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Anatomy of the central Chile forearc and influence on megathrust seismogenic behavior (*Invited*)

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Geodetic and seismologic observations for the Maule earthquake will allow spatial patterns of pre-, co- and post-seismic megathrust activity to be inferred with unprecedented detail, giving a unique opportunity to evaluate controls exerted on megathrust seismogenesis by long-term features of both converging plates. The forearc above the ruptured megathrust has a distinctive geological structure compared with the rest of the Chilean margin characterized by a Late Paleozoic batholite forming most of the coastal cordillera and intruding a

metamorphic accretionary complex. Southern and northern limits of the earthquake coincides with long-lived NW-oriented fault zones. We use gravity anomalies defined by the Earth Geopotential Model 2008 (EGM2008) to gain hints into the mass distribution below the surface and derive some proxies for megathrust shear strength. Particularly, we compute gradients of the gravity anomaly to map geologic structures under the sea; perform a forward gravity modeling under geologic and seismological constraints to obtain a 3D model of forearc anatomy; calculate the Vertical Stress Anomaly (VSA) that is caused by the heterogeneous density structure of the forearc and constitutes the principal component of normal stress loading the megathrust; and use spectral isostatic analysis to invert gravity and topography into flexural rigidity (D), a parameter controlled in a subduction setting by the degree of mechanical coupling between both plates. The 3D model shows a 30-40 km width active accretionary prism that is unique in its size along the Chilean forearc. The width of this prism seems to decreases from north to south, coinciding with a remarkable reduction of VSA and most notably of D. These changes should imply a weakly coupled northern megathrust region below a light forearc dominated by ancient and modern accretionary complexes, as compared to the high expected coupling below the Arauco peninsula. We compared this against epicenters recorded by NEIC before and after the earthquake and find that, as for the rest of the Chilean margin, earthquakes tend to nucleate where VSA and D are high. Co-seismic slip inferred by available models do not penetrated below the modern accretionary prism and rupture breaks mostly strong (high VSA and D) patches of the megathrust, although a significant fraction and magnitude of slip occurred where the magathrust appears weak. We will compare our results with distribution of pre-seismic locking and post-seismic deformation derived from GPS and aftershocks in order to refine our analysis. At this stage it becames apparent that forearc geology controlled the along-strike and updip extent of co-seismic rupture although it is less clear how it is related to slip distribution into the ruptured region

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