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Improvements in real-time automated processing of IR images acquired by the Osservatorio Vesuviano permanent thermal infrared surveillance network at Campi Flegrei caldera (Italy)

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The permanent thermal infrared surveillance network of Osservatorio Vesuviano (INGV) acquires IR frames of diffuse degassing volcanic areas and fumarole fields from 5 stations in the Campi Flegrei caldera (Italy) and a station in the crater of Vesuvius. The stations acquire IR frames at night-time and transfer them to a dedicated server in the Surveillance Center where they are processed by an automated system (A.S.I.R.A. – Automated System of IR Analysis). The results are displayed in the control room of Osservatorio Vesuviano as trends of residual temperature values of the maximum temperatures observed in the IR scenes after the removal of seasonal effects. These trends give interesting indications about the evolution of shallow temperatures field of monitored areas. As the amount of information contained in the infrared frames is few investigated by this first version of ASIRA a new advanced version was developed. Some functionalities of this new automated system, written in Matlab environment, include: a) efficient quality control of IR scenes, b) IR images co-registration in respect of a reference frame, c) seasonal correction by using two different methodologies, d) more sophisticated statistical procedure to extract temperature values, e) analysis of temperature variations of each pixel of the IR frame, f) production of IR matrix and processed data archives ready to generate several kind of plots useful to surveillance purpose. The main new feature of ASIRA is the removal of seasonal effects from every pixel of the IR frame. It gives the opportunity to produce stimulating elaborations of all the pixels of IR frame, such as the map of the temperature changing rate, which can provide interesting information about the migration of fumarole activity. Although this new version of ASIRA is mainly aimed to volcanic surveillance, its features produce data useful to a more wide volcanic research.