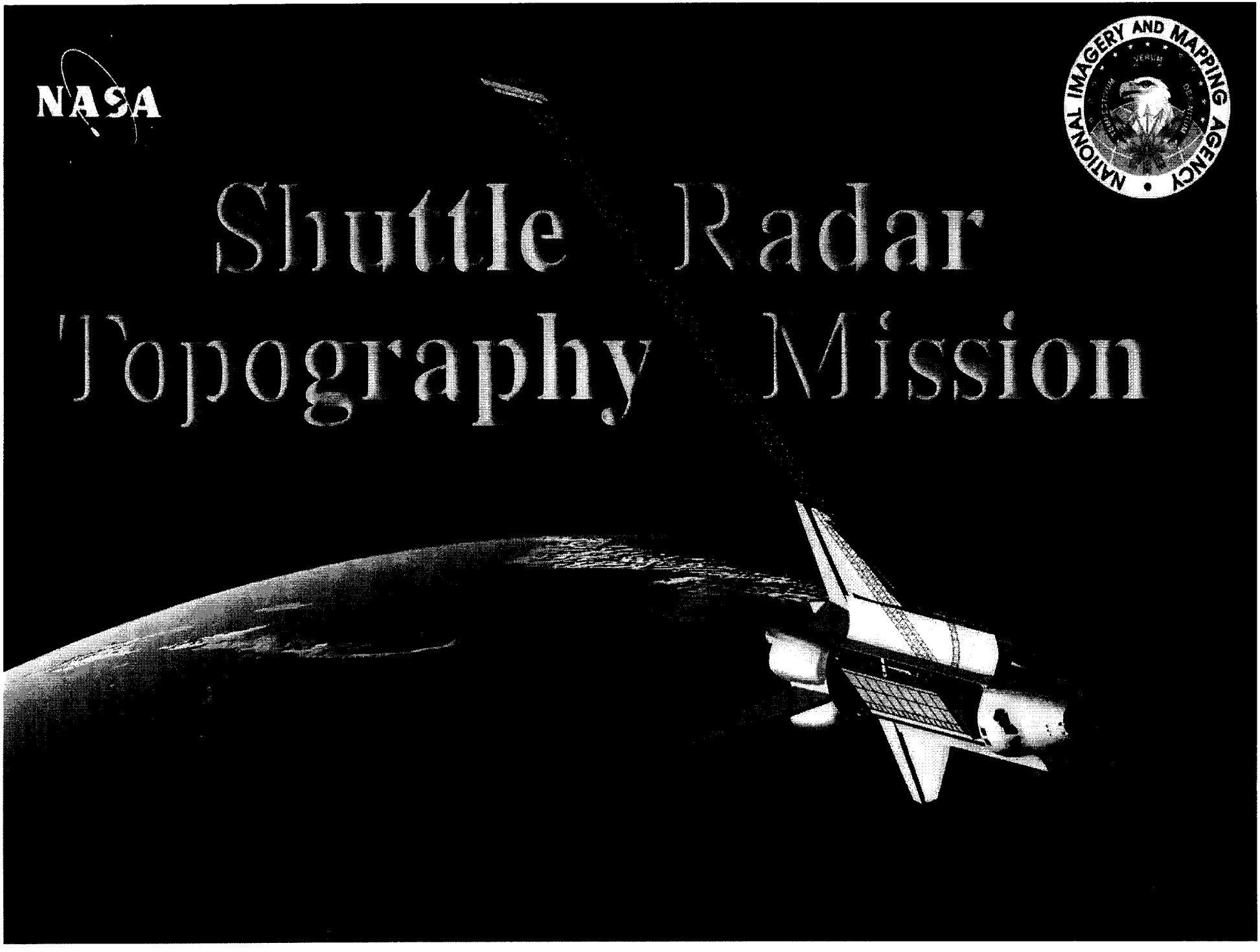
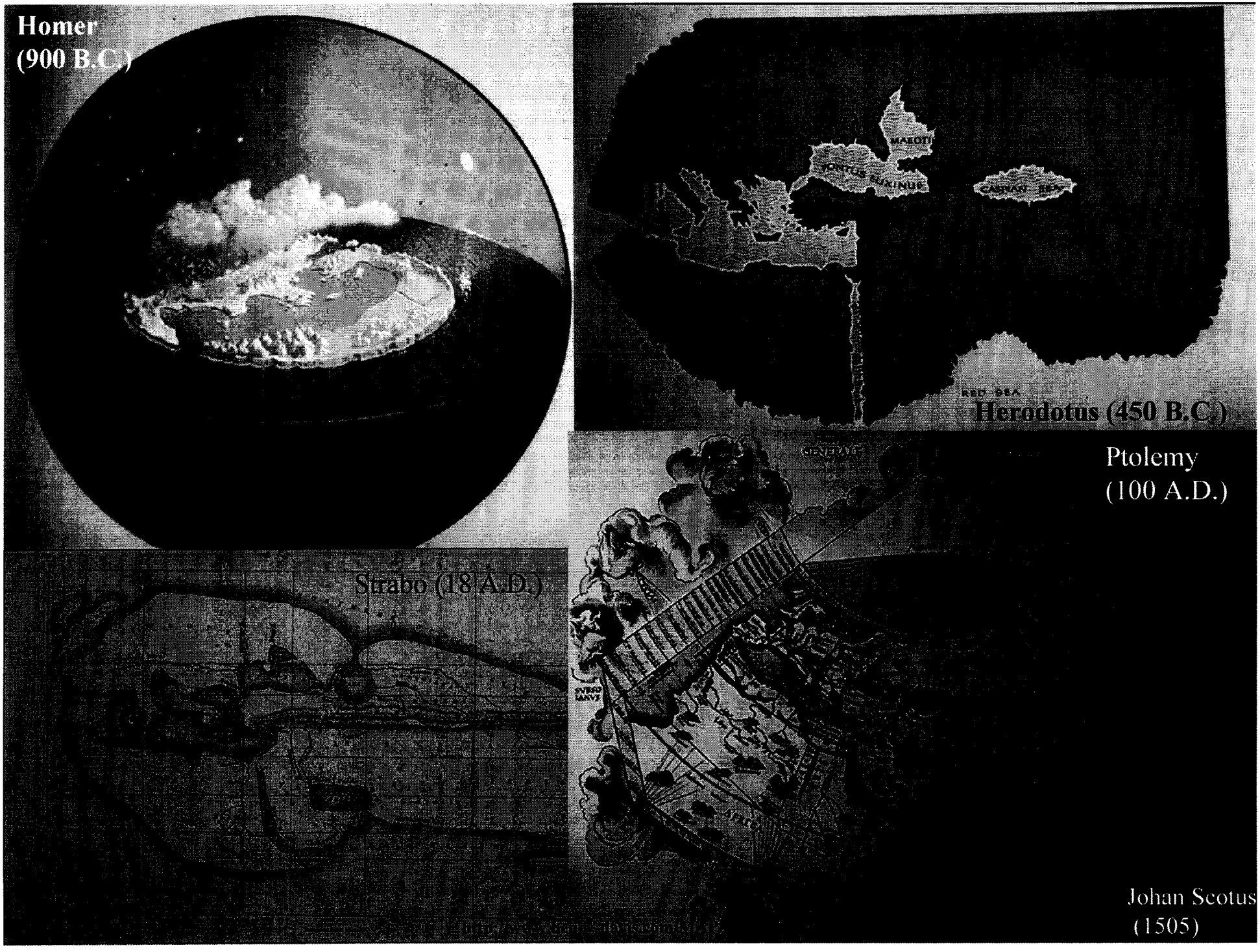
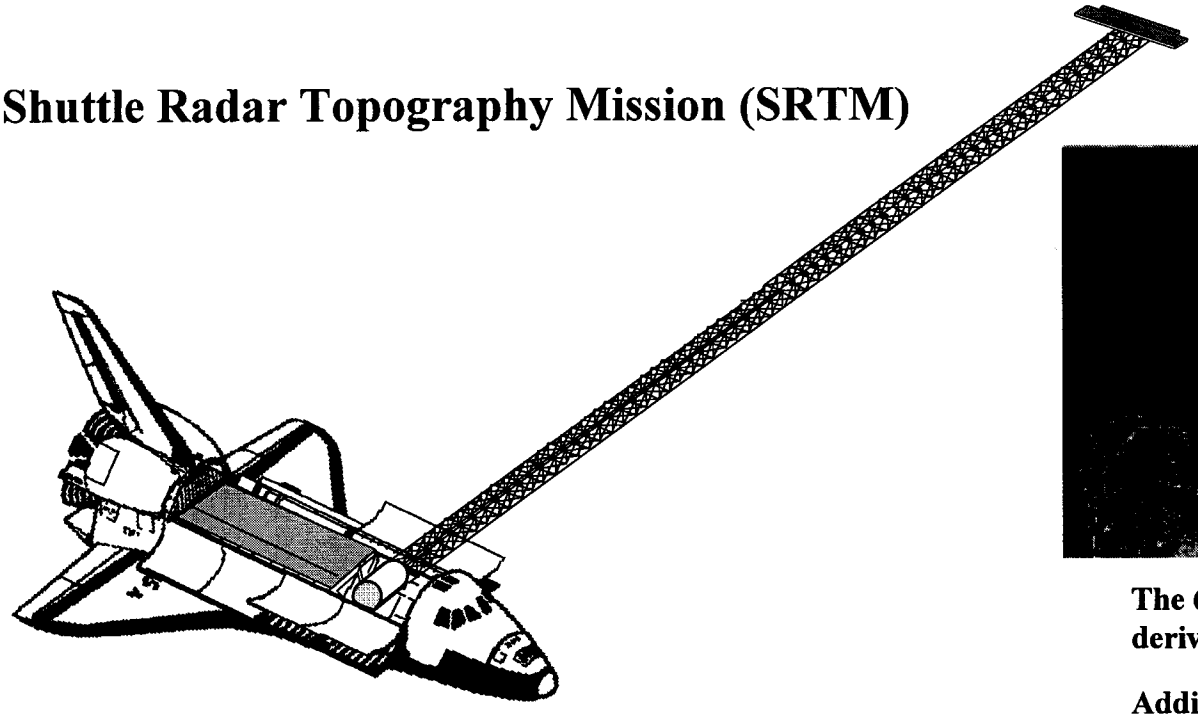

