Tutorial 1: When is a system in thermal equilibrium and when it is not?

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Every single observation made by the instruments that measures different properties of the Earth atmosphere tells us the same thing – everything is local and nothing is global. In total contrast, the whole concept of man-made global warming and man-made climate change is based on the assumption that everything is in equilibrium, that the whole atmosphere can be treated as a homogeneous system and the Earth's annual temperature can represented by a single number.

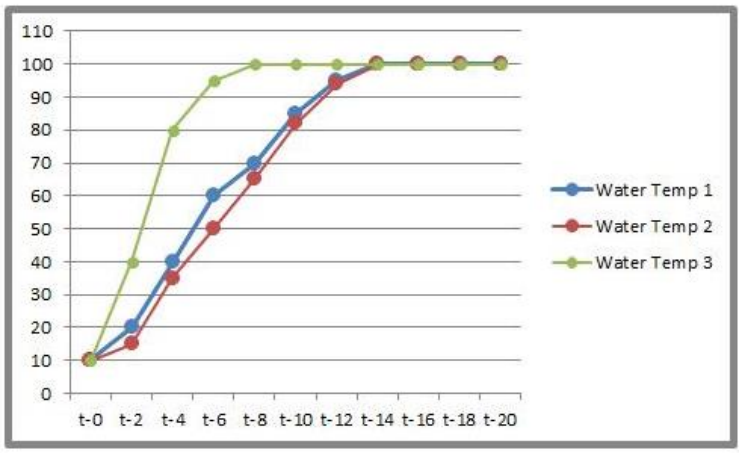
The main conflict that has been raging on for last 20 years or so and is highlighted in my paper is that the instrumental data, i.e. thermometer, is telling us that no alarming trends could be detected in temperature patterns observed in last 161 years, while the trends observed in purely theoretical (based on calculations) space of annual averages, the averages that have been obtained as a mathematical derivative of thermometer data, are detecting alarming trends.

So, rather than me telling you which one of those two contradicting views about our atmosphere is correct one, I will let you perform couple of experiments at your home, record those experiments, look at the resulting graphs and then decide which of those two scenarios makes more sense to you. Remember, human brain is the greatest computer there is and everyone is capable to differentiate between things that make no sense and things that do make sense.

Experiment No.1

What you need for this experiment is a saucepan half filled with cold tap water, couple of thermometers (no mercury-based please), stop-watch, notebook and pen – just like the school experiment when you have been introduced to the experimental sciences for the first time.

You place one thermometer very near the side of the pan and another one near the centre of it (single thermometer will do as well) take the reading and mark that reading as t=0 (lower case 't' representing time intervals, while upper case 'T' will represent temperature in ^{O}C. Now you start to apply maximum heat to the pot and say, at every two minutes intervals you record temperature, until water starts to boil. If you plot time vs temperature you will obtain the following graph:



Graph 1. At 100^{O}C temperature all water molecules are in equilibrium

How do we interpret this graph? The fact that the observed temperature readings of heated water, before it reaches its boiling point at $100^{O}C$, vary and that those readings depend on the location of that thermometer tells us that the system is a heterogeneous one. It can be best described as a network of large number of 'local' temperatures, but each one of those local temperature trends is going in the same direction – upwards. Once the water molecules reach $100^{O}C$, the whole system changes from heterogeneous into a homogeneous system where all molecules inside that pan are in thermal equilibrium with each other. And as you can see, we know that the system is in equilibrium since as long as there is enough of water left to cover the 'active' part of thermometer, you will always read the same temperature irrespective of location of that thermometer. If you look carefully at Graph 1, you will also noticed this mysterious light-green line labelled as Water Temp 3 that has reached boiling point much quicker than other two lines. You see I cheated and included that set of datapoints to look like they have been generated in the same experiment, which they have not been. The experiment that produced datapoints coloured in light green would be done using standard practices in chemistry laboratory which is to apply external stirring to the starting mixture before the heating is applied and also submerge the flask containing water molecules into a hot oil bath so that the system gets equal amount of external heat across its surface. So what are the main conclusions from that very simple experiment?

