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Corrosion in offshore wind energy: assessment of marine aerosol concentration using the BSC-CALIOPE air quality modelling system in Europe

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Corrosion of wind turbine components in offshore environments is a major issue. Sea salt aerosols greatly affect metallic structures when surfaces are wet. In Europe, wind power installed capacity has experienced a rapid growth. In regions such as the North Sea, Celtic Sea and the Baltic Sea a few offshore wind farms have been already installed and many others are under consideration. Offshore wind turbines are exposed to corrosive attack affecting their efficiency. Such corrosion attack and the corrosion rate depend on: the metallic materials, technical parameters, operating conditions and the atmospheric environment.

According to the ISO9226, data on the corrosivity of the atmosphere are essential for the development and specification of optimized corrosion protection for manufactured products. This corrosivity determination can be based on either in-situ corrosivity assays for a specific location or estimations based on atmospheric environmental information. Model data can be used to estimate local atmospheric parameters, since there are only a few observations of atmospheric composition and corrosivity determination tests need long exposition periods.

In this study, marine aerosol load in Europe is assessed by using data from simulations using BSC's CALIOPE air quality model system. The simulations are run for three years: 1990, 2000 and 2010. Sodium, chloride and total sulfate aerosols are studied. An evaluation of the modelled aerosol concentration is performed using the EBAS database.

This study has been motivated by the interest of a private stakeholder in assessing marine aerosol load in an specific wind farm. Model results will help to illustrate the added value of air quality modelling systems for estimating the risk of metal corrosion of offshore wind turbine components.