NASA
NATIONAL IMAGERY AND MAPPING AGENCY
Shuttle Radar Topography Mission


Homer
(900 B.C.)
MAEOTIS
PONTUS EUXINUS
CASPIAN SEA
RED SEA
Herodotus (450 B.C.)
Ptolemy
(100 A.D.)
Strabo (18 A.D.)
Johan Scotus
(1505)

The Shuttle Radar Topography Mission (SRTM)

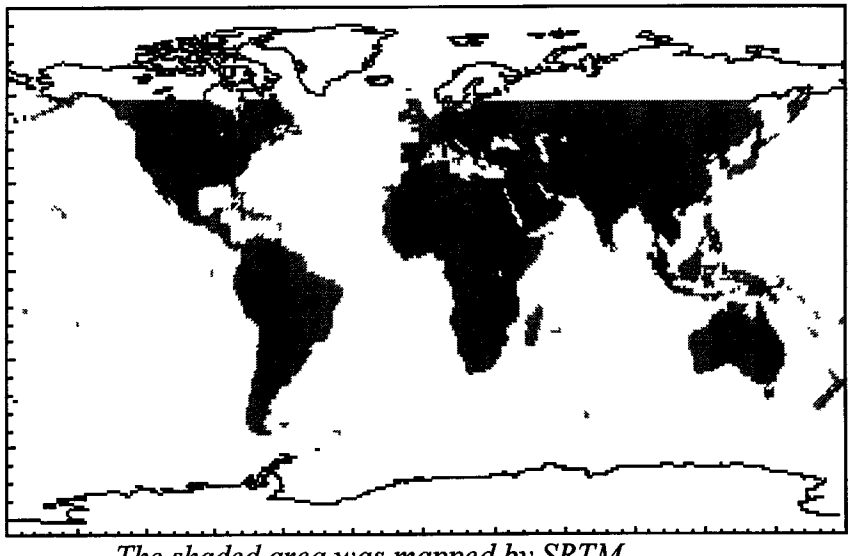


The 60 meter long deployable mast is derived from Space Station hardware.

Additional C-band and X-band antennae are located at the end of the mast.

Avionics are added for attitude and orbit determination.

The X-band interferometer is supplied by the German and Italian space agencies.

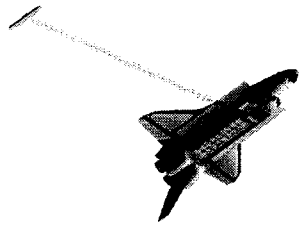


The shaded area was mapped by SRTM.

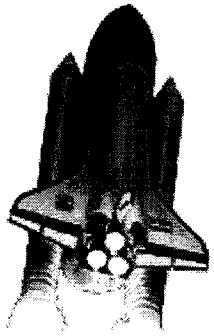
SRTM acquired data with 225 km swaths for ten days, imaging all of the Earth's land surface between 60° N and 56° S latitude.

The data will be processed into a digital topographic map. SRTM will also produce a rectified, terrain-corrected C-band image mosaic of 80% of the Earth's land surface at 30 meter resolution.

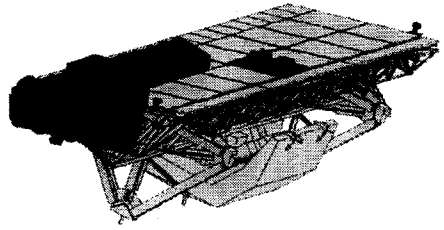
SRTM Mission Overview



Launch
Current manifest STS-101, 9/16/99
Could move to as early as 6/99
11-day flight

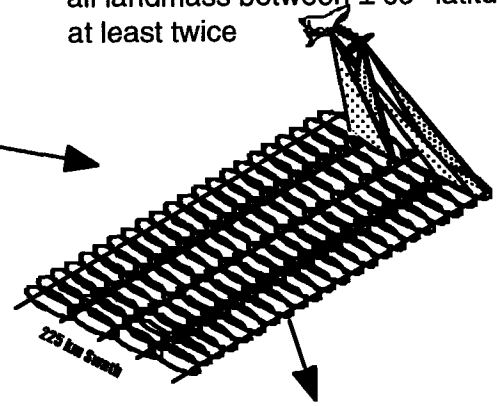


Reflown hardware : antenna & support structure, RF electronics, command/telemetry system, power distribution system, digital data system, recorders, target tracker, attitude gyros

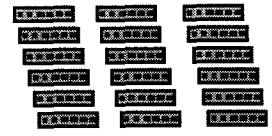


New hardware: Canister & mast, secondary antenna, star tracker, GPS

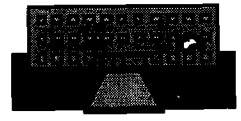
225 km interferometric swaths map all landmass between ± 60° latitude at least twice



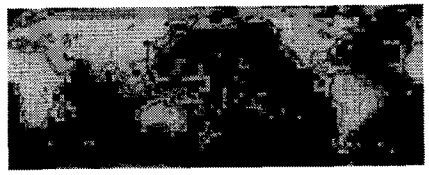
Data recorded on-board
~ 6.5 TBytes C-band
~ 3.3 TBytes X-band



Data returned with Shuttle to Ground Data Processing Facility

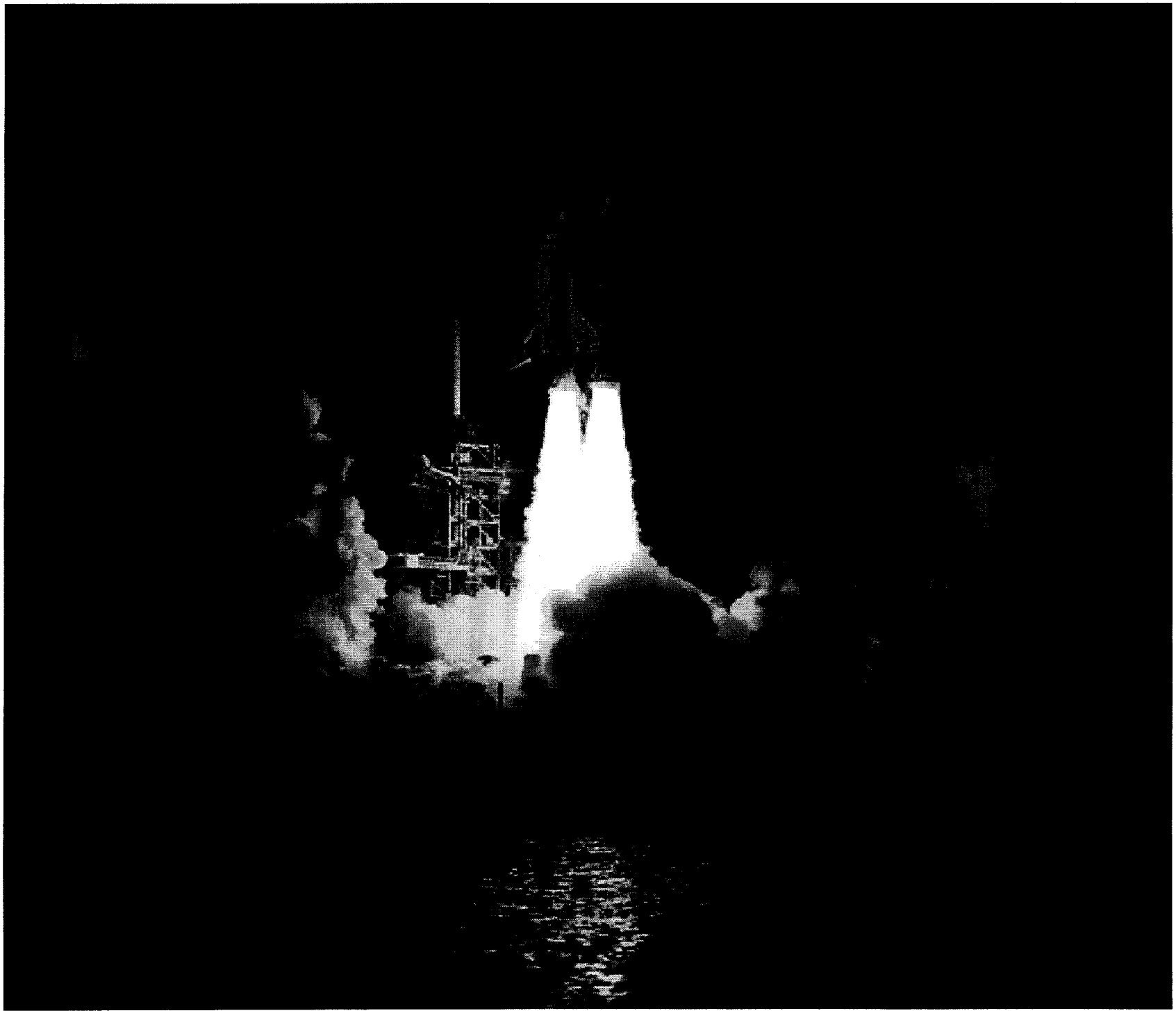


One year processing



Digital elevation data delivered in 5°x5° mosaicked blocks
Images delivered as rectified, mosaickable strips

