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Present-day strain partitioning and strain transfer across the Fairweather and Denali Faults in SW Yukon – SE Alaska

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In SW Yukon – SE Alaska, the present-day Pacific – North America relative motion (∼55 mm/yr) is highly oblique to the main plate boundary, resulting in strong strain-partitioning tectonics that link the Aleutian subduction to the west to Queen Charlotte transform to the south. This transition region is also the site of present-day orogeny (St Elias) and accretion of the allochthonous Yakutat Terrane to the Northern Cordillera.

Multiple datasets (GPS, geomorphology, seismicity) are integrated to characterize and quantify strain patterns in this transpressional system, with particular emphasis on strain partitioning between strike-slip and shortening deformation. New campaign and permanent GPS stations straddling the main faults (Denali, Fairweather: vertical lithospheric scale faults) indicate that that 95% of the Pacific-North America strike-slip motion is accommodated on the main plate-boundary Fairweather Fault, leaving near-zero motion on the Denali Fault only ∼100 km inboard. In contrast, the fault-perpendicular component is strongly distributed between shortening offshore and in the orogen, and 25% of the convergence transferred inland. This latter strain transfer could explain the seismicity observed in the Mackenzie Mountains 500 – 800 km from the coast.

In the region of highest convergence obliquity, GPS data show a diffuse indentor-like deformation, with strong along-strike variations of the main fault slip rates. Preliminary results of a regional geomorphology study give further information about the Denali fault, along which previous data indicate a velocity decrease from 8 mm/yr (Matmon et al.,2006) to 4 mm/yr (Seitz et al., 2010) over 200 km along strike. A high resolution DEM (2m) processed from Pleiades data acquired in September 2013 highlights a significant vertical component on the Denali fault. Systematic metric scale displacements are measured along the “inactive” part of the fault, showing recent deformation since the Last Glacial Maximum in the region (∼20 kyrs ago). Sampling of geomorphological markers for Be10 and OSL datation is planned in the summer 2014 in order to estimate slip rates along the southern part of the main transpressional faults (Denali, Totschunda).