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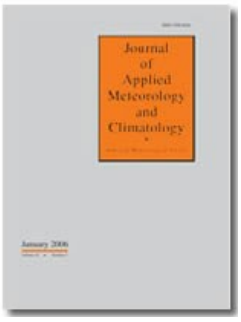

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Weather Modification by Carbon Dust Absorption of Solar Energy

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Abstract

Growing global population pressures and predicted future food and energy shortages dictate that man fully explore his potential use of solar energy. This paper investigates the possibility of beneficial weather modification through artificial solar energy absorption. A variety of physical ideas related to artificial heat sources on different scales of motion are considered. Interest is concentrated on the feasibility of mesoscale (~100–300 km) weather modification through solar energy absorption by carbon aerosol particles of size ~0.1 μm or less. Particles of this size maximize solar energy absorption per unit mass.

It is hypothesized that significant beneficial influences can be derived through judicious exploitation of the solar absorption potential of carbon black dust. There is an especially high potential for this in the boundary layer over tropical oceans and in the formation of cirrus clouds and the consequent alteration of the tropospheric IR energy budget. If dispersed in sizes $\leq$0.1 μm, solar energy absorption amounts as high as ~2×10^{10} cal lb^{-1} per 10 h or about 4×10^{11} cal per dollar per 10 h can be obtained. This is a tremendously powerful heat source, especially if it stimulates additional radiation energy gains from extra cloud formation and/or enhanced surface evaporation. Preliminary observational and modeling information indicates that this artificial heat source can be employed on the mesoscale (~100–300 km) to achieve significant economic gains by means of precipitation enhancement and tropical storm destruction alleviation. It may also be possible to use carbon dust to enhance precipitation over interior land areas, alter extratropical cyclones, inhibit high daytime summer temperatures and severe weather, prevent frosts, and speed up springtime snowmelt in agriculturally marginal regions.

A discussion of this physical hypothesis from the meteorological, radiational, engineering and ecological points of view is made.

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