port AQ stations comparatively to the national AQ network
- Exceedance of PM10 concentrations at port AQ stations as result of port activities (dry bulk discharge, emissions from ships, machinery and road traffic)

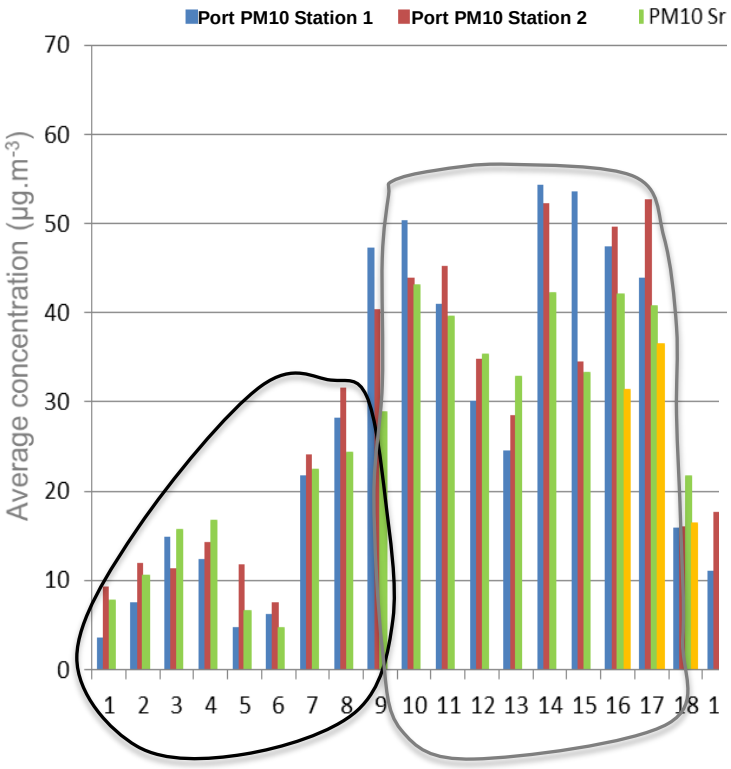
Case study on a Portuguese port

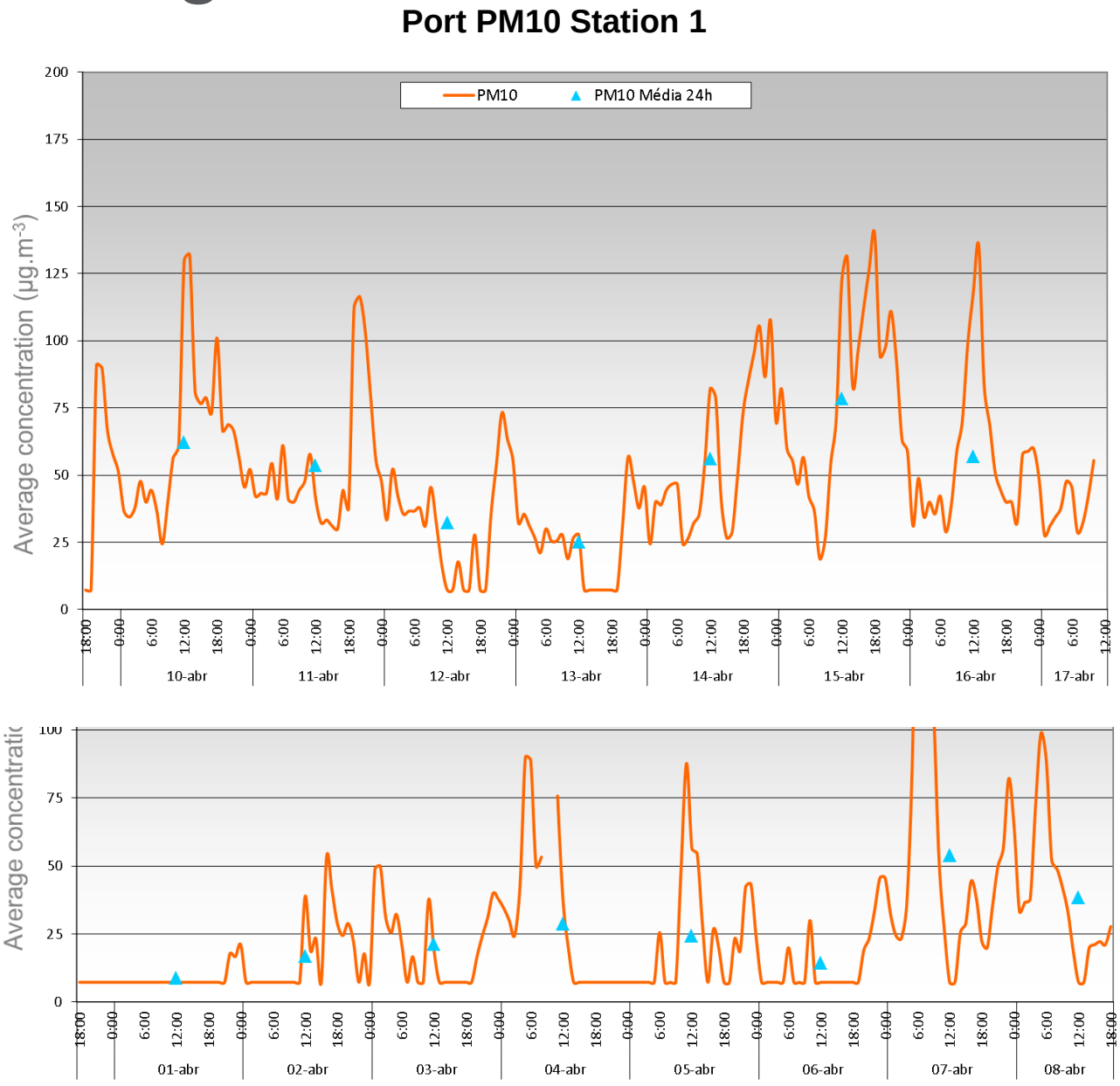
AQ monitoring campaign

Air quality monitoring campaign with hourly measurements of PM10 (beta attenuation monitoring), NOx, benzene, CO, SO_2 and PM2.5

Case study on a Portuguese port

AQ monitoring campaign





cost
EUROPEAN COOPERATION IN SCIENCE

Case study on a Portuguese port

Noise Monitoring Program

TCN
D2N
D2S
} Sources

TCN - Receptor
D2N - Receptor
D2S - Receptor

Sensitive areas (houses)

Case study on a Portuguese port

Noise Monitoring Program

Continuous measurement of noise levels near the source

- **Discharge of bulk minerals** (stone pieces) **and containers**
- **Continuous measurement of L_{Aeq}** (Equivalent Continuous Sound Level)
- **Alert levels**
- **Connected to the Port's control panel**

