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Does extrusion occur at both tips of the Taiwan collision belt? Insights from active deformation studies in the Ilan Plain and Pingtung Plain regions

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Abstract

We analyse the present-day deformation in two key areas of the Taiwan collision belt, the Ilan Plain to the NW and the Pingtung Plain to the SW. Our approach is mainly based on consideration of horizontal displacement revealed by recent geodetic (GPS) surveys, derived strain rate tensors indicating horizontal deformation and three-dimensional seismotectonic stress regimes issued from inversion of focal mechanisms of earthquakes. We reconstruct a consistent, albeit complex, tectonic pattern involving non-rigid rotations (clockwise in NE Taiwan, anticlockwise in SW Taiwan), transitions from pure compression near the mountains to transtension near the sea and simple shear affecting the deforming domain (NW–SE left-lateral in NE Taiwan, NNE–SSW right-lateral in SW Taiwan). These tectonic patterns reflect lateral extrusion processes towards mechanically weak domains with respect to collision zone, i.e., adjacent subduction zones (Ryukyu to the NE, Manila to the SW). The extrusion of the Ilan Plain area occurs towards the SE, whereas that of the Pingtung Plain area occurs towards the SW. The extrusion in NE Taiwan is facilitated by the opening of the Okinawa Trough, so that velocity and deformation rates are higher than in SW Taiwan despite less active collision in this northern area. The symmetry of the extrusion patterns is altered by differences in relative positions and orientations of collision belt and adjacent subduction zones, which depend on the plate tectonic configuration and tectonic history of the Taiwan region.
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1. Introduction

Neotectonic studies allow better understanding of the active deformation processes, based on field analysis of active faults, geodetic surveys, remote sensing and seismology. Other approaches, such as structural geology and morphological analysis, allow evaluation of the relationships between present-day and long-term deformation, being aware that the seismotectonic variations within the seismic cycle may introduce major bias in the evaluation of active deformation. We are combining these different approaches to investigate the geometrical and mechanical relationships between the Taiwan collision belt and the adjacent subduction zones. In this paper, particular attention is paid to the present-day patterns of active deformation and seismotectonic stress at the NE and SW tips of this NNW–SSE trending, approximately 400 km long mountain belt (Fig. 1).

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