



Probability of air temperature inversions in Gornoslasko-Zaglebiowska Metropolis on the background of weather conditions

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Air temperature inversions in the urbanised areas are of a special relevance due to health aspects. Górnośląsko-Zagłębiowska Metropolis is the biggest and most populated urban area in Poland and is considered to be most polluted region in Central Europe. This paper aims at identification of the intra-annual diversity in daily course of air temperature inversions occurrence and intensity on the background of complex weather conditions including wind speed, cloudiness, atmospheric circulation types, the type of air masses and the radiation balance in particular earth radiation during cloudless nights.

The meteorological data of 10 min resolution is taken from meteorological station located in the central part of the Metropolis. We gathered the high-quality data for the period of 2002-2018. The data on circulation and air mass types is of daily resolution. Thermal structure of the atmosphere was identified base on differences between air temperatures at the heights of 100 m and 2 m. Positive differences in air temperature indicate inversion while negative differences stand for normal conditions - a decrease in air temperature in line with an increase in altitude. We calculated: (i) the probability of air temperature inversions (ATI) in daily course taking into account 3 classes of inversions intensity, (ii) conditional probability of air temperature inversions for various intervals of meteorological elements and circulation types, (ii) conditional probability of air temperature inversions for complex weather types. Finally, we compared the concentration of air pollutants during days without and with air temperature inversions regarding their various intensity.

Seasonal variation was found in the probability of air temperature inversions with maximum in summer nights and minimum in winter. In contrast the period of high probability of inversions was the longest in winter (between 16UTC to 09UTC with max c.a. 23% between 00 and 02UTC) and the shortest in summer (between 18 and 05UTC with max ca. 60% between 21UTC and 02UTC). Air temperature inversion are also frequent in spring. High frequency of summer and spring inversions was due to cloudless and calm nights occurring more frequently in warm part of a year than in cold months. Maximum intensity of ATI varied from 8⁰C in July to 11⁰C in December and January. The probability of ATI was minor at nights with cloudiness >60%. The ATI significantly correlated with wind speed however only at lower level which indicated that inversion can coexist with stronger winds above the height of 100m. The frequency of ATI was related to atmospheric circulation which helped in identification of the ATI genetic type.

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