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Time-scale characterization of the hydrothermal fluid movement of the Piton de la Fournaise volcano during 1992 to march 2005.

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This study treats of 13 years of self-potential experiments on the top on the Piton de la Fournaise volcano. Between 1992 and 2005, twelve SP profiles collected on the top of the summit cone have been analyzed by a multi-scale tomography. This method based on the complex wavelet transform allows us to obtain a best understanding of the hydrothermal system of the Piton volcano and needs no a priori information of SP sources. We show clearly the existence of 5 major fluid circulation cells, which move with the time, inside the Piton de la Fournaise hydrothermal system. These hydrothermal fluid cells are localized in three dimensions and their depth is directly related to shallow magma intrusion. Moreover the fluid displacements are directly influenced by the eruptive activity. Initially, between 1992-1998, the quiescent period is characterized by deeper localization of hydrothermal fluid cells. With the resumption of eruptive activity, the fluids move upward to shallow depths due to pressurization of the hydrothermal system. Since 2001, we show a quasi-constant pressurization of the hydrothermal system with the existence of a zone ($<$300m) where hydrothermal fluids are contained. However since 2003, the hydrothermal fluids have moved slowly downwards due to depressurization of the hydrothermal system. This shows a quasi-constant activity of the volcano, but with future weak eruptions. Continuous wavelet transform of the SP signal allows for 3D determination of hydrothermal fluid displace-

ment through the time and is a promising new technique for improved forecasting of changes in eruptive activity.