

# DIGITAL SURFACE MODELS FROM EO DATA PROCESSING

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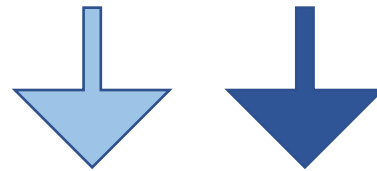


ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA 

- SCIENTIFIC RATIONALE

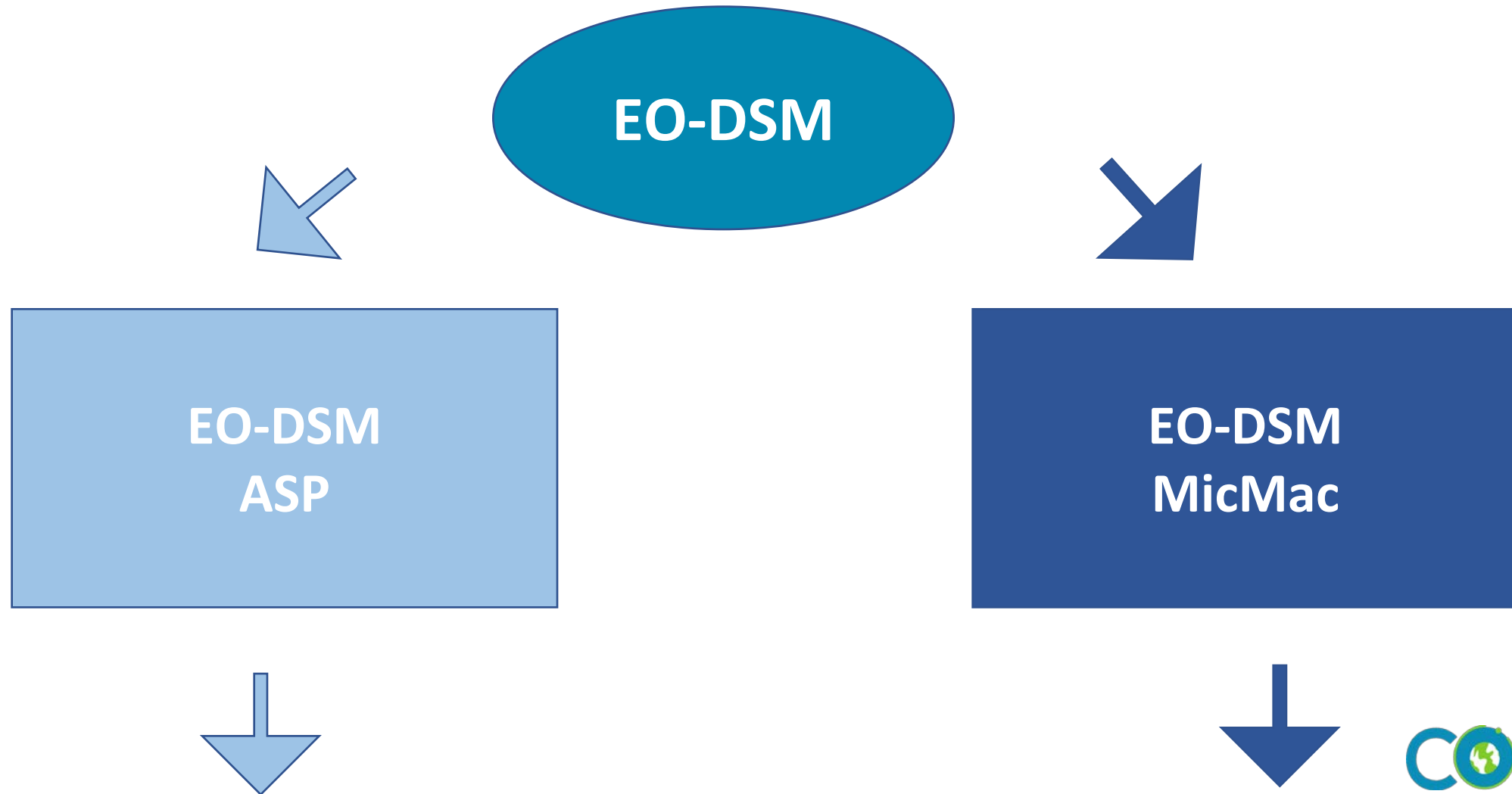
Reconstruction of **accurate** and **high spatial resolution** topographies (Digital Surface Models - DSMs) in a relative **short time elaboration**

Active volcanic areas frequently affected by rapid surface changes  
due to effusive and explosive activities  
(lava flows, fall out deposits, pyroclastic flows)



