# Man, volcanoes and the sun have influenced Europe's climate over recent centuries

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This is a photograph of Mount Etna in Italy. Credit: Gaeti

An International research team has discovered that seasonal temperatures in Europe, above all in winter, have been affected over the past 500 years by natural factors such as volcanic eruptions and solar activity, and by human activities such as the emission of greenhouse gases. The study, with Spanish involvement, could help us to better understand the dynamics of climate change.

Up until now, it was thought that Europe's climate prior to 1900 was barely affected by external factors, but now a group of scientists has shown that natural phenomena such as volcanic eruptions or solar radiation, as well as human emissions of aerosols and greenhouse gases, have had an impact on the evolution of Europe's climate over the past

five centuries.

"The influence of the increase in levels of greenhouse gases, in particular, can be clearly seen since the end of the 17th Century", Jesús Fidel González Rouco, a physicist at the Complutense University of Madrid and co-author of the study, which has recently been published online in the journal *Nature Geoscience*, tells SINC.

The researchers studied how natural and human factors affected temperatures across Europe throughout the seasons in the years from 1500 to 2000. The results show that winter is the season in which changes in levels of greenhouse gases and aerosols from manmade sources can be seen to have the clearest influence.

As reliable temperature records do not go back any further than 150 years, the team carried out simulations using three climate models and reconstructed past climate scenarios based on old instrumental observations, information recorded in historical documents and by studying tree rings.

## Lessons for climate change

"For the first time we are able to attribute causes to how the climate has evolved over several centuries, working at continental and seasonal scale", says González Rouco. "And the relevance of this approach is based on the fact that the impact of any possible climate change can be greater for societies and ecosystems within the range of these spatial and time-based scales".

Scientists say that Europe's climate "has in the past been sensitive to variations in radiative forcing from natural and human sources (changes in the energy received from the Sun, in volcanic activity, or in levels of greenhouse gases), so it is to be expected that the intense current and

future variations in these forcings will play a significant role in the future evolution of Europe's climate".

**More information:** Gabriele Hegerl, Juerg Luterbacher, Fidel González-Rouco, Simon F. B. Tett, Thomas Crowley y Elena Xoplaki. "Influence of human and natural forcing on European seasonal temperaturas". *Nature Geoscience*, 16 de enero de 2011 (avance on line). DOI: 10.1038/NGEO1057

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