Tectonic Processes

GPS Data to Constrain Internal Rigidity of the Caribbean Plate and Tectonics of the Northern Lesser Antilles Forearc

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Determining how the Caribbean (CA) plate moves with respect to neighboring plates has been a major challenge to geoscientists for decades. GPS data have been used in the Caribbean to address its relative motion and tectonic processes along its boundaries. We have used almost two decades of data to investigate two tectonic problems of the Caribbean plate:

1) Caribbean plate rigidity, and
2) Whether a forearc sliver exists along the Lesser Antilles forearc.

Based on paleomagnetic data, shortening between the Americas would yield two separate plates in the Caribbean (Pindell et al., 1988; Muller et al., 1999). However, the current resolution of the GPS data (mean residual rate 0.9 mm/yr) does not agree with significant deformation between western and eastern GPS sites and suggest a single-plate model for the Caribbean, where most of the motion must be accommodated along its complex boundaries. One of these has been identified in the eastern Caribbean along the northern Lesser Antilles (LA) GPS-derived velocity vectors at sites within the CA plate and its boundaries were compared to earthquake data. In a number of subduction zones, misfits between slip vectors and predicted convergence azimuths from Euler vectors suggest the presence of a forearc sliver, where trench-parallel motion occurs along strike-slip fault systems (McCaffrey, 1992).

Comparing slip vectors of shallow thrust events to the predicted motions of GPS-based Euler vectors show a systematic northerly misfit, suggesting a trench-parallel component of motion taken up by the Northern LA forearc (NLAF) block (Lopez et al., 2006).

References