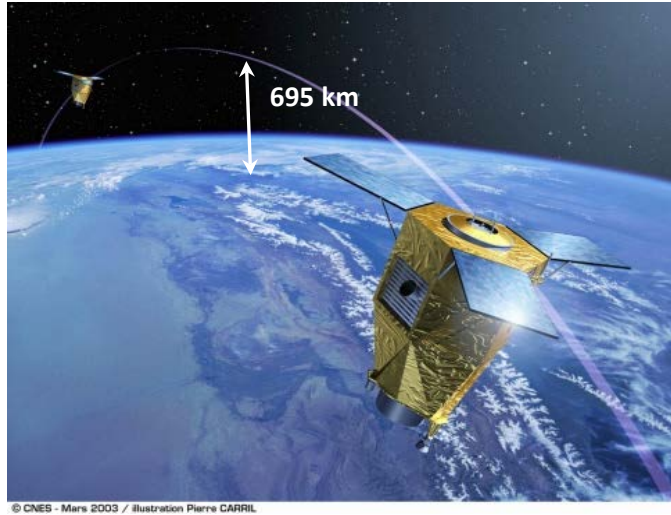
- Quantification of key parameters to study the volcanic process
- When the active volcanic areas are densely populated, an updated and accurate topography (DSM) is fundamental for a correct modelling of the volcanic hazard in order to mitigate the volcanic risk

# Modulo EO-DSM



# • OBSERVATIONAL INFRASTRUCTURE

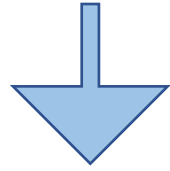
## Plèiades Pan and Multispectral data



Company: Airbus Defence and Space  
Launch: Plèiades 1A (16 Dic 11), Plèiades 1B (2 Dic 12)  
Site: Kourou (Guiana Francese)  
Revisit interval: 1 day  
Sun-synchronous orbit  
Life time: 5 years  
Intensity: 11 bits per pixel (2048 livelli)  
Swath: 20 km a nadir  
Strip mapping (mosaic): 100 x 100 km  
Stereo Imaging: 20 x 280 km

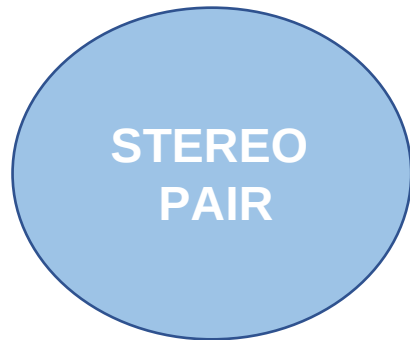


# • TECHNIQUE



## NASA-ASP

**Ames Stereo Pipeline (ASP)**, a suite of open source automated geodesy and stereo - photogrammetry tools intended to process stereo imagery with or without accurate camera pose information.



Data Pre-Processing

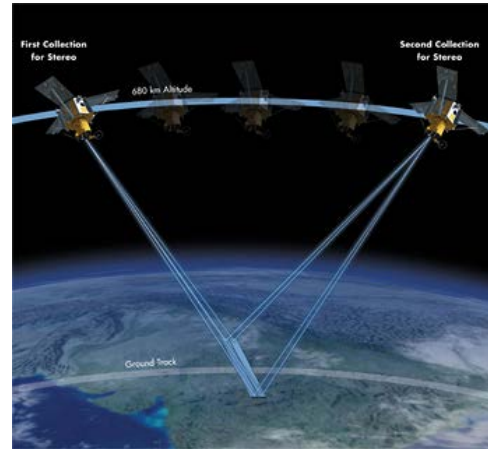


Feature Matching

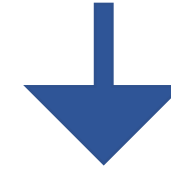


3D Reconstruction

## STEREO - SATELLITE PHOTOGRAMMETRY



- Images acquisition
- Multispectral sensor
- Stereoscopy technique
- Satellite positioning

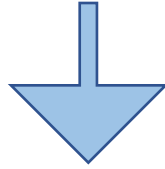


## MicMac

**MicMac** is a free open-source photogrammetric suite developed by the French IGN (Institut Géographique National) that can be used in a variety of 3D reconstruction scenarios.



# • INFRASTRUCTURE FOR DATA MANAGEMENT

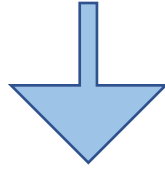


- Agreement with Airbus Defence and Space
- Direct purchase



- Etna Supersite
- Virunga Supersite
- SVOP project
- ESA third party mission
- Direct purchase

