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Seismic velocities and slabs in the deep mantle beneath america

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Slab structure in the deep mantle is investigated from seismic velocities by considering both P-wave and S-wave velocity anomalies. We have used a waveform cross-correlation technique on broadband data, for measuring P1-P2 and S1-S2 differential travel times between 2 stations for a given event and PcP-P and ScS-S for given earthquake-station couple. In order to achieve path coverage as similar as possible for both wave types, we have only kept source-receiver configurations for which we could make both P-wave and S-wave differential measurements. Earthquakes and receivers are lying along a great circle path that spans the area from Alaska to South America. We invert the 37,000 P and S wave differential travel times simultaneously using 2° x 2° x 200km constant velocity blocks, and then we calculate the bulk sound velocity in each block that is sampled by both P and S-wave. Synthetic tests are performed and results are only interpreted in the well resolved areas.

Beneath the Aleutian, a fast anomaly that can be associated to the subducted Pacific and Kula plates is visible down to 800km depth on the S-wave velocity map and slightly deeper on the P-wave and bulk sound speed maps. Beneath North America, the Farallon fast anomaly can be follow on both P-wave and S-wave speed maps down to at least 2000km but the corresponding bulk sound fast velocity is only visible down to about 1000km. Further South, the Farallon fast anomaly is observed down to the CMB. Finally, beneath South America, we can only resolve the lower mantle in which we see a strong fast anomaly down to 1300km depth.

Our joint model enable to determine the seismic properties of the Pacific, Kula and Farallon slabs which are then interpreted using plate history reconstruction.