biodiversity over the past two decades, but, except for a few flagship species, detailed studies are still lacking. Nevertheless, in a recent survey and synthesis, Fu *et al.* (*4*) estimated that Gezhouba, TGD, and about 10 more dams that are expected to be built on the Yangtze will adversely affect more than 40 fish species, including 19 endemic to the river. Riverine mammals (e.g., manatees, dugong, and Chinese river dolphin) are even more vulnerable to damming effects than fish and freshwater invertebrates (*4*, *5*). Sedimentation, altered food web and species interactions, and physical injuries and noise disturbance from increased navigation are also likely to negatively impact the riverine biodiversity. To alleviate these problems and conserve biodiversity, establishing nature reserves in biodiversity hotspots and reconnecting the river with its disconnected lakes are critically important (*4*).

Nothing alters a river and impairs its associated aquatic and riparian biodiversity like a dam (*5*). Globally, numerous studies have shown that dams reduce fishery productivity, release toxic substance into water, cause eutrophication and the depletion of dissolved oxygen, build up sediment, and result in a series of downstream habitat changes (*3*, *6–8*). Riparian ecosystems are particularly sensitive to hydrological changes caused by dam operations and may serve as ecological indicators for environmental monitoring (*9*). The total surface area of reservoirs in the world is estimated to be as large as 1,500,000 km^2 (*3*, *10*), an area more than six times the size of the United Kingdom. Recent studies also suggest that these reservoirs, inundating vast areas of terrestrial biotic communities, may reduce the regional carbon sink and increase the emission of greenhouse gases (CO_2 and CH_4) because of the accelerated decomposition by bacteria of the organic matter stored in plants and soil (*10*, *11*). These emissions are estimated to be 7% of the global warming potential of other documented anthropogenic sources, thus challenging the common view of hydroelectric generation as a carbon-free source of energy (*10*).

The construction of dams is increasingly regarded as the biggest conservation threat to aquatic and riparian biodiversity in many river basins throughout the world. To fully understand the ecological consequences of a single dam may prove extraordinarily complex because of the multiplicity of its effects. Much remains to be learned about the real impact of TGD on the aquatic biodiversity. One thing is for sure, though: The rising water brings a tremendous amount of energy, but what it buries beneath are thousands of years of cultural heritage and millions of years of biological evolution.

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Have Clouds Darkened Since 1995?

IN MODELING CLIMATE, CLOUDS HAVE BEEN A cause of great uncertainty. In his article "Making clouds darker sharpens cloudy climate models" (News of the Week, 20 June, p. 1859), Richard A. Kerr reports on some recent findings concerning the cloud absorption anomaly (CAA) debate. The essential message of his article is that radiative transfer models (RTM) underestimated the amount of solar radiation absorbed by clouds 40% in 1995 and that this underestimate has been fixed as a result of the debate, leading to much greater absorption in Global Climate Models (GCMs). This is incorrect—our perception of cloud reflection remains as bright as in 1995, although the atmosphere as a whole may have darkened in some GCMs due chiefly to enhanced absorption by aerosols and gases, but not clouds. We do agree that the debate has played certain positive roles in improving GCMs.

Although the CAA has been discussed for over 50 years (*1*), it did not become a big issue until 1995, when three studies claimed that clouds absorbed about 25 to 30 W m^{-2} (annual and global mean) more solar radiation than models had previously predicted (*2–4*). This claim has been debated from the very beginning (*5*). Because nearly all recent studies show good agreement between observations and models, the dust of the CAA debate appears to be settling down. Unfortunately, the interpretation of the debate is muddled (*6*). Given the extreme importance of the subject in climate change studies, it is imperative to provide a correct, clear, and objective assessment.

The study of Ackerman *et al.* (*7*), which is cited by Kerr, does not suggest that "clouds really do seem to be darker than once presumed." The RTM they used to compute cloud reflection was essentially the same as the one used in the 1995 studies, although water vapor absorption was changed slightly. Overall, model calculations agree with observations to within 10% under cloudy conditions. Although 10% is close to the range of observation uncertainty, the systematic difference could be eliminated by accounting for the heterogeneity of surface albedo in a state-of-the-art RTM (*8*). Agreements within the range of uncertainties were found by all teams participating in the DOE Atmospheric Radiation Measurement (ARM) Enhanced Shortwave Experiment (ARESE II) except for one (*6*), which still found significant CAA but of much smaller magnitude than their earlier claims. Valero showed larger discrepancies between observations and calculations by various models including one used in a GCM. Note that the highly simplified RTMs used in GCMs do not represent the state of our knowledge of radiative transfer. Thereby, a deviation from such a model or any other coarse models cannot be construed as a sign of deficiency in our understanding of radiative transfer theory.

Reasonable doubts have been cast on the quality of the data and analysis methods employed in some studies supporting CAA. The major findings of CAA from ARESE I (*9*, *10*) suffered from a serious contamination problem in their aircraft radiometer measurements (*11*) and calibration errors in the weather satellite data employed (*12*), which led to substantial overestimation of cloud absorption. While the calibration error is likely a contributing factor to earlier studies using the same type of satellite data, the analysis method used in (*2*) has been criticized as an ill-posed comparison of nonuniform clouds observed in nature with uniform clouds in GCMs (*13*, *14*). The inherent disparity in the transfer of solar photons in uniform and nonuniform clouds can lead to a false CAA.

Given that many painstaking efforts are being made to lower the estimated uncertainties of radiative forcing of climate to well within 1 W m^{-2}, any systematic discrepancies between models and observations warrant due attention. A 40% increase in atmospheric absorption (~30 W m^{-2}) would require a revolutionary change in our understanding of radiative transfer theory that could shake its foundation (*15*). As the anomaly is more than 10 times the radiative effect of doubling CO_2, the results of some climate change studies using GCMs would lose credibility if the CAA were true. A lack of solid evidence for the CAA thus relieves many fundamental concerns.

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16. All authors have been supported by the DOE ARM program. The lead author is grateful to A. Trishchenko and H. B. Barker for their contributions to his continual pursuit of the issue. Many other papers related to CAA are left out due to space limitations. Those by Z.L. can be found at www.atmos.umd.edu/~zli.

Response

LI AND HIS COLLEAGUES HOLD THAT THE 1995 studies that originally provoked the debate over cloud absorption were from the start obviously flawed, largely in their choice of oversimplified radiative transfer models. If state-of-the-art models had been used and certain flawed observations ignored, they say, clouds would seem no darker now than then. Not everyone saw it that way at the time, but all might now agree with the story's conclusion that "the models were clearly at fault." Some will see clouds as darker than presumed, others may not.

RICHARD A. KERR

A Fine, Midsize City in Former East Germany

I WOULD LIKE TO COMMENT ON THE RANDOM Samples item about Jean-Jacques Hublin's appointment to the Max Planck Institute for Evolutionary Anthropology in Leipzig (19 Sept., p. 1667), which is referred to as a "staid" city. I suspect that the author has not visited Leipzig or the former East Germany