- **INFRASTRUCTURE FOR DATA PROCESSING**

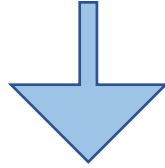


**hosted by parallel computing  
server (CED Roma 1)  
able to manage million of points**



**hosted by a rack-mountable  
workstation (CED Catania)  
AMD ThreadRipper 3970X  
32 core (64 thread)**

# • PRODUCTS AVAILABLE

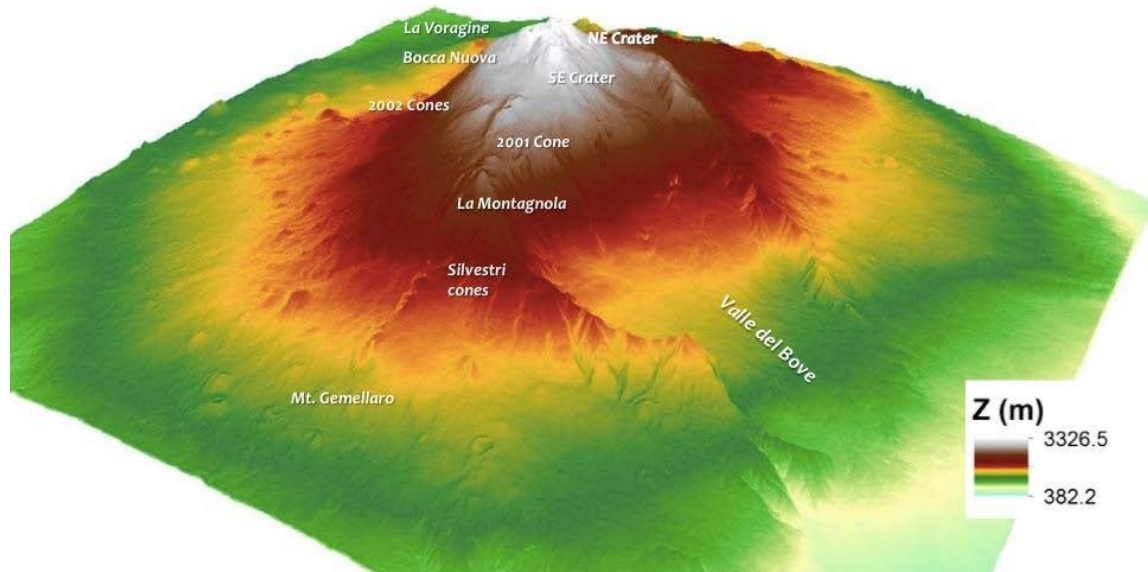


## Mt. Etna, Stromboli, Virunga



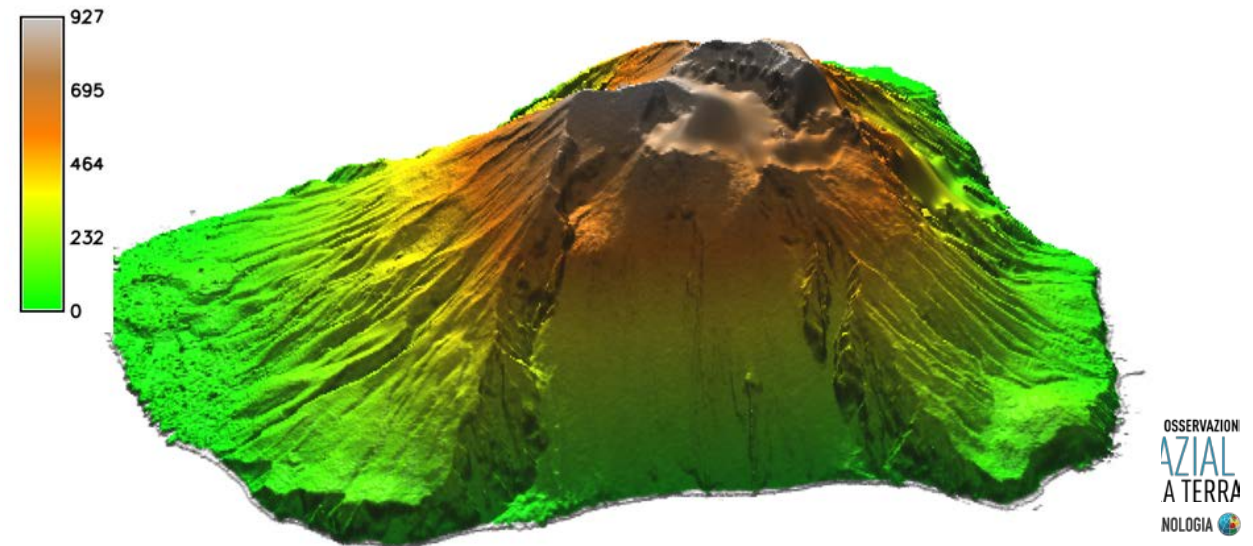
**Geo-referenced and orthometric DSM  
stored in raster format: ascii; tiff; esri grid**

