Title	**Temporal trends in sulphate concentrations at European sites and relationships to sulphur dioxide**
Author	Alan M. Jones, Roy M. Harrison
Journal	Atmospheric Environment, Vol. 45(4)
Abstract	Temporal trends in sulphate data taken from UK networks from the period 2001–2008 have been examined, together with trends in relevant precursor gases. In general, trends in sulphate are small, and the data sets are not of sufficient length to determine the direction of trend with confidence. Since relatively short periods of high or low concentration near to the start or finish of the period have a disproportionate influence, the choice of period over which the trend is calculated is crucial to the outcome. All six sites showed a significant reducing trend in sulphur dioxide, while ammonia data appear to be affected by sampling problems and site relocations and clear trends are not apparent. Data relating annual mean airborne concentrations of sulphur dioxide and sulphate from several countries can be related through a relationship of the form: ? $[SO_4^{2-}]$ = a•? $[SO_2]^b$ + c in which a, b and c are constants and ? represents concentrations. While constant b remains the same for different countries, a and c can change in ways that appear to relate to either the distance from major SO_2 sources, or the oxidising capacity of the atmosphere. Using the relationship between SO_4^{2-} and SO_2 derived from UK sites allows estimation of the reduction in sulphur dioxide emissions affecting UK sites needed to reduce sulphate concentrations by 1 μg m^{-3}. This is 55% and 49% for Harwell and North Kensington respectively.
Year	2011
Pages	873- 882
keywords	Sulphate trends; Sulphur dioxide; Abatement; Non-linearity

Title	**Environment and productivities in developed and developing countries: The case of carbon dioxide and sulfur dioxide**
Author	Surender Kumar, Shunsuke Managi
Journal	Journal of Environmental Management, Vol. 91(7)
Abstract	We propose a productivity index for undesirable outputs such as carbon dioxide (CO_2) and sulfur dioxide (SO_2) emissions and measure it using data from 51 developed and developing countries over the period 1971–2000. About half of the countries exhibit the productivity growth. The changes in the productivity index are linked with their respective per capita income using a semi-parametric model. Our results show technological catch up of low-income countries. However, overall productivities both of SO_2 and CO_2 show somewhat different results.
Year	2010
Pages	1580- 1592
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Title	**Investigating the influence of sulphur dioxide (SO_2) on the stable isotope ratios ($d^{13}C$ and $d^{13}O$) of tree rings**
Author	K.T. Rinne, N.J. Loader, V.R. Switsur, K.S. Treydte, J.S. Waterhouse
Journal	Geochimica et Cosmochimica Acta, Vol. 7(8)
Abstract	This study reports the influence of a 20th century pollution signal recorded in the $d^{13}C$ and $d^{18}O$ of absolutely dated tree rings from *Quercus robur* and *Pinus sylvestris* from southern England. We identify a correspondence between the inter-relationship and climate sensitivity of stable isotope series that appears to be linked to recent trends in local SO_2 emissions. This effect is most clearly exhibited in the broadleaved trees studied but is also observed in the $d^{13}C$ values of the (less polluted) pine site at Windsor. The SO_2 induced stomatal closure leads to a maximum increase of 2.5‰ in the isotope values ($d^{13}C$). The combined physiological response to high pollution levels is less in $d^{13}O$ than $d^{13}C$. The SO_2 signal also seems to be present as a period of reduced growth in the two ring-width chronologies. Direct, quantitative correction for the SO_2 effect represents a significant challenge owing to the nature of the records and likely local plant response to environmental pollution. Whilst it appears that this signal is both limited to the late industrial period and demonstrates a recovery in line with improvements in air quality, the role of atmospheric pollution during the calibration period should not be underestimated and adequate consideration needs to be taken when calibrating biological environmental proxies in order to avoid development of biased reconstructions.
Year	2010
Pages	2327- 2339
keywords	

Title	**Effect of intermittent exposures of SO_2 on the leaf blight caused by *Alternaria brassicicola* on Indian mustard**
Author	Mujeebur Rahman Khan, Mohd Mahmud Khan
Journal	Agriculture, Ecosystems & Environment, Vol. 139(4)
Abstract	Effects of low levels of SO_2 were investigated on the *Alternaria* blight on Indian mustard cultivars under artificial treatment condition. Ten cultivars of Indian mustard, *Brassica juncea* L. viz., Alankar, BS-2, Kalamoti, Karishma, Kranti, Mahyco Bold, Pusa Bold, Rohini, Swarna and T-59 were exposed to 5.7 (ambient), 71.5, 143 and 214.5 µg SO_2 m^{-3} concentration for 5 h day^{-1} on alternate days for 3 months in open top exposure chambers to evaluate resistance/tolerance against the gas. SO_2 at 71.5 and 143 µg m^{-3} concentrations did not incite any measurable injury to mustard cultivars. However, 143 µg SO_2 m^{-3} caused visible injuries to all cultivars screened and led to a significant reduction in plant length, yield, and oil contents ($P = 0.05$). Effects of intermittent exposures of SO_2 on leaf blight caused by *A. brassicicola* on the mustard cultivars were also studied. The fungus inoculated plants developed dark brown to almost black necrotic circular lesions, and severity of the blight increased on plants exposed to 143 µg SO_2 m^{-3}, but decreased at 214.5 µg SO_2 m^{-3}. The interaction between the gas and the fungus was found to be dependent of SO_2 concentration. The gas at 71.5 and 143 µg SO_2 m^{-3} promoted pathogenesis of *A. brassicicola* with result the cv. Kalamoti, expressing tolerance to the fungus, becoming susceptible and exhibiting greater blight and plant growth reductions at 143 µg SO_2 m^{-3}; the gas injury was also relatively greater in this treatment. The gas promoted sporulation of the fungus. Interaction of 214.5 µg SO_2 m^{-3} concentration and *A. brassicicola* was found to be antagonistic. The cv. Kalamoti showed resistance to *A. brassicicola* and did not exhibit significant suppression in the yield. The exposures especially 143 µg m^{-3} apparently broke the tolerance reaction of the cv. Kalamoti and greater lesions (32%) developed on the leaves of inoculated plants, fungus inoculation, however, did not influence the sensitivity of the cultivars to SO_2. Synergistic interaction between 143 µg SO_2 $m^{-3}$and the fungus was recorded on six cultivars out of ten cultivars tested, whereas the interaction at 214.5 µg SO_2 $m^{-3}$was antagonistic on two cultivars (Alankar and Mahyco Bold) and on rest near to additive. At 214.5 µg SO_2 m^{-3}, the sporulation was suppressed but increased at 143 µg SO_2 m^{-3}. The study has shown that lower concentration of SO2 (143 µg SO_2 m^{-3}) stimulated the Alternaria blight but the higher concentration (214.5 µg SO_2 m^{-3}) suppressed the disease.
Year	2010
Pages	728- 735
keywords	Sulphur dioxide; *Alternaria brassicicola*; Indian mustard germplasm