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# Distributed temperature sensing of active volcanoes by using optical methods: application to Campi Flegrei caldera (Southern Italy).

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The measurement of surface temperature in active volcanic areas, and its temporal variation, provides critical constrains in understanding the physical processes occurring at depth. Quiescent and active volcanism is almost always accompanied by heat output and thus thermal data are essential to assess the amount of energy being released and the mass transport within the shallow crust. The thermal state of volcanoes and the temperature records are also important in correlating the areas of higher heat discharge with the main tectonics and structural features of volcanic edifices. Furthermore, thermal variations may be one of the precursors of an impending eruption, and is crucial for eruption forecast. Among the different volcanic edifices, calderas are associated with the highest heat discharges at the surface as well as geothermal gradients. Thus, the high risk caldera of Campi Flegrei (Southern Italy) has been the site for the application of an innovative method for temperature monitoring of volcanoes, by using a fiber-optic system and exploiting the stimulated Brillouin scattering principle. In particular, a numbers of two systems, the first one located in submarine environment 2400m along the Gulf of Pozzuoli and the second one installed inside a deep borehole (501m), have been developed and both provide the remote DTS along the fibers optics cables, with spatial resolution of 1m and accuracy of ±1°C. We report the main results of this important advancement in the monitoring of high risk volcanic areas. The adopted systems can be also applied to many calderas, which are often partially or largely submerged and are difficult to monitor, and to active volcanoes with harsh environmental conditions (e.g: very high temperature-pressure, aggressive saline fluids into the rocks, deep geothermal reservoirs).