Scientists use meteors to investigate climate change and giant waves at the 'edge of space'

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A new research radar based in Antarctica is giving scientists the chance to study the highest layer of the earth's atmosphere at the very edge of space.

Using the new radar, scientists will be able to investigate climate change and explore the theory that while the lower atmosphere is warming, the upper atmosphere is cooling by as much as 1 degree Centigrade each year.

They will also be able to find out more about the complex waves, tides and other mechanisms that link this region - known as the mesosphere - to the lower regions of the atmosphere.

At heights of around 80-100km (50-62 miles) the mesosphere is notoriously difficult to investigate and is the least-explored part of the Earth's atmosphere.

The low air pressure at this altitude means that it is impossible to fly aircraft in the mesosphere and even the huge weather balloons that are used to measure stratospheric ozone cannot climb high enough to reach this altitude.

Satellites begin to burn up when they enter the mesosphere, so the new radar - just installed at the Rothera research base in Antarctica in a joint project between the University of Bath and the British Antarctic Survey (BAS) - will help scientists explore the region using remote sensing.

"Fortunately, nature provides us with an excellent answer to the problem of investigating the mesosphere," said Professor Nick Mitchell who heads the project in the Department of Electronic and Electrical Engineering at the University of Bath.

"Meteors, or 'shooting stars', burn up in the mesosphere. The meteors drift just like weather balloons so we can use a radar on the Earth and bounce radio waves off the meteors to find how fast they are moving and so measure the winds at the edge of space.

"The fading of the radio echoes from the meteors also lets us measure the temperature of the atmosphere. We can detect thousands of meteors in any one day and with this information study the waves and tides that flow around the planet on a continuous basis.

"The mesosphere has been called the miner's canary for climate change; meaning that it is very sensitive and the changes there may be larger than in any other part of the atmosphere.

“Evidence of these changes comes from sightings of noctilucent clouds, very unusual clouds seen only in polar regions and known to be in the mesosphere. These clouds don’t seem to have been observed before 1885 and may mark the onset of a long-term cooling of the upper atmosphere”.

The researchers hope to use this temperature data to see if the effects of climate change are present in the upper atmosphere.

The radar is the latest element in a global array of radars being installed by the University of Bath group. It will be used in tandem with an identical radar at Kiruna, inside the Arctic Circle in Northern Sweden, to find out if there are any differences between the Arctic and Antarctic upper atmosphere.

“We know that there are big differences lower down in the atmosphere, for instance in the stratosphere the ozone hole is much larger over the Antarctic than over the Arctic, but we don’t really know what the differences are like higher up,” said Professor Mitchell.

First results from the radar show that it is detecting about 5,000 meteors ever day. Analysis at the University of Bath has revealed frigid temperatures in the mesosphere, the lowest temperatures of about -130ºC, paradoxically occurring at midsummer.

The Rothera radar has been installed by Dr Peter Younger, a postdoctoral researcher from the University assisted by colleagues from BAS.

The radar is made of six antennas about 2 metres high set up over a space the size of a football pitch. The site itself is a rocky beach on the edge of Marguerite Bay – a landscape of icebergs, penguins and seals. Dr Younger has just returned to the UK having spent two months on the

installation.

Source: University of Bath