01DB OPER@
NOISE MEASUREMENT AND MONITORING STATION

Case study on a Portuguese port

Noise Monitoring Program

Long term measurement of noise levels in the sensitive receptors

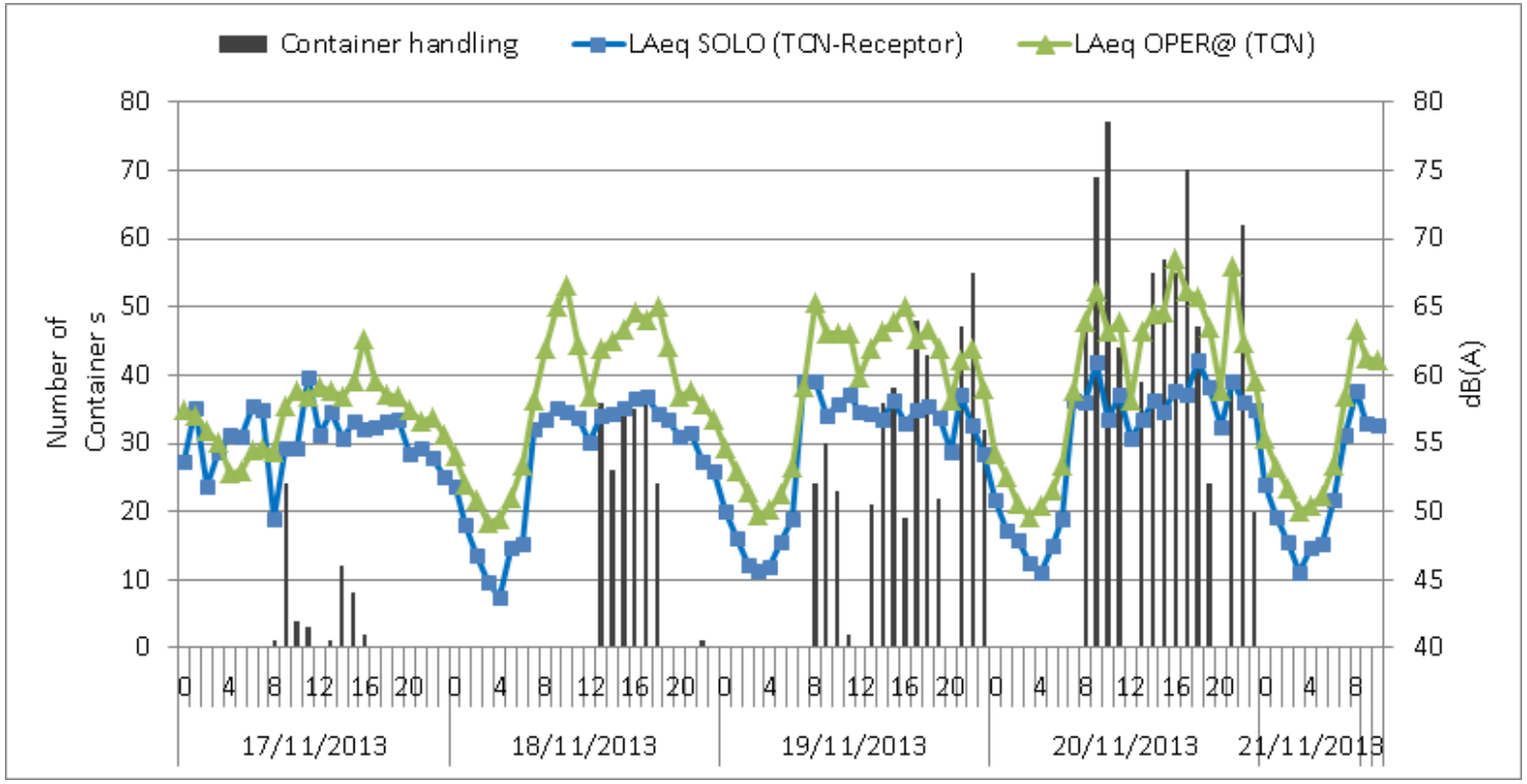
- Long term measurement of L_{Aeq} (7 days)
- Located in 3 sensitive areas (houses)
- Assessment of regulatory compliance

01DB SOLO SLM
(SOUND LEVEL METER)

Case study on a Portuguese port

Noise Monitoring Program

- The highest values match the period of container movements.
- Values measured in the source **OPER@ (TCN)** follow the same trend of the measured values in the receptor **SOLO (TCN-Receptor)**.



The main source of noise at this location is the container handling

Case study on a Portuguese port

How to conduct a detailed assessment of air quality and noise within the port vicinity to include the impacts of the whole port activity?

Case study on a Portuguese port

A new air quality monitoring strategy with a wide network of air quality and noise sensors in the port area is being studied, allowing for real-time monitor on a large number of locations.