NIMA data validation, verification, product generation and distribution to users



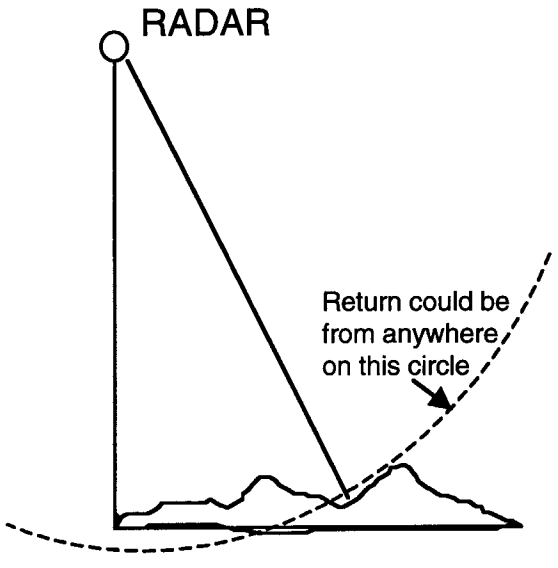
The Shuttle Radar Topography Mission (SRTM) flew on Endeavour Feb11, 2000 for 11 days with objective of generating three-dimensional maps of 80% of Earth's landmass.

SRTM was 100% successful, yielding 12 terabytes of raw data and completely covering the Earth from tip of South America to Greenland.

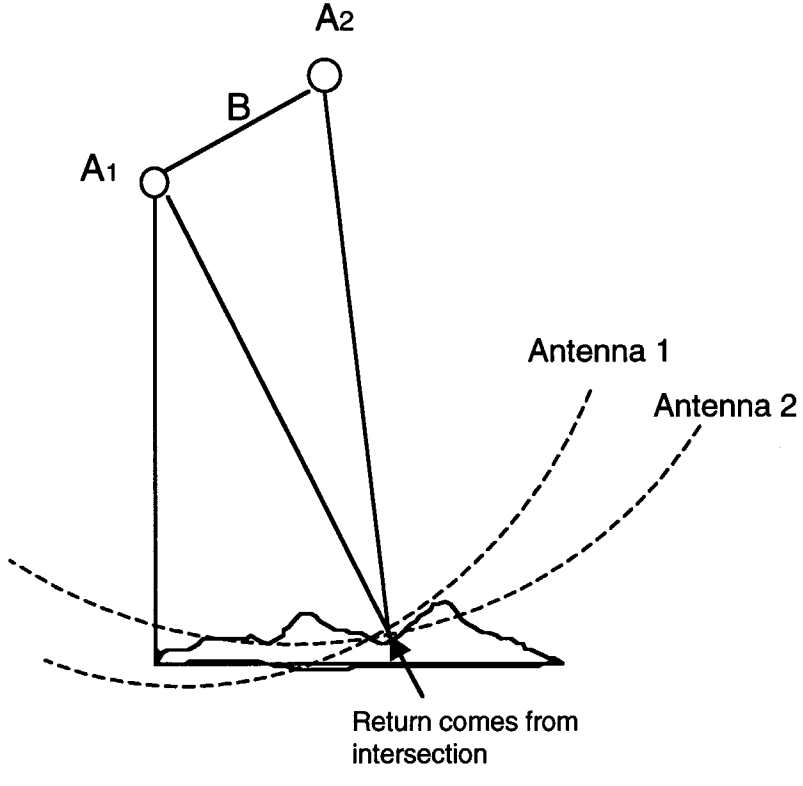
The completed data set will contain more than 180 billion individual elevation measurements, with resolution exceeding best existing global maps by two orders of magnitude.

RADAR INTERFEROMETRY

HOW DOES IT WORK?



SINGLE ANTENNA SAR



INTERFEROMETRIC SAR

Interferometry for Topography

Measured phase difference:

$$\phi = -\frac{2\pi}{\lambda}\delta\rho$$

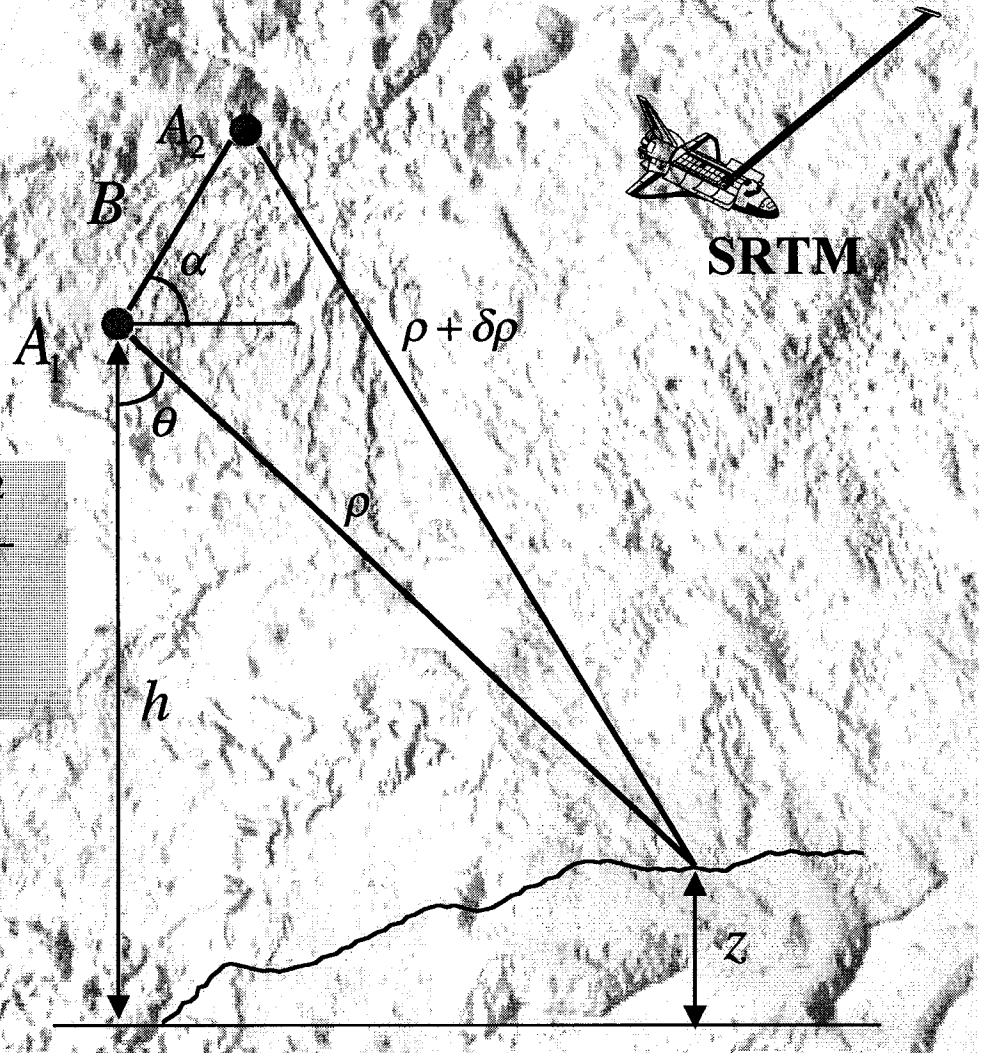
Triangulation:

$$\sin(\theta - \alpha) = \frac{(\rho + \delta\rho)^2 - \rho^2 - B^2}{2\rho B}$$

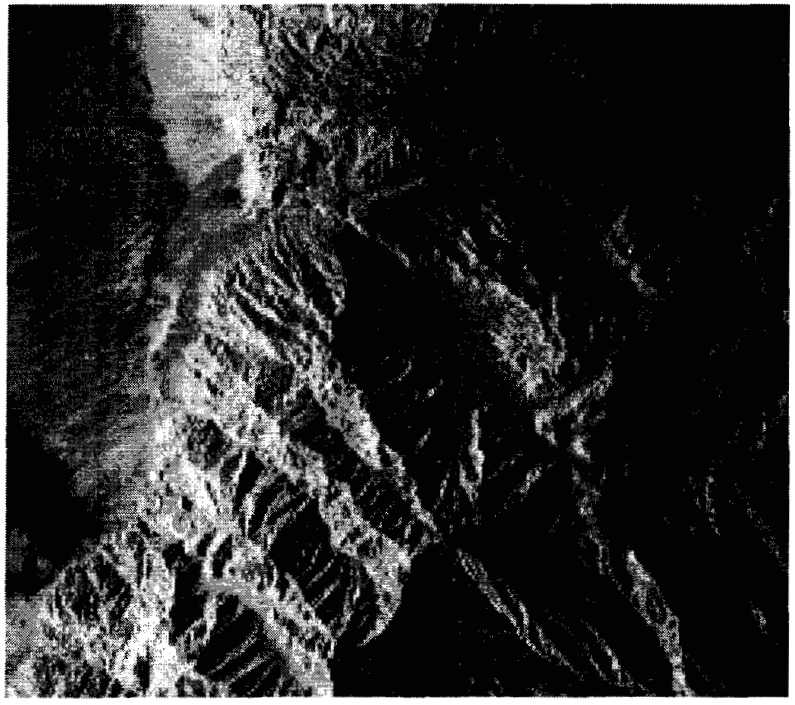
$$z = h - \rho\cos\theta$$

Critical Interferometer Knowledge:

