Red sky in sight shows charging at height

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Credit: University of Reading

The Saharan dust cloud that cast a red glow over the UK last autumn helped scientists to take a step forward in understanding how to prepare for future volcanic eruptions.

Smoke from forest fires in Spain and Portugal joined dust from the Sahara in a dense plume carried to the UK on 16 October 2017, in strong winds remaining from Hurricane Ophelia. University of Reading scientists responded immediately by making airborne measurements to investigate the unusual event.

Weather balloons designed for volcanic eruptions were sent into the plume, and revealed a strong static charge caused by turbulence within it. The findings, published in *Environmental Research Letters*, will improve

scientists' understanding of how dust clouds behave in the atmosphere. This includes volcanic ash clouds, which frequently ground flights around the world, costing airlines and businesses billions.

Professor Giles Harrison, Professor of Atmospheric Physics at the University of Reading, said: "As well as joining everyone else in marvelling at the eerie red sun created by the dust plume, we seized the opportunity to explore it using lasers from below and by sending a balloon directly into it. We think these are the first combined measurements of electric charge and turbulence inside a Saharan dust plume over the UK.

"Charging clearly readily occurs in plumes like this one, which changes how dust and smoke particles interact with clouds. Understanding dust behaviour and transport is important because of its effects on climate, air quality, soils and marine life.

"Saharan dust clouds behave in a very similar way to volcanic ash clouds, such as the 2010 eruption in Iceland that left millions of airline passengers stranded across Europe, so the benefits of this research are clear."

Volcano tech

Charging of plume particles influences how fast they fall through the air and how effectively they are removed by water droplets. In the October 2017 event, the dust particles fell into a cloud-forming layer before reaching the ground. The scientists argue that models of dust transport should be updated to incorporate electrical aspects of dust clouds, to better predict how particles are transported over long distances.

Dust episodes like the one last autumn can make the sun appear unusually red. This happens because air scatters the blue part of the

sunlight, and some dust particles also absorb blue light. Red sunlight remains, which, together with some green and yellow wavelengths passing through the dust layer, leads to red or brown sun and skies.

The weather balloons sent into the Saharan dust plume carried the University of Reading's specially developed VOLCLAB technology, which was created for monitoring volcanic ash clouds. Unlike research aircraft, the balloons could be used in the strong winds.

Research at the University of Reading is looking to help airlines overcome the problems posed by volcanic eruptions. Scientists are working with British Airways, engine manufacturer Rolls Royce and the Civil Aviation Authority to develop a tool to calculate how much ash a plane encounters along its flight path, and the associated uncertainty, for the first time. This would allow airlines to make more informed decisions on when to cancel flights due to ash in the air.

More information: R Giles Harrison et al. Saharan dust plume charging observed over the UK, *Environmental Research Letters* (2018). DOI: 10.1088/1748-9326/aabcd9

Provided by University of Reading