AQ and noise sensor network

This network (15 sensor box) will be integrated in the smart management interface of Port authorities, crossing information with the type of vessels and cargoes, enabling real-time alerts with the adoption of effective prevention and mitigation procedures.

Conclusions

To reach a higher quality of life in port cities it is important to avoid potential health-affecting AQ and noise impacts

To reduce exposure of port communities to high levels of atmospheric pollutants

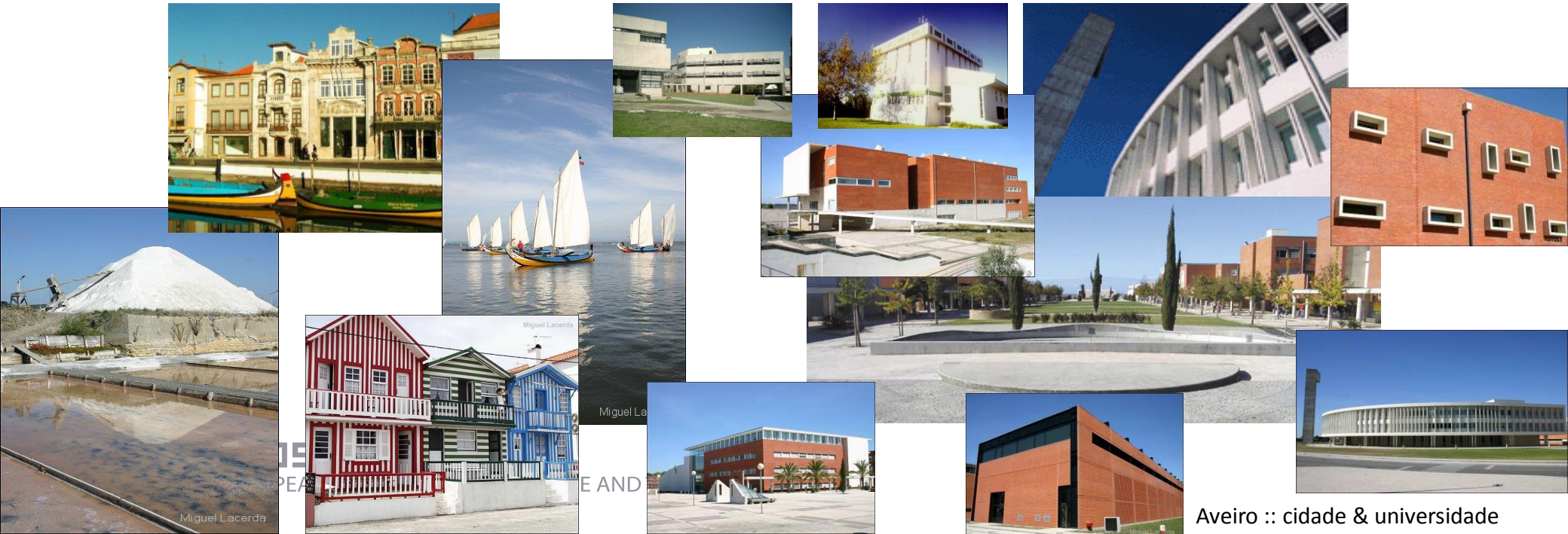
To reduce noise annoyance and sleep disturbance to the inhabitants of port communities

Conclusions

- Environmental monitoring of port operations in real time is essential to allow for rapid responses from port authorities
- Data communication protocols and data management software are a relevant part of the sensors network
- Conventional AQ and noise measuring equipment have an important role for regulatory purposes
- It is important to make information available to the local community : Local authorities (mayor, region, health…)
- Sensor monitoring networks data are determinant for improving the air quality and noise assessment over Port areas using modelling tools
- A new strategy for environmental monitoring at ports based on air quality modelling scenarios allows to prepare for critical situations and possible crisis management

Thank you!

Carlos Borrego
www.ua.pt/gemac
www.ua.pt/idad



Aveiro :: cidade & universidade