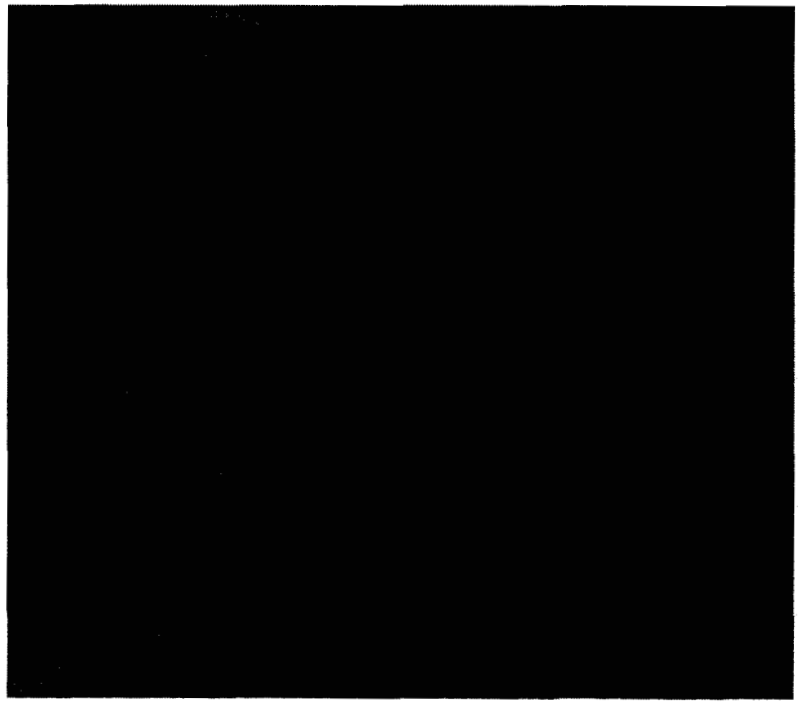
- **Baseline, (B, α) to mm's**
- **System phase differences, to deg's**



Radar Interferometry Example



Standard Radar Image



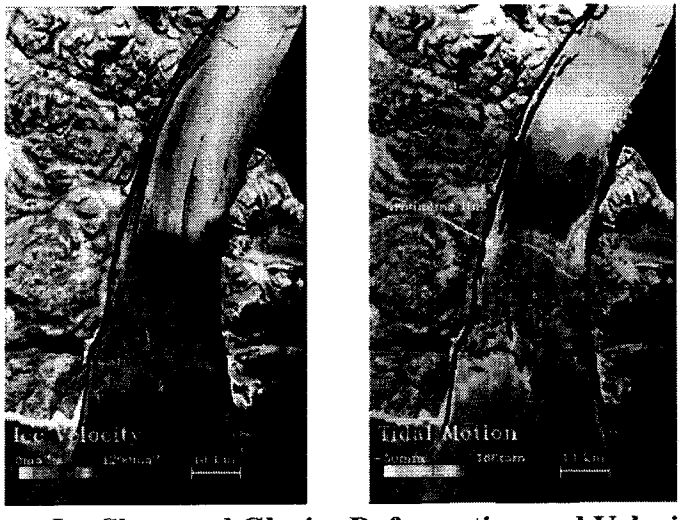
Interference fringes follow the topography

One cycle of color represents 1/2 wavelength of path difference

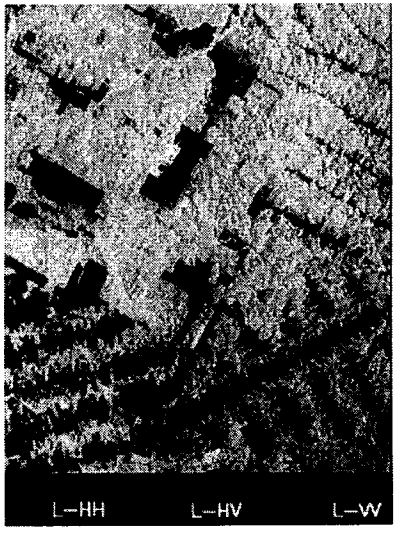
The Role of SAR in Understanding the Earth System and its Response to Natural and Human-Induced Changes

Improved Prediction of:

Climate



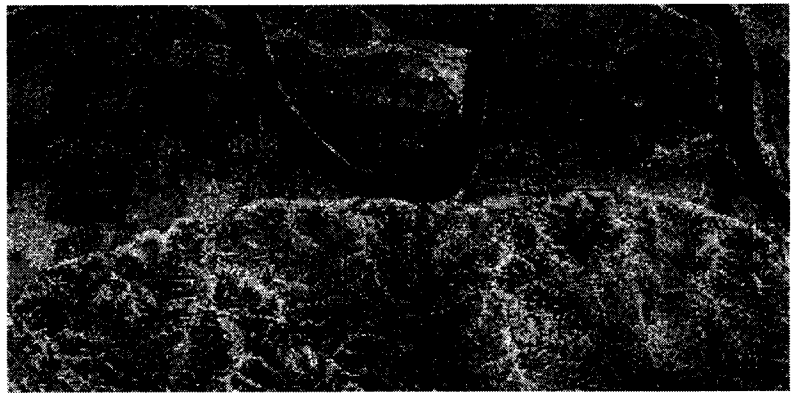
-Ice Sheet and Glacier Deformation and Velocity
-Vegetation Type and Changes in Freeze/Thaw
-Forest Regrowth



and Natural Hazards

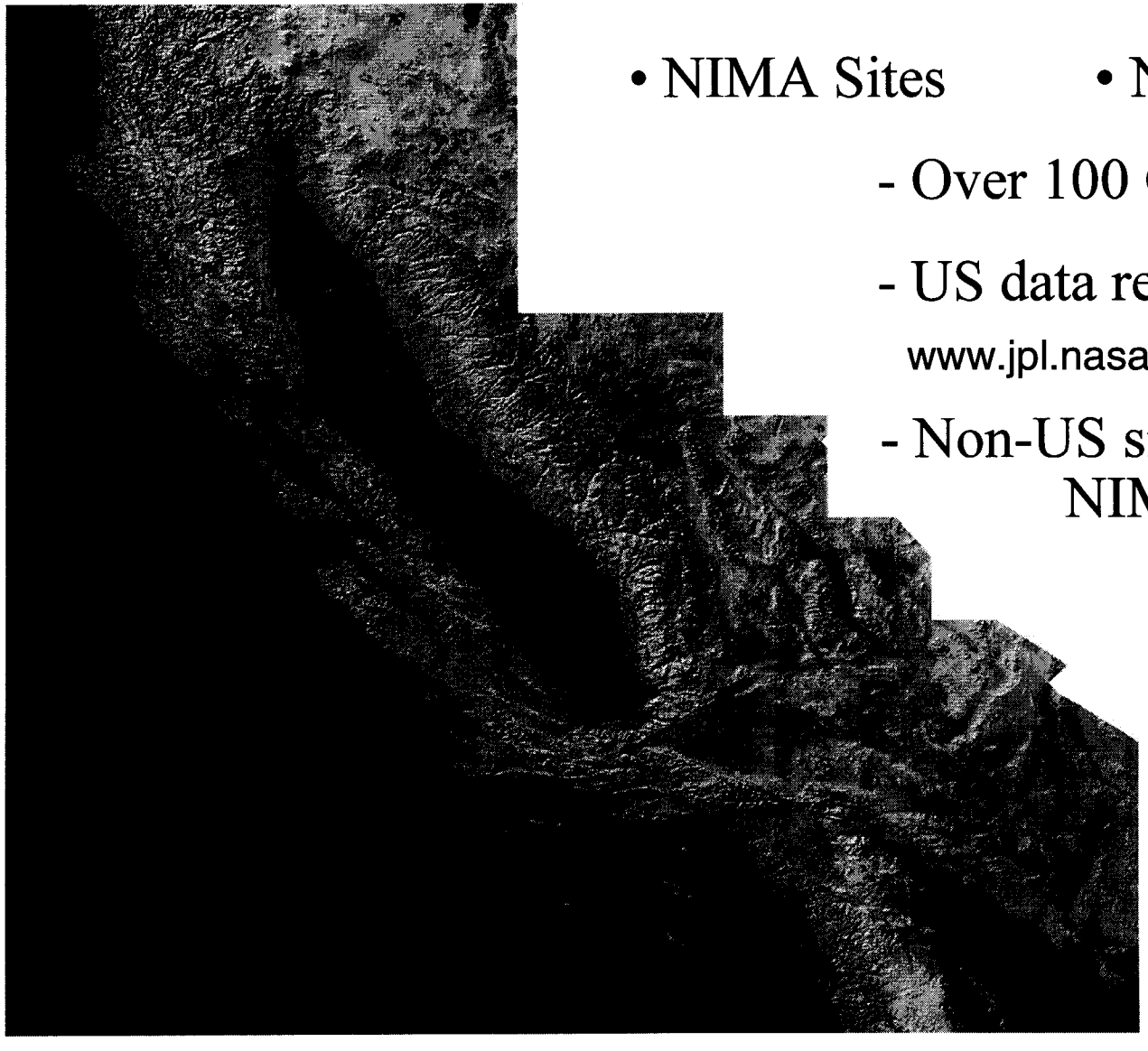
Weather

-Coastal Winds and Rain Cells
-Snow Extent and Water Equivalent
-Sea Ice Motion and Extent
-Soil Wetness



