Dynamics of the Caribbean and Panama plates

S.A.C. van Benthem, Utrecht University, the Netherlands; R. Govers, Utrecht University

Despite extensive GPS campaigns, geological fieldwork and strain measurements during the last decade, the actual tectonic forces driving the Caribbean and Panama plates are still not completely understood. In this work we try to get an insight into some actual processes governing the Caribbean plate. We use a finite element, elastic thin shell model on which we will apply surface and body forces. Those forces represent the plate interactions, slab pull, interaction with the mantle at the base of the plate and lithostatic stress gradients. In particular we benefit from new slab geometry constraints from seismic tomography. We investigate various setups of forces: (1) The Grenada Basin is often assumed to be a back-arc basin, and we test the influence of a suction force at the Southern Antilles. (2) The buoyant Cocos Ridge, might prevent part of the Cocos Plate from subducting under the Panama plate, causing it to indent into the Panama Plate. We model this extra force at the Northern Panama plate. (3) We examine the mechanical contribution of the Caribbean slab. (4) We examine the contribution of corner flow and basal drag at the bottom of the plate, either induced by the absolute plate motion of the Caribbean and Panama plates, or by the presence of mantle flow. We use the force sets, representing (1)(4), to solve the mechanical equilibrium equation and compare the calculated strain and velocity fields with observations. We find (1) more realistic torque balance solutions in the presence of back-arc spreading, (2) better resolved GPS velocities with an indenter, (3) that a different geometry of the subducted Caribbean Slab influences the strain field, and (4) we find no significant contribution of neither corner flow, nor basal drag.