

6.120 Attribution of Atmospheric Sulfur Dioxide over the English Channel to Dimethylsulfide and Changing Ship Emissions.

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Abstract:

Atmospheric sulfur dioxide (SO₂) was measured continuously from the Penlee Point Atmospheric Observatory (PPAO) 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. New International Maritime Organization (IMO) regulation came in to force in January 2015 to reduce the maximum allowed sulfur content in ships' fuel tenfold in Sulfur Emission Control Areas such as the English Channel. Our observations suggest a three-fold reduction in ship-emitted SO₂ from 2014 to 2015. Apparent fuel sulfur content calculated from coincidental SO₂ and carbon dioxide (CO₂) peaks from local ship plumes show a high level of compliance to the IMO regulation (>95%) in both years (~70% of ships in 2014 were already emitting at levels below the 2015 cap). 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.