-Flood Characterization
-Landslide Risk Assessment
-Earthquake and Volcanic Risk Assessment

Pre-production Sample Data Sets

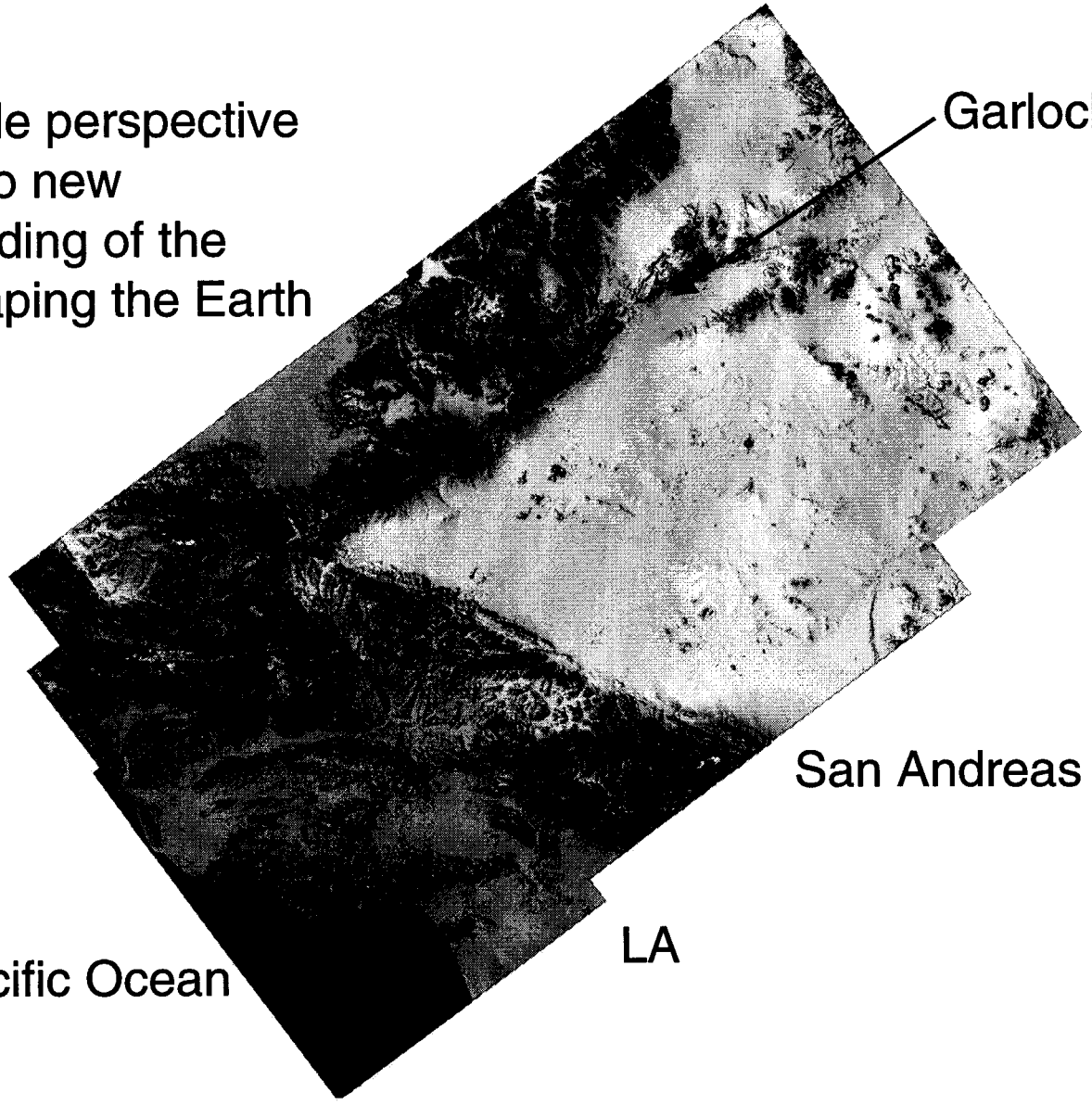


- NIMA Sites
- NASA PI Sites
  - Over 100 GB processed
  - US data released to public
    www.jpl.nasa.gov/srtm/pub_dist.htm
  - Non-US sites awaiting NIMA approval

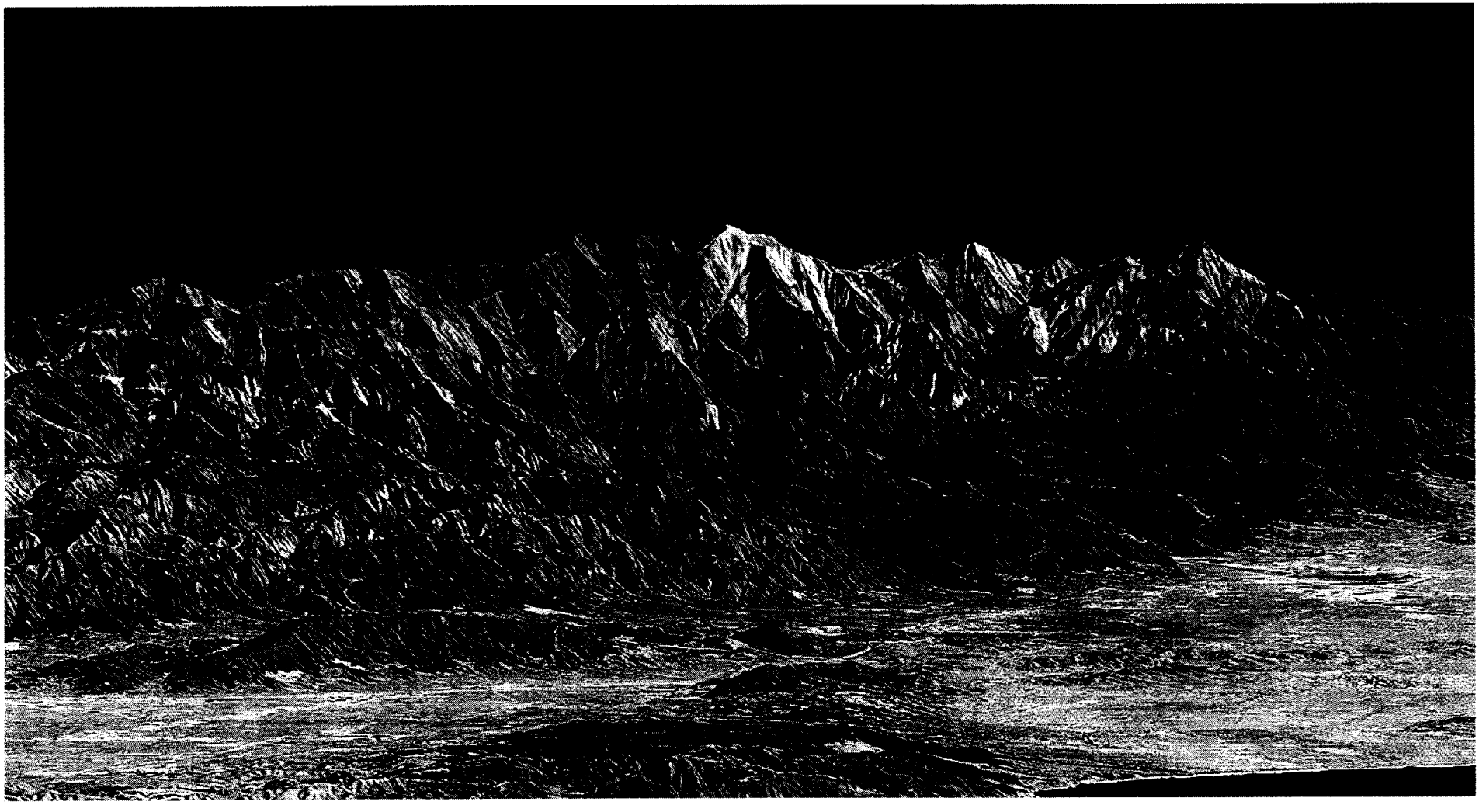
Mosaic of 64 SRTM Cells (1.6 GB) Covering California

SRTM Views California

Large scale perspective can lead to new understanding of the forces shaping the Earth

