When looking at an infrared satellite image, it’s really important to remember that you’re looking at a plot of temperature. We can draw conclusions about where clouds are and how high their tops are by assuming that temperatures decrease with increasing height in the troposphere, but this assumption doesn’t always hold true.

Let’s start with this infrared satellite simulator, which allows us to control surface temperature and cloud height, and we’ll start with a situation where the surface temperature is around -8ºC, or about 18ºF, so it’s a chilly morning. And, we have a mid-level cloud which shows up over here in the brighter gray on the simulated gray-scale infrared image.

But, what if this mid-level cloud here was a low cloud like stratus? To simulate that, we’ll drag the cloud down into the lower troposphere. The cloud essentially disappears on the simulated infrared image, because its top has a very similar temperature to the surrounding ground.

In fact, if the ground cooled off some more where skies were clear, something odd happens. We’ll drop our surface temperature down to about -13ºC, or 9ºF, and the result is that the simulated infrared image actually appears brighter in the area were skies were clear than it does where low clouds were located, because the ground is actually colder than the tops of the low clouds.

Now, if we imagine that this around dawn, and then the sun rises, causing our surface temperatures to increase, watch what happens. If we increase our surface temperature to 0ºC, or 32ºF, now the simulated infrared image takes on a more typical appearance, where cloud tops appear brighter.

The scenarios I’ve shown you here really aren’t that uncommon. Sometimes the tops of low clouds have very similar temperatures, or are even warmer than the ground overnight or early in the morning. And, the appearance of infrared imagery can change dramatically during the day as the ground warms up even if the clouds themselves change very little. The key to figuring out what’s going on in a given infrared satellite image is to remember that you’re looking at temperature. Combining that knowledge with other observations will help you interpret infrared satellite images in a wide variety of situations.