

# Effect of Changing Groundwater Levels on Himalayans (Himalayan Slip)

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## Himalayan Slip

- The slip occurs at the Main Himalayan Thrust (MHT), due to hydrological variations and human activities, over which there is the periodic release of accumulated strain.
  - The Global Positioning System (**GPS**) and Gravity Recovery And Climate Experiment (**GRACE**) data were used to quantify the variations of hydrologic mass.
  - **The GRACE satellites**, launched by the US in 2002, monitor changes in water and snow stores on the continents, enabling the researchers to study terrestrial hydrology.
- **The combined GPS and GRACE data suggest a 12% reduction in the rate of the subsurface slip.**
  - The subsidence rate is associated with groundwater consumption.
  - Subsurface slip refers to how fast the fault is slipping relative to the foot and hanging wall.
  - The slip occurs at the Main Himalayan Thrust (MHT), due to hydrological variations and human activities, over which there is the periodic release of accumulated strain.
- Water acts as a lubricating agent and in the dry season, the rate of the slip of the fault in the region is reduced.

- **There are normal and common reasons also affecting the Himalayas apart from the groundwater levels.**
  - The Himalayan foothills and the Indo-Gangetic plain are sinking because its contiguous areas are rising due to tectonic activity associated with land mass movement or continental drift.
  - In the Himalaya, seasonal water from glaciers as well as monsoon precipitation plays a key role in the deformation of the crust and the seismicity associated with it.
- **This is the first study to look at the rising Himalayas from a hydrological standpoint.**
- Since the Himalayas play an important role in influencing climate in the Indian subcontinent, the study will help in understanding the effects of hydrology on climate.

### **Tectonic activity and groundwater**

- The Himalayan foothills and the Indo-Gangetic plain are sinking because its contiguous areas are rising due to tectonic activity associated with land mass movement or continental drift.
- The new study shows that subsidence and uplift are found to be associated with seasonal changes in groundwater, apart from the normal, common reasons.
- Water acts as a lubricating agent, and hence when there is water in the dry season, the rate of the slip of the fault in this region is reduced.
- In the Himalaya, seasonal water from glaciers, as well as monsoon precipitation, plays a key role in the deformation of the crust and the seismicity associated with it.
- The subsidence rate is associated with groundwater consumption.

## **GRACE Mission**

- The Gravity Recovery and Climate Experiment (GRACE) was a joint mission of NASA and the German Aerospace Center.
- Twin satellites took detailed measurements of Earth's gravity field anomalies from its launch in March 2002 to the end of its science mission in October 2017.
- By measuring gravity anomalies, GRACE showed how mass is distributed around the planet and how it varies over time

## **Fault**

- It is a planar or gently curved fracture in the rocks of the Earth's crust, where compressional or tensional forces cause relative displacement of the rocks on the opposite sides of the fracture.
- When rocks slip past each other in faulting, the upper or overlying block along the fault plane is called the hanging wall or headwall; the block below is called the footwall.

## **Main Himalayan Thrust**

- The Indian plate under thrusts the Eurasian plate along a northerly dipping detachment surface known as Main Himalayan Thrust (MHT) that separates the downgoing Indian plate from the overriding Himalayan wedge