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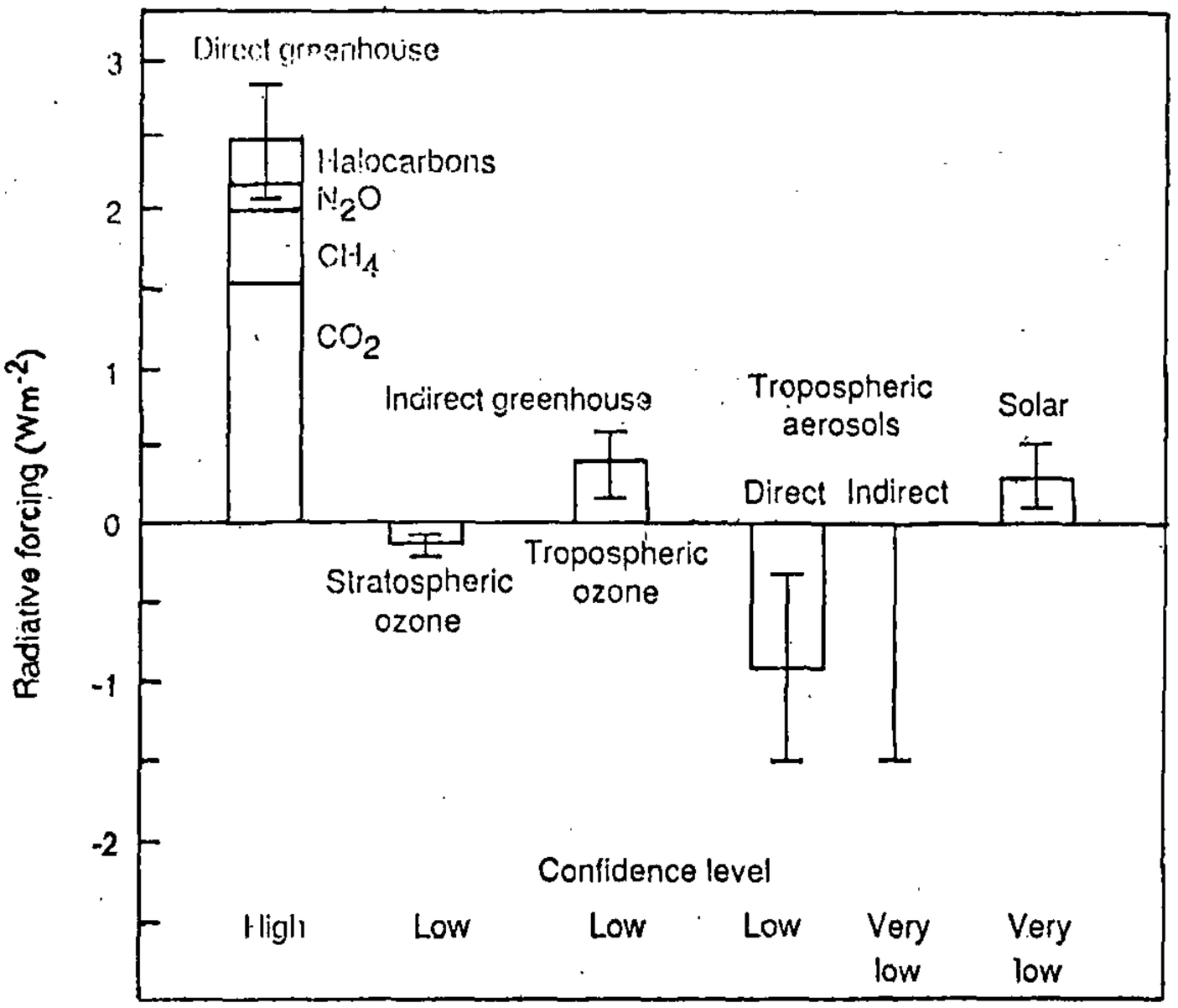

Figure 1. Estimates of the globally averaged radiative forcing due to changes in greenhouse gases and aerosols from pre-industrial times to the present day and changes in solar variability from 1850 to the present day. The height of the bar indicates a mid-range estimate of the forcing whilst the lines show the possible range of values (IPCC report).

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Response:

In his comments R. N. Singh has proposed the importance of solar radiation on the climatic effects with reference to our paper in *Current Science* It appears that he has overlooked our fifth paragraph, on p. 95 which is reproduced here: 'Global radiation data from 1957 to 1987 show a decreasing trend during winter months for a number of stations. Jodhpur shows a decreasing trend throughout the year, while an increasing trend is found in diffuse radiation over India during the winter months' (vide ref. 6 corrected under errata on p. 406 of *Curr. Sci.*, 1998). This was discussed in detail in the above reference. To quote from this paper: 'In practice, nonlinearities may manifest themselves in two ways at the global mean level and in the pattern of climate change. For the first, the key parameter in the climate sensitivity, defined as the equilibrium global mean temperature change per unit change in radiative forcing. This parameter, uncertain by a factor of at least three, is thought to lie between 0.3°C and 1.0°C for every 1 W/m^2 of forcing with about 90% confidence'. Therefore, Singh's suggestion about solar control on climatic change with different methodologies adopted by various authors depicting incoherent results from analysis of observational data is not applicable.

