Modeling Mechanisms for trench parallel flow in the Cocos-Nazca Subduction System

Bailey Valint [1]***, Margarete Jadamec*** [1,2]

[1] *Department of Geology, University at Buffalo*
[2] *Institute for Artificial Intelligence and Data Science, University at Buffalo*

Seismic observations along with geodynamic models of subduction zones suggest that although mantle flow and surface plate motion are commonly aligned far from plate boundaries, mantle flow may become decoupled from surface plate motion in subduction zones. For example, in Central America, shear wave splitting results within the mantle wedge indicate shear in a trench parallel direction, suggesting the existence of mantle flow parallel to the strike of the Middle America Trench and perpendicular to the direction of surface plate motion (Abt et al. 2009). Previous 3D models of the subduction system produce toroidal flow around the Cocos and northern Nazca slab edges, but produce little trench parallel flow farther north in the mantle wedge (Jadamec 2016). Here, we extend the previous work and test additional hypotheses for the generation of the northwestward trench parallel flow. This poster will present initial work that implements a predefined zone of weakened viscosity within the mantle wedge to test the effect of the reduced viscous resistance facilitating northward flow. In addition, the models will test a variable upper plate structure. The 3D model configurations are built with TECT_Mod3D, formerly SlabGenerator (Jadamec and Billen 2010). Because these are high resolution geographically referenced models, the predictions can be directly compared to observations from the region. The results from predicted flow in the mantle wedge will be compared to shear wave splitting observations to constrain the fit of the trench parallel flow component. Model derived surface plate velocities will be compared to known plate motion vectors and long-term GPS data.

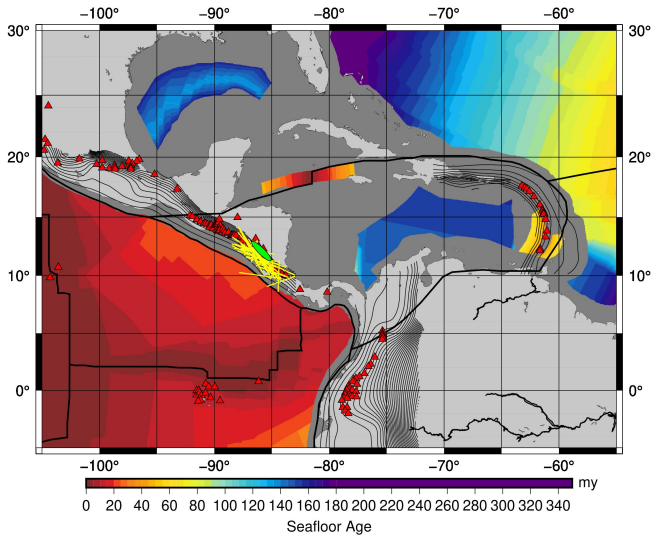

Figure 1. Tectonic Setting of the Cocos-Nazca Subduction System. Coloured background is the sea floor age grid (Seton et al. 2020; Müller et al. 2019), black lines are plate boundaries (Bird 2003), red triangles are Holocene volcanoes (Venzke 2013), thin black lines are slab contours (Hayes et al. 2018), yellow bars are shear wave splitting data (Abt et al. 2009), the green ellipse is the zone of highest mantle wedge attenuation projected onto the surface (Rychert et al. 2008). Made with GMT (Wessel et al. 2019).