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A Geodynamical Perspective on the Subduction of Cocos and Rivera plates beneath Mexico and Central America

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The Middle America subduction zone (MASZ) is one of the world most complex convergent margins as it involves the subduction of the Rivera and Cocos young oceanic plates beneath the North American and Caribbean plates and is bounded by the Gulf of California rift and the Panama slab window. Characterized by contorted and unusual slab geometry, irregularly distributed seismicity and volcanism, exceptionally large slow slip events (SSE) and non-volcanic tremors (NVT), this subduction system represents a great natural laboratory for better understanding geodynamic processes at a fundamental level. Based on a solid observational foundation, and incorporating the latest experimental results into a coherent geodynamical framework, we shed light on the main processes controlling the subduction system evolution in this region. The tectonics, volcanism, slab geometry and segmentation along the margin are reviewed from a geodynamical perspective. We proposed and discussed a series of evolutionary scenarios for the Mexican and Central American subduction zones, providing a coherent starting base for future geodynamical modeling studies tailored to this active margin. We discuss comparatively the recently discovered SSEs and NVTs along the MASZ, and try to differentiate among the proposed mechanisms responsible for these observations. Finally we discuss the recent seismic anisotropy observations in a geodynamic context, offering an integrated view of mantle flow pattern along the entire active margin. Although the MASZ as a whole may be considered a fairly complicated region with many unusual features and sometimes controversial interpretations, its complexity and unusual characteristics can improve our knowledge about the linkage between deep and surface processes associated with subduction zone dynamics.