

Improvement of the Etna Volcanic Ash Monitoring and Forecasting system P-32

S. Scollo ¹, F. Azzopardi ², A. Boselli ³, M. Coltelli ¹, R. Ellul ², G. Leto ⁴, G. Pisani ⁵, M. Prestifilippo ¹, G. Spata ¹, N. Spinelli ⁵, X. Wang ⁶, R. Zanmar Sanchez ⁴

(1) Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo, Italy; (2) Physics Department, University of Malta, Malta; (3) CNISM and IMAA-CNR, Tito Scalo (Pz), Italy; (4) INAF, Osservatorio Astrofisico di Catania, Catania, Italy; (5) CNISM and Dipartimento di Scienze Fisiche, Università di Napoli Federico II, Napoli, Italy; (6) SPIN-CNR and Dipartimento di Scienze Fisiche, Università di Napoli Federico II, Napoli, Italy.

Mount Etna, in Sicily, is the largest volcano in Europe and one of the most active in the world. Since 2011 Etna produced 40 lava fountains that formed eruption columns rising up to ten kilometers (Fig. 1) and dispersed volcanic ash toward the neighboring countries. As an example, Malta is located at the center of the Mediterranean, 100 km south of Sicily and is sometimes affected from the tephra fallout (Fig. 2 and 3).

In order to reduce the hazard from volcanic cloud dispersal and fallout (Fig. 4 and 5) and prevent damages to aviation operations, an automatic system for monitoring and forecasting of volcanic ash dispersal between Sicily and Malta has been realized in the frame of the VAMOS SEGURO project.

The project has been recently selected as European best practice in the prevention and mitigation of natural hazards among the territorial cooperation projects.



