

SAHARAN DUST INTRUSIONS IN SPAIN BETWEEN 2004 AND 2023

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Air pollution is a crucial factor in people's quality of life and health. Depending on the concentration and composition of pollutants present in the atmosphere, there are a series of health and environmental issues. Therefore, it is very important to carry out pollution studies to determine the necessary actions to maintain the overall well-being of public health. Atmospheric particulate matter (PM) is defined as a complex mixture of extremely small particles and liquid droplets suspended in the atmosphere that cause serious health effects, influence radiative balance, cloud formation, or modification of albedo. These particles have a wide range of morphological, physical, chemical, and thermodynamic properties. Determining the concentrations of PM in the atmosphere is a key parameter in assessing air quality. PM10 is a magnitude generally used to measure the aerosol amount present in the atmosphere, while PM2.5 refers to particles associated with hazardous effects on human health, as their ability to penetrate the respiratory system is greater than that of bigger particles. Due to the proven influence of this pollutant on human health, climate, and ecosystems, both contributions derived from human activities and those originating from natural sources are regulated in European legislation, although the latter can be evaluated but not controlled (Tahirí, 2021).

Intrusions of African air masses are responsible for increasing the level of mineral particulate matter in areas that may be far away from the continent that is the source of this material (Alonso Pérez, 2007). During dust storms, surface-level events that spread across the troposphere, particles are transported by powerful turbulent winds across extensive distances (Bodenheimer et al., 2019). Due to its strategic position, the Iberian Peninsula receives very often suspended particulate matter from North Africa (Russo et al., 2020).

This study focuses on the temporal trend of natural Saharan dust intrusion events in Spain from 2004 to 2023. Data obtained from the Ministry for Ecological Transition and Demographic Challenge (MITECO) have been analyzed to determine yearly and seasonal trends across nine geographical regions: Canary Islands, Balearic Islands, Southwest peninsula, Southeast peninsula, Centre peninsula, Levante, Northwest peninsula, North peninsula, and Northeast peninsula. Furthermore, the duration of these events has been analyzed. Additionally, the evolution of weather types, following a well-known classification by Lamb (1972), has been studied to assess potential correlations with intrusion events.

Subsequently, a detailed examination was conducted on the unprecedented extreme Saharan dust event that occurred in March 2022. An analysis was carried out using aerosol concentration data from various sampling stations across Spanish territory to delineate the longitudinal and latitudinal dispersion gradient of African dust particles during that episode. The Hysplit model has been employed to determine the origin of air masses, alongside other tools such as the NAAPS and Multimodel models, which provide information on the arrival of Saharan dust to the Peninsula.

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