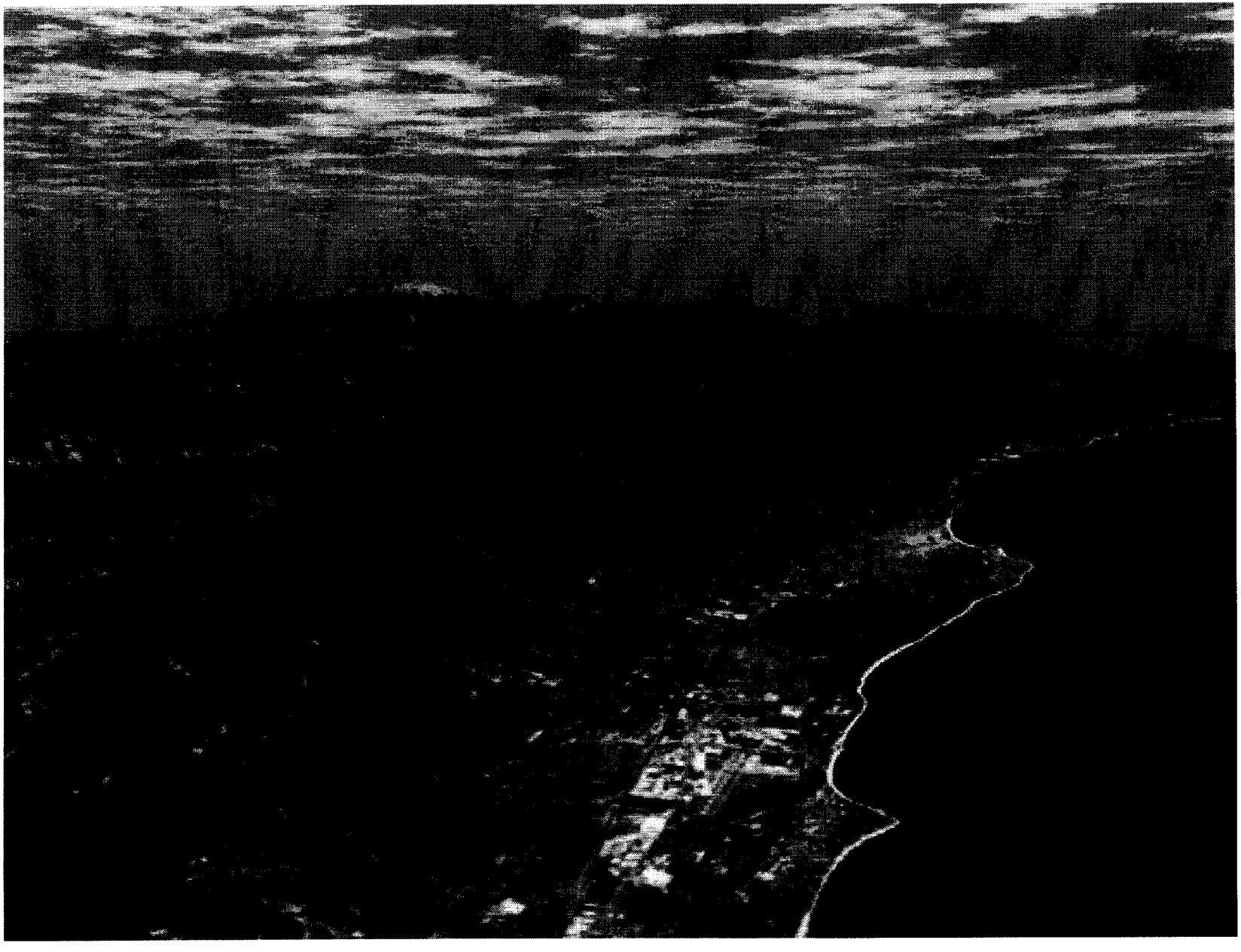


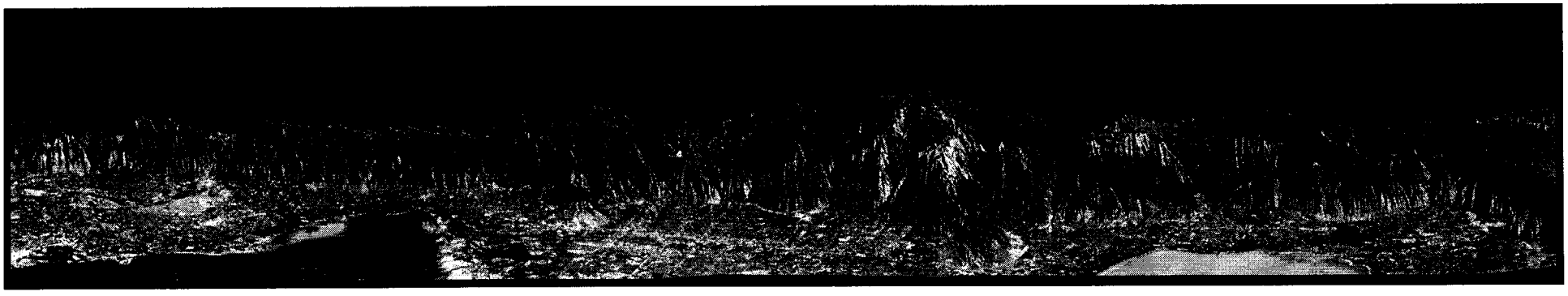
Los Angeles and the San Gabriel Mountains
Landsat overlaid on SRTM digital topography



Kamchatka: Computer-generated scene using Landsat and SRTM

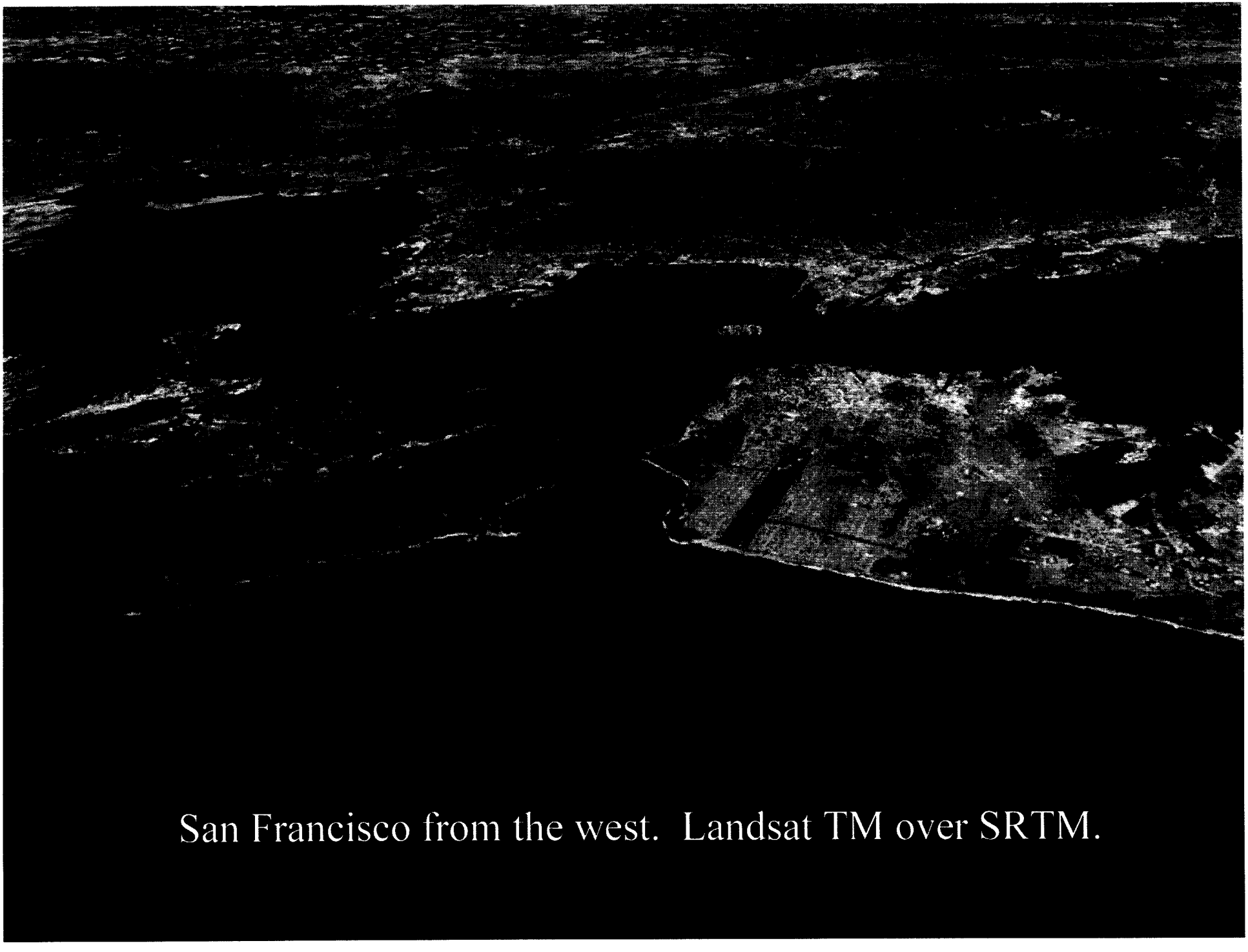
Santa Barbara, California: Landsat and SRTM





