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Structural setting of Mt. Etna volcano investigated by integration of PS and GPS data

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Mt. Etna has been exploited as a very favorable volcanic test site for the application of the recently developed Permanent Scatterer SAR technique (PS), thanks to the fruitful cooperation between the INGV of Catania, the Politecnico of Milano and Tele-Rilevamento Europa (T.R.E.). The PS technique provides a very detailed map of the ground deformation allowing the kinematics of the active faults on Mt. Etna and ground compaction phenomena to be detected and analyzed. More recently, the PS technique has been applied to repeated ERS images taken from ascending and descending satellite passes. By appropriately combining the ascending and descending PS data, the horizontal (E-W) and vertical component of ground velocities are discriminated. The comparisons of the three-dimensional GPS data with PS horizontal and vertical ground deformation data show a good agreement. Thanks to the absence of flank eruptions from 1993 to 2001, the studies of Mt. Etna through this period focus on the long-living phenomena as the movements produced by the activity of either the deep volcanic sources or the tectonic / volcano-tectonic features. The preliminary results confirm that the E-W motion component of the eastern flank of Mt. Etna is by far the dominating measured deformation. The ground deformation pattern is strongly influenced by the structural setting of the Mt. Etna and the kinematics of the different faults dissecting the volcano can be defined by PS data. Gradient on E-W motion is detected only on some faults: e.g. Fasano-S. Gregorio fault shows a main E-W horizontal component of displacement. On the NE sector of the volcano, on the Giarre wedge and on the central part of the SE block there is no gradient on the E-W motion evidencing an uniform horizontal velocity of this part of the volcano. The main N-S

component resulting form the right lateral strike-slip of “Timpe” faults produces secondary effects on PS measurements. This component is thus measurable only on GPS vectors. Gradients of the vertical motion show significant dip-slip components along many faults (e.g.: Mascalucia, Trecastagni and Timpe). An evident eastward decrease of the vertical velocity also affects each block on the SE flank evidencing a westwards tilt of each block. On the southern part of the eastern flank, the dip of GPS vectors and the pattern of the PS vertical velocities indicate a tilt, suggesting the rotational sliding of this flank; this hypothesis agree with a “decollement” along listric surfaces (at least in SE flank) already identified by analysing GPS data.