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## The Dangers of Overselling

We have seen that funding of the science of weather modification underwent a period of rapid rise, followed by an abrupt crash. One of the leading causes of that crash, we believe, is that the program was oversold. The claims that only a few more years of research and development will lead to a scientifically-proven technology that will contribute substantially to water management and severe weather abatement, were either great exaggerations, or just false. This is largely because we greatly underestimated the complexity of the scientific and technological problems we were (and still are) faced with.

The same can be said about human impacts on global climate. There are many scientists who are claiming that the short-term (periods of year-to-year, or decades) variations in weather and climate are clear evidence that we are experiencing the effects of anthropogenic greenhouse emissions. Moreover, many claim that the `forecasts' being made by global climate models, represent realistic expectations of global-averaged changes in temperature and rainfall in the next decade or century. In our opinion, both of these claims represent overselling of the climate program. These claims appear and are discussed in the professional literature (e.g., Schneider, 1990; Titus, 1990a,b; IPCC, 1991; Kellogg, 1991) and in the lay press (e.g., Brooks, 1989; Schneider, 1989; Thatcher, 1990; Bello, 1991; Luoma, 1991; UCAR/NOAA, 1991). Titus (1990a), for example, proposes the rerouting of the Mississippi River to save coastal Louisiana! As an example of such extreme claims to mitigate anthropogenically caused global warming, a 1991 National Academy Press report (National Academy of Sciences, 1991) has considered the insertion of 50,000 100 km  $\square$  mirrors in space to reflect incoming sunlight. Such gross global climate engineering represents a close analog to the exaggerated claims in weather modification which were made in the 1960s and 1970s. Short-term variations of weather and climate are clearly within the *natural variability* of climate to the extent that we can realistically assess it. Moreover, the models are not really `forecast' models. They are simply research models designed to simulate the responses of hypothesized anthropogenic changes to weather and climate, *other things being the same*. Besides having many limitations in their physical/chemical parameterizations, they are not designed to simulate (or predict) the consequences of many other natural factors affecting climatic change. That is because we simply do not know enough about all the processes of importance to climatic change to include them in any quantitative forecast system. What it amounts to is that many scientists are grossly underestimating the complexity of interactions among the earth's atmosphere, ocean, geosphere, and biosphere. These problems are so complex that it may take many decades, or even centuries, before we have matured enough as a scientific community to make *credible predictions* of long-term climate trends and their corresponding regional impacts. Even then, we may find that the uncertainty level of those predictions due to outside (the earth) influences may be so large that those predictions are not useful for social planning.

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