

1. Clouds absorb and emit the energy in large increments, or “like black bodies”, as they are made up of tiny water drops. During the daytime, if clouds are present, they absorb the heat so that surface temperature is lower. At night, if the sky is clear, the heat energy is emitted into space, making the surface temperature cooler.
2. Following 9/11, there was a huge decrease in the amount of planes that flew out, meaning fewer contrails. In order for contrails to form, the temperature must be cold enough for the moisture from the jet to form into ice crystals. These contrails are what act as artificial clouds, causing the same effects as clouds, leading to extreme temperatures. Contrails are able to lower the daytime highs by reflecting sunlight into space, and nighttime lows are affected by the radiated heat is trapped.
3. The troposphere gets heat from the ground, so that is why as the altitude increases, temperature decreases, whereas for the stratosphere, the temperature increases as altitude increases. This occurs because the troposphere is in direct contact with the surface, whereas the stratosphere is above, so it doesn't have direct contact. Also, the stratospheric air is very thin, meaning that the air density and pressure of the stratosphere are much lower. This is what causes a divide in the layers of the atmosphere.
4. The boundary between the troposphere and the stratosphere is called the tropopause. Near the equator, the altitude is approximately 20 km. At the poles, the altitude is lower, sometimes as low as 7 km. I would rank the atmospheric residence as the following:
  1. (iii) a volcano or some other means capable of injecting into the stratosphere
  2. (ii) a passenger jetliner cruising at 30,000 feet
  3. (i) smokestack