# Weather and climate

By Dr. Timothy Ball

There is confusion about the difference between weather and climate. Some exploit this confusion to offset the argument that if you can't predict the weather four days ahead how is certainty ascribed to climate predictions for 50 and 100 years. The simple answer is the certainty is totally unjustified. Few people know that when they run their computer model predictions they get a different result on every run, even starting at the same point each time. So they do many runs and average the results. The different results with each run reflect the randomness of weather, sometimes referred to as the butterfly effect. This is the notion that if a butterfly flaps its wings in Japan it will cause later weather change in North America.

Weather is the total of the elements that you experience when you stand outside. Climate is the average of all weather over a period of time or in a region – it is a statistic. So the climate prediction is only as good as the understanding of daily weather and its mechanisms, which is very poor.

When you stand outside you experience weather. It is what scientists call white noise because it is the total of individual red noises. It is also the total of and the interaction between everything from cosmic radiation from deep space to volcanic heat on the bottom of the oceans and everything in between. A simple diagram of the complexity just within the atmosphere/ocean portion illustrates the problem.
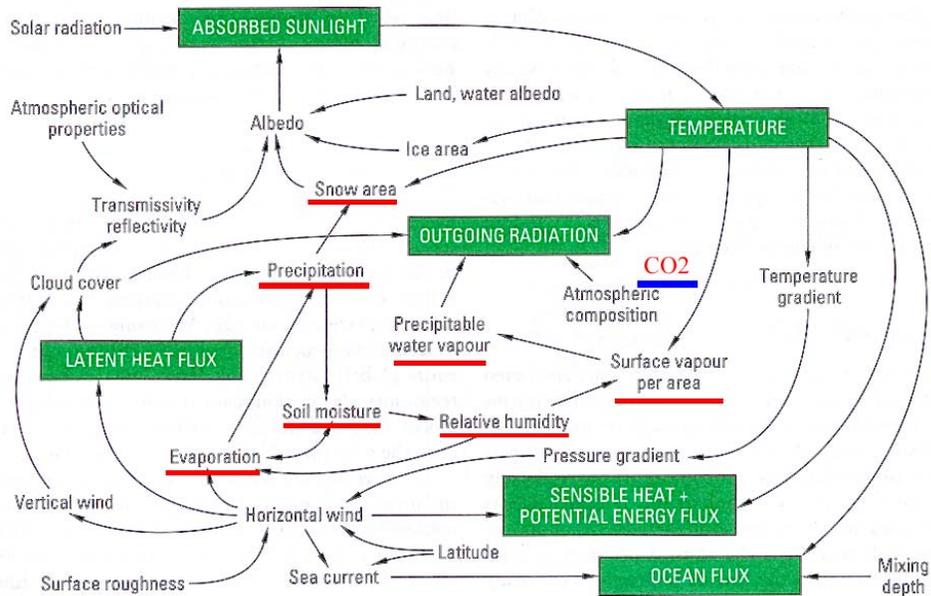
Source: After Fundamentals of Physical Geography, Briggs, Smithson, Ball et al.

Imagine standing outside a stadium with 90,000 fans. What you hear is the white noise of their combined individual red noise. To analyze and understand the white noise and how it varies over time you have to first isolate each individual noise. Then you must determine which are more important than others and how they interact with each other. Note that total carbon dioxide (CO2) is just one very small part, less than 4% of the item "Atmospheric composition". Red lines indicate variables related to water in its various forms. One of these is water vapor, by far the most important greenhouse gas being 95% by volume, yet essentially ignored. It is only one of many weather elements ignored or misunderstood in attempts to understand climate change.

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