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Estimation of crustal shortening in the Himalaya: problems and possible solutions using the model deformation experiments

ASHOK KUMAR DUBEY
Wadia Institute of Himalayan Geology, Dehra Dun - 248 001, India

The convergence rates between India and Asia obtained by the GPS technique (e.g. Jouane et al., 1999, Bilham et al., 1997) show a large variation which can be attributed to the fact that the following geological structures, characteristic of the Himalaya, have been ignored in the studies.

1. Development of superposed folds indicating maximum compression in E-W to NW-SE directions (i.e. normal to the movement of the Indian plate).
2. The seismic activities in the region reveal simultaneous development of contrasting geological structures like thrust, normal, and strike-slip faults in the region.

The GPS data have been applied to the entire Himalaya although it is suitable only for the strike-slip faults (i.e. horizontal displacements). In additionto this, the technique has the following disadvantages.

(i) The model deformation experiments reveal that the true magnitude and direction of the particle movement paths can be determined only by choosing at least two fix points outside the deforming body which is undergoing translation. A single fix point can provide the distance but not the direction of displacement. No such fix points are available and GPS studies are based on location of fix points inside the deforming body.

(ii) The studies are performed over a very short duration of time as compared to the development of natural geological structures.

(iii) The technique ignores folding, and considers the consumption of natural strain by faulting alone.

In view of the above, the results obtained from the GPS technique are open to questions, especially in an active orogenic belt like Himalaya.

References

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