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## Quantifying the urbanization induced temperature effect of weather station De Bilt (Netherlands) between 1900-2000.

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Generally it has been hypothesized that the spatial expansion of cities may affect the 2m temperature record nearby these cities. We quantify the impact of the expansion of the city Utrecht (Netherlands) on the WMO station De Bilt, Netherlands (3.7 km east from Utrecht city center), the key station for climate studies in the Netherlands. Therefore, the mesoscale model WRF-ARW is run for a number of weather situations for both the land use in 1900 and 2000. In this period, Utrecht expanded by about a factor four, though De Bilt remained "rural". The urbanization induced temperature effect is then estimated by subtracting the two runs. This is repeated for four episodes of a week, each representing a different large-scale flow regime. Consequently, the results are scaled up from the individual cases to yearly estimates using frequency distributions of the large-scale flow regimes for the Netherlands. Also, we estimate the uncertainty of the model results by varying the boundary-layer scheme. The model results by the MRF boundary-layer scheme, indicate that the expansion of Utrecht would have resulted in an average temperature rise of  $0.32\pm0.11$  K on the De Bilt temperature record, with a maximum of 0.38 K in the westerly wind regime. Using the alternative MYJ boundary-layer scheme, a  $0.27\pm0.11$  K temperature rise is found in the twentieth century. Both estimates are close to earlier model studies for London and Brussels. On the other hand, the estimates are substantially larger than an earlier estimate based on comparison of observed temperature records nearby De Bilt, which suggested an urbanization induced temperature effect of only 0.11±0.06 K. Overall the present results suggest that a substantial part of the observed temperature trend in De Bilt of 1.2 K could be explained by urbanization effects.