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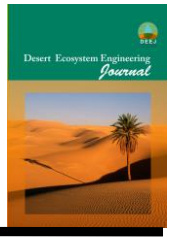

Investigating the Effect of Inversions on the Air Pollution of Desert Ecosystems in the Special Economic Zone of the Persian Gulf

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Extend Abstract

Introduction: This study tries to investigate the temperature inversion and its role in the concentration of air pollution in the region by using the data observed by Bandar Abbas Radio Sound and the recorded data of meteorological parameters and air pollution in the site of the Persian Gulf Special Economic Zone and to know the characteristics of temperature inversion and its effect on the distribution of industrial pollutants.

Materials and methods: The Special Economic Zone of the Persian Gulf Industries is located in the 13 km of Shahid Rajaee Highway, west of Bandar Abbas in Hormozgan Province - the northern shores of the Persian Gulf. In order to analyze anemometer data and state of the direction and speed of winds in the region, Wind rose Plot software was used. In order to investigate the characteristics of temperature inversion in the region and its relationship with the concentration of air pollutants, radiosonde data and the Bandar Abbas Skew-T diagram were used. After downloading the data, using the RAOB software, Skew-T diagram was drawn for Bandar Abbas and the temperature inversion characteristics were obtained from it. In order to model and predict the possibility of temperature inversion, logistic regression model fitting was used. Temperature inversions according to intensity in four separate groups including: weak (0.000-0.010), medium (0.011-0.20), severe (0.021-0.030) and very severe (high 0.031) was divided. In order to equate the intensity of inversion and the effect of climatic variables and characteristics of the temperature, altitude and pressure layer on its intensity, multiple linear regression was used in a step-by-step method. The concentration of standard air pollutants, including PM_{10}, CO, O_3, NO_2 and SO_2 were obtained from the pollution control center at the site of the Persian Gulf Special Economic Zone on a daily basis. After examining the pollutants, their concentration was compared on days of inversion and non-inversion, and their relationship with atmospheric characteristics and characteristics of inversions was investigated.

Result: The winds speed classes of the region were prepared on a seasonal scale. The results show that the south and southeast winds are the dominant winds in the region, which is known as the sea breeze. The results of extracting days with temperature inversion in the industrial area showed that the most inversions are in June and May; Also, Feb and Apr are on the same floor in the third row. In July, August and September, the number of inversions decreases and peaks again in autumn. The results of comparing the mean of Student's t-test showed that among meteorological parameters, temperature and wind speed in inversion days and unstable days (no inversion) have significant differences, but relative humidity, air pressure and wind direction, although in two

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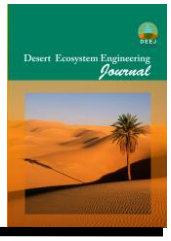

types There are few changes in the inversion conditions, but their differences are not significant. The logistic regression results show that the dependent variable of temperature inversion can be explained with 67% confidence using independent variables. Therefore, the final model is drawn with the variables of ground pressure, wind speed and sensible heat flow according to the equation. Weak inversions are the most frequent. About 51.2% of inversions have weak intensity, 37.9% have medium intensity, about 7.7% have high intensity and only about 3% have very high intensity. According to the monthly scale, the highest percentage of the frequency of weak weather was in July (73%) and the lowest in March (30%). But extreme inversions are the most frequent in January (11%) and in the warm half of the year there are no extreme inversions. The annual average intensity of inversion in the region is average (0.017), but in the hot half of the year (spring and summer), the intensity of inversions is weak and in the cold half of the year (autumn and winter), and the average of the strongest inversions is in March. It happened. The standardized concentration difference of PM_{10}, CO, O_3, SO_2 and NO_2 pollutants was investigated under stable (inversion) and unstable (non-inversion) atmospheric conditions, and the results of the Student's t-test showed that the average concentration difference of PM_{10}, CO, O_3 in inversion conditions and The lack of inversion was significant at the 0.01 level; However, no difference was observed in the concentration of SO_2 and NO_2. The concentration of all pollutants was also higher during inversion than in non-inversion conditions. Therefore, inversion plays an important role in the concentration of atmospheric pollutants in the region. Inversion increased the concentration of PM_{10} by 56 µg/m3 compared to non-inversion conditions. CO concentration also increased by 0.46 ppm under the influence of inversion. Air inversion and stability have the greatest effect on ozone (O_3), which increased by 61.5 ppb. Also, sulfur dioxide increased by 0.11 ppb and nitrogen dioxide by 2.6 ppb on inversion days compared to non-inversion days.

Discussion and Conclusion: The results of the investigation of the wind situation in the industrial area west of Bandar Abbas show that the dominant wind is south and south-east, and then the south-southwest directions are the first-order winds. Velocity greater than 12 meters per second exists only in the south direction and with negligible frequency. In most directions, the wind speed is less than 6 meters per second, which was consistent with the results of Kamijani et al. (2014); So that they came to the conclusion that the frequency of high-speed wind decreases from the west to the east of the Persian Gulf, and in Bandar Abbas and the east of the Persian Gulf, the frequency and strength of southerly winds increases compared to the west coast of the Persian Gulf, which is the main reason for the formation of low pressure. In the summer season, this low pressure moves to the eastern coast of the Persian Gulf in the Oman Sea, which increases the frequency of southerly winds, especially on the coasts of Bandar Abbas and Qeshm. In winter, due to the decrease in wind speed, the depth of the layer and the intensity of the inversion increased, and on the contrary, in the summer, the intensity of the inversion decreased with the increase of the wind speed. In the northern cities of Iran, including Tehran, Mashhad and Tabriz, the inversion is more in winter and is of the radiation type, which is the main reason for the stability of the air and the formation of the inversion; However, in the studies related to Tehran, Mashhad and Tabriz (Shamsipour et al., 2013; Sadeghi et al., 2014; Yaori and Saseh, 2011), the role of wind speed and relative humidity has not been mentioned much; However, the results of the current research show that wind speed and relative humidity on the ground have a significant correlation with the intensity of the inversion.

Keywords: Inversion, Logistic Regression, Air Pollution, PM_{10}, Bandar Abbas.