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Relations between megathrust frictional properties and long-term deformation of the forearc

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In this presentation, we compile relations between megathrust frictional properties, earthquake ruptures, seismic coupling and upper plate deformation retrieved from mechanical analysis.
We first show that aseismic zones are characterized by friction larger or equal to 0.1 whereas seismic asperities have dynamic frictions lower than 0.05. These values lead to critical wedges above aseismic zones, characterized by several active thrust faults and stable zones above seismic asperities leading to the formation of forearc basins. We then discuss the consequences on the trench-coast distance. We show that, since aseismic zones have higher friction and thus larger taper, segments fully creeping will develop peninsulas whereas seismic asperities characterized by low friction and very low taper will develop a subsiding coast.
We then discuss how variations of properties between seismogenic and aseismic zones imply thrust or normal faults at transitions. Normal faults are observed down-dip of the seismogenic zone, often correlated with the coast, whereas thrusts are observed at the up-dip limit at the basin/ accretionary prism transition.
Finally, we discuss the relation between the vergence of faults in accretionary prisms and coupling. We show that normal faults and landward vergence are due to occasional or repeated propagation of earthquakes to the seafloor. The upper plate morphology is thus strongly controlled by the mechanical behavior of the megathrust.