Transients

We have shown that under equilibrium conditions the temperature distribution within planetary atmospheres is independent of the concentration of greenhouse gases. This has been confirmed empirically by Nikolov and Zeller,and by Michael and Ronan Donnelly.

This does not mean that greenhouse gases have no effect at all, only that any effect they may have is short lived. However, when talking about the bulk of the atmosphere 'short lived' may still involve time scales of decades. Indeed, it is reasonable to claim that the equilibrium state is never likely to be observed on the Earth at all.

We cannot hope to match the equilibrium model to actual atmospheric measurements, because the real atmosphere is changing all the time. We need some representation of the dynamics.

The first attempt to model the dynamics of the atmosphere with a simple model was undertaken by Lorenz in the 1960s. His model was simple (only involved three states) largely because that represented the limits of the computers available at the time. He discovered that small changes in his model start conditions resulted in massive changes in the results and these results deviated from each other the longer the model was run for slightly different start conditions.

As this was back in the days when scientists used computers to assist in their understanding, rather than blindly handle-cranked and treated like oracles, Lorenz realised he had discovered a feature of non-linear equations which is actually quite common. That feature is known as chaotic behaviour.

The Lorenz equations themselves look fairly innocuous:

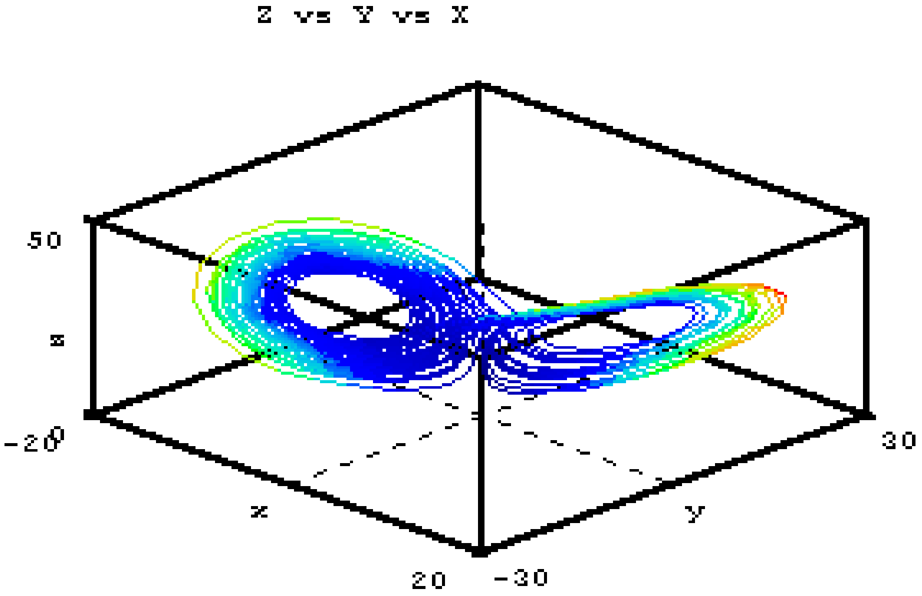
$$\frac{dx}{dt} = s(x-y)$$
$$\frac{dy}{dt} = rx - y - xz$$
$$\frac{dz}{dt} = -bz + xy$$

where x, y and z are the state variables, s, r and b are constants and t is the independent variable (in the original application this was time). With the parameter values r=27, s=10 and b=2.6666, rather than generating a single simple trajectory in phase space, the solution is what became known as the butterfly instability.

We are left with the problem that if even the simplest representation of the behaviour of the atmosphere produces a chaotic solution, how are we to believe that sophisticated solutions explicitly integrating the exceedingly complex governing equations are likely to be better behaved numerically? The lack of agreement between the many climate models indicates that their solutions are indeed chaotic.

It is this chaotic behaviour which renders long term weather forecasting extremely difficult. Extrapolating the solutions over several decades produces only nonsense.

