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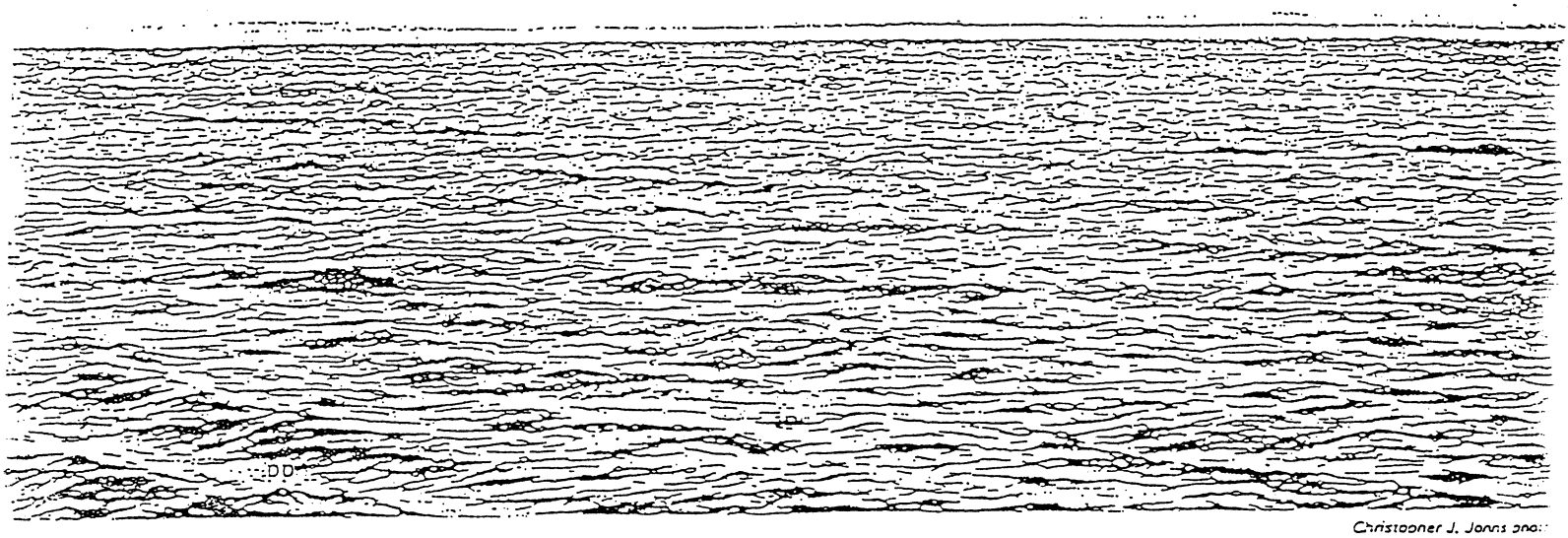
A Skeptic Speaks Out

by Richard S. Lindzen



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Amidst the present thoughtful approaches to the purported coming global warming, one cannot help feeling that expressing doubts about the phenomenon is in distinctly poor taste. Risking this, I will nonetheless proceed.

There is, superficially, a basis for expecting Greenhouse warming. However, it is not evident that a few degrees' warming would indeed constitute a catastrophe. In the absence of an atmosphere, the Earth would have an average temperature of about -18 degrees Celsius. The actual average temperature is 15 °C. The difference is due to the presence of Greenhouse substances in the atmosphere.

Of these substances, the most important by far are water vapor and layer clouds. There are also minor Greenhouse gases like carbon dioxide (CO_2), methane, nitrous oxide, and chlorofluorocarbons, and these are known to be increasing in concentration. It seems only reasonable that the increase in these gases will lead to warming, and this suspicion is supported by complex computer models which predict that a doubling of CO_2 will lead to warming of about 1.5 to 5 °C. The lower value does not seem overly worrisome, but the larger value might be quite noticeable.

As reasonable as the above scenario may seem, there are serious reasons for believing that it represents a very substantial exaggeration. There are also ample reasons for believing that most viable strategies for mitigating a warming trend would have little impact on global temperature, regardless of which scenario one believes. Moreover, the present sense of urgency concerning such actions is supported by few facts.

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In discussing doubts about the warming scenario, it is difficult to know where to begin. However, a useful start might be to note that the Greenhouse Effect as it actually operates for the Earth is neither simple nor straightforward. The Earth is, as already noted, warmer than it would be in the absence of Greenhouse substances. However, if the Earth's surface were restricted to cooling only by radiating heat away from the planet (as represented in most explanations of the Greenhouse Effect), then the Earth would have an average temperature of 77 °C, given present concentrations of Greenhouse substances.