Fig. 1

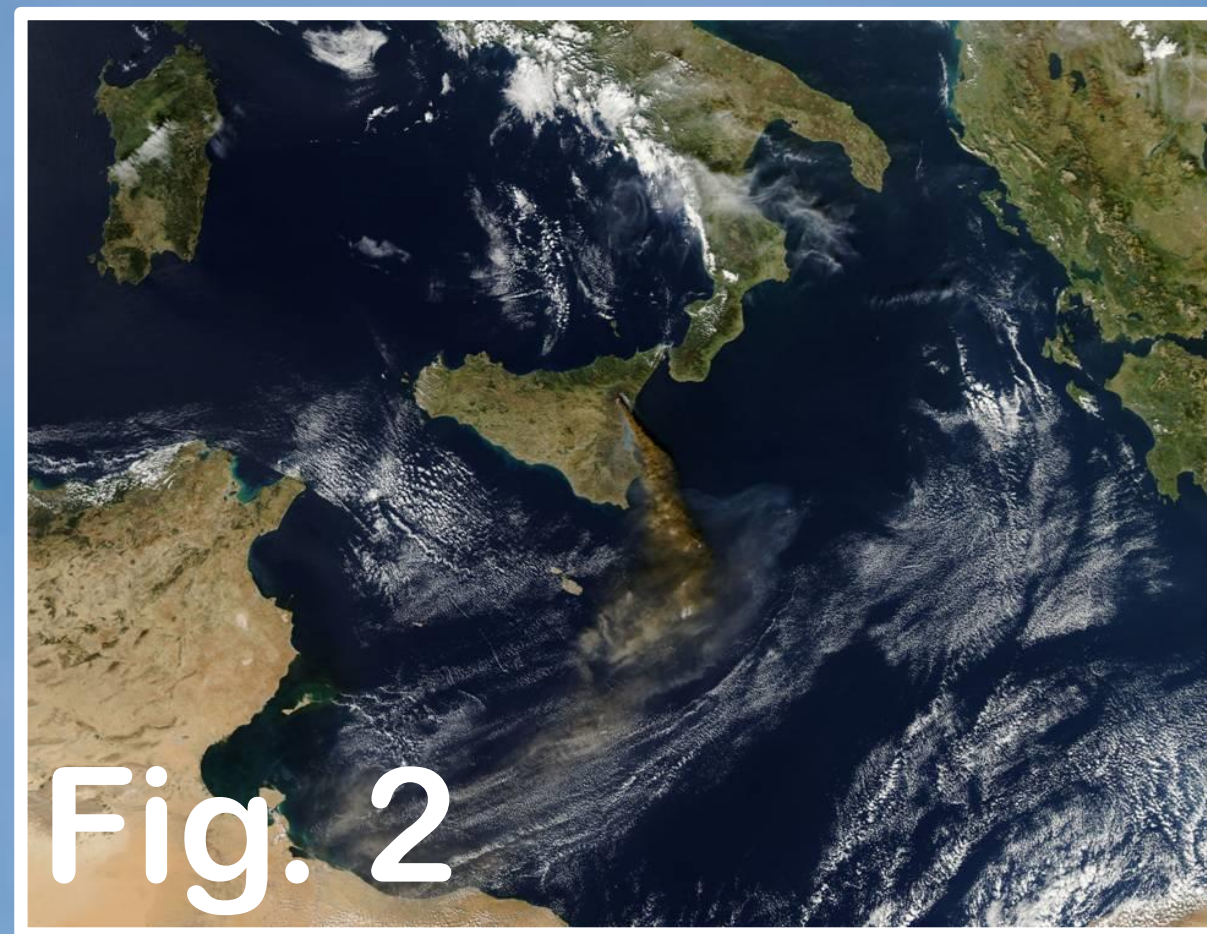


Fig. 2



Fig. 3

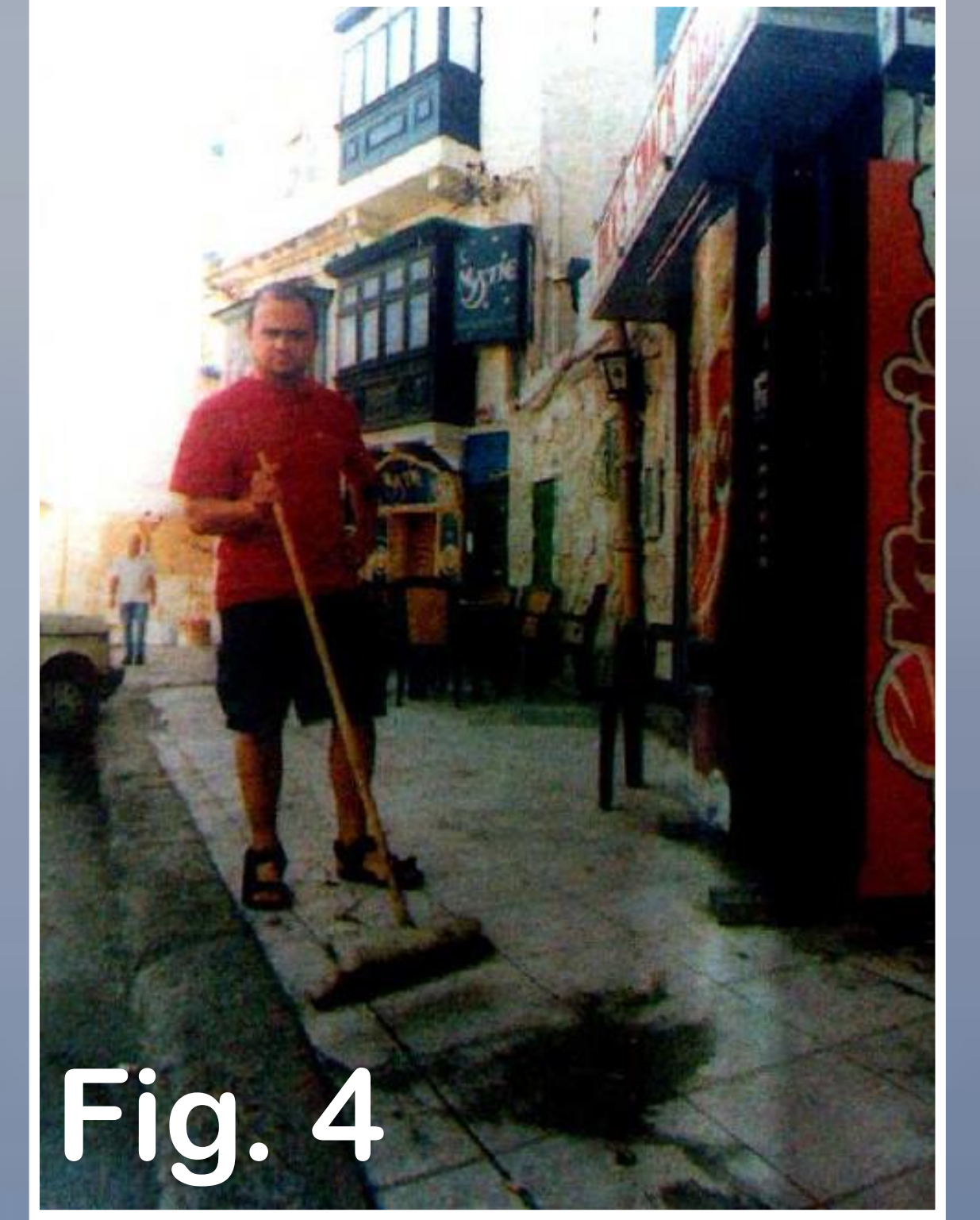


Fig. 4



Fig. 5

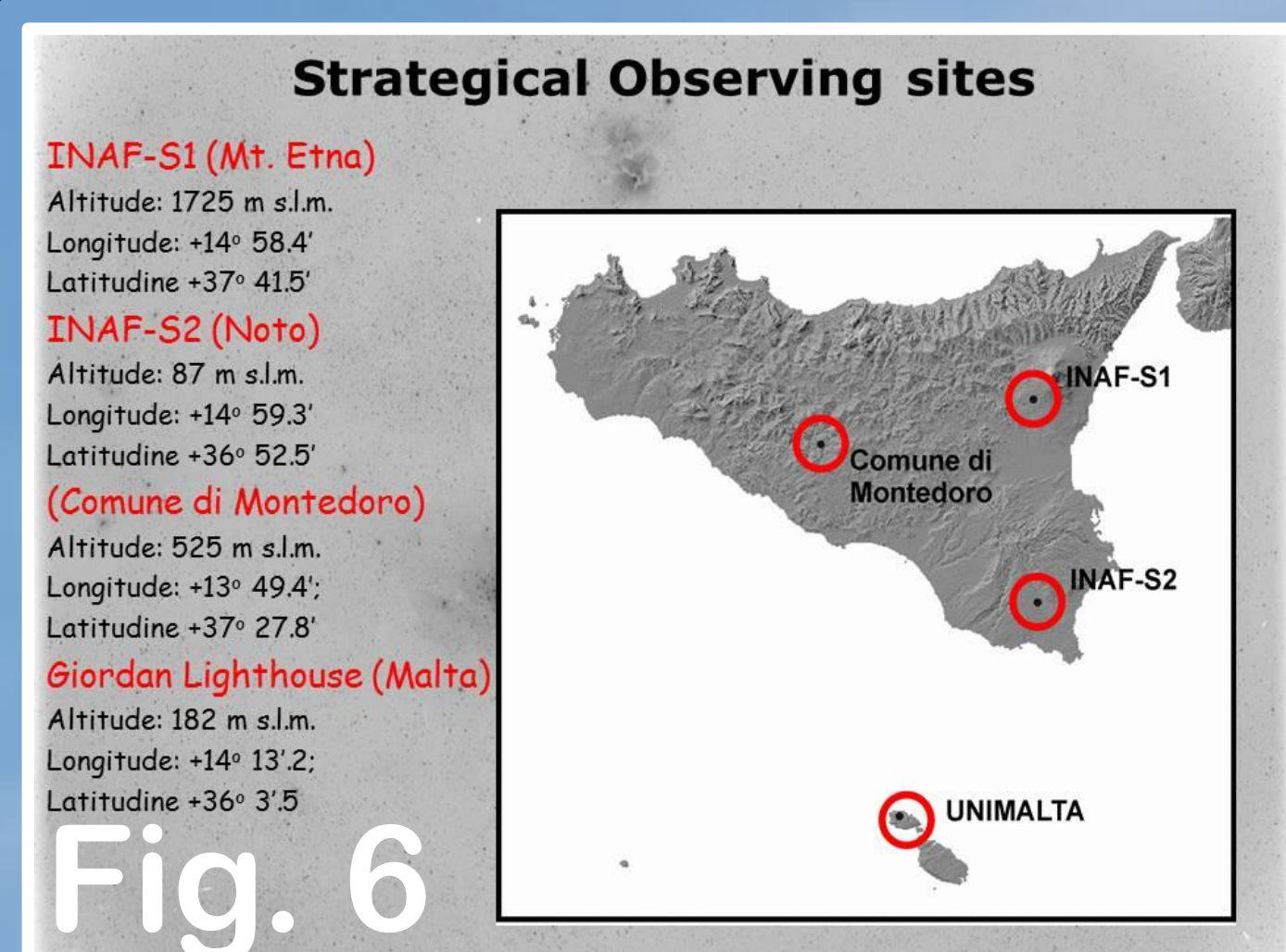


Fig. 6



Fig. 8



Fig. 9

New instruments have been installed both in Sicily and at the University of Malta observatory facility at Giordan lighthouse and at Xewkija, Gozo (Fig. 6 and 7). This station comprises monitors for Carbon Monoxide and Dioxide (CO and CO₂), Sulphur Dioxide (SO₂), Water Vapour (H₂O), volcanic ash and meteorological parameters (Fig. 8 and 9).

