SEISMIC EVIDENCE OF THE UPPER MANTLE ANISOTROPY BENEATH FRENCH POLYNESIA : PLUME PRELIMINARY RESULTS

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In order to investigate upper mantle structure, dynamics and flow beneath French Polynesia, we deploy a broadband seismic network in November 2001 for a two years period [Barruol et al., 2002]. The network is deployed over the five polynesian archipelagos, over two major fracture zones (Marquesas and Australs) and samples oceanic lithosphere between 30 and 100 My old. This multidisciplinary project called PLUME (Polynesian Lithosphere and Upper Mantle Experiment) aims to improve the body and surface wave tomographic imaging of the upper mantle beneath the french Polynesia, and particularly the geometry at depth of the mantle plumes related to the surface hotspots (at least four). PLUME should also bring constraints on the upper mantle flow and the interaction between hotspots and the oceanic lithosphere.

To illustrate this last point, we present preliminary observation of teleseismic shear wave splitting of PKS, SKS, SKKS, and deep S phases. Data are recorded at the 10 PLUME temporary stations (between 8 and 12 months of data), the 4 permanent LDG/CEA broadband stations, the 4 permanent IRIS broadband stations, and the permanent GEOSCOPE station. The splitting parameters are calculated using the method of Silver and Chan [1991] and the alternative multi-events method of Wolfe and Silver [1998].

Despite the presence of rather high seismic noise on the Pacific islands, we find some evidence of individual splitting at the temporary PLUME stations with a NW-SE fast split direction, i.e., rather close from the plate motion vector. Delay times are

slightly above 1.0 s. Since most of the teleseismic events arrive from the western Pacific subductions zones with a NW backazimuth, we observe numerous unsplit SKS phases, some of them of very good quality. Two of the four LDG stations exhibit an anisotropy trending N070°W and with a delay time around 1.5s.

In addition to the teleseismic shear wave splitting that sample the upper mantle along the vertical direction beneath a given station, we examine the P-wave polarization that may give complementary and independent constraints on upper mantle anisotropy. In an anisotropic medium, the quasi-P wave polarization is indeed slightly deviated from the propagation direction. Statistical analysis of this deviation as a function of the event backazimuth can be used to get some information on upper mantle anisotropy. Such technique has the main advantage to increase the azimuthal coverage but also to sample the upper mantle anisotropy beneath a station with some lateral offset since the incidence angle are much larger than the SKS phases.