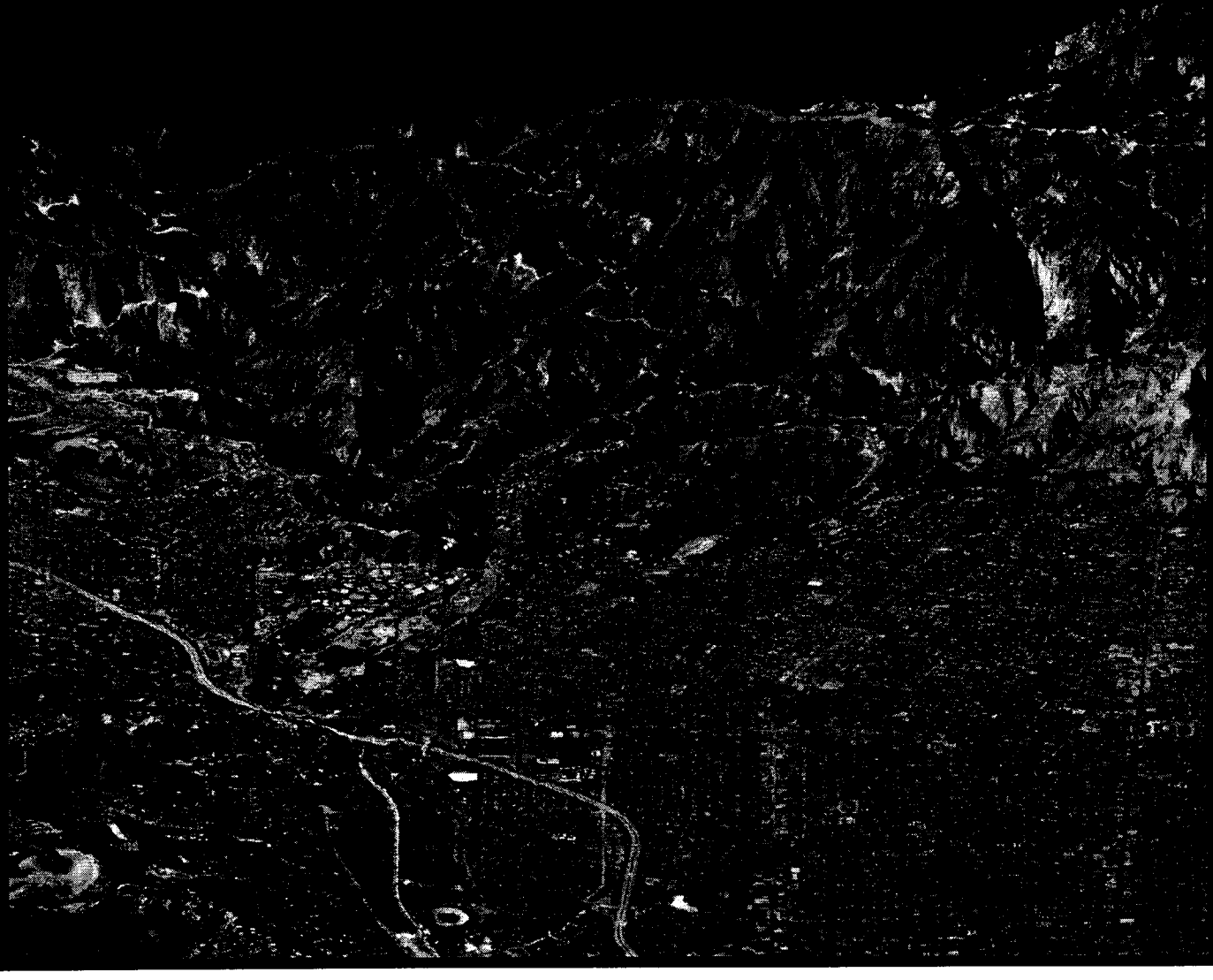
Salt Lake City from the west (above) and from the south.

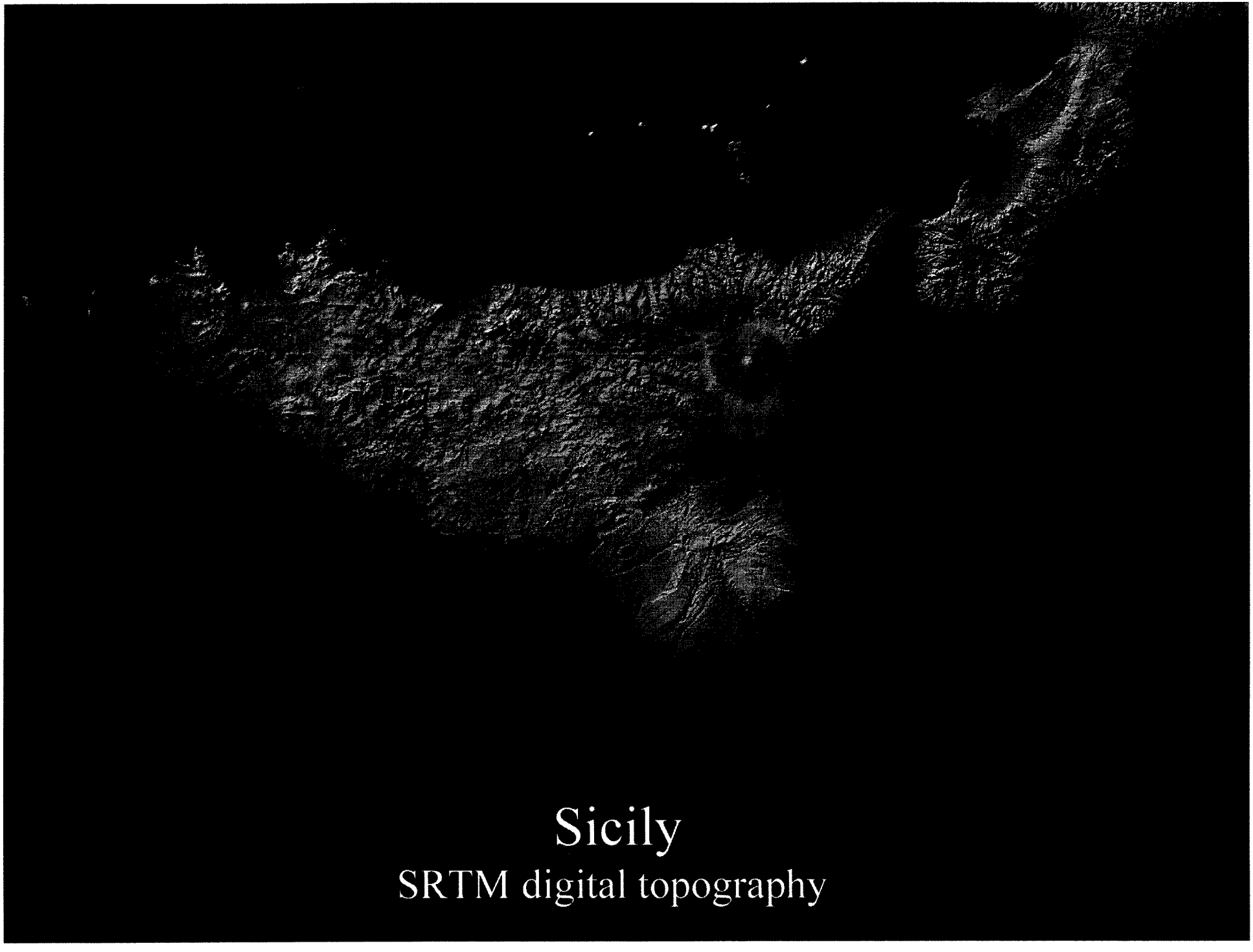
Landsat TM over SRTM digital topography



San Francisco from the west. Landsat TM over SRTM.

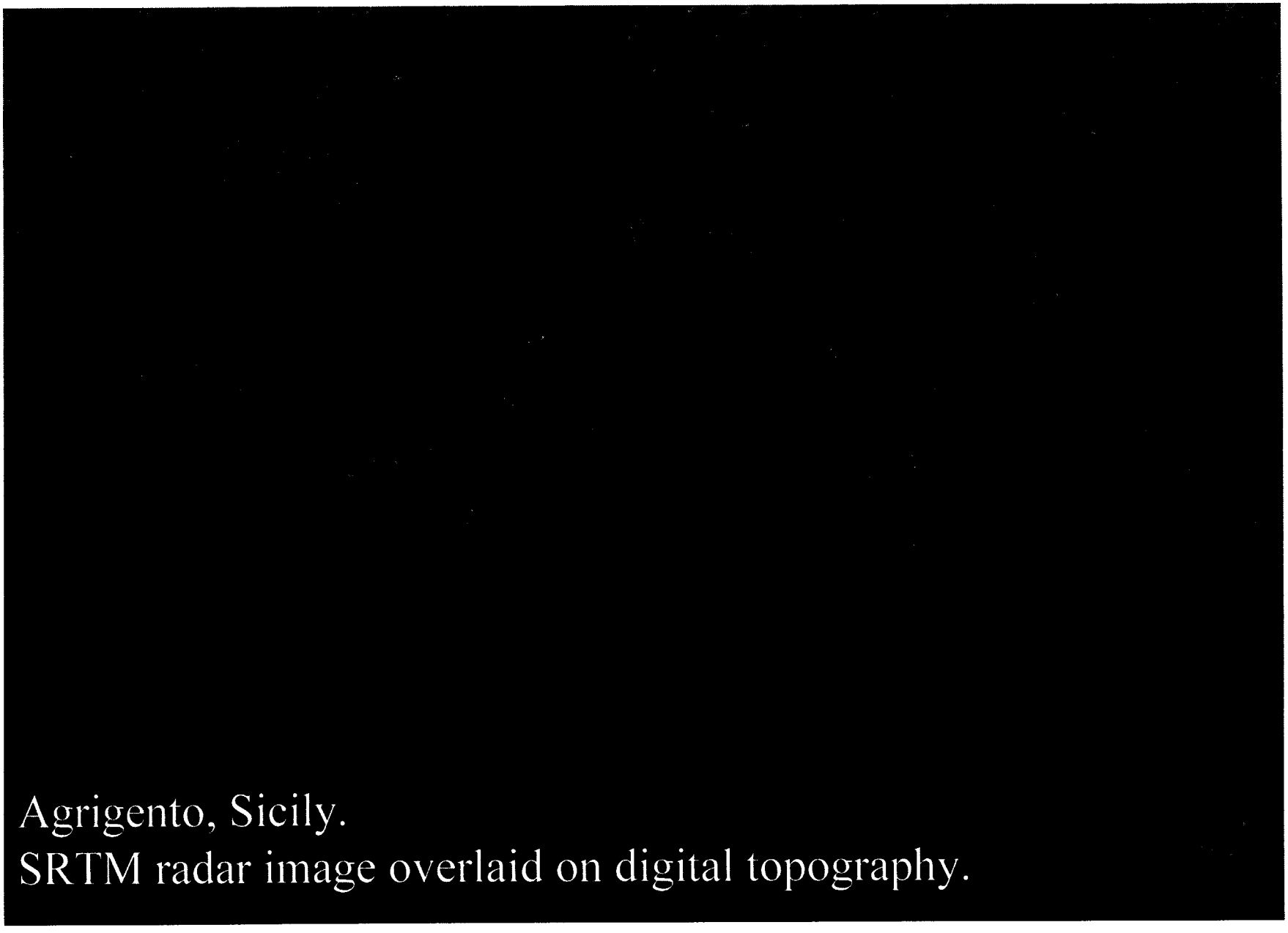
JPL and the San Gabriel Mountains:
Airphotograph overlaid on SRTM digital topography