In order to avoid this problem, there has been widespread agreement that 'climate' should deal with variations over a thirty year timescale. This raises two issues, one theoretical, the



other practical. The separation of dynamic behaviour into modes having different time constants (or characteristic frequencies or periods) presupposes the system is linear. The atmosphere equations are not remotely linear and such a modal decomposition is not valid. What looks by eye to be a high frequency mode is merely part of the nonlinear solution chaotic systems may make sudden unpredictable changes, and indeed such sudden, unexplained changes are features of the Earth's long term climate history. The practical problem is that we only have about 150 years of data, from which we can extract five data points. The prospects of making precise predictions on the basis of such little data are not good.

It might be possible, however, to construct a linear model which deals with perturbations in atmospheric states which is more or less valid over a limited timescale. This approach is widely used in control system design in order to construct a linear model around the expected operating condition. Since the purpose of the controller is to maintain the system on condition, the actual closed loop plant remains within its linear range under the action of the controller.

It's application to simplified atmosphere models,where no such feedback control is present is also a questionable activity. Most of modern control theory concerns itself with how wrong the linearised equations may be before control is lost.

The process of formulating the linear model is called system identification. This is done by linearising the governing non-linear dynamic equations, or by fitting appropriate transfer functions to observed responses to known inputs, or a mixture of both.

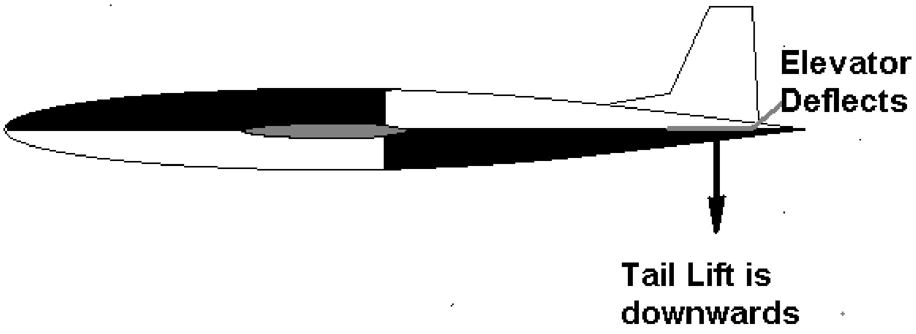
When the governing equations are awkward to linearise and there is no control over the system inputs, system identification becomes particularly tricky.

Towards a Simple Model

It would be incorrect to claim that climate scientists who are convinced of the reality of the greenhouse effect are necessarily incompetent. After all, they include many of the finest skeptic minds, who cannot be dismissed lightly.

The fact of the matter is that there is empirical evidence that appears to support the greenhouse theory. But as already mentioned, we are observing a transient, and not an equilibrium state, so it is hard to draw definite conclusions about the steady state from the empirical evidence.

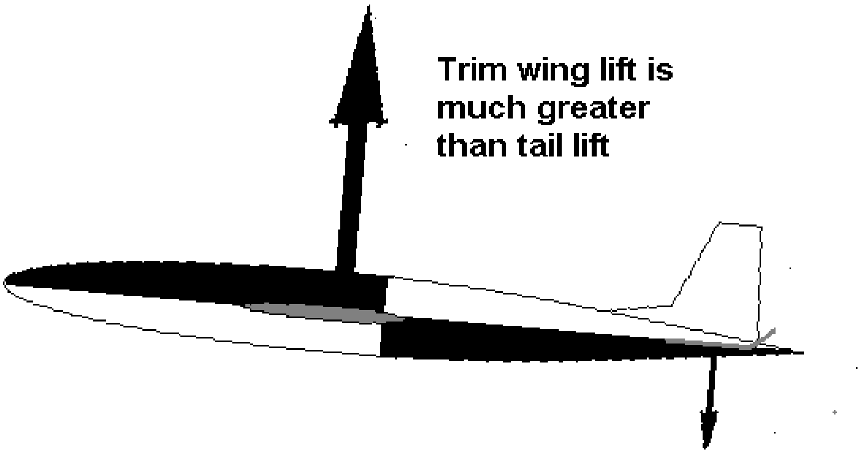
It is quite possible for a system to behave differently over short timescales compared with its long term behaviour.



