Researchers uncover the origin of atmospheric particles

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In a study led by the University of Leeds, scientists have solved one of the most challenging and long-standing problems in atmospheric science: to understand how particles are formed in the atmosphere.

The research paper, published online today in the journal *Science*, details the first computer simulation of atmospheric particle formation that is based entirely on experimental data. The research was made possible thanks to a sophisticated laboratory called CLOUD, based within the research facility CERN in Switzerland.

The lead scientist on the study, Professor Ken Carslaw from the School of Earth and Environment at the University of Leeds said: "This is a major milestone in our understanding of the atmosphere. The CERN experiment is unique, and it has produced data that seemed completely out of reach just five years ago."

Clouds in the atmosphere consist of tiny droplets, which form when water condenses around small particles in the atmosphere called 'aerosols'. Understanding how aerosols are formed is therefore vital for understanding cloud formation – a process that has, until now, been an uncertain quantity in climate models, introducing problems for climate change projections.

For over 30 years, scientists have been able to build computer simulations of atmospheric gases based on measurements of chemical reaction rates made in a laboratory. This capability has been essential to our current understanding of the atmosphere, including the destruction of the ozone layer.

Until now, the same level of understanding has not been possible for aerosol particles in the atmosphere because of the enormous challenges involved in reliably measuring particle formation in a laboratory.

The CLOUD experiment can measure the 'nucleation' of new atmospheric particles – that is, when certain molecules in the atmosphere cluster together and grow to form new particles – in a specially designed chamber under extremely well controlled environmental conditions.

Nucleation is important because, by current estimates, about half of all cloud droplets are formed on aerosol particles that were created in this way.

Professor Carslaw concludes: "These new results will give us much more confidence in how particles and clouds are handled in global climate models."

More information: E. M. Dunne et al. Global atmospheric particle formation from CERN CLOUD measurements, *Science* (2016). DOI: 10.1126/science.aaf2649

Provided by University of Leeds