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On the Urban Rainfall Anomalies and relation to Orographic Suppression

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It was recently suggested that air pollution suppresses orographic precipitation in Israel (Givati and Rosenfeld, 2004, 2005) and other regions in the world following the trend analysis of the orographic rainfall ratio Ro. A comprehensive evaluation of these findings over Israel (Alpert et al, 2008) shows that the aforementioned findings result from a consistent improper use of Ro.
A correct estimation of Ro requires selecting stations undisturbed by topography, or other inland effects, as much as possible. Furthermore, if coastal stations are chosen right over the area of the positive rainfall urban enhancement due to thermal heat island or urban barrier effects, a seemingly decreasing "orographic ratio" is unavoidable. In addition, the Ro definition mathematically requires some negative trend in a region where both the orographic and coastal rainfall increase in similar amounts, like the case over central Israel with 6-8% rainfall increases in last 50 years.
A full separation of the different aforementioned factors in this complex situation cannot be done without a comprehensive model simulation study that includes realistic urban dynamical effects, like heat islands, barriers, surface moisture, as well as anthropogenic aerosol interactions with clouds. The urban effects on rainfall were analyzed in the last 60 years over the greater Tel-Aviv urban area, and our preliminary results support the many earlier findings on urban climate that dynamical urban effects are predominant.

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