Detecting clouds from both sides now

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Researchers have developed a more precise method to detect the boundary between clouds and clear air, by exploiting the swinging motions of a weather balloon and its payload.

"Bows and flows of angel hair, and ice cream castles in the air;" we've looked at clouds that way. But the interface between clouds and clear air isn't as well-defined as these imaginative shapes might lead us to believe. Detecting that hazy line can help scientists to better understand the processes that lead to cloud formation, which is important for good weather forecasts and climate modeling. Now atmospheric scientists from the University of Reading in the United Kingdom have designed a sunlight-measuring tool that uses the natural swinging and spinning of a rising weather balloon to distinguish clouds from clear air and may provide higher-resolution measurements of cloud boundaries than is currently possible. The researchers describe their device in a paper published in the American Institute of Physics' journal Review of Scientific Instruments.

Traditional cloud detection using weather balloons relies on measurements of temperature and relative humidity. The Reading researchers reasoned that they could sense clouds optically, using a simple and inexpensive design: a light sensor carried on a weather balloon. This sensor responds to the intensity of light, producing a maximum reading when pointing directly at the Sun in clear air but reduced readings at oblique angles to the Sun. As the sensor swings beneath a moving balloon, its orientation to the Sun changes continually, resulting in large fluctuations in the sensor's light intensity readings in

cloudless conditions. But inside a cloud – where light intensity is roughly the same in all directions – the fluctuations become much smaller. The team showed that cloud edges could be detected by looking for an abrupt change in the size of these fluctuations.

Laboratory experiments demonstrated that the new instrument worked consistently over the wide range of temperatures that weather balloons encounter. In test flights, the optical technique was able to detect cloud boundaries with greater precision than traditional relative humidity measurements alone. Though this method works best to detect the upper boundaries of clouds, the researchers say that the new system could also be used to determine lower boundaries of clouds in broken cloud conditions or for high-level clouds.

More information: "Balloon-borne disposable radiometer for cloud detection" has been published in the *Review of Scientific Instruments*.

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