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A data sequence acquired at Mt. Etna during the 2003-03 eruption highlights the potential of continuous gravity observations as a tool to monitor active volcanoes

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Microgravity studies through discrete observations have been continued at Mt Etna for more than 15 years and have allowed mass redistributions occurring at depths between 8 km b.s.l. and a few hundred meters below the surface to be detected and correlated with paroxysmal phases of the activity. Since 1997 continuously recording gravity stations have been also installed at Etna to couple the network for discrete measurements and extend the range of periods of measurable anomalies down to a few minutes. A gravity sequence acquired at a station on the N slope of Etna (PDN, 2800 m a.s.l., 2 km from the active North-East crater) and encompassing the 2002-03 flank eruption shows important changes which have been correlated with the ensuing volcanic activity. A marked gravity decrease (400 microGal in less than one hour) took place about 4 hours before lava was first outpoured from the eruptive fissures along Etna's NE-Rift. This anomaly reversed soon afterward at a high rate. The strong gravity decrease is interpreted as the opening, by external forces, of a shallow fracture system 1 km W of the gravity station. Magma from the central conduit entered the new fracture system passively, and propagated through it towards lower portions of the NE-Rift. Both the arrangement of the new fracture system and the eruptive dynamics are in keeping with the inferred intrusive mechanism of the 2002 NE-Rift eruption. Successively, on three occasions in November and December 2002, decreases of the gravity field (with amplitude up to 30 microGal) occurred simultaneously with increases of the tremor amplitude (up to a factor of 4). The simultaneous gravity/tremor anomalies last 6 to 12 hours and terminate with steep changes (lasting up to 90 minutes) which bring the signals back to their original levels. Basing on volcanological observation encompass-

ing the simultaneous anomalies, the accumulation of a gas cloud at some level in the conduit plexus feeding a new eruptive vent could have acted as a joint source. This study highlights the potential of continuous gravity observations, especially if used in conjunction with other geophysical and/or volcanological evidences, to both study the internal dynamic of a volcano and to improve the confidence of volcanic hazard mitigation.