Distribution of Active Faults and Lithospheric Discontinuities in the Himalayan-Tibetan Orogenic Zone Identified by Multiscale Gravity Analysis

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Full paper

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Abstract

To reveal the spatial distribution of major active faults and structural discontinuities in the Himalayan-Tibetan orogen, this paper presents wavelet multiscale analysis of the Bouguer gravity field and solves the total horizontal derivatives of each wavelet detail. The results show that, in general, the crustal discontinuities on the Pamir Plateau and in the Himalayan tectonic zone are significant. On the northern margin of Tibet, active faults are mostly visible only in the deep crust. In eastern Tibet, crustal discontinuities decrease as depth increases. The Himalayan crust is undergoing E-W extension, and material discontinuities are significant along N-S-trending normal faults. The Sangri-Nacuo fault is the tectonic boundary between the Himalayan tectonic zone and the eastern Himalayan syntaxis and cuts off the entire lithosphere of Tibet. The spatial structural distributions of the western and eastern Himalayan syntaxes are very different. The former is relatively intact and extends deeper in the lithosphere, while the latter is more complex and shallower than the Mohorovicic discontinuity, and its overlying crust has deformed intensely from the collision between the Indian and Eurasian plates. Further, the structural distribution in the upper mantle reveals that the wedging Indian plate in the western Himalayan syntaxis almost reaches the SW margin of the Tarim basin and forms a closed structure in western Tibet, which could help to explain the eastward extrusion of the Tibetan Plateau.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Tables

Due to technical limitations, table 1 is only available as a download in the Supplemental Files section.

Figures
Figure 1

Major active faults related to the Himalayan-Tibetan orogenic zone

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Figure 2

Wavelet decomposition of Bouguer gravity anomalies. (a)~(g) are the 1st- to 7th-order wavelet transform details. (h) is the 7th-order wavelet approximation. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 3

Distributions of the total horizontal derivatives at 0.5 km depth. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 4

Distributions of the total horizontal derivatives at 2.5 km depth

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Figure 5

Distributions of the total horizontal derivatives at 6.5 km depth Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 6

Distributions of the total horizontal derivatives at 10 km depth Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 7

Distributions of the total horizontal derivatives at 17 km depth Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.
Figure 8

Distributions of the total horizontal derivatives at 85 km depth

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Figure 9

Distributions of the total horizontal derivatives at 136 km depth Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

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