- If you sample any given system using any instrument and those readings are dependent on the location of that instrument, then the system is heterogeneous, i.e. a network of local systems
- If the opposite is true, i.e. that all the instrument's readings are the same irrespective of the instrument's location, than that system is homogeneous and could be described as 'global'
- It is strictly forbidden in experimental sciences to plot the results from different experiments performed using different experimental protocols on the same graph, as I did. And the reason I did it is to highlight the problems with interpreting graphs that are design to miss-present the experimental results, infamously known in man-made global warming community as 'Mike's Trick'

Experiment No. 2

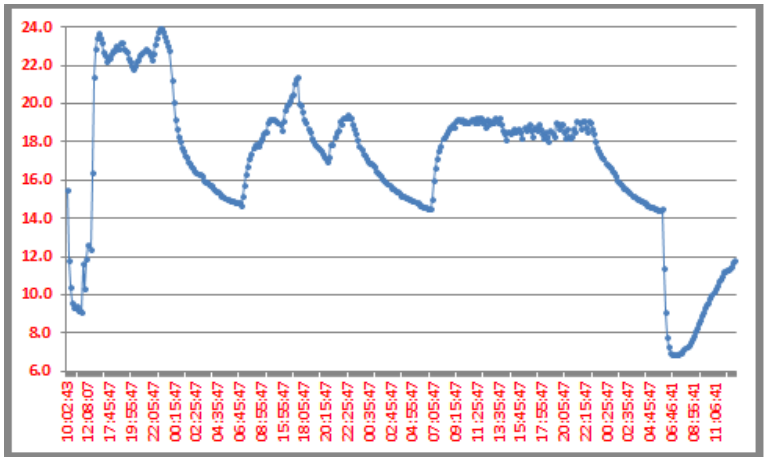
This is a very simple and easy to do experiment that will take very little time but will help you to understand what is so horribly wrong with assuming that our atmosphere is a homogenous system.

Fill the pan half full with cold water and put thermometer in. Let us assume that the starting water temperature is $10^{O}C$ and that the temperature in your house is set at $20^{O}C$. Now, the only source of heat is temperature of the air inside the house and what you will find that it will take few hours for water to reach equilibrium with the air around it, i.e. to reach $20^{O}C$. Larger the pan, more water need to be heated and longer it will take to do it.

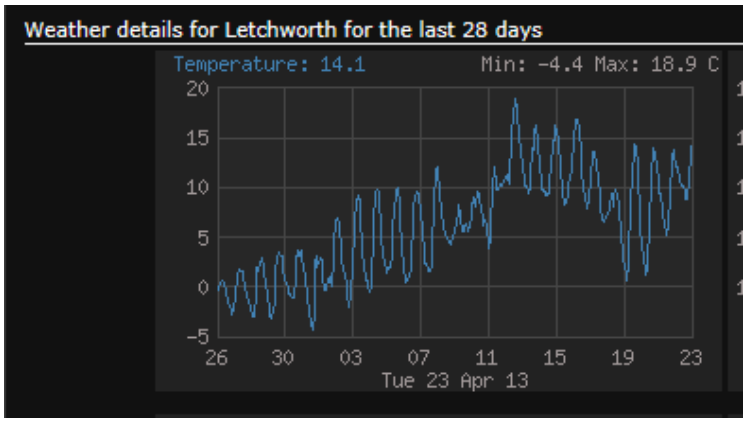
Having performed those two very simple experiments, we have learned the following:

- We know how to differentiate between heterogeneous and homogeneous systems
    - If sampling results depend on location – system is heterogeneous
    - If sampling results are the same irrespective of location – system is homogeneous
- It takes different amount of time for different systems to reach equilibrium

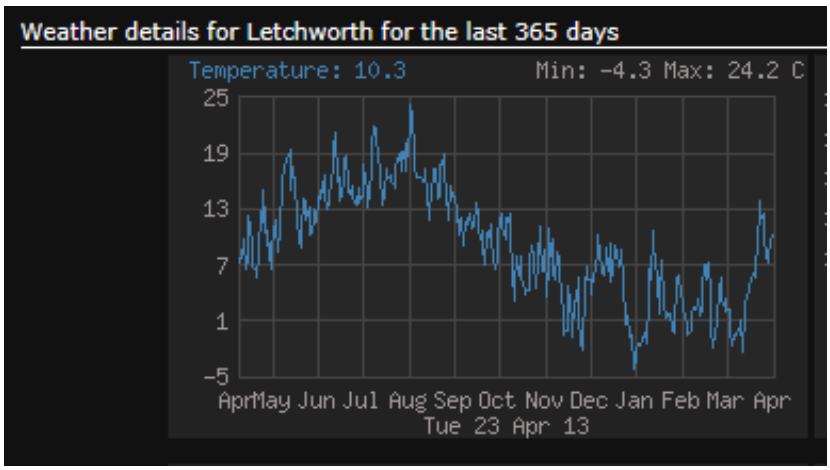
So let us now look at air temperatures, at different times and different places and see whether we can come up with some unambiguous conclusions.



