of mean global average temperature. Gradually they had came to a consensus that the increase in temperature predicted when CO_2 concentrations double would be 3 °C ($\pm$1.5°).

Controversy. Two reports, both based on empirical data instead of modeling, aroused doubts about the extent of CO_2-induced warming of the surface atmosphere. Sherwood Idso (US Water Conservation Lab, Tucson, Arizona) published a paper in *Science* in March 1980 indicating that empirical methods yielded a temperature increase of 0.26 °C, an order of magnitude less than the 3 °C estimated by a majority of researchers. Reginald Newell (MIT) and T. G. Dopplick (Scott AFB, Illinois) published in the *Journal of Applied Meteorology* in June 1979, the results of their study of the effect of doubled CO_2 on the tropical ocean in which they obtained a similarly low value of 0.25 °C for increased surface temperature due to CO_2.

The Academy is expected to complete by next summer the balance of a study covering a wide range of climate effects, from new estimates of actual atmospheric concentrations of CO_2, to the impact of projected CO_2-induced climate effects on agriculture. The Climate Review Board of the Academy felt a certain urgency about reassessing CO_2-induced temperature increase however, due to the concern aroused by the two minority findings, a spokesman told us.

The CO_2 panel under Smagorinsky recently completed this evaluation. They concluded that the finding of a previous Academy Study, entitled "Carbon Dioxide and Climate: A Scientific Reassessment," completed in July, 1979 under the direction of the late Jule Charney (MIT), did not need revision; thus their estimate that temperature increases 3 °C ($\pm$1.5°) when atmospheric CO_2 doubled was reaffirmed. The panel also evaluated the findings of Idso, and Newell and Dopplick, and found that their reasoning was flawed.

Idso compared several sets of empirical observations of changes in downward radiative flux at the surface with changes in surface temperature. For example, Idso told us he examined how minimum surface air temperature responds to changes in the humidity of the air above the Arizona desert and used these results to calculate the radiative effects of humidity. This computation yielded what Idso calls a surface air temperature response function. Idso got a similar surface air temperature response function from evaluations of empirical observations of atmospheric dust, and of how surface temperature varies with solar radiation. Using this function Idso determined that surface air temperature was not as sensitive to changes in CO_2 as was predicted by climate model studies, and in fact, calculated that air temperature would only increase 0.26 °C when CO_2 concentration doubled.

The Academy stated that Idso's empirical observations were not inconsistent with climate model predictions. Members of the panel used Idso's empirical data, plugged them into various climate models and reconfirmed the models' predictions of mean surface temperature variations when CO_2 concentrations are doubled. The Academy stated however, that Idso's "approach is misleading when applied to estimation of the response of global-mean equilibrium climate to increased CO_2." They note in particular that the time and space scale of Idso's observations are not appropriate for predicting global climate changes and that Idso did not take into account feedback mechanisms that amplify or reduce the effects on temperature of changes in CO_2 concentrations.

The panel raised similar objections to Newell and Dopplick's study of the effect of doubled CO_2 on the tropical ocean, noting that feedback mechanisms involving energy transfer were not taken sufficiently into account. Newell and Dopplick held atmospheric parameters fixed and calculated an increase of energy at the surface due to CO_2 doubling; using formulas for energy transfer at the surface they estimated a small temperature increase for the tropical ocean. The panel also found that this study did not consider the interactions of tropical air masses with air masses of other latitudes. The effect of increased atmospheric moisture on heat transfer is underestimated, the panel said, "probably because the moisture and temperature of the air column are not allowed to come completely into equilibrium." Newell told us, "I don't feel that the issue has been resolved completely. In particular the question of why sea-surface temperature now has a 29°C maximum and paleoclimate data indicate that it was essentially constant in the past, remains unexplained. I think this reflects an evaporational limit on sea-temperature over large areas where upwelling, vertical mixing and admixing are small."

Commenting on the Academy's clarification of the results of these two studies, Richard C. J. Somerville (Scripps Institution of Oceanography) said, "This is an example of good scientific progress. The two studies have raised important questions about the validity of basic assumptions that are important in evaluating the whole global-warming issue. The scientific community was forced to examine these questions and resolve them, and can now proceed to look at the regional and transient aspects of the climate impact problem with greater confidence in the predicted temperature effect of CO_2 increases." —JC

Knapp is new NSF assistant director

KNAPP

Edward A. Knapp, head of the Los Alamos Accelerator Technology Division, has become NSF assistant director for mathematical and physical sciences.

Knapp received his PhD in physics from the University of California, Berkeley, in 1958. When he first joined the staff at Los Alamos in 1958, Knapp was involved in the early work on controlled thermonuclear reactions. He subsequently turned to accelerator physics and was part of the team that planned the Los Alamos Meson Physics Facility, a half-mile proton linac. During the construction of the facility, Knapp led the group designing the accelerator structures for LAMPF. Knapp spent 1972 at CERN and has recently been actively exploring a collaboration between CERN and Los Alamos on a high-energy physics program. In 1973 he became responsible for the applied physics program and the medical pion beam at LAMPF, which has been successfully used in cancer treatment. Knapp was responsible for organizing the Lab's Accelerator Technology Division, which he has headed since 1977.