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Lightning flash densities in urban and rural areas along the Mediterranean coastline of Israel

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Lightning flash densities near Tel-Aviv and Haifa, the two largest metropolitan areas in Israel, are compared to rural areas along the Mediterranean coastline. The average flash density in the Tel-Aviv area is ∼1.2 flashes/km2/year, increasing from south to north and reaching a maximum in Haifa-bay and the near-by Mt. Carmel. Based on 4 years of lightning data obtained from the Israeli Electrical Company LPATS system (2004/5-2006/7 and 2008/9), we mapped flash densities by using high-resolution Google-earth visualization tools. The maximum lightning flash density is typically found to occur just west of the coastline above the Mediterranean Sea and to decrease eastward over land. The urban complex of the metropolitan Tel-Aviv area shows a clear increase in total lightning density compared to more rural regions to its north and south. An increase in positive-cloud-to-ground (+CG) flash density is present downwind from the Tel-Aviv urban area. A clear mid-week effect is also apparent in +CG densities with peak currents >50 kA north-east of the Tel-Aviv metropolitan area. The second maximum in flash density is found north of Haifa and its surrounding industrial complex, where it is probably dominated by the orographic effect of Mt. Carmel. A possible explanation for the lightning density anomaly in the Tel-Aviv area may be the Urban-Heat Island (UHI) effect, which alters the storm dynamics by enhancing convection and invigorating lightning activity downwind. Alternatively, aerosols emitted from industrial and vehicle activities may be ingested by the passing thunderclouds, modifying the microphysical processes within them and enhancing the ice mass flux, known to be directly related to the flash rate.