The classic example is the rotation of a statically stable, tail controlled, aircraft to its trim angle of attack. When the pilot pulls back on the stick the elevator deflects almost immediately, so the transition begins with a net downwards lift.

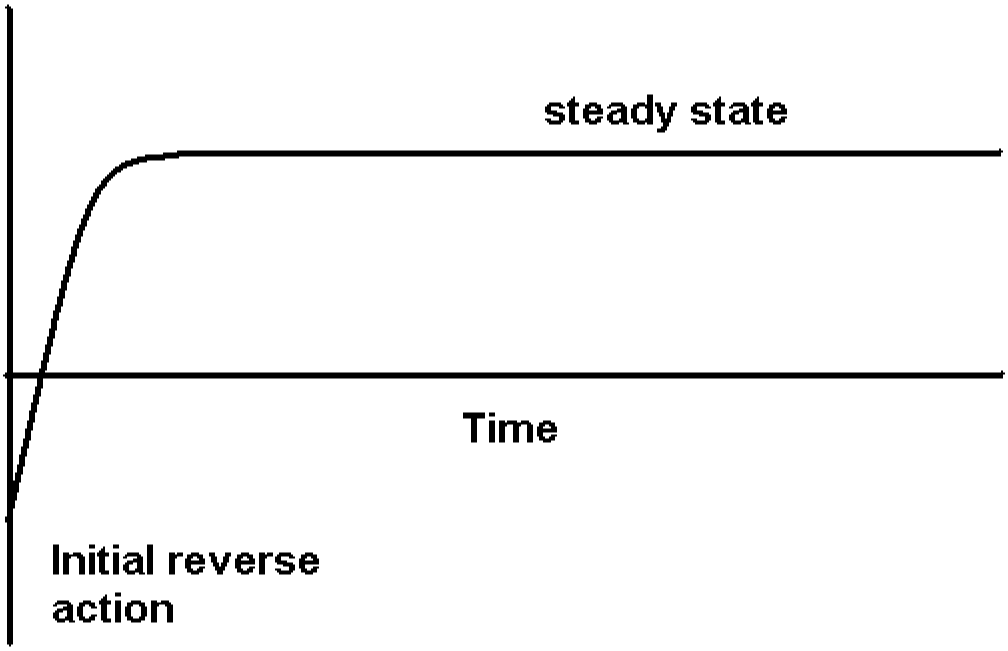
This generates a moment around the centre of gravity causing the nose to rise. This moment must overcome the inertia of the aircraft and the damping effect caused mainly by the upwards translational motion of the centre of gravity as the wing lift builds up. These contributions, particularly the damping, are usually augmented by the autopilot response.

Finally, the aircraft reaches its trim state with the airframe now in moment equilibrium with the elevator moment. Most of this balancing moment arises from the upwards lift of the tail which cancels the lift due to the camber change caused by deflecting the elevator. In this final (equilibrium) state the net lift is upwards.



If we consider the interaction of convection and radiation in the troposphere, it is evident that anything which influences the radiative component takes effect pretty well immediately because radiation travels at the speed of light. However, adjusting the convective flow requires the flow field to change, which we should expect to be a much slower process.

We have qualitatively a similar situation to our trimmed aircraft, with transient behaviour differing significantly from the steady state.



We speculate that the effect of water vapour on temperature might exhibit this type of behaviour.

There is evidence that water vapour may enhance any greenhouse effect. As water vapour is a powerful greenhouse gas any heating of the atmosphere by whatever means causes increases in the water vapour concentration. This it is claimed enhances the CO_2 caused greenhouse effect. It is this 'feedback' which it is claimed raises the potential temperature rise to worrying levels.

Climate science has a strange definition of 'feedback' which would not stand scrutiny by any control engineer. It deals with a modified steady state, without reference to how the system got there. In a system containing phenomena which exhibit reverse action, feedbacks, effects based on observing the transient, have nothing to do with the steady state response.

If the surface temperature rises for any reason, more moisture will evaporate into the atmosphere. This will condense forming clouds which will contain droplets large enough to reflect much of the infra red back to the surface. The same clouds also increase the albedo, but arguably they prevent heat loss during the night, so their effect on the average solar flux is to increase it, possibly by an amount which offsets the increase in albedo.

