

Investigating the Aerosol Load of Eastern Mediterranean Basin with Sentinel-5p Satellite

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Abstract : Aerosols directly affect the radiative balance of the earth by absorbing and/or scattering the sun rays reaching the atmosphere and indirectly affect the balance by acting as a nucleus in cloud formation. The composition, physical, and chemical properties of aerosols vary depending on their sources and the time spent in the atmosphere. The Eastern Mediterranean Basin has a high aerosol load that is formed from different sources; such as anthropogenic activities, desert dust outbreaks, and the spray of sea salt; and the area is subjected to atmospheric transport from other locations on the earth. This region, which includes the deserts of Africa, the Middle East, and the Mediterranean sea, is one of the most affected areas by climate change due to its location and the chemistry of the atmosphere. This study aims to investigate the spatiotemporal deviation of aerosol load in the Eastern Mediterranean Basin between the years 2018-2022 with the help of a new pioneer satellite of ESA (European Space Agency), Sentinel-5P. The TROPOMI (The TROPospheric Monitoring Instrument) traveling on this low-Earth orbiting satellite is a UV (Ultraviolet)-sensing spectrometer with a resolution of 5.5 km x 3.5 km, which can make measurements even in a cloud-covered atmosphere. By using Absorbing Aerosol Index data produced by this spectrometer and special scripts written in Python language that transforms this data into images, it was seen that the majority of the aerosol load in the Eastern Mediterranean Basin is sourced from desert dust and anthropogenic activities. After retrieving the daily data, which was separated from the NaN values, seasonal analyses match with the normal aerosol variations expected, which are high in warm seasons and lower in cold seasons. Monthly analyses showed that in four years, there was an increase in the amount of Absorbing Aerosol Index in spring and winter by 92.27% (2019-2021) and 39.81% (2019-2022), respectively. On the other hand, in the summer and autumn seasons, a decrease has been observed by 20.99% (2018-2021) and 0.94% (2018-2021), respectively. The overall variation of the mean absorbing aerosol index from TROPOMI between April 2018 to April 2022 reflects a decrease of 115.87% by annual mean from 0.228 to -0.036. However, when the data is analyzed by the annual mean values of the years which have the data from January to December, meaning from 2019 to 2021, there was an increase of 57.82% increase (0.108-0.171). This result can be interpreted as the effect of climate change on the aerosol load and also, more specifically, the effect of forest fires that happened in the summer months of 2021.

Keywords : aerosols, eastern mediterranean basin, sentinel-5p, tropomi, aerosol index, remote sensing

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