



## **Study of the impact of cruise and passenger ships on a Mediterranean port city air quality – Study of future emission mitigation scenarios**

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An increase of the passenger ships traffic is expected in the Mediterranean Sea as targeted by the EU Blue Growth initiative. This increase is expected to impact the Mediterranean port-cities air quality considering not only the conventional atmospheric pollutants but also the toxic ones that are emitted by the ships (e.g. Nickel). The aim of this study is the estimation of the present and future time pollutant emissions from cruise and passenger maritime transport in the port area of Thessaloniki (Greece) as well as the impact of those emissions on the city air quality. Cruise and passenger ship emissions have been estimated for the year 2013 over a 100m spatial resolution grid which covers the greater port area of Thessaloniki. Emissions have been estimated for the following macro-pollutants;  $\text{NO}_x$ ,  $\text{SO}_2$ , NMVOC, CO,  $\text{CO}_2$  and particulate matter (PM). In addition, the most important micro-pollutants studied in this work are As, Cd, Pb, Ni and Benzo(a)pyrene for which air quality limits have been set by the EU. Emissions have been estimated for three operation modes; cruising, maneuvering and hotelling. For the calculation of the present time maritime emissions, the activity data used were provided by the Thessaloniki Port Authority S.A. Moreover, future pollutant emissions are estimated using the future activity data provided by the Port Authority and the IMO legislation for shipping in the future. In addition, two mitigation emission scenarios are examined; the use of Liquefied Natural Gas (LNG) as a fuel used by ships and the implementation of cold ironing which is the electrification of ships during hotelling mode leading to the elimination of the corresponding emissions. The impact of the present and future passenger ship emissions on the air quality of Thessaloniki is examined with the use of the model CALPUFF applied over the 100m spatial resolution grid using the meteorology of WRF. Simulations of the modeling system are performed for four different emission scenarios; present time scenario, future time scenario, future time scenario plus use of LNG and future time scenario plus use of cold ironing. The differences in pollutant levels between the scenarios examined are presented and discussed