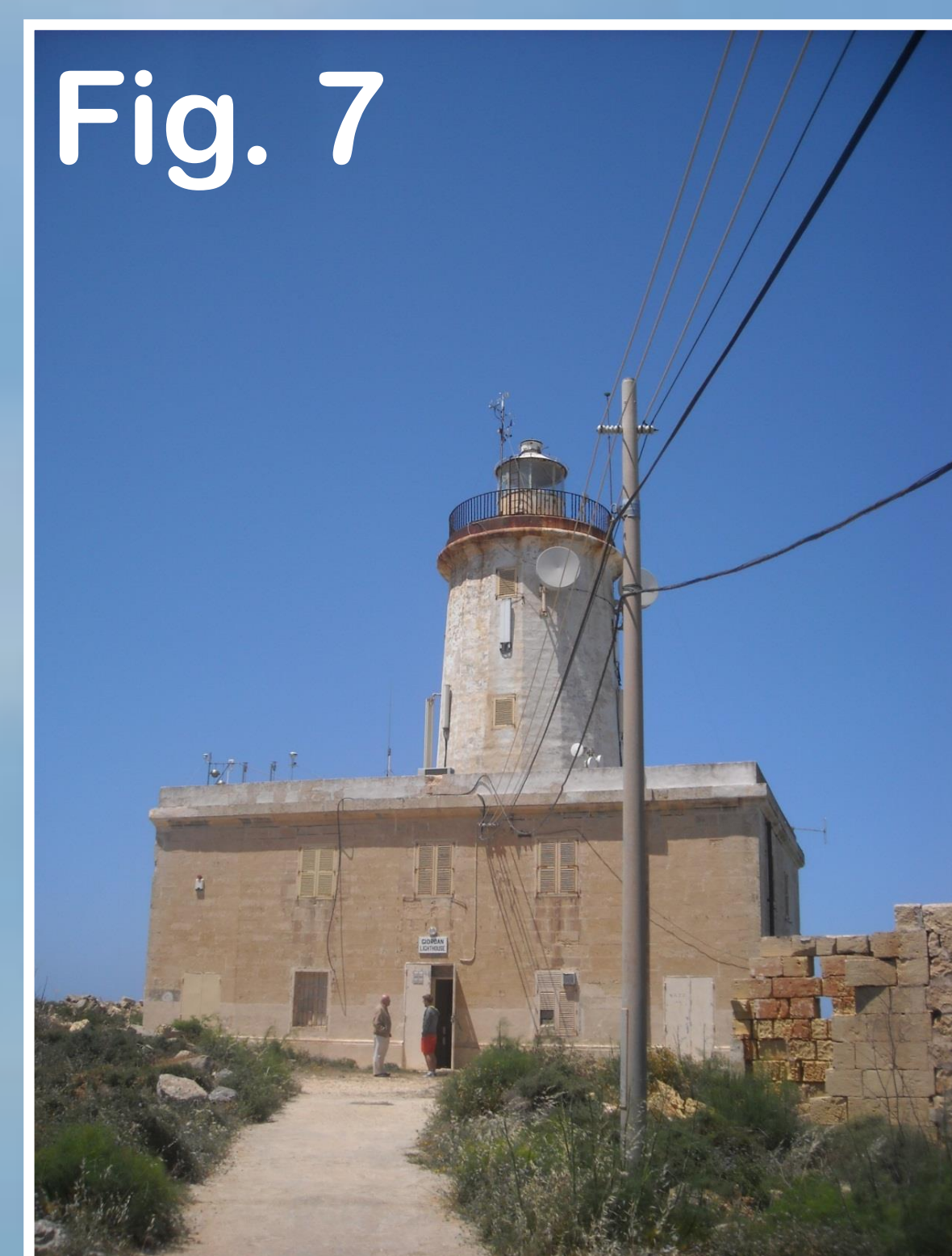


Fig. 7

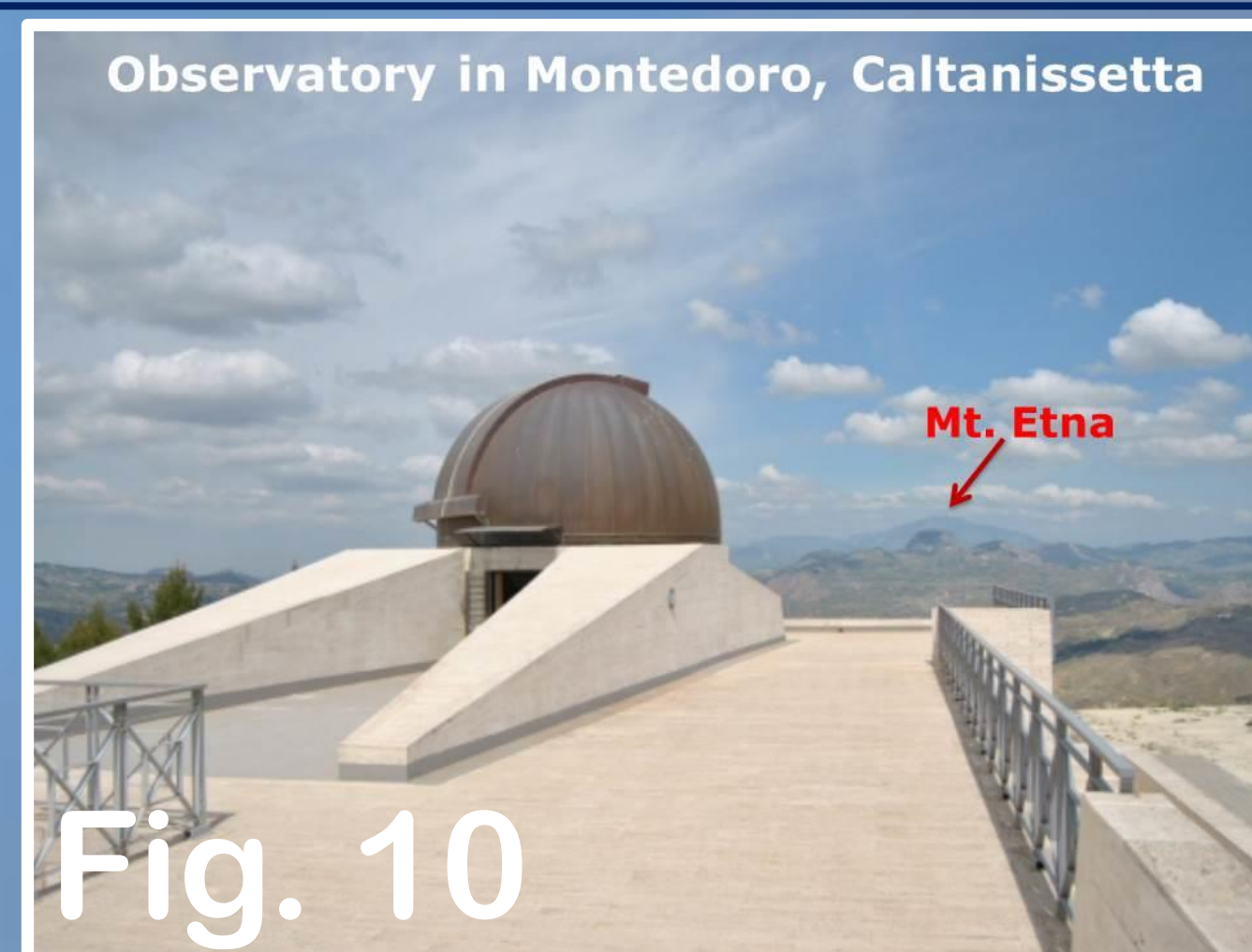


Fig. 10



Fig. 11

A innovative transportable scanning lidar system, designed and realized by CNISM is operating in two suitable sites, Montedoro (Caltanissetta) (Fig. 10) and at Serra La Nave (Fig. 11), 7 km away from the Etna summits. The lidar instrument (Fig. 12) is able to detect aerosol layers, estimate the column height and give a 3D vision of volcanic plumes using the scanning capabilities (Fig. 13 and 14).