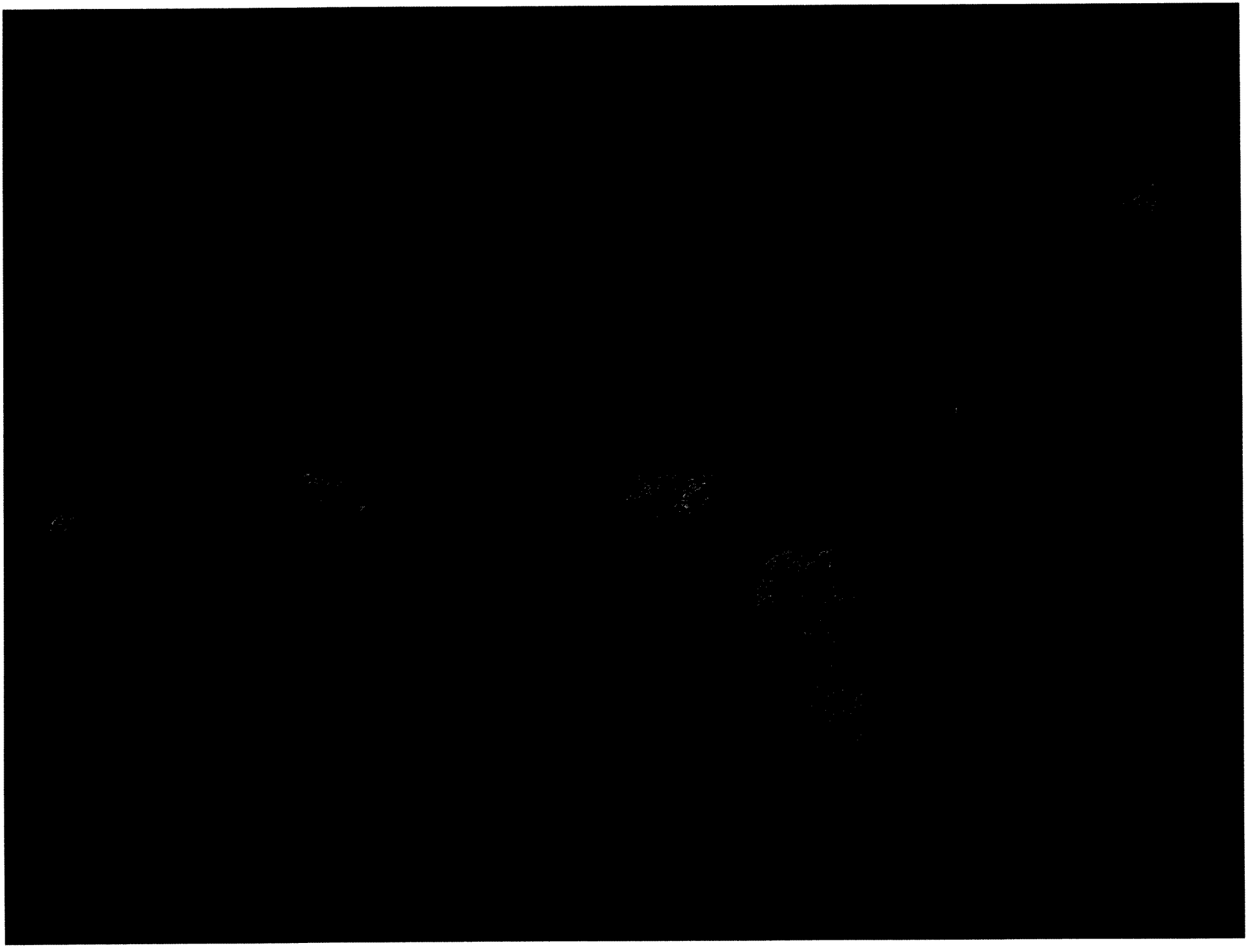


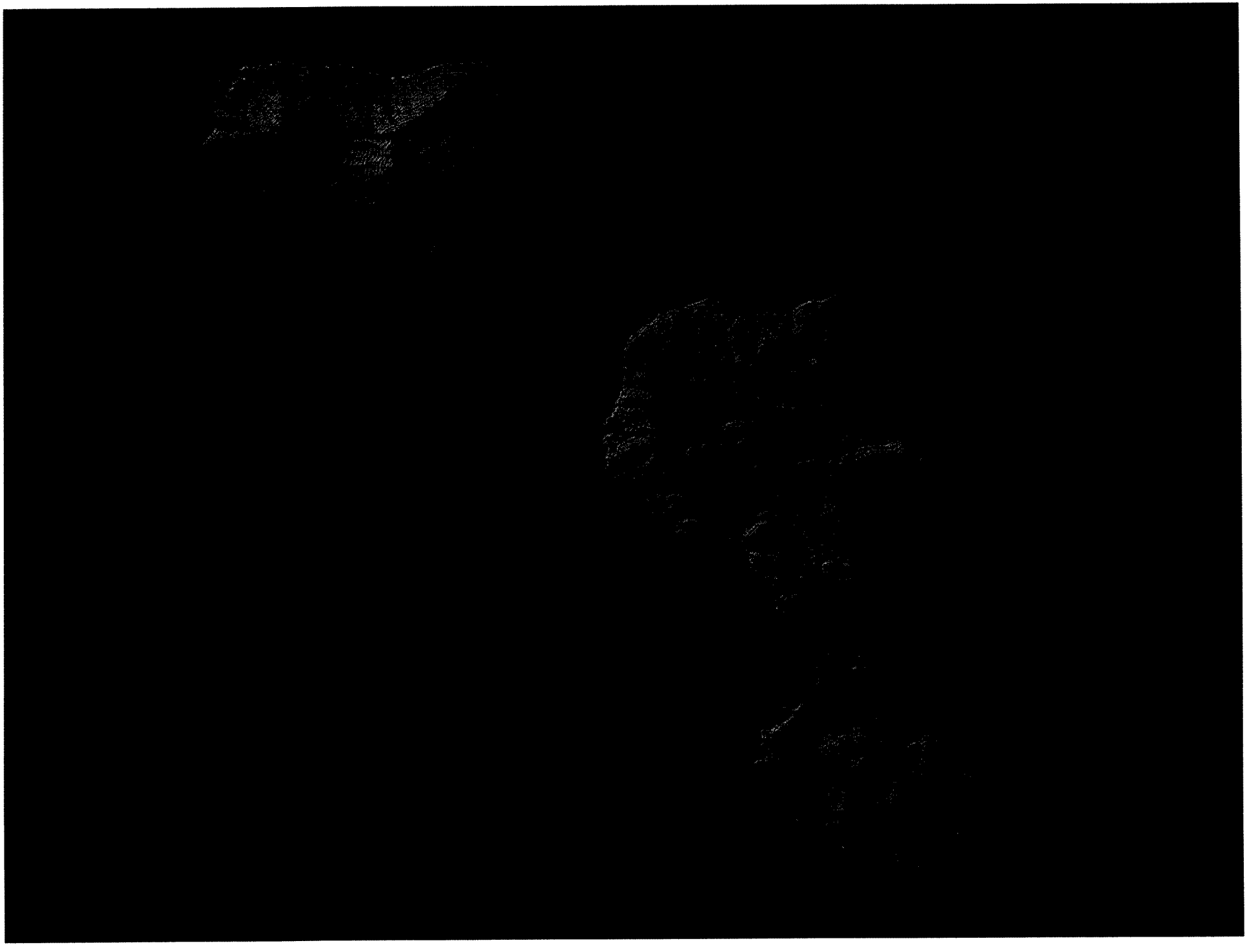
Sicily

SRTM digital topography