The aspects of anthropogenic related climate impacts monitored through background air pollution monitoring network (BAPMON) of India Meteorological Department are felt mainly in the troposphere, Singh while showing stratospheric changes of certain pollutants has not provided any atmospheric model to indicate the solar radiation control on climate change in his article. It is a well-known fact that all climate and weather phenomena on earth are controlled by the sun.

The effect of the solar cycle of 11 years, specifically mentioned by Singh and other competing factors, was investigated by the Inter-governmental Panel on Climate Change (IPCC). The results of this study (Figure 1, extracted from the IPCC report), clearly show low impact of solar variability and lower confidence level in the overall temperature change. The solar variability contribution is estimated at 0.3 W/m^2 based on observations from space-borne satellites since 1850. On the other hand, tropospheric aerosols (SO_2) have large negative effect with a little better confidence level. The competing effects of SO_2 and CO_2 on future climate have been worked out from multilayer radiative-convective models using emission data based on fossil fuel combustion. This has direct relevance to the power sector, as both CO_2 and SO_2, are derived from energy production and

industry-related energy consumption. The largest contribution to temperature rise is made by CO_2, which is emitted during fossil fuel combustion. The policy framework for energy envisages taking these factors into consideration, keeping in view the uncertainties in model predictions and that our emphasis broadly pertained to the observations in the Indian region and suggested strategic actions.

Thus, the remarks of Singh appear to be due to lack of review of recent Indian publications and also the IPCC study report pertaining to estimation of the total solar irradiance and its overall effect on climate change.

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Bats of Indian Institute of Science campus

The lush green Indian Institute of Science campus is located in the north of Bangalore. The Maharaja of Mysore, Krishnaraja Wodeyar IV, generously gifted the Institute with 150.54 hectares of land. At present the extent of land holding of the Institute is 179.28 hectares (Suresh, H. S. and Harish Bhat, *The Flora of IISc Campus, Technical Report*, 1998). Prior to its establishment in 1909, it was said to have open scrubland and farmland. The present landscape is largely due to the planning of the visionaries like C. V. Raman, G. H. Krumbigel, Homi Bhabha, B. S. Nirody and C. N. R. Rao.

The vegetation consists of a large number of avenue trees, such as *Delonix regia* (may flower), *Samanea saman* (rain tree), *Swietenia mahogany* (mahogany) and several species of *Cassia*, *Tabebuia*, and groves of *Ficus benjamina*. Other types of vegetation within the campus include block plantations of *Acacia* and *Casuarina*, thickets of *Lantana* and open grasslands. Grassy marsh and a pool formed of an old quarry are the only wetland habitat.

Many bat species like the Indian short-nosed fruit bat (*Cynopterus sphinx sphinx*), the Indian flying fox (*Pteropus giganteus giganteus*), the Egyptian mouse-tailed bat (*Tadarida aeygptica*), Pigmy pipistrelle (*Pipistrellus mimus*), Coromandra pipistrelle (*Pipistrellus coromandra*), Ceylon pipistrelle (*Pipistrellus ceylonicus*) and Indian false vampire bat (*Megaderma lyra*) have been observed in this campus. The Indian short-nosed fruit bat is the most common and abundant species in the campus. The presence of a large number of fruiting plant species such as *Muntingia calabura* (Singapore Cherry), *Broussonetia papyrifera* (paper mulberry), *Mangifera indica* (mango), *Psidium guajava* (guava), *Tamarindus indica* (tamarind), *Santalum album* (sandal wood), *Manilkara zapota* (sapota), *Terminalia catappa* (Indian almond), *Musa paradisiaca* (banana), *Syzygium cuminii* (jamun) provide enough food for these fruit bats. At the roosting sites of the short-nosed fruit bat, which are generally the window eaves within the campus, about 100 to 150 individuals were counted.

The roosting site of the other fruit bat, the common Indian flying fox, which forages within the campus is observed just about 500 m from the campus. About 200 of them have been observed foraging within the campus at night. The rest of the species are insectivorous, generally observed hawking insects at streetlights at night. The roosting sites of these insectivorous bats are crevices in walls, roofs of buildings and between pipes. Generally these species are observed in lesser numbers in the campus compared to fruit bats.

Bats are helpful to humans in many ways. Fruit bats help in the dispersal of many species of plants. The insectivorous bats control very large number of insects. Insectivorous bats tend to roost in roofs of buildings during daytime and defecate and thus create hatred in the minds of people. Some species may produce disturbing sounds. Alternative roosting places available for these bats such as hollow trees, etc. are constantly being removed. A proper study of their roost preference within the campus could reduce these problems, so that bats could have a more congenial relationship with humans.

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