Scientists demonstrate the sharpest measurement of ice crystals in clouds

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Scientists have created an instrument designed to help determine the shapes and sizes of tiny ice crystals typical of those found in high-altitude clouds, down to the micron level (comparable to the tiniest cells in the human body), according to a new study in *Optics Letters,* a journal published by the Optical Society. The data produced using this instrument likely will help improve computer models used to predict climate change.

Among the hundreds of factors climate scientists must take into account in modeling weather, the nature of clouds is one of the most important and least understood. The best researchers could do in the past to measure cloud ice crystals was to try to record images of them, but for crystals below 25 microns, the images were too blurred to allow accurate determination of the crystal's shape.

Researchers need to know the shape and sizes of these ice crystals because these properties influence how much incoming sunlight gets absorbed in the atmosphere and how much gets reflected right back out into space. This, in turn, can have a huge impact on the magnitude of possible global warming or cooling.

Now scientists from the University of Hertfordshire and the University of Manchester in the United Kingdom and Colorado State University in the United States have developed an optical scattering instrument that can evaluate the size of the crystals in a different way. Using this instrument, the researchers have been able to determine sizes and shapes

of cloud ice crystals all the way down to the tiniest micron levels.

The research team actually has built two versions of the instrument: one designed to operate on ground-based cloud simulation chambers or to operate in the fuselage of research aircraft; the other, an aerodynamic version that fits under the wing of the aircraft and measures the cloud particles directly as the aircraft flies through the cloud. Neither instrument attempts to make a full image of the ice crystal, since this would suffer the same resolution limits of existing instruments. Instead they record the detailed pattern of scattered light from each individual crystal and then interpret these patterns using either theoretical models or by comparison with recorded patterns from known crystal shapes. From this data a crystal census of varying sizes and shapes can be made.

"The new instruments should help map out a more complete understanding of complex crystal shapes found in atmospheric clouds, especially cirrus clouds, which on any day can cover more than 20 percent of the Earth's surface," says one of the researchers, Hertfordshire scientist Paul Kaye. "We believe that this optical scattering instrument could help climate modelers reduce one of the greatest areas of uncertainty in interpreting the influence of clouds and in making more accurate climate predictions."

In addition, recent reports have examined the effect that pollution and the clouds caused by pollution have on reducing solar radiation reaching the ground, a development that may counterbalance global warming to some extent, and this new technology could help scientists better monitor and understand this situation.

Source: Optical Society of America