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Flow rate emission and global impact study of ships plumes in Venice lagoon area

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Ships' emissions, in terms of nitrogen dioxide (NO2) and sulphur dioxide (SO2), are considered to have not negligible environmental impact on populated harbour areas, especially those where high touristic traffic take place. A new methodology, named FRE-DOAS (Flow Rate Emission DOAS), based on spatially scanning spectral measurements of diffusely scattered solar radiation, combined with a radiative transfer model appears an appropriate tool for evaluation of ships' flow rate emissions (expressed in g/s). The present work is describes FRE-DOAS and results obtained during three field campaigns performed in October 2007, 2008, 2009 (the month with the significant traffic in the Venice port). The global impact of ships passage on the Venice area is evaluated from these measurements applying a statistic approach based on the number of ships, their characteristics and typology. We estimated the total gas mass emitted from each kind of ships cataloguing them by emission rate, dimensions, engine and paths inside the lagoon, and when it was possible the variation during the years. Possibility to improve methodology is discussed too.