

## **Pakistan monsoon floods: climate change or geological rundown?**

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The July-August 2010 floods in Pakistan brought havoc and misery that is unprecedented in memorable history. Various estimates put the humanitarian crisis to be larger than the combined effects of the three worst natural disasters: Asian tsunami, Kashmir and Haiti earthquakes. In flood science, such a catastrophe is known as a once-in-a-century flood. The question is: Are these floods caused by regular geological processes or by climate change? The answer is not simple.

Although Himalayan glaciers feed the Indus River but the bulk of its flow is due to summer monsoon that triggers floods. Counting, dating and correlating the flood-laden sand beds on a flood plain help develop a time-series of flooding events that shed light on the monsoon system. Analysis of some of these beds near Sukkur and Bahawalpur by a group of scientists indicate that around 4000 BC, a warm period existed that fed heavy monsoon rains into the Indus. Then by 2000 BC the climate cooled with no monsoon rains, turning a large part of the Indus valley into desert. However, the cause(s) of these thousand-year cycles of Indus drought and flood is contentious. To some, geological records reveal that thorough out the Holocene the monsoon activity was pretty much a geological rundown at least on a 1000-year cycle. Others think that climate change may be the reason as their models predict that the monsoon intensity is sensitive to the surface temperature of the Indian Ocean. During times of cooler climate, less moisture is picked up from the ocean, the monsoon weakens, and the Indus river flow is reduced. Whereas, some have found a clear correlation between human action, climate and monsoon activity.

While there is huge uncertainty regarding exact correlation between global warming and intense monsoon activity, the fact remains that that the distribution of monsoon rains has become more uneven i.e. total rainfall stays the same, but it comes in shorter, more intense bursts. Such as in the July-August 2010, more than half of the normal monsoon rain fell in only one week instead of its typical spread over three months. Rivers just cannot cope with all that water in such a short time. This uncertainty entails lack of planning and preparedness and, thus, the future may hold more flood misery for the people of Pakistan.