



Air temperature inversions in the boundary layer of the atmosphere in Sosnowiec (Southern Poland)

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The air pollution is one of the key problems in urban areas. Oppressive and health dangerous are episodes of high air pollution concentration that are usually linked to air temperature inversions (ATI). Therefore, the research into ATI in urban areas is important. Our study aims at determining the frequency of air temperature inversions in 2m and 100m vertical profiles of the atmosphere in Sosnowiec, located in one of the most polluted areas of Poland and assessing relations between the occurrence of air temperature inversions and wind speed, cloudiness and atmospheric circulation. We used air temperature data of a 10 min temporal resolution to calculate laps rate and select inversions. The measurements were performed at 5 cm above ground level over grassy surface, at 2 m in standard meteorological station and at altitude of 100 m (5 m above the roof of the Faculty of Earth Sciences). The inversions were selected based on differences calculated from air temperature at 200 cm and 5 cm and at 100 m and 2 m. Positive differences ($\geq 1^{\circ}\text{C}$) indicated the inverse thermal structure of the atmosphere. We analysed ATI with respect to their intensity.

In Sosnowiec, the air temperature inversions (ATIs) were very frequent. They constituted 73% of days in the lower profile of 200-5 cm and 39% of days in the upper profile of 100-2 m. In lower profile (5-200 cm), the highest number of ATIs was observed in autumn while in the upper profile (2-100 m) in summer. Very intense ATIs ($\geq 5^{\circ}\text{C}$) constituted c.a. 5% of days (200-5 cm) or 3% of days (100-2 m) depending on the profile; their occurrence peaked in spring. There were clear relations between the frequency of ATI and atmospheric circulation with no seasonal variations. In the upper profile (100-2 m), these relations were stronger than in the lower profile (200-5 cm). In Sosnowiec ATIs were most probable to occur during air advection from the south and southwest (advection inversions) and during centre of anticyclone or anticyclonic ridge (radiation inversions). The probability of ATI occurrence in lower profile was very low during air advection from the northern, north eastern and eastern directions when southern Poland was under an influence of low. In the research period no ATI were observed in the upper profile during air advection from the northeastern direction. The ATI were also dependent on cloudiness, particularly in the upper profile where the probability of ATI were minor at nights with cloudiness $>60\%$.