But the Greenhouse Effect is so powerful that the Earth wisely finds more efficient ways to cool its surface. For example, by means of air currents in cumulus clouds, storm systems, and large-scale circulations, it transports heat from regions of large Greenhouse-heat absorption (near the ground, and in tropical latitudes) to regions of much-reduced absorption (higher altitudes and latitudes), thus short-circuiting over 75 percent of the Greenhouse Effect.

Present climate models do not reproduce the intensity and distribution of these air currents adequately. As a result, they would, without gross adjustments, fail to predict the present temperature of the Earth. Even with such adjustments, however, the models still are likely to fail to properly apportion cooling between radiation and motion. The use of such models to predict the future seems unwise at best.

The situation is further complicated in that present models predict that the

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One point at issue in the Greenhouse debate is how the oceans, with their vast capacity to hold heat, may affect global-warming scenarios.

warming from simply doubling CO_2 is very modest (between 0.6 and 1.2 °C). The larger predictions come from so-called "positive feedbacks"—effects of global warming that would in turn exacerbate the warming trend. In the models, any warming is accompanied by increased water vapor, increased upper-level clouds, and decreased sea ice and snow—all of which act to amplify the warming.

Much scientific debate centers on the reality—or lack thereof—of these feedbacks. Model experiments show that small changes in the specifications of clouds can turn a positive feedback into a negative feedback. The standard equations for water vapor show that warming is indeed accompanied by increased water vapor near the ground; however, these equations also show that warming would be accompanied by decreased water vapor above about four miles.

As noted above, air currents short-circuit Greenhouse absorbers (especially water vapor) near the ground. Calculations performed at GISS show that water vapor above four miles is 100 to 1,000 times more effective (molecule for molecule) in determining surface temperature than is water vapor near the ground. Thus, the distinct possibility exists that the positive feedbacks could turn out to be negative and could actually reduce the already small direct response to increased CO_2. This is one vital area where we can reasonably expect much improved information within a few years.

Data from the last 100 years support the suspicion that existing models are exaggerating the predicted warming. The point here is that models which predict future warming on the order of 1.5 °C from a doubling of CO_2 also "predict" warming over the last century of the order of 2 °C. A warming of 2 °C has not occurred over the last hundred years. However, there is presently much debate over whether the temperature records over the past century indicate a warming of 0.5 °C or not. Such warming does appear in the land-based record for the globe; however, the warming mostly occurs before 1940, before the bulk of industrial additions of minor Greenhouse gases to the atmosphere.

Some scientists have noted that this warming may simply be a natural rebound from the "little ice age" of the 18th century. Others have noted that it could be an artificial result of poor sampling. Still others have noted that this record has not been adequately corrected for the temperature distortions characteristic of urbanization. Indeed, the temperature record for the continental United States—which *has* been carefully corrected for urbanization effects—does not show such warming. Finally, since fluctuations on the order of 0.5 °C occur from year to year within any climate record, the observed trend is still indistinguishable from normal climatic variability. Of course, all this debate obscures the obvious fact that 0.5 °C is less than the models suggest we should be seeing.

A possible explanation is that the oceans, with their huge heat capacity, may be delaying the warming. However, one model which has a sufficient adjustment for delay to be compatible with a warming of only 0.5 °C is grossly at odds with present oceanographic data. Moreover, the delay in this model is so great that even the 4.5 °C warming predicted for a doubling of CO_2 would be delayed for more than 100 years. Another model with a more reasonable specification of ocean delay predicts that we should have already seen a 1 °C warming. This model could be made compatible with a 0.5 °C warming only by eliminating almost all positive feedback factors. If, as seems entirely likely, even the 0.5 °C warming is an artifact, then this model would have to be still further adjusted to reflect negative feedbacks.

Where then does this leave us? At the very least, it leaves us with an unobserved phenomenon predicted by models operating beyond the limits of their credibility. For the reasons I have sketched, I feel there are substantial smaller than predicted by current models. In either case, there is little basis for implementing draconian policy—especially if the nominally disastrous consequences of warming have also been exaggerated.

What about policies which are less than draconian? Should we not do at least something in case warming should prove to be a more serious problem than I am suggesting? Can there be any harm in implementing policies that should be implemented anyway? In answer to these questions, it must be understood that, according to those models which predict large warming, there is little that any non-draconian policy *could do* which would lead to significant mitigation. Under the circumstances, it is misleading to attach these policies to the problem of global warming. This is particularly dangerous for policies that are independently virtuous. The harm done in attaching such policies to warming is simply that it allows these policies to be discredited for irrelevant reasons.

In light of the above analysis, one may reasonably ask how the issue of global warming has generated such dramatic concern. At least part of the answer must lie in the fact that the Greenhouse hypothesis fits conveniently into the agenda of many groups who see that fear of this illusive phenomenon may help generate support for a wide range of activities. The dangers of this situation are evident. □