

# A long-term view of Episodic Tremor and Slip in Cascadia

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Episodic Tremor and Slip, or ETS, is a well-recognized phenomenon in the Cascadia subduction zone. Constraining the precise location of geodetically measured slip during ETS is important for clarifying the relationship between slip and tremor during ETS, the location of ETS slip relative to the strongly locked zone, and the role of ETS in the overall slip budget. Here I present a new method for separating GNSS time series in Cascadia into long-term average ETS (LTA-ETS) and inter-ETS components, deriving long-term average ETS velocities for each site. These velocities are then inverted for a time-averaged ETS slip-rate on the plate interface. I find that ETS and its role in the slip budget is highly variable and segmented along strike. The southern segment accommodates the most slip in ETS events, more than the expected plate convergence rate. However, the subducting Gorda section of the Juan de Fuca plate in southern Cascadia undergoes significant internal deformation and is not well approximated as a rigid body. Therefore, the convergence rate here may be higher than expected from calculations based on Juan de Fuca motion. This inversion represents the highest resolution image of the ETS zone derived from geodetic data to date. Slip correlates well with tremor locations, and a possible second updip ETS zone is detected. These results motivate the need for future seafloor geodetic studies offshore Cascadia, both to confirm the presence of the offshore updip ETS zone, and to directly measure the plate convergence rate in the southern segment where the highly deformed Gorda plate is subducting.

