The science of sunsets

Winter sunsets are fantastically colourful: Why?

By Katharine Fletcher

Red sky at night, shepherd's delight
Red sky in the morning, shepherds take warning

Many of us have heard this saying regardless of whether we're tending sheep.

But why, particularly during winter here in the Ottawa Valley, are sunsets so colourful?

Winter sunsets: Riot of colour

From my west windows at my farmhouse, winter sunsets are a riot of colour. They are often layers upon layers of brilliant scarlet, gold, magenta, violet – all of which bleed together. The colours "drop off" the horizon, chasing the setting sun, and flare upwards, where colours such as magenta and violet bleed into the darkness of the starry night sky.

Drama of winter

When Eric and I first moved to our country property in 1989, a long-time resident of the Pontiac spoke a truism. She said we had never really lived "until you've seen the moonlight reflected on the snowy fields and woods." She was right: the indigo shades of blue on a moonlit winter's night are sheer magic.

This is particularly so after the drama of winters' sunsets.

Moreover, when we contemplate sunsets we wonder what makes them so colourful.

The science of sunsets

But how are colourful sunsets created? For the answer, think of light hitting a crystal you have suspended in your window.

Sunlight beams to Earth in rays from the Sun. As these rays enter Earth's atmosphere, they divide into a rainbow kaleidoscope of colours. This splitting of the colour spectrum is created as rays bounce off water droplets and atmospheric particles.

Seeing red

Colloquially we say we're "seeing red" if we're angry. And so, we give human attributes to the sky, saying that a red sunset may resemble an "angry" or "troubled" sky.

However, when we see red in a sunrise or sunset, the colour tells us that the atmosphere is particularly saturated with particles and moisture. At both these times of the day, the sun appears at its lowest visible point on the horizon. Light has to travel through a great deal of dust and other particles, at this level.

Light and colour: Wavelengths

Although we cannot perceive them, light actually is made of wavelengths. Red wavelengths are the longest of the entire gamut of colours in the colour spectrum; blue are the shortest.

Predictions of weather

For the most part, Earth's weather systems travel from west to east. In the early days of ship travel, traders called this phenomenon the Western Trade Winds.

This is why, when we watch television forecasters telling us about the weather we should be able to expect, usually they talk of "systems" coming in from the west and bringing with them clouds, rain, snow – or clear skies.

Shepherds take warning?

Okay, but what about that saying?

Red sky at sunset (west) indicates the existence of dense dust particles. Refracted light is split and the density results in red wavelengths being produced, and we see

red sunsets. What is coming in from the westerly trade winds? A high pressure system with stable air: this means good weather. Sailors and shepherds, therefore, “take delight” in the coming day.

Red sky at sunrise (east) means that a high-weather system has just “blown through” on the westerly trade winds. Again: we see red because of the long wavelengths created as the light bounces off lots of dust particles. Because the westerly has blown through, the high pressure system has gone, and low pressure with unstable air, clouds and precipitation may be approaching. Shepherds and sailors, therefore, “take warning” for the former may need to find shelter from the elements for the flock, while the sailor must batten down the hatches in preparation for inclement weather.

All of which tells me that during winter, because red sunsets are particularly vivid, the westerlies must bring in more dust and moisture in the air. Now why is that? Well, I don’t know! (Sadly, I don’t have an answer for everything…)

Family Science project: Replicate colourful refraction

How can we see the colours in light? Buy an inexpensive, small crystal and hang it in your child’s window. Sit back and watch for what resemble fairy “Tinkerbells” of coloured, refracted light as they dance about the room. The light, split and bent as it passes through the facets of the crystal, is reacting just as sunlight does when it hits moisture and dust particles in the sky.

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