

***A survey on the synoptic patterns based on critical periods of air
pollution in severe inversions of Tabriz, Iran***

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Extended Abstract

Introduction

Air pollution as one of the most important technological risks of contemporary era is mainly resulted from the emergence of large cities and fast growing industries. One of the main objectives of climatic and environmental studies is to survey atmospheric pollutions. Tabriz is one of the metropolises where air pollution is a problem. However, what is essential to consider the severity of air pollution in the city of Tabriz is the function of atmospheric processes that act widely. In this case temperature inversion is one of the most important factors. Weather condition of each single day is affected by synoptic conditions. Therefore, sometimes it can result in stability and tranquility in the atmospheric conditions and due to the concentration of pollutants in lower atmospheric layers and the lack of or poor atmospheric motions, the severity of pollution increases. Given the importance of weather stability in the occurrence of atmospheric problems, it seems essential to investigate the synoptic conditions of Tabriz city during critical air pollution periods and providing recommendations and preventive measures. For this reason, the present article aims to investigate the cause of severe and periodic air pollutions in Tabriz.

Materials and Methods

The daily data of Tabriz pollution over a 6 year period (2008-2013) were the data of current study (CO, PM10) that were collected from the Department of Environmental Protection, East Azerbaijan Province. Among these data, four successive pollution periods along with temperature inversion were selected by EXCEL filtering software. Then, the situation of pollutants regarding their healthiness and unhealthiness were studied using PSI index. Also in this article due to the direct effect of temperature inversion on intensity of pollutant concentrations and depth of temperature inversion, Skew-T maps were used to determine the

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pollution periods of Tabriz. According to the purpose of this study which was to identify the synoptic systems affecting air pollution in Tabriz, to identify synoptic patterns that influence the amount of pollutants in polluted days, daily synoptic maps at ground level and 500 hp of pollutant days were received from NCEP/NCAR and to investigate the synoptic patterns affecting sustainable and long-term periods of air pollution in Tabriz.

Results and Discussion

The study area is often influenced by synoptic patterns of mid-latitudes. The most important seasonal thermal systems that affects large sections of the country are Siberian high pressure and low pressure summer heat. During the cold season, Siberian high pressure is strengthened which can affect the frequency of large areas of Iran including Tabriz. In the most days of the year especially in cold season, due to shortness of the length of day and cold radiation at night, temperature inversion including radiation and subsidence can occur in the area. The local characteristics of the area especially lack of high speed winds in cold seasons, i.e., autumn and winter, can reduce the intensity of inversion layer. The concentration of pollutants has provided the situation for air pollution. When a high-pressure system constantly during successive days focuses on a special area, the intensity of temperature inversion reaches its peak. Then, with the arrival of a low pressure systems inversion fades away. In general, the main factor reinforcing inversion in high temperature is due to the continuity of high-pressure systems which can cause long-term pollutions.

Conclusion

In present study, we investigated the atmospheric patterns affecting air pollution in Tabriz during the statistical period of 2008-2013. The main objective of this study was to investigate the relationship between sea level and 500 hPa synoptic patterns with temperature inversion and prolonged periods of pollution. The results showed that the concentration of pollutants in most days was due to the intensity inversion layer in a way that when the intensity of temperature inversion reaches more than 5°C it has the greatest impact on the increase of the concentration of pollutants in all investigated periods. The findings also indicated a strong correlation between the function of strong and weak inversion layers with low pressure and high pressure systems in a way that strong inversion layer is always associated with high pressure systems. Results indicate that the Siberian high pressure has a significant role in the occurrence of pollutions in Tabriz city. The circulation system in more than half of the studied days can cause formation of high concentration of pollution in Tabriz. This synoptic system due to the establishment of cold weather on the Zagros and the combination of high pressure developed in the Zagros Mountains has created strong pressure. However, this system is more powerful when in middle levels of atmosphere in all phases the high altitude was 500 hPa level along with the stack system based on the region have developed and intensified the high pressure on the ground and caused the stability of clear weather and also caused the formation of a strong inversion layer and increase in the concentration of suspended particles in the atmosphere of the city of Tabriz.

Keywords: *air pollution, high pressure system, synoptic patterns, Tabriz, temperature inversion.*