

Use of remote sensing in monitoring frequency and distribution of dust storms over Southern Baluchistan

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Abstract

Dust storm is an environmental hazard that propagates with turbulent winds and obscures visibility less than 1km in severe conditions. Its occurrence depends on climatic and geological conditions of arid and semi-arid regions. Studying temporal and spatial extent of dust storm is essential in terms of assessing loss to human health, agriculture, industrial installations and communication sources. Remote sensing shows remarkable advantage in tracking previous event records and comparing it with present events. Identification of dust point sources can give information about chemical nature of storm and its subsequent effects. Areas having less than 100 mm annual rain are susceptible to dust activity as evident from storm cases and average rainfall in Southern Baluchistan. Based on temporal records, severe dust storms sometimes stay for two to three days which is critical in the hyper arid climate of Baluchistan where rainfall is scanty and wind speed is very low for quick dust fading. Aim of study was to find trends in occurrences of dust storms over Baluchistan from 2000 to 2013 by analyzing dust days record of MODIS data and ground observations. In the research, MOD021km terra product was used to develop catalogue of storm occurred over Baluchistan since 2000 after desiccation of Sistan Lake in Iran. Dust enhanced product was developed to trace source region and spatial extent of dust storm by using brightness temperature differences of thermal emissivity bands of MODIS sensor. Events recorded by MODIS were compared with storm occurrence records observed by existing eleven met observatories in Baluchistan and similar slightly decreasing trend was found. However, rise in dust storm frequency were observed at every three years' interval. One of the interesting facts is that before 2001, dust plumes of Sistan basin were localized to Iran but by 2002 onwards, they were expanding and approaching Baluchistan territory. Pre Monsoon and monsoon were active seasons when storm occurrence frequency was substantially high because it provides favorable atmospheric conditions for dust loadings. Lowest storm frequency was observed in the following years i.e. 2002, 2005, 2006 and 2009. Highest dust frequency was seen in years i.e. 2004 and 2008. Nonetheless, dense thick storm occurrence was observed in every year except 2006, in which no storm was observed. Dust frequency was higher in southern Pakistan in comparison to eastern Pakistan. Thus, Baluchistan is most vulnerable province to white sand and dust particles originated from dry lake beds of Sistan basin and Hamun wetlands. Adjacent to those dry lake beds, Chagai, Nushki, Panjgur, Washuk and Kharan districts were most frequently hit by storm. Storm monitoring can assist in understanding dust pathways for development of prediction systems in this way; it can help planners and decision makers in preventing its damages to the environment. There is a pressing need to adopt protective measures against dust storms for minimizing mortality rates of humans and its hazardous effects to physical and biological environment of Baluchistan.