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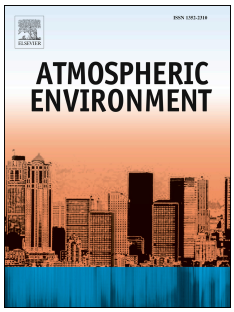

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An investigation of atmospheric mercury accumulated in the snow cover from coastal zone of the Baltic Sea, Poland the urbanized

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Abstract

The preliminary research on Hg snow chemistry was conducted in the industrially-impacted region of the southern Baltic Sea during winter campaigns in 2008 and 2009. Mercury content in urban snow samples was quantitatively determined through the use of an atomic absorption technique. The average total Hg concentration value in shallow snow cover from the urbanized coastal zone of the Baltic Sea was calculated to be 8.6 ng L^{-1}. A strong relationship between the anthropogenic emission factors (contribution from local and regional coal combustion processes) and low temperature was identified for all the examined snow episodes. The highest Hg concentration in the urban snow samples was observed during the southern advection, which indicated that local/regional anthropogenic emission predominantly affected the Hg deposition. Other environmental variables (meteorological and chemical) were also investigated to establish the most important atmospheric processes and sources of Hg in the urban snow cover and to assess the changes in atmospheric Hg chemistry during the winter season.

Highlights:

1. The first data of Hg transformation in snow cover from Gdynia.
2. Coal combustion, traffic and shipping activities were identified as dominant source of Hg.
3. The contribution by long-range transport from polluted areas in Europe was substantial.
4. Hg distribution pattern in snow cover was irregular.

Keywords: Hg, snowfall, air pollution, coal combustion, sources, atmospheric transport

1. Introduction

In the last few decades, snow chemistry has become widely investigated in field, lab and modeling studies to better understand complex processes of atmospheric compounds, including transport and deposition pathways, impact on climate change, aquatic/soil systems and human health. In many polar surveys, it was stated that the snowpack plays an important role in the biogeochemical cycle of various contaminants, and can act as their source or temporary reservoir (Dommergue et al., 2003, Steffen et al., 2002).

Due to large differences in physical properties (e.g. albedo, density, temperature, porosity, snow metamorphism, snow specific surface area) and chemical composition of snow grains and ice crystals (organic/inorganic compounds, dissolved/particulate ions, volatile/non-volatile impurities), snow cover is often regarded as a very active and heterogeneous system. Many recent works pay a special attention to dynamic and bidirectional air-surface exchange of gaseous Hg that strongly depends on solar radiation, especially on that of shorter wavelength (i.e. UV-A, UV-B) that enhances halogen activation (Dastoor et al., 2008). Considering abrupt changes of environmental conditions (temperature and relative humidity, insolation and cloudiness, wind pressure, boundary layer height),