Linkage Between Geologic Hazards, Glacier Dynamics and Climate Change- a View

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Geologic hazards can trigger atmospheric hazards and vice versa. For example, climate change has an indirect connection to earthquakes. Climate change will cause drought in some regions and will increase precipitation in other regions. Efforts to mitigate the effects of drought and flooding will require the construction of large water reservoirs. Likewise, the decrease in snow pack (glaciers) in high mountains (due to global warming) means that this natural form of water storage will be lost. The loss of snow pack will also necessitate the construction of large reservoirs. It is well established that the impoundment of water within reservoirs can cause earthquakes. Furthermore, the goal of reducing the concentration of carbon dioxide in the atmosphere also provides an impetus to construct new hydro-electric power plants in place of coal-fired plants. Such hydro-electric plants are commonly located in the foothills of mountain belts, geographic regions that host active faults. Reservoirs built for water storage or hydro-electric power may induce earthquakes, often near to major population centers. The above details clearly warn us to be more prudent in implementing major irrigation and energy generation projects/programs, giving due importance to environmentally sustainable options.

Seismic imaging studies have shown that regionally extending upper/mid crustal low velocity layers have played significant role in the Himalayan Orogeny. It is noticed that even in the lesser Himalayan region, consisting of number of thrust zones, due to ongoing collision between Indian and Eurasian plates, subduction of Indian plate below the Eurasian and subsequent subduction of Asian mantle towards south has number of conductors inline or parallel to the strike of Delhi-Aravalli Fold Belt. These conductors may be linked with fluid generated due to collision at the contacts of orthogonal structure of Indian plate. The concept of underplating correlates to the presence of the crustal conductors in the collision zone of the Lesser Himalayas. These conductors are likely to have a linkage with the upper mantle in the form of partial melts. Similar scenario is expected to exist even in the middle and Higher Himalayas. Presence of such fluid filled regionally extending low velocity layers in different segments of the 2500 km long Himalayan Belt can create a complex stress domain. Since stress regime varies from one region to the other and with time within a region the fluid filled crustal layers can create instability leading to large magnitude structural and evolutionary changes, leading to movement of upper mantle flows both horizontally and vertically, making Himalayas seismotectonically unstable. In such a scenario, any change to Himalayan Glaciers (in time and space) that cover vast stretches of the mountain chain can significantly affect the stress regime as these glaciers do contribute to fluid migration vertically down to deeper unstable Himalayan crust This also laterally denude the surficial features. This

process in totality, not only alters the geomorphology of the Himalayas but also the regions climate, as surface manifestations do influence the hydrologic cycle. In the region's climate and climate related abnormal natural hazards need special attention of both earth and atmosphere scientists (in unison), as clear understanding of the linkage between glacier dynamics, abnormal monsoon aberrations and lithosphere dynamics can alone bring out quality models.

To start with we need to put an end to the ongoing Himalayan glacier controversy and carry out in a concerted manner monitoring of the structure and dynamics of all the glaciers, in time and space. From the data we can identify vulnerable segments that have direct impact on our environment. Depending on the magnitude of the problem, associated with different segments of the Himalayan belt and adjoining regions, we then need to take appropriate steps to arrest further deterioration and advise all the concerned to take needed precautions to avoid triggering of natural hazards and lessen the impact due to climate change.