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Upper plate controls on episodic margin migration revealed by numerical modeling

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Thus far, relatively simplistic models of free subduction have been employed in which the trench and plate kinematics are emergent features completely driven by the negative buoyancy of the slab. We investigate here on the role of the upper plate and its effect on the plates and trench kinematics in a fully dynamic numerical model of free subduction that incorporates an overriding plate. Although the vertical sinking is under control of the slab buoyancy as in the models without upper plate, the partitioning of motions at surface are very sensitive on the constrains imposed by this latter, varying from the stationary trench to rollback-dominated. We found that 1) the trench motions are strongly controlled by the motions of upper plate, being zero for far-field fixed plates and increasing for smaller upper plates approaching the size of island arcs and 2) reduction of length by consumption of the subducting plate reduces the rollback favoring plate advance toward the stationary trench. The dynamics highlighted here have implications in the episodic margin migration and back arc basin opening and show that the upper plate plays a relevant role in shaping plates margins.