



Changes in Atmospheric Sulfur Dioxide (SO₂) over the English Channel – 1.5 Years of Measurements from the Penlee Point Atmospheric Observatory

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Atmospheric sulfur dioxide (SO₂) was measured continuously from the Penlee Point Atmospheric Observatory near Plymouth, United Kingdom between May 2014 and November 2015. This coastal site is exposed to marine air across a wide wind sector. The predominant southwesterly winds carry relatively clean background Atlantic air. In contrast, air from the southeast is heavily influenced by exhaust plumes from ships in the English Channel as well as near the Plymouth Sound. International Maritime Organization regulation came into force in January 2015 to reduce sulfur emissions tenfold in Sulfur Emission Control Areas such as the English Channel. We observed a three-fold reduction from 2014 to 2015 in the estimated ship-emitted SO₂ during southeasterly winds. Dimethylsulfide (DMS) is an important source of atmospheric SO₂ even in this semi-polluted region. The relative contribution of DMS oxidation to the SO₂ burden over the English Channel increased from ~1/3 in 2014 to ~1/2 in 2015 due to the reduction in ship sulfur emissions. Our diel analysis suggests that SO₂ is removed from the marine atmospheric boundary layer in about half a day, with dry deposition to the ocean accounting for a quarter of the total loss.