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THE ROLES OF WATER VAPOR, RAINFALL AND SOLAR RADIATION IN DETERMINING AIR TEMPERATURE CHANGE MEASURED AT BET DAGAN, ISRAEL BETWEEN 1964 and 2010

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Monthly mean values of climate at Bet Dagan in the central coastal plain of Israel, downwind of Tel Aviv, were analyzed to yield seasonal and annual values of long- and short wave irradiance which were then related to changes in air temperature measured between 1964 and 2010. Over half the large inter-annual variation and significant increase in atmospheric long-wave radiation, which averaged 0.7 Wm-2 per decade, was associated with concurrent changes measured in specific humidity; the remaining changes, by increases in concentrations of carbon dioxide and other anthropogenic radiatively active gases. Large decadal variations and a significant overall reduction in short-wave solar radiation were measured averaging 3.6 W m-2 per decade which were, in part, attributed to urban pollution. The resulting strong negative all-wave radiative forcing averaged 2.9 Wm-2 per decade. Changes in down -welling long and short wave irradiances together accounted for 58% of inter-annual variation in the mean annual temperature. Climate sensitivity to short-wave radiation forcing was very low, 0.0004 0 C per W m-2, compared with that of long-wave, 0.253 0 C per W m-2, resolving the paradox of the sharp rise in temperature accompanying negative radiative forcing. Possible physical mechanisms explaining the decoupling between annual values of solar irradiance and air temperature are discussed. A significant, inverse correlation between temperature and the annual number of rain days was found, accounting for 21 % of the inter-annual variation in air temperature unexplained by surface radiative forcing. During the last 45 years changes in annual temperature at Bet Dagan, a near-coastal site with a strong urban influence situated in the semi-arid Mediterranean climate, were associated, in the following order of importance, with changes in water vapor, rainfall and solar radiation.