PORT PERFORMANCE PREDICTION THROUGH MARITIME OPERATIONS SIMULATION

INTRODUCTION
In recent decades, international shipping trade has grown considerably and ports have been extended in order to satisfy the demands of new ships and cargo. Port management has become a difficult task due to the high number of simultaneous operations in ports and the random nature of the agents that are involved in port operations (climate agents, ship arrivals). This makes necessary an aid-decision making tool that reproduces maritime operations and estimates the uncertainty of the port performance.

In this work, the software, based on the methodologies proposed in Benedicto et al (2013) and García Morales et al (2015), is presented. The software has a user-friendly interface, reproduces port operations for a given case and provides a set of indicators that measure the performance of the simulated case, like waiting times or occupancy of berths and harbor services. Port performance is characterized from a statistical point of view. Software validation, with Algeciras Port (Spain) as pilot port, is also presented.

THE SOFTWARE
The software comprises several modules to (1) define the case study, (2) reproduce port operations, (3) analyze the results and (4) compare different scenarios. The case study is defined by the (i) harbor configuration (channels, docks, anchorages, etc.); (ii) the climate historic data-base -used to simulate the climate conditions that affect ship operations-; (iii) ship traffic, characterized, among other variables, by ship arrivals, dimensions or port services demand; (iv) harbor services offered by the port, namely, pilots and tugs assistance and mooring and (v) management and operational criteria, such as priorities or safety procedures.

VALIDATION CASE
The software has been validated with a real case study. The Port of Algeciras is located at the south of Spain, in the strait of Gibraltar. The port has been modelled with the software, using the information provided by the Port Authority (docks and berths, ships arrivals and their characteristics, port services, etc.) for the year 2014. This information was also used to obtain some parameters to measure the port performance, such as berth occupancy rate or occupancy rates and use of harbor services. The values obtained from the simulations were compared to the real calculated values. In Figure 2, the annual percentage of time in which N resources are providing simultaneously a specific port service is shown. Real values as well as simulated ones are shown.

CONCLUSIONS
The presented software, which reproduces the port performance accurately, has proven to be a useful decision support tool for port management and planning.

REFERENCES