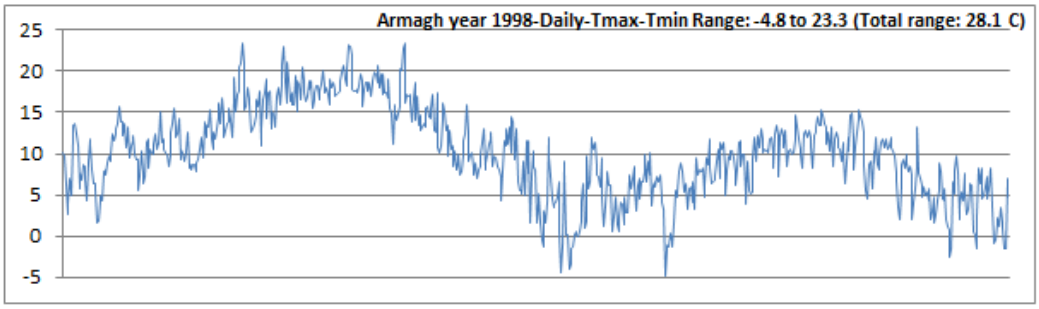
Graph 2. Temperature recorded at the back of our garden, Letchworth UK, between 15/12/2012 at 10:02 and 28/12/2012 at 13:06 at 10 minutes intervals (403 readings in total)



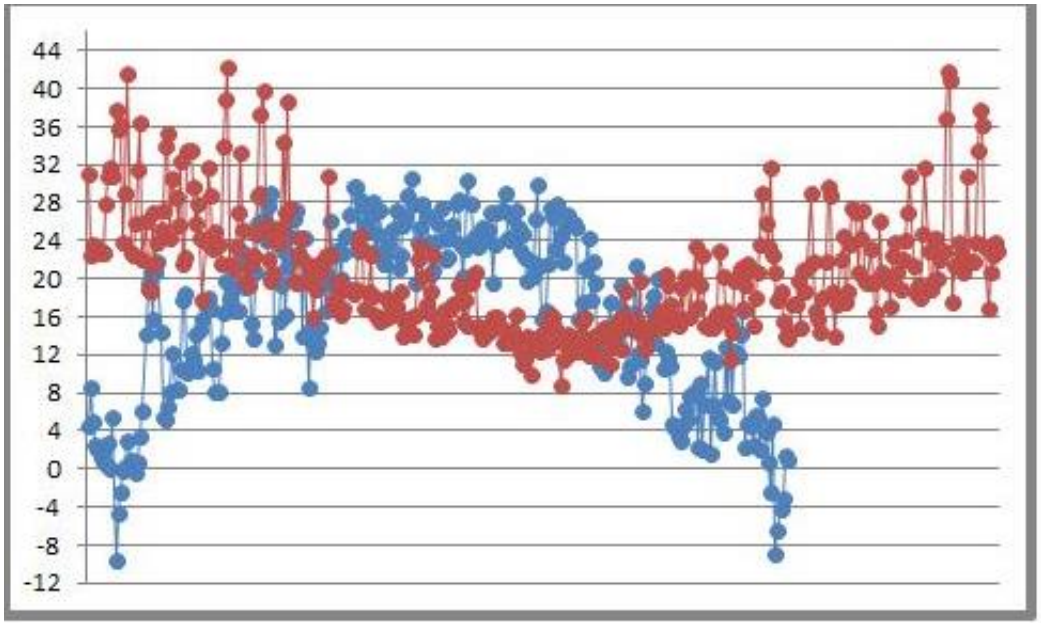
Graph 3. Temperatures at Letchworth recorded at the automated weather station situated in Letchworth Garden City, UK for last 28 days



Graph 4. Same location for last 365 days



Graph 5. Day-Night readings for year 1998 at Armagh Observatory, UK



Graph 6. Tmax data in Melbourne, Australia and temperatures recorded at 13:00 in Waterloo, Canada for year 1998

What all those graphs have in common is that wherever the thermometer is based, whichever day, month or year we look at, the same conclusion is reached – in terms of temperatures, the Earth is network of huge number of local temperature patterns, the Earth's atmosphere is a heterogeneous system that NEVER reaches equilibrium and any calculations and predictions that are based on assumption that the Earth's atmosphere is a homogeneous system must be wrong. And if there is no global warming, then the whole pseudo-science explaining that global warming must be wrong.