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Changing trends of surface solar radiation at Bet Dagan and their relation to climate

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Significant widespread reductions in global radiation between the late 1950's and the 1980's followed by increases and partial recovery have been documented for many places around the globe. The largest reductions have been reported for industrialized cities like Hong Kong and Bet Dagan, Israel (-1.8 and –0.91 W m^{-2} $year^{-1}$, respectively). The cause of the decreases was most likely anthropogenic aerosols, but other factors may also be involved. One of the ways to determine the cause is to analyze measurements made under different climatic conditions, including those associated with cloudiness. This can help to determine how much of the aerosol effect is due to direct, and how much due to indirect forcing.

The influences of decreases in solar radiation on climate and vegetation are important concerns, but since very little is known about the spatial and seasonal distribution of this phenomenon, only gross predictions can be made. If, for example, solar radiation decreases mainly during the winter, the influence on vegetation in northern climates will be minor.

This study targeted the diurnal and seasonal course of changes that have occurred in solar radiation and their relation to climate at Bet Dagan, south-east (and down-wind) of Tel Aviv, between 1965 and 2003. Significant increases in minimum temperatures were quite large, reaching values exceeding 0.05^{o}C per year. However, daily maximum temperatures increased only in July-September. Is this because of the cooling influence of dereasing solar radiation? The least change occured in December and January. Global radiation was characterized by early high values, followed by a decade of low values in the 1980's, followed by medium to low values, which never reached the

high pre-1980 level. Direct radiation decreased until about 1985, and then recovered. Diffuse radiation was characterized by high values during the 1980's, complementing the values of diffuse radiation. The monthly-diurnal distribution of significant linear trends in global and diffuse radiation for early and late periods shows that the changes in radiation were not homogeneous, but were characteristic of certain seasons and times of day. In particular, the early large decrease in global radiation was mostly in the morning and evenings of the summer, and at mid-day only in February and November. The trends in diffuse radiation in the two periods were complementary, i.e. the decreases in the first period and increases later occurred mostly in late spring and late summer. Climate norms most similar to the patterns of change in solar radiation are the relative humidity, and the changes in diffuse radiation may correspond to the seasons and times of lowest relative humidity. Since diffuse radiation is highly correlated with cloudiness, these results may indicate changes in cloudiness at these times.