

Memo to: The Climate Club -- C759 9 November 1986

From: Walt Roberts

Provocation No. 130

Clouds that Shine in the Night

I first saw noctilucent, or night-shining, clouds on a July evening some years ago, at Watson Lake in the Yukon Territory. I was flying my twin engine Beech Baron to Alaska with my co-pilot friend Chris Finnoff and my son David, an accomplished Alaska mountain climber, and David's wife, Sharon. We had flown from Boulder, Colorado and were following the Alaska-Canada Highway, but decided to stop overnight at Watson Lake, before continuing the rest of the way to Bettles Field, whence we planned a trip into the Brooks Range of Northern Alaska.

We were at 60 deg latitude, so the night became relatively dark. In that darkness the feathery pale-bluish clouds shone with a eerie glow, low and to the north, beckoning us to our destination beyond the Arctic Circle. For a long time I had been fascinated by them, though I'd never seen them. As a solar physicist, I speculated about whether they exhibited some dependence in their formation on the activity of the sun that so profoundly affects the radio reflecting layers of the atmosphere, the aurora borealis and other high latitude geophysical phenomena.

Thus, I am pleased to see, in the latest issue of the Journal of the Royal Astronomical Society, a marvelous summary article about noctilucent clouds by my astronomer friend and colleague, Mike Gadsden, of Aberdeen University in Scotland. These clouds are often seen on clear nights in the Scottish summer.

The clouds have been studied at least since 1884, when a scientist named Leslie recognized them as something very different from ordinary clouds. Their composition and origin have long been a mystery. As Gadsden states, they are probably made up of microscopic crystals of ordinary ice. They are found in a thin layer between 80 and 85 kms above the earth, where the atmospheric temperature reaches its coldest values of perhaps -150 deg C in summer months. The mystery comes from the fact that at this high altitude air pressure is only one-millionth that of sea level, and there is VERY little water vapor to form into ice.

Leslie called them "weird small cloud forms, at times very regular, like ripple marks in sand, or the bones of some great fish or saurian embedded in a slab of stone." At an altitude of 85 kms, the noctilucent clouds are illuminated by the light of the sun, even though the sun is a half-dozen degrees or more below the horizon for the ground-based observer.

The bluish color is the result of the partial absorption of yellow wavelengths by ozone in the atmosphere before the sunlight strikes the clouds. Molecular absorption of yellow light in the so-called Chappuis absorption bands is responsible. The absorption is great because the sunlight, in its nearly horizontal path to the clouds, passes through ozone-rich layers of the atmosphere over a very long path length.

Gadsden points out that there is indeed a connection with solar activity. When the sun is low in flare and sunspot activity the clouds are more frequent, answering my earlier question. This probably is because at the 80-85 km level of the atmosphere the temperatures are lower at weak solar activity, thus promoting the formation of longer-lived ice particles. But the elusive clouds still pose many unsolved questions for future research workers.

The earliest records of the clouds are from 1884, but it is fascinating that Lewis Carroll has the Walrus and the Carpenter, twelve years earlier, telling the baby oysters of something very like the night-glowing clouds:

"The sun was shining on the sea,
Shining with all his might,
He did his best to make
The billows smooth and bright --
And this was odd, because it was
The middle of the night."

I first saw noctilucent, or night-glowing, clouds in the Yukon Territory, Alaska, in the Yukon Delta, about 1950. I was on a boat with my son David, an accomplished Alaska mountaineer, and we were following a trail through the Brooks Range of Northern Alaska.

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