

# Ground-level ozone pollution helped to recover normal ozone levels over the Iberian Peninsula

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The reconstruction of ozone levels over the Iberian Peninsula between 1979 and 2008 reveals that positive trends began eight years after the ratification of the Montreal Protocol. Furthermore, results show that Spain quickly recovered part of its lost ozone thanks to tropospheric ozone, a secondary pollutant derived from industrial emissions. Credit: SINC

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Researchers from the Andalusian Centre for Environmental Studies and the University of Granada have rebuilt the [ozone](#) column trends recorded

between 1978 and 2008 that rise up over the [Iberian Peninsula](#). The study was published weeks ago in the *Atmospheric Environment* journal.

The results highlight the influence that the [prohibition](#) of [aerosols](#) and chlorofluorocarbon gases (CFC) has had. According to Manuel Antón from the Department of Applied Physics of the University of Granada, "although these types of emissions were banned by the 1987 Montreal Protocol, our study reveals that stratospheric ozone did not show signs of recovery until 1995."

"We established two measurement periods. For the first, between 1979 and 1994, we saw that stratospheric ozone depletion was significant with higher levels in the north of the peninsula," states Antón. According to the study, the effects of depletion were felt more in cities such as Barcelona, Santander and La Coruña who all saw a reduction in ozone levels of approximately 4% per decade due to dynamic factors in the stratosphere.

The second period studied, between 1995 and 2008, differed from the first. For example, ozone levels showed positive trends with greater recovery levels (2.5% per decade) in the north-east of the Peninsula where levels were higher than other regions due to industrial emissions. Antón says that "we have seen that the troposphere ozone contributes in recovering total ozone levels."

In contrast to the [stratospheric ozone](#), which acts as a filter against harmful radiation, the tropospheric or ground-level ozone found in the lowest layer of the atmosphere is a secondary pollutant. It mainly comes from the photochemical processes that transform nitrogen oxides and volatile particles from burning fossil fuels into ozone. Heat and light from the sun stimulate such processes which is why ground-level ozone is such a common pollutant in [Spain](#).

The results show that in highly industrial areas such as the north-east of Spain, the recovery of the ozone layer was quicker thanks to the ozone contribution of the troposphere to the stratosphere. However, the authors of the study warn that "other anthropogenic effects could complicate the recovery process and result in areas with altered [ozone levels](#)."

**More information:** M. Antón, D. Bortoli, P. S. Kulkarni, M. J. Costa, A. F. Domingues, D. Loyola, A. M. Silva, L. Alados-Arboledas. Long term trends of total ozone column over the Iberian Peninsula. Atmospheric Environment. [Doi: 10.1016/j.atmosenv.2011.08.058](https://doi.org/10.1016/j.atmosenv.2011.08.058)

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