**spatial resolution: 2 m  
planimetric accuracy: 2 m  
vertical accuracy: +/- 0.8 m**

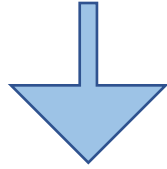


**Geo-referenced DSM in raster format: geotiff  
Ortho-images in raster format: geotiff**

**spatial resolution: 1 m  
planimetric accuracy: 1-2 m  
vertical accuracy: +/- 1.6 m**



# • CURRENT DISTRIBUTION OF PRODUCTS

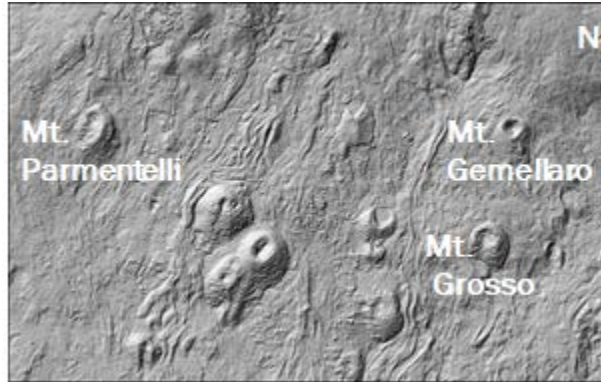
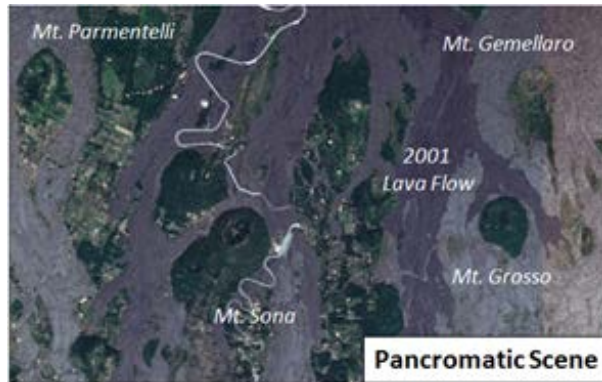


## - On line web site

Link: <https://doi.org/10.5066/P9IGLDYE>

Description: *Mt\_Etna-DSM*

Doi: 10.5066/P9IGLDYE



## - On line Data Bases

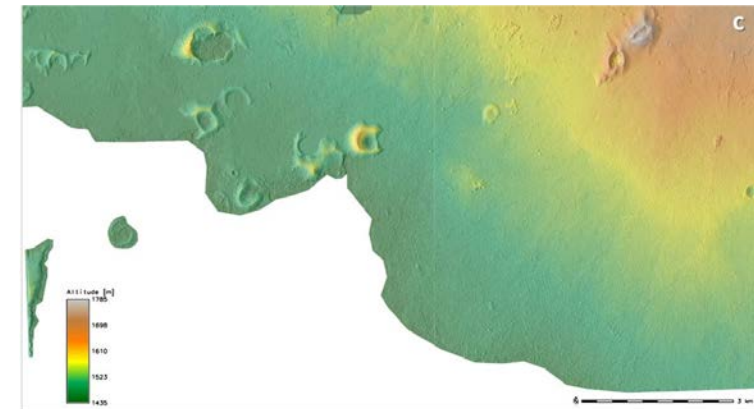
Link: PANGAEA

<https://doi.org/10.1594/PANGAEA.899176>

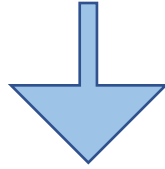
<https://doi.org/10.1594/PANGAEA.899140>

DATA MDPI:

<https://doi.org/10.3390/data4030120>



# • PROGRAMS/PROJECTS OF REFERENCE

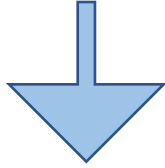


- **USGS-INGV Agreement**
- **Pianeta Dinamico Project**
- **UNO Department Project**



- **Allegato B2 DPC - Task11**
- **Ricerca Libera “Tune”**
- **Pianeta Dinamico “PANACEA”**

# • TEAM AND AFFILIATIONS



- *Marina Bisson (INGV-Pisa)*
- *Maria Fabrizia Buongiorno (INGV-ONT)*
- *Claudia Spinetti (INGV-ONT)*
- *Oleg Alexandrov (NASA-AIMES)*
- *Thomas Cecere (USGS - Reston)*
- *Monica Palaseanu-Lovejoy (USGS – Reston )*



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- *Giuseppe Bilotta (INGV-OE)*
- *Annalisa Cappello (INGV-OE)*
- *Cristina Proietti (INGV-OE)*
- *Luc Girod (UiO)*

# • PERSPECTIVES and NEEDS



- Comparison of DEM obtained by ASP and MICMAC procedures in a common test area
- Testing the procedures by using different bands and different type of satellite data (WorldView 2-3, Skysat)
- Testing the procedures in different context from the volcanic one
- Define INGV validated standard products in volcanic areas
- Established source of data
- Common platform to make available the products