Subject offered for a contract starting october 2014

SUBJECT TITTLE: Modelling seismic noise and analysis of the sources

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Host lab/ Team : *please fill in and leave out meaningless information*
IPGP- Team seismology – UMR7154

Financing: Doctoral contract with or without assignment

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Presentation of the subject: (1 or 2 pages)

Seismic noise is recorded by broadband seismometers in the absence of earthquakes. It is generated by the atmosphere-ocean system with different mechanisms in the different frequency bands. Even though some mechanisms have been known for decades, an integrated understanding of the noise in the broadband period band 1-300sec is still missing. The purpose of the PhD is to use novel theoretical, numerical and signal processing methods to provide a unified understanding of the noise sources and quantitative models of the broadband noise.

Between 3 and 12 sec, seismic noise is called secondary microseism. It is mainly composed of Rayleigh waves generated by ocean waves (Longuet-Higgins, 1950). Following a first numerical model of the secondary microseism noise (Kedar et al., 2008), Ardhuin et al., 2011 have extended the numerical modeling of noise sources with a more accurate description of ocean waves, including coastal reflections. This allowed the first quantitative and general understanding of the secondary microseismic peak between 3 and 12 s periods (Stutzmann et al., 2012).

The PhD will model the full seismic spectrum from 1 s to 300 s and will consider different source mechanisms, including wave interactions and the interaction between ocean wave and bathymetry at the coast. Seismic sources derived from the wave model will then be coupled with the spectral element method (Cupillard et al. 2012) to accurately model seismic data by taking into account the 3D Earth structure. More particularly, the PhD will investigate the effect of the bathymetry and of the ocean-continent boundary on the seismic wave generation to improve the accuracy of the propagation modeling and to investigate how Love waves are generated.

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These analysises will lead to the identification and characterization of source events, which can then be used use to improve noise tomography, and seismic monitoring.

Ardhuin, F., E. Stutzmann, M. Schimmel, and A. Mangeney, (2011) "Ocean wave sources of seismic noise," *JGR*, vol. 116, p. C09004.

Kedar, S., Longuet-Higgins, M., Graham, F.W.N., Clayton, R. & Jones, C., (2008). The origin of the deep ocean microseisms in the North Atlantic Ocean, Proc. R. Soc. Lond. Ser. A., 464(2091), 777–793.

Longuet-Higgins, M. (1950). A theory of the origin of microseisms, Phil. Tra. Roy. Soc., 243(857), 1–35.

Stutzmann E. , F. Ardhuin, M. Schimmel, A. Mangeney, G. Patau (2012). Modelling long-term seismic noise in various environments. Geoph. J. Int, doi:10.1111/j.1365-246X.2012.05638.x

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