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## Investigating Dominant Fluctuations of Dust and Wind Speed in Hirmand Watershed

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### Extended Abstract

#### Introduction

The southeastern region of Iran is faced with dust phenomenon, which is primarily caused by 120-day Sistan winds and topographic conditions. Moreover, considering the great influence of the winds on the occurrence of dust in the study area, fluctuations of wind speed and dust are of great importance. Therefore, this study sought to investigate and analyze the cycles governing dust and wind speed in Hirmand watershed.

As a climatic event, dust phenomenon may occur in all weather conditions. However, the phenomenon disturbs human activities and damages social infrastructures such as agriculture, transportation, and industries in arid and semi-arid regions.

Dust storms frequently occur in some parts of the world, especially the Middle East. However, the occurrence of successive dust storms has so increased in the region during the last decade that it is also observed in the cold and rainy months. In this regard, studies conducted on dust storms in Iran suggest that in addition to natural factors that create the mass of fine dust, environmental or human factors are also involved in the occurrence of such a phenomenon and its long-term stability and continuity.

**Materials and methods:** The current study set out to examine and analyze the cycles governing dust and wind speed in the Hirmand watershed. To this end, the required data concerning wind speed and dust data were collected from 2000 to 2018 (18-year period) from seven synoptic stations located within the Hirmand watershed, including Zabul, Zahak Hamon, Nusratabad, Zahedan, Dermian, Deh Salam, Nehbandan, and Birjand stations, using the information published by the National Meteorological Organization (Figure 1). After extraction and quality control of the data, the code of phenomena related to dust has been used to extract the dust. After preparing the annual wind speed and dust data, spectral analysis has been used to analyze the cycles.

**Results:** Fluctuations (cycle), probability, and variance of dust were calculated for Hirmand watershed stations. The high variance indicates the importance of the dominant fluctuation of the cycle. In Birjand station, the time series of dust showed two short-term cycles of two and six years, and the probability of the occurred cycles were 0.2 and 0.5, respectively. Therefore, as the variance of the two-year cycle was found to be higher, it could be said that the cycle in the dust time series of Birjand station is very important.

However, only one dominant cycle of two years was observed in Nehbandan station, whose occurrence probability was reported to be 0.5. Moreover, the variance of the two-year cycle in Nehbandan station was 529, indicating the significance of the cycle in the time series of Nehbandan dust.

As for the Zabul and Zahak stations (located in eastern half of Hirmand watershed), the dust was found to have six and two-year fluctuations. On the other hand, an 18-year cycle was observed in the dust time series of Nusrat Abad station. Moreover, the examination of wind speed fluctuations in Hirmand watershed stations revealed that wind speed was also dominated by short-term fluctuations (just like what was found for the dust). However, various cycles of six and eleven years were observed in some stations. For instance, an eleven-year cycle was found to have

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prevailed in the drainage station. Therefore, it can be argued that the fluctuations governing dust and wind speed are similar, indicating the relationship between these two parameters in the southeast region of Iran.

**Conclusion:** Sistan basin is known as one of the most active sources of dust and windy desert environments in the world. Although dust activity in Sistan reaches its maximum during summer, the region may be hit by rare severe dust storms in winter. Many studies conducted on precipitation have already used spectral analysis method and the extraction of ruling cycles. However, the technique has not been used in the study of dust and wind.

The analysis of dust cycles showed that the major fluctuations governing the dusts of the Hirmand watershed occur in a short-term (two to four years). Moreover, the status of cycles governing wind speed revealed that short-term fluctuations of two to four years prevailed in most stations (the same as what occurred for the dust). Therefore, the fluctuations governing these two parameters in Hirmand watershed vary from two to four years. A similarity is also observed in the dominant cycles of wind speed and dust, indicating the fact that the dominant cycles of this part of Iran are the same under the influence of the macro-scale oceanic atmospheric system.

**Keywords:** Dust, Wind Speed, Fluctuations, Dominant Cycle.