This is a more credible greenhouse effect than the absurd idea that carbon dioxide molecules somehow preferentially radiate downwards.

So we expect the water vapour to initially amplify the heating. The other effect of moisture content is to reduce the temperature lapse rate. This has the opposite effect of the greenhouse effect, causing cooling, but requires water vapour to propagate through the troposphere before this effect becomes apparent. The longer term effect of the water vapour is then to cause cooling. Whether the cooling process overshoots or simply returns to the original state remains the subject of pure guesswork.

Carbon Dioxide and Other Greenhouse Gases

Although water vapour is most likely the dominant influence on the atmosphere, the current panic is based around carbon dioxide. Since this interacts with the spectrum band where the Earth surface radiates, it is likely to have a disproportionate effect on the outgoing flux., and consequently has become the cause of concern. Small changes in emissivity in this region will allegedly cause large changes in temperature.

We do not support the view that the effects are small because there is only a small concentration of CO_2 . Once the greenhouse effect is accepted as the complete description, prophesies of doom must necessarily follow. Our position is that, in the long term, the concentration of greenhouse gases makes no difference at all to the troposphere temperature distribution.

From the equilibrium equations it is evident that there is no long term influence of greenhouse gases, but the issue which must be addressed is; how 'long' is the 'long term', and what peak temperatures are likely to be experienced during the transient?

We assume that the convective flow patterns in the atmosphere change only slowly, we find ourselves proposing the stratified grey body model on which the theoretical greenhouse effect is more conventionally based.

Changes in the local emissivity affect the local radiative flux immediately, so we may characterise a local rise in temperature in an infinitesmal layer of gas due to changes in emissivity as:

$$\delta z \rho C_p \frac{dT}{dt} = \delta \epsilon \sigma T^4 + 4 \epsilon \sigma T^3 \delta T$$

where z is height, t is time, T is absolute temperature, C_p is the specific heat at constant pressure σ is the Stefan Bolzmann constant and ε is the emissivity as defined in the Emperor's New Greenhouse.

So we may find the rate of change of temperature as:

$$\rho C_p \frac{dT}{dt} = \sigma T^4 \frac{d\epsilon}{dz} + 4 \epsilon \sigma T^3 \frac{dT}{dz}$$

The steady state corresponds to:

$$T \frac{d\epsilon}{dz} = -4 \epsilon \frac{dT}{dz}$$

Or, after integration;

$$\frac{T}{T_0} = (\frac{\epsilon}{\epsilon_0})^{\frac{1}{4}}$$

We removed the minus sign because it is associated with the 'dz' on the left hand side of the equation. Temperature varies directly with emissivity, but emissivity varies inversely with height.

A 2K rise in temperature at the surface would correspond to only a 3% increase in emissivity, so it is not difficult to see how this type of calculation can cause panic.

However, the result is spurious because we know the the convective flow field will adapt to a new equilibrium in which the emissivity is all but irrelevant.

Comment

This work is far too speculative to justify definite conclusions, but arguably is no worse than much that finds its way into publication, and is hyped beyond recognition by the media.

It is disappointing to see alleged scientists treating their models as oracles, and not as tools for gaining understanding of the processes involved; that is; deciding which effects dominate under particular circumstances and why.

At the very least we should expect to see linearisation of the governing equations so that eigenvalue decomposition at a range of operating points may be performed and some understanding of the timescales associated with particular phenomena gained.

Without this understanding, predictions of future climate belong only in the waste paper bin.

The closest to even approach this type of systems analysis was Murray Salby, who was ostracised for his trouble when his findings failed to support the catastrophe narrative.

Salby, Nikolov and Zeller and the Donnelly's, are all rapidly becoming unpersons as far as Google searches are concerned. Is there a pattern emerging here which brings into question the integrity and honesty of the climate science community? Why, if the counter arguments are such nonsense, do we get no reasoned refutation from the hysterical alarmist community? – only insults and deplatforming.