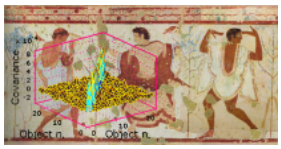

Comparison of Source Regions of Major Anthropogenic Compounds at the Two Coastal Regions of Turkey

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Abstract

In this study, source regions of anthropogenic compounds and element in rural areas at the Black Sea coast and the Mediterranean coast of Turkey are compared. The Black Sea and Mediterranean coast stations were located at Amasra-Bartın and Antalya, respectively. The source regions of SO_4^{2-}, NO_3^- and NH_4^+ were determined by using potential source contribution function (PSCF). Statistical significance of source regions assigned by PSCF were assured using bootstrapping with 3000 iterations. Source regions effecting Mediterranean and Black Sea regions have some similarities. Especially emissions to the atmosphere in some regions in the Russia and some Balkan countries have effects on both of the stations.

Introduction

Turkey is surrounded by many different cultures which results with many different emissions from many different industries. The effect of these sources depends not only on the quantity of the emissions from the source but also on the distance between the source and the receptor. In order to develop an effective control strategy, it is necessary to determine the locations of pollutant sources [1]. In order to determine the locations of the sources, a methodology called trajectory statistics were developed. This method combines geographical information with the concentration data [2].

In this study, Potential Source Contribution Function (PSCF) [2] was used for the comparison of the source location of SO_4^{2-}, NO_3^- and NH_4^+ at two rural coastal stations of Turkey.

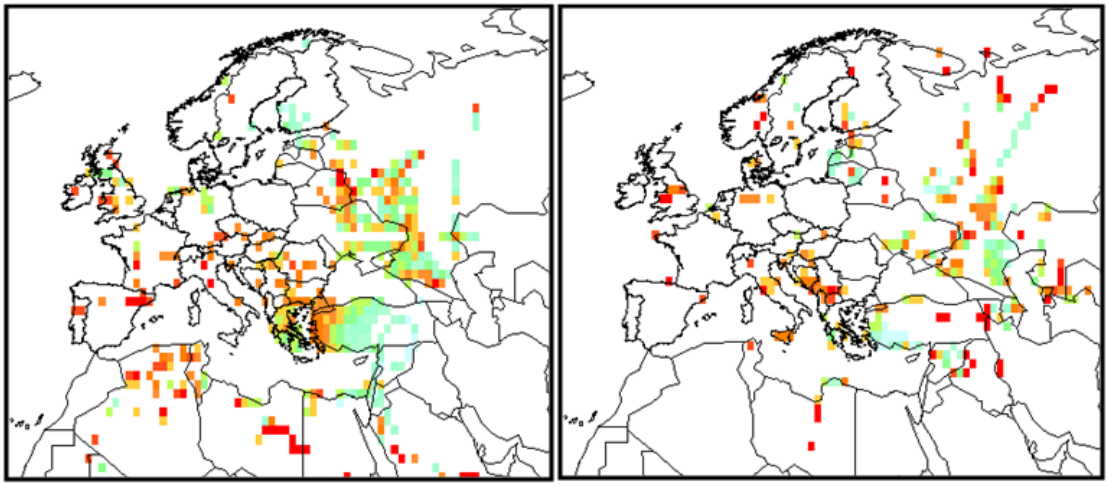
Materials & Methods

The Mediterranean station is located at the coast approximately 20 km to the east of Antalya (31.0°E, 36.8°N). In this study, results of 1992 and 1993 aerosol samples will be discussed. During this period, a total of 600 daily aerosol samples were collected with high volume samplers on cellulose fiber filters. The station on the Black Sea coast is located 20 km to the east of the town of Amasra. The distance between the station and the Black Sea is approximately 3 km (32.3°E, 41.5°N). Daily aerosols samples were collected in between April 1995 and July 1997. During this time period 354 daily aerosol samples were collected. Only a brief discussion of sampling methodology and analytical tools are presented here, because a detailed discussion on experimental techniques is given elsewhere [1]. Briefly, anions SO_4^{2-} and NO_3^- were measured with a Varian 2010 HPLC which is connected to a JASCO-875 UV-Vis detector using a VYDAC 302 IC anion exchange column. Ammonium ion was determined by the direct Nesslerization method by using a Unicam 8625 UV-Vis spectrometer. The Potential Source Contribution Function (PSCF) is the conditional probability that a parcel with a certain level of pollutant concentrations arrives at a receptor site after having passed through a specific upwind source area. In the PSCF calculations, it is assumed that a species emitted within a grid cell is swept into the air parcel and transported to the receptor site without loss through diffusion, chemical transformation or atmospheric scavenging. The statistical significance of the spatial distribution of the PSCF values is examined by making the use of non-parametric bootstrap method [3].

Results & Conclusions

The most important potential sources of SO_4^{2-} on the Mediterranean coast were found to be the western part of Turkey, especially Aegean cost, north west Turkey, Greece, particularly Athens and west coast and northeast coast of Black Sea (Fig.1). The potential source regions of SO_4^{2-} for the Black Sea region are more limited. The western part of Turkey also observed as a potential source region as in the case of Mediterranean station. However, the contribution of this region to SO_4^{2-} concentration to Black Sea aerosols is less when compared with the input to the Mediterranean station. Similar to the Mediterranean station, UK, northeast coast of Black Sea and central parts of Russia are also source regions of SO_4^{2-}. Even though, there are some common source regions with Antalya station, such as potential source areas in the Russia, most of the source regions are not the same. Same disparity of source regions between Black Sea and Mediterranean coasts of Turkey was also observed in NO_3^-. Nitrate source regions in the Mediterranean regions that lies to the north of Turkey are similar to SO_4^{2-} source regions. The potential sources of NO_3^- in the Mediterranean are located in Greece, Serbia and Italy. The potential regions effecting the concentration of NO_3^- in Black Sea are also similar SO_4^{2-} source regions. Middle East region is the most important potential source region for the Black Sea. Source regions of NO_3^- in Black Sea and Mediterranean Sea are different from each other. As in the cases of NO_3^- and SO_4^{2-}, NH_4^+ ion in Antalya station has potential sources in northeast Black Sea. Some regions of Turkey also contribute to the NH_4^+ concentration such as Marmara region and south eastern region. The most important potential region of NH_4^+ in Amasra is the southern regions of Turkey. Other potential regions of NH_4^+ are central parts of Russia, region in the Russia-Belarus border, eastern parts of Caspian Sea and England.

The contribution of southern part of Turkey to the Black Sea station is higher than the Mediterranean station. The other source regions are different than those found for the Antalya station. The results of the comparison clearly demonstrated that different air flows to receptor areas and rain scavenging during transport have profound influence on the source region apportionment of different receptor areas.



(a) (b)

Fig.1. Distribution of SO_4^{2-} PSCF values in the Mediterranean (a) and Black Sea (b) (Calculated for the highest 40% of measured concentrations)

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