

## **Analysis of widespread fissures associated with groundwater depletion and extreme rainfall using multi sensor data**

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**Abstract** During June 2008, widespread fissures were observed in the northern flank of the Indian Peninsular shield of the Indo-Gangetic plains. These fissures were found to be up to 2 km-long and emerged after excessive rainfall. At some places, these cracks/fissures were found to be up to 10 m deep. The emergence of such cracks in widespread regions attracted the attention of people living in the surrounding regions and was believed to be a sign of an impending earthquake. A detailed analysis of multiple satellite sensors (GRACE, TRMM, AMSR-E) and ground data was carried out to study the long term behaviour of the water storage equivalent and soil moisture. The rainfall and soil moisture data were analysed for the period 2000–2008 and a decline in the rainfall and soil moisture were observed during summer (March–May), showing poor recharge of groundwater in the region. The monthly water storage equivalent retrieved from GRACE satellite data also showed low water storage in the entire region representing a low groundwater table and low soil moisture, which is quite obvious due to the poor monsoon and steep population growth during 2000–2008. Such a declining trend in the soil moisture, especially in the peninsular shield covered by a thin soil layer, make it liable to the formation of cracks and fissures after excessive rainfall due to a sharp vertical gradient in the stress.

**Key words** cracks; GRACE; fissures; Peninsular shield; Indo-Gangetic plains; remote sensing; soil moisture; rainfall