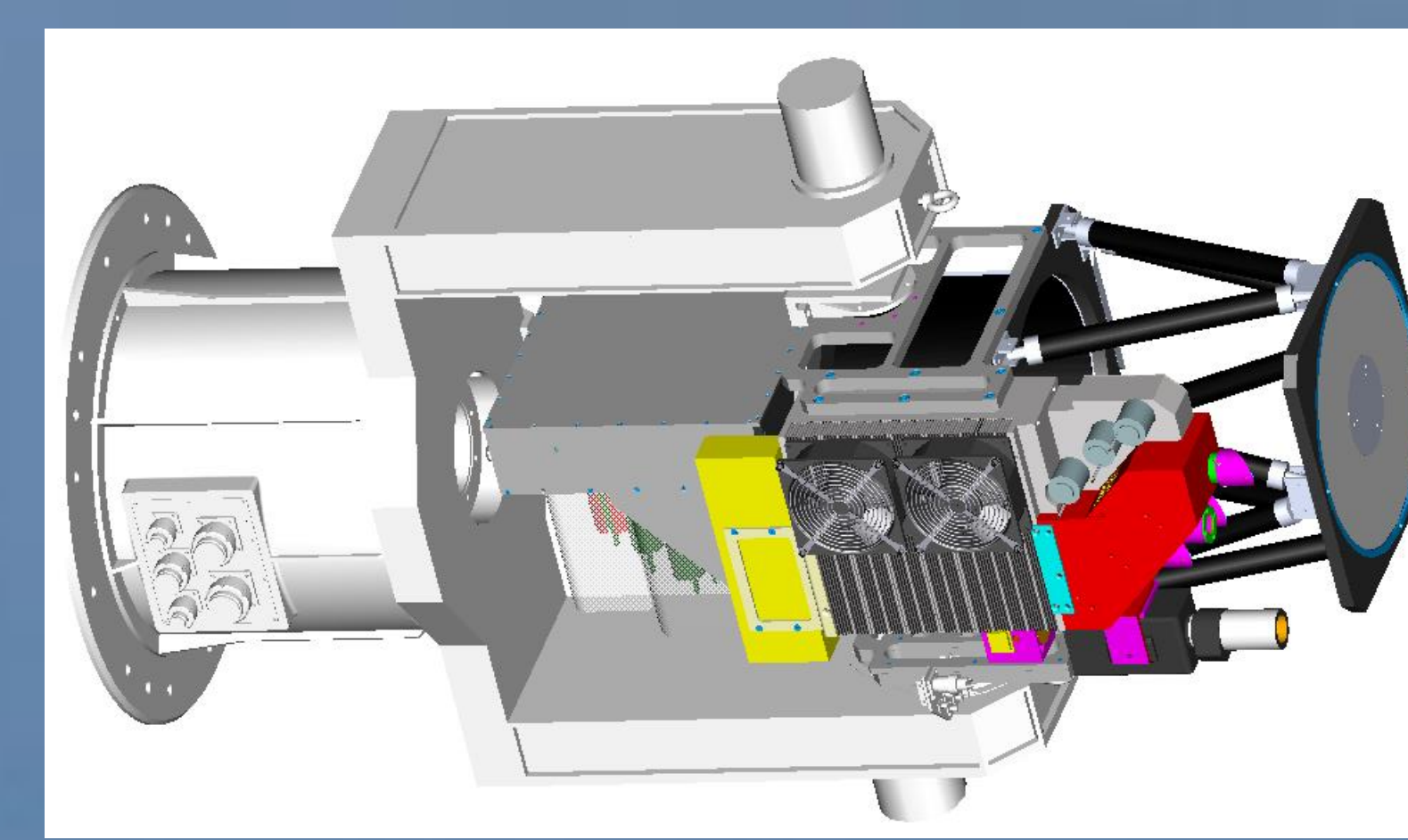


Fig. 12

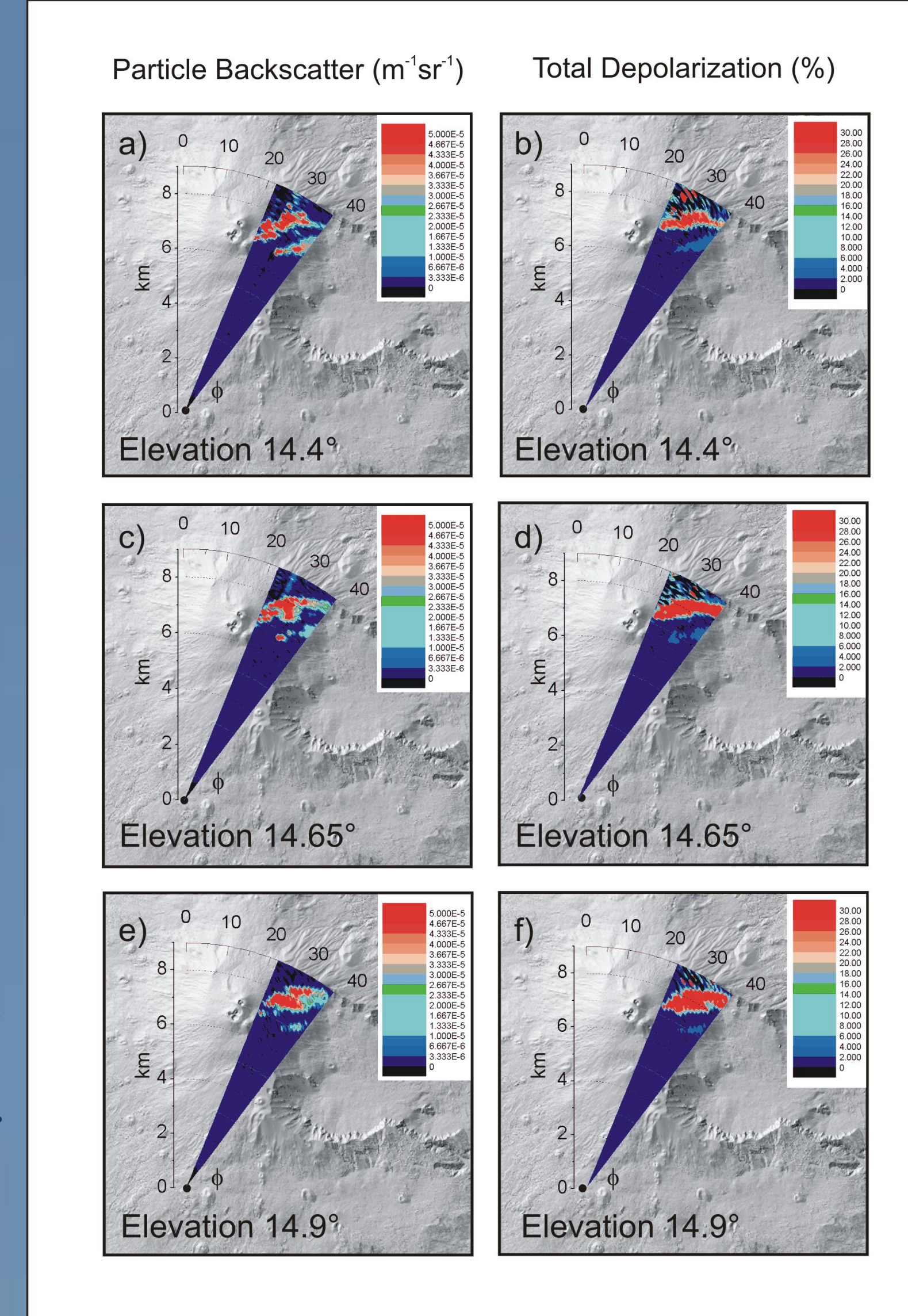


Fig. 13

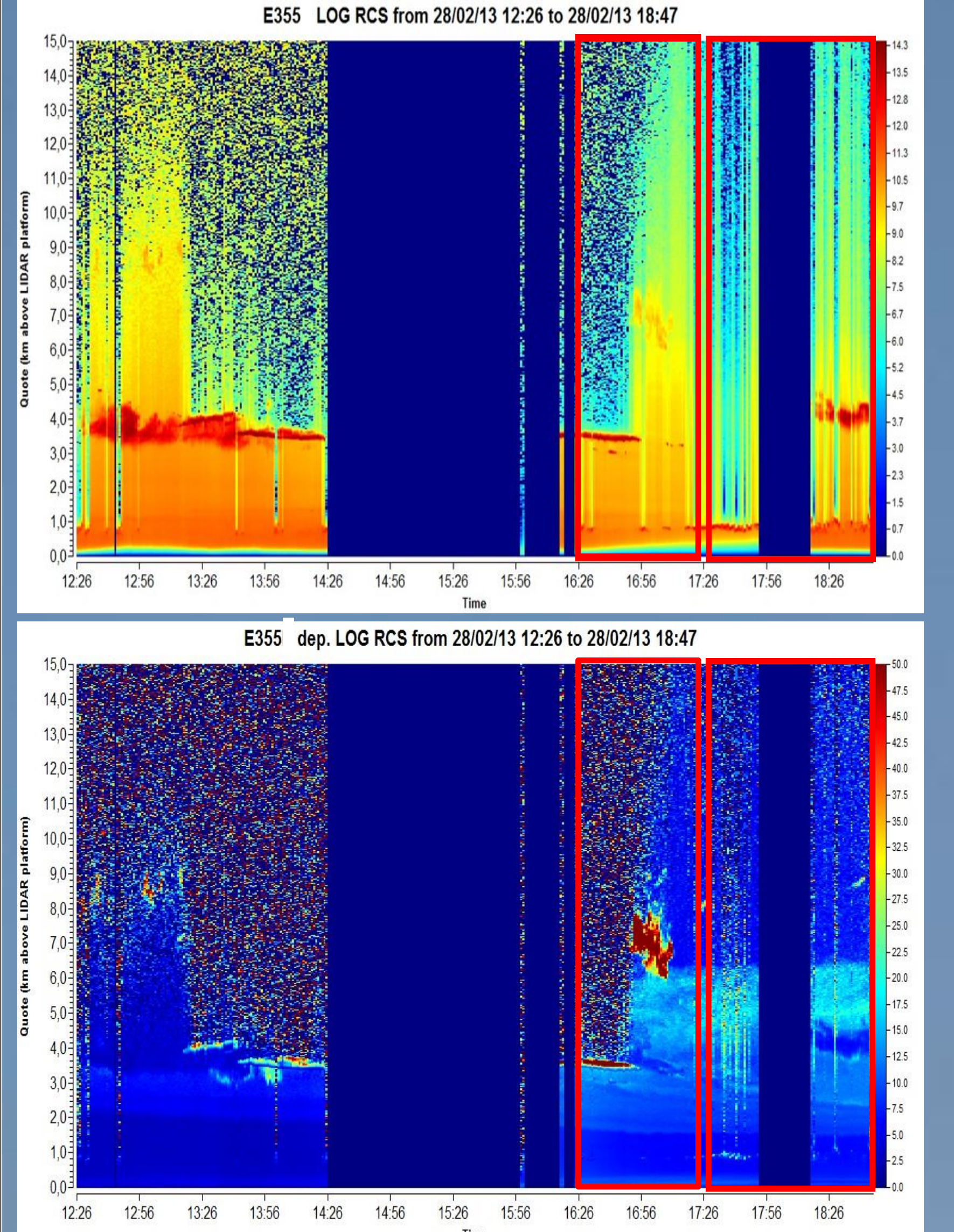


Fig. 14

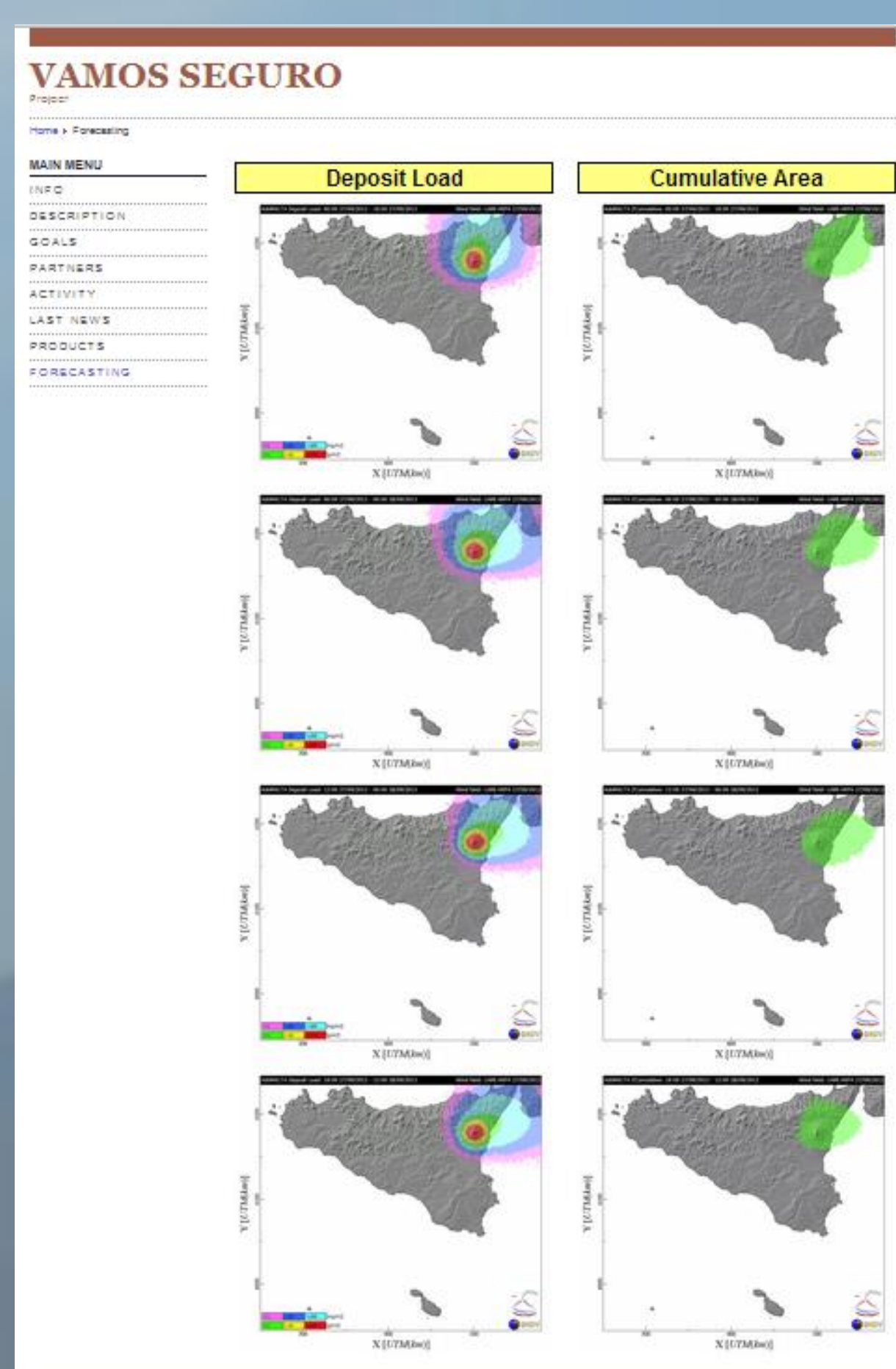


Fig. 15

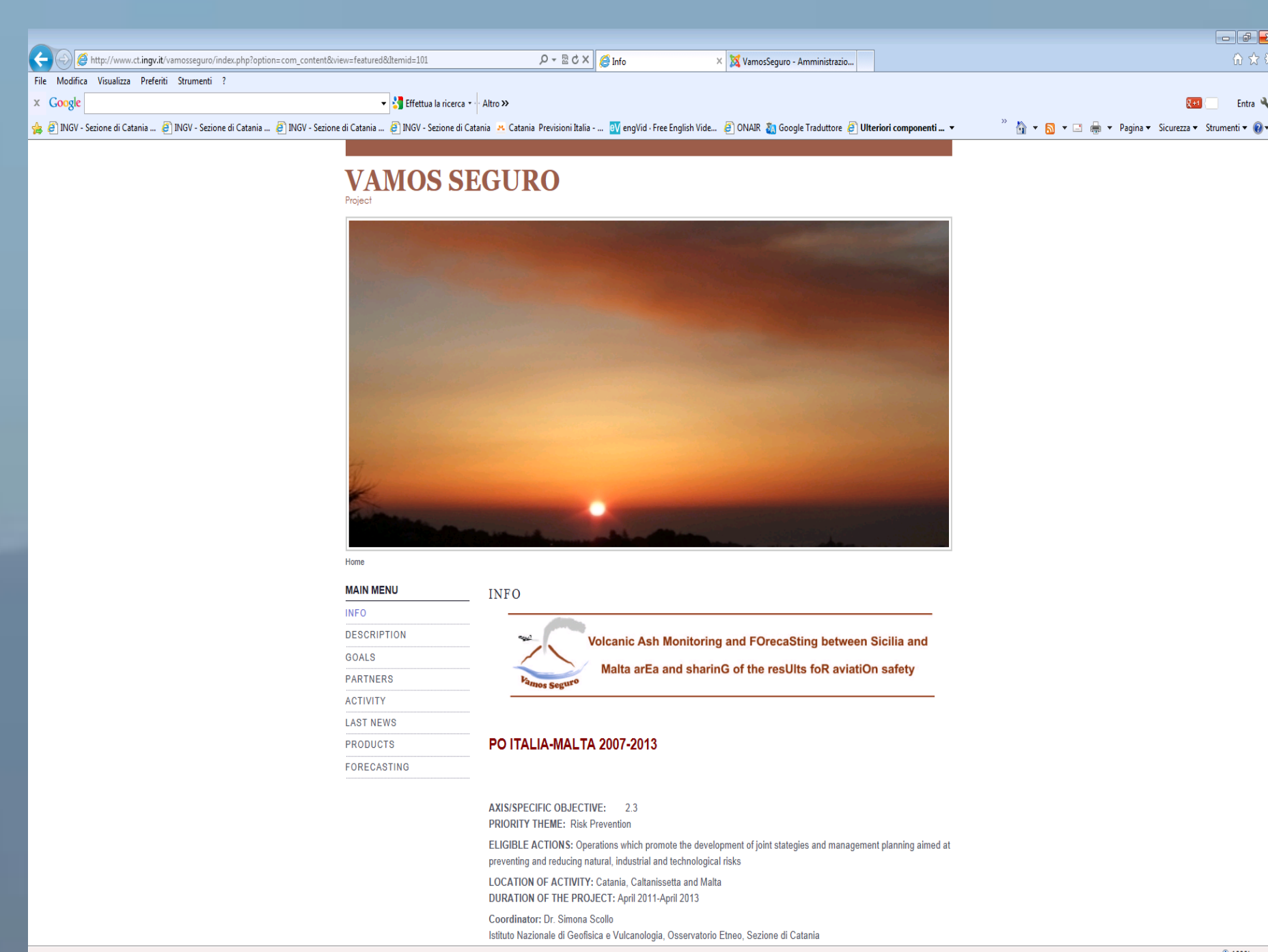


Fig. 16

The automatic forecasting system simulates the region affected by the volcanic ash plumes in case of Etna eruptions on a daily basis. Every day an automatic system downloads weather forecasts from meteorological mesoscale models, runs the PUFF-parallel model, plots hazard maps of volcanic ash dispersal and deposition for certain scenarios (Fig. 15 and 16) and publishes the results on the project's web-site: www.ct.ingv.it/vamosseguro (Fig. 17 and 18).

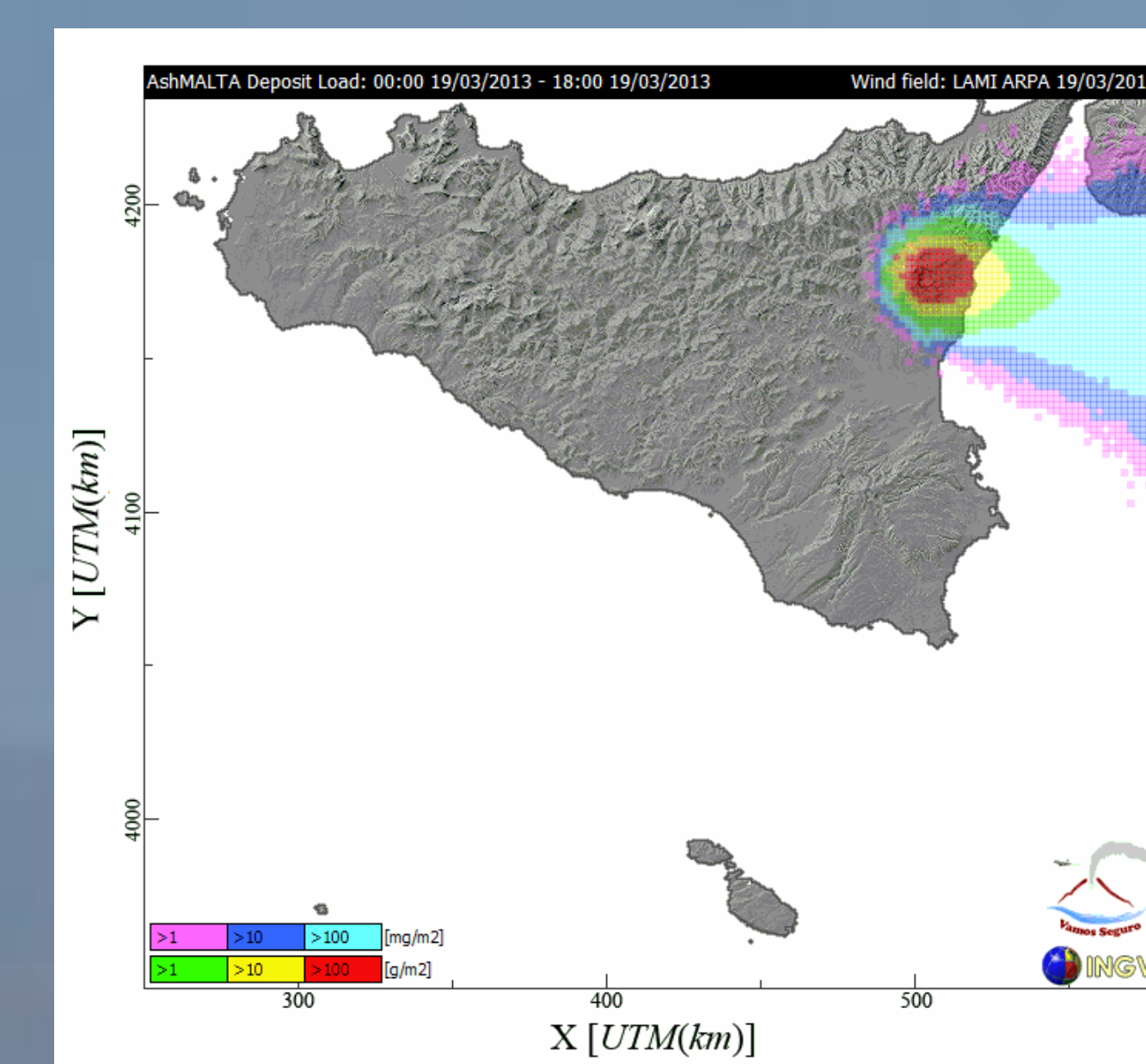


Fig. 17

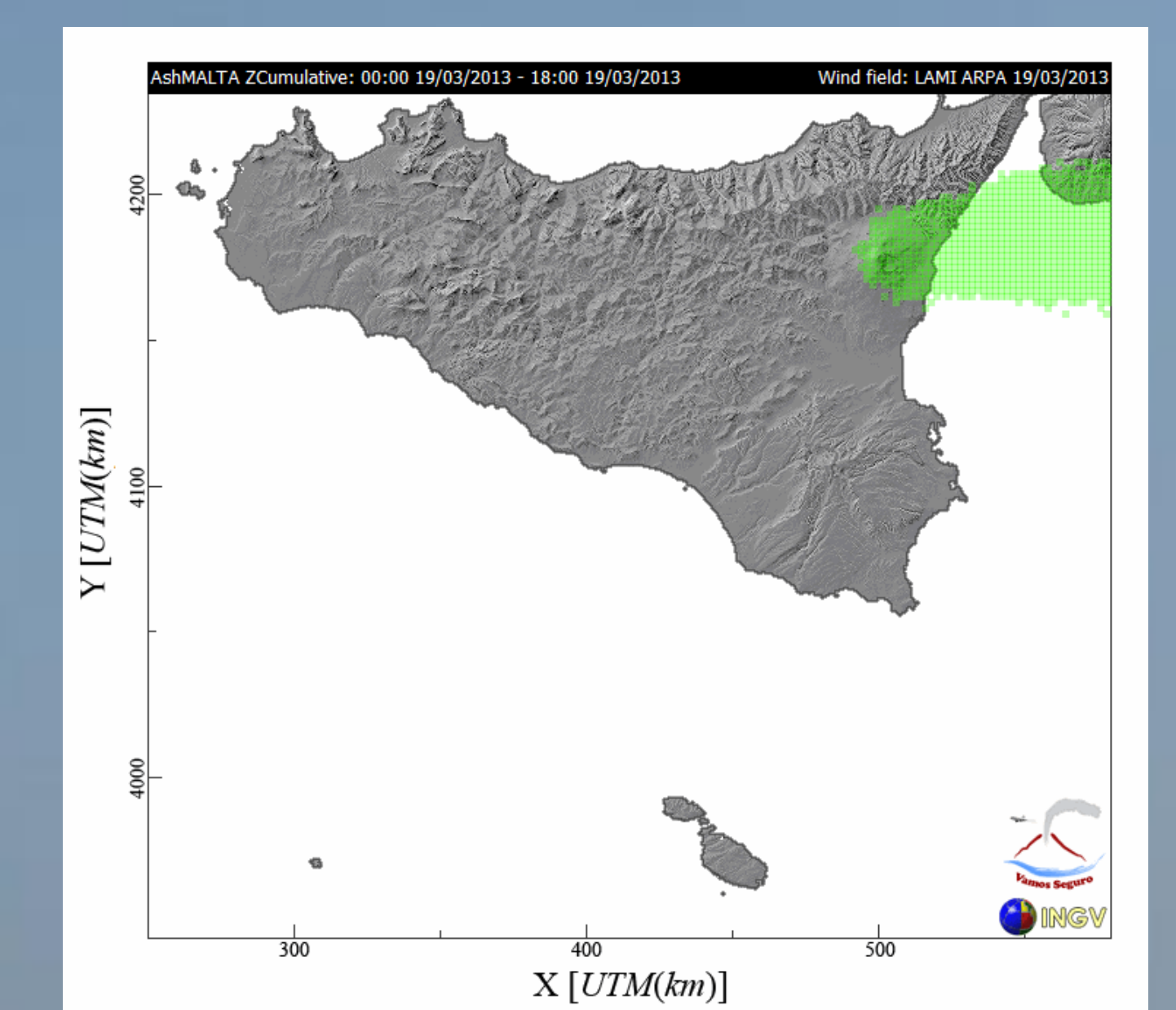


Fig. 18

Warning messages will be issued during the main eruptive events and, with the support of the Malta International Airport Meteorological Office, they should be transmitted to the competent Civil Authorities.