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Quantifying the contribution of wetlands drying to aerosol generation across Iran

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Wetlands are accounted as important providers of ecosystem services, which yield several functionalities such as the support of biodiversity, flood control, soil stabilization to reduce dust generation, natural treatment of surface waters, groundwater replenishment, climate regulation and economic benefits. Over the past decades, the impacts of anthropogenic manipulations amplified by climatic changes have threatened both the quantity and quality of wetlands, worldwide. A continuous monitoring of wetlands is thus necessary to protect them from further destruction, as well as to devise and assess the success of any rehabilitation plans. The conventional methods of water body monitoring chiefly include field surveying, which is time consuming, costly, and limited in extent. Alternatively, remotely sensed data have facilitated a much less expensive and more extensive monitoring of water bodies over a wide range of spatiotemporal resolutions. In this study, we implemented a learning-based classification framework fed by remote sensing data to evaluate the historical trends of the most important wetlands across Iran using the Google Earth Engine cloud computing platform. To this end, we used Landsat imagery between 2000 and 2020 to extract the water body of wetlands in dry seasons to consider the most critical condition. We also examined different spectral indices to identify the best combination giving the largest classification accuracy for each wetland, separately, based on their distinct conditions of water depth and vegetation cover. We then quantified the contribution of wetlands drying to the generation of dust storms via a frequency-intensity index given the annual number of dusty days and the Aerosol Optical Depth (AOD) provided by MODIS. According to the results, the majority of the studied wetlands show significant descending trends with the average loss of 31% in surface area. The aerosol analysis also witnesses the expansion of dust generation sources around most of the retreated wetlands, particularly in those years when the wetlands areas were smaller than the long-term average. The above observations point out a potential threat for the agricultural activities and highlight serious consequences for the health of nearby urban and rural residents.

Keywords: Wetland, Dust Storm, Remote Sensing, Environmental Monitoring, Ecosystem Protection