How climate change could affect European ozone pollution

A study by Swedish scientists provides new insights into how climate change could affect future ozone concentrations in European countries. The findings of this study suggest that average ozone concentrations will increase more in Southern Europe than in more Northern and mountainous regions under the influence of climate change in the 21st century.

Ground-level ozone is one of the most serious air pollutants in Europe today. High levels of ozone can affect the respiratory system and increases morbidity and mortality, particularly in sensitive groups of the population. Ozone also damages vegetation, reduces crop yields and corrodes building materials. Ozone concentrations are highly dependent on environmental conditions, including temperature. It is thought to be likely that long-term changes in climate will affect levels of future ozone pollution. Concentrations in Europe tend to be highest in the hottest months of the year, between April and September.

In a modelling study of ozone concentrations in Europe, the researchers investigated the effects of climate change on the factors that influence ozone concentrations. They focused mainly on two factors in particular: emissions of isoprene (a volatile organic compound acting as a fuel for ozone formation) that are produced by trees, and “dry deposition” – the uptake of ozone by plants. They used a chemistry transport model (MATCH), developed for assessing European air quality problems, to model chemical changes in the atmosphere in a future climate change scenario. According to the model, a warmer climate increases the emissions of isoprene from trees and a warmer, drier climate will reduce the uptake of ozone in plants.

According to the study, average summer ozone concentrations will increase more in southern Europe than in northern Europe and the Alps over the remainder of this century. Daily maximums will increase significantly in southern, north-western continental, central Europe and Britain.

Uptake by plants will be more important than isoprene emissions in influencing ozone concentrations in southern Europe, say the researchers. Plant uptake will decrease under climate change and may be responsible for up to 60 per cent of the change in ozone levels. However, in mountainous regions, such as the Alps, a decrease in snow cover may help increase uptake by plants, particularly in the winter, reducing ozone concentrations.

Climate change is predicted to nearly double isoprene emissions. The researchers estimate that up to 30 per cent of future increased ozone concentrations will be due to increased isoprene emissions. Changes in mixing between upper and lower layers of the atmosphere may also affect ozone concentrations with more stable weather conditions in southern European countries acting to increase concentrations.

The researchers note that their results are based on just one climate simulation and that different emissions scenarios and climate models could produce different results.


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