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Climatic characteristics of summer human thermal discomfort in Athens and its connection to atmospheric circulation

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The variability of summer human thermal discomfort in Athens and its connection to atmospheric circulation is studied. The data used are daily values (12:00UTC) of air temperature, mixing ratio and atmospheric pressure at the National Observatory of Athens, for the warm season (1 May – 30 September) and for the period 1954-1999 (46 years). From the above parameters, the Predicted Mean Vote (PMV) discomfort index is calculated for calm and light wind (3m/s) conditions. The variability of thermal discomfort is examined in terms of the inter-annual variation of: i) the mean summer 12UTC PMV values and ii) the frequency of summer discomfort days (PMV>2 and PMV<-2). According to the results, a significant increase in discomfort (intensity and frequency) is found from the middle 1980's to the end of the period under study. Also, the seasonality of thermal discomfort is studied by examining the intra-seasonal variation of the 46-year mean daily 12UTC PMV values as well as the discomfort cases for each summer day during the 46-year period. From middle July to middle August, the mean 12:00 UTC PMV values exceed the discomfort thresholds (PMV>2). Furthermore, the onset and the cessation of the discomfort period are studied. The results show that the onset takes place around the beginning of July and the cessation around the end of August, but from the middle 1980's to the end of the period under study the dates of onset and cessation have slightly moved earlier and later, respectively, leading to a higher summer discomfort period. Finally, the connection between human thermal discomfort and atmospheric circulation is studied by examining the distribution of discomfort cases into 6 objectively defined circulation types for Athens. According to the results, the extreme high discomfort conditions prevail mainly under the two of the six circulation types, which dominate during July and August and can be characterized as the typical high-summer pressure patterns. Both of them are characterized by the presence of the summer thermal low of the SW Asia and high pressure values over Europe. The difference appears in the position and the intensity of the anticyclone center and the pressure gradient over the Aegean Sea. It is found that the discomfort increase after middle 1980's is more evident for the second circulation type. On the contrary, low PMV (<-2) discomfort conditions prevail mainly during the other four circulation types, which are more frequent during May, June and September.