OUR PLANET FROM SPACE

VOLCANIC CLOUD PRODUCTS

Volcanic eruptions emit large quantities of gases and aerosols into the atmosphere with severe implications for environment, human society and aviation. In particular, volcanic clouds are very dangerous for aviation operations as they can cause damage to aircrafts´ systems and engines not only close to volcanoes, but also at large distances from the eruption themselves. Recently, the 2010 Eyjafjallajökull eruption in Iceland, forced the disruption of the airspace in Europe generating the largest air traffic shutdown since World War II with thousands of flights interrupted, passengers left stranded and total losses for airline companies of over three billion euros.
A reliable estimation of the different parameters related to volcanic clouds (as altitude, ash concentration etc.) is required, to meet the needs of operational users and to support policy makers, early warning systems, aviation safety and industry.

graphic design Laboratorio Grafica e Immagini | INGV

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The Multimission Acquisition SysTem (MAST) and Products Generation

The satellite data acquisition system is installed at the INGV headquarters in Rome since 2018. Several satellite measurements, coming from Geostationary (GEO) and Polar (LEO) platforms, are acquired and processed in near real time (NRT).

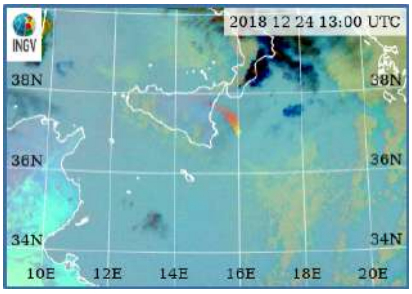
DATA ACQUISITION

The GEO and LEO satellite data are transferred to two acquisition and processing servers. The hardware system is duplicated for a complete redundancy of all MAST components, necessary to increase the reliability of the whole system. After the acquisition, the measurements are processed in NRT and the different research products made available for monitoring and civil protection purposes.

VOLCANIC CLOUD DETECTION

using multispectral instruments in the TIR

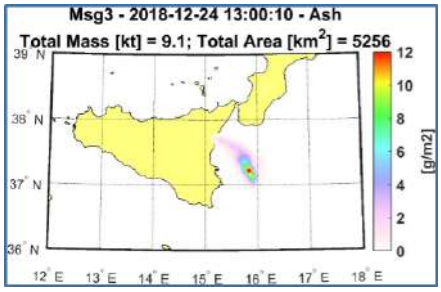
Exploiting an RGB combination of the satellite channels centered at 8.7, 11.0, 12.0 μm, it is possible to qualitatively highlight volcanic ash and SO_2 clouds. Using this procedure the volcanic cloud appear red when ash is the most abundant species present in the volcanic cloud and green if the species most abundant is SO_2. Other techniques can be considered based on different channel combinations or artificial intelligence.



VOLCANIC CLOUD RETRIEVALS

using multispectral instruments in the TIR

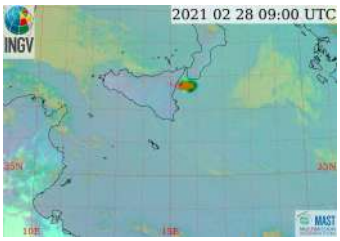
From the satellite images, different products can be generated as volcanic cloud altitude, mass, optical thickness and effective radius of ash particles and SO_2 mass. The reliable NRT products generated contribute to mitigate the effect these natural phenomena have on both environment and population. Detection and retrievals in the TIR guarantees the monitoring during day and night.

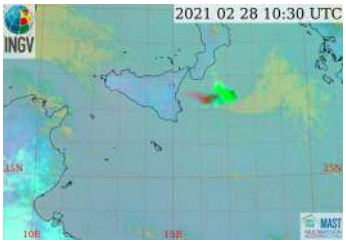


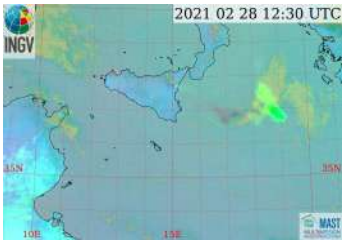
VOLCANIC CLOUD MONITORING

For the volcanic cloud monitoring, the measurements of both GEO (SEVIRI-MSG) and LEO (MODIS-Terra/Aqua, VIIRS-NPP, SLSTR-S3) satellites instruments are considered. The synergistic use of GEO and LEO multispectral systems allows to exploit the GEO high revisit time, with the better LEO spatial resolution. In particular, on the whole full disk, the GEO-SEVIRI measurements are available every 15 minutes that reduces to 5 over Europe. This gives the possibility to follow the volcanic cloud evolution with continuity as also to generate time series of the different products.

time







All the space-related INGV flyers are here!

VALIDATION ACTIVITIES

In order to improve early warning systems and support policy makers on emergency managements, reliable volcanic cloud products have to be generated. To do that, great effort is dedicated to cross-comparison and validation activities by exploiting both the ground based and (other) satellite systems.