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Ridge subduction and afterslip control aftershock distribution of the 2016 Mw 7.8 Ecuador earthquake

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We characterise the aftershock sequence following the 2016 Mw=7.8 Pedernales earthquake. More than 10,000 events were detected and located, with magnitudes up to 6.9. Most of the aftershock seismicity results from interplate thrust faulting, but we also observe a few normal and strike-slip mechanisms. Seismicity extends for more than 300 km along strike, and is constrained between the trench and the maximum depth of the coseismic rupture. The most striking feature is the presence of three seismicity bands, perpendicular to the trench, which are also observed during the interseismic period. Additionally, we observe a linear dependency between the temporal evolution of afterslip and aftershocks. We also find a temporal semi-logarithmic expansion of aftershock seismicity along strike and dip directions, further indicating that their occurrence is modulated by afterslip. Lastly, we observe that the spatial distribution of seismic and aseismic slip processes is correlated to the distribution of bathymetric anomalies associated with the northern flank of the Carnegie Ridge, suggesting that slip in the area could be influenced by the relief of the subducting seafloor. To explain our observations, we propose a conceptual model in which the Ecuadorian margin is subject to a bimodal slip mode, with distributed seismic and aseismic slip mechanically controlled by the subduction of a rough oceanic relief. Our study sheds new light on the mechanics of subduction, relevant for convergent margins with a complex and heterogeneous structure such as the Ecuadorian margin.