



The Tiamat Hypothesis

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The cause of abrupt climate change has not yet been determined. Citing a lecture by Broecker (1997), Adams, Maslin and Thomas (1998) have suggested that in some cases abrupt climate change could have been triggered by a change in sea ice extent which was amplified by the greenhouse effect of water vapour. However, the models do not show this amplification, nor do they agree with the majority of observational data sets which show more warming at the surface than in the troposphere, and this difference between models and observations may arise from errors that are common to all models (Wigley et al., 2006.)

The basis of the radiation scheme for outgoing long wave radiation (OLR) used in climate models is Schwarzschild's equation. This states that the radiation emerging from a layer of an atmosphere is equal to the amount of radiation entering the layer, less the amount absorbed, but increased by the amount emitted by the gas in the layer. The amount emitted by the gas layer is determined by the source function.

Considerable research has gone into investigating the absorption lines of the main greenhouse gases, thus the absorbed amount must be correct. However, the source function used in the models is based on Planck's function for blackbody radiation. Greenhouse gas molecules do not emit blackbody radiation. They emit fluorescence which is a type of line radiation, not the continuous radiation emitted by hot bodies. Therefore it would seem that the wrong source function is being applied. Planck's function depends on temperature, and so when the temperature rises its use predicts that more OLR will be emitted to space. This would produce a negative feedback. However, the correct source function should be based on the spontaneous emission of greenhouse gas molecules, which depends on pressure. Since atmospheric pressure depends on the mass of the atmosphere which varies little, there is no negative feedback to limit the effects of any forcing.

When the surface temperature rises, the increased blackbody radiation from the surface will be absorbed by the greenhouse gases, and passed to other air molecules via radiationless de-excitation and collisions. Thus the air temperature will continue to rise until some negative feedback intervenes to return the climate system to a stable state. On Earth, this intervention is provided by changes in cloud which alters the planetary albedo

The saturated water vapour pressure is determined by the Clausius-Clapeyron relationship. Thus, when the sea surface temperature rises, the concentration of water vapour in the atmosphere can increase almost exponentially. This potential for an abrupt temperature rise could be the cause of the rapid climate changes seen in the Dansgaard-Oeschger events, and provide a vital clue to the evolution of the climate that will result from the anthropogenic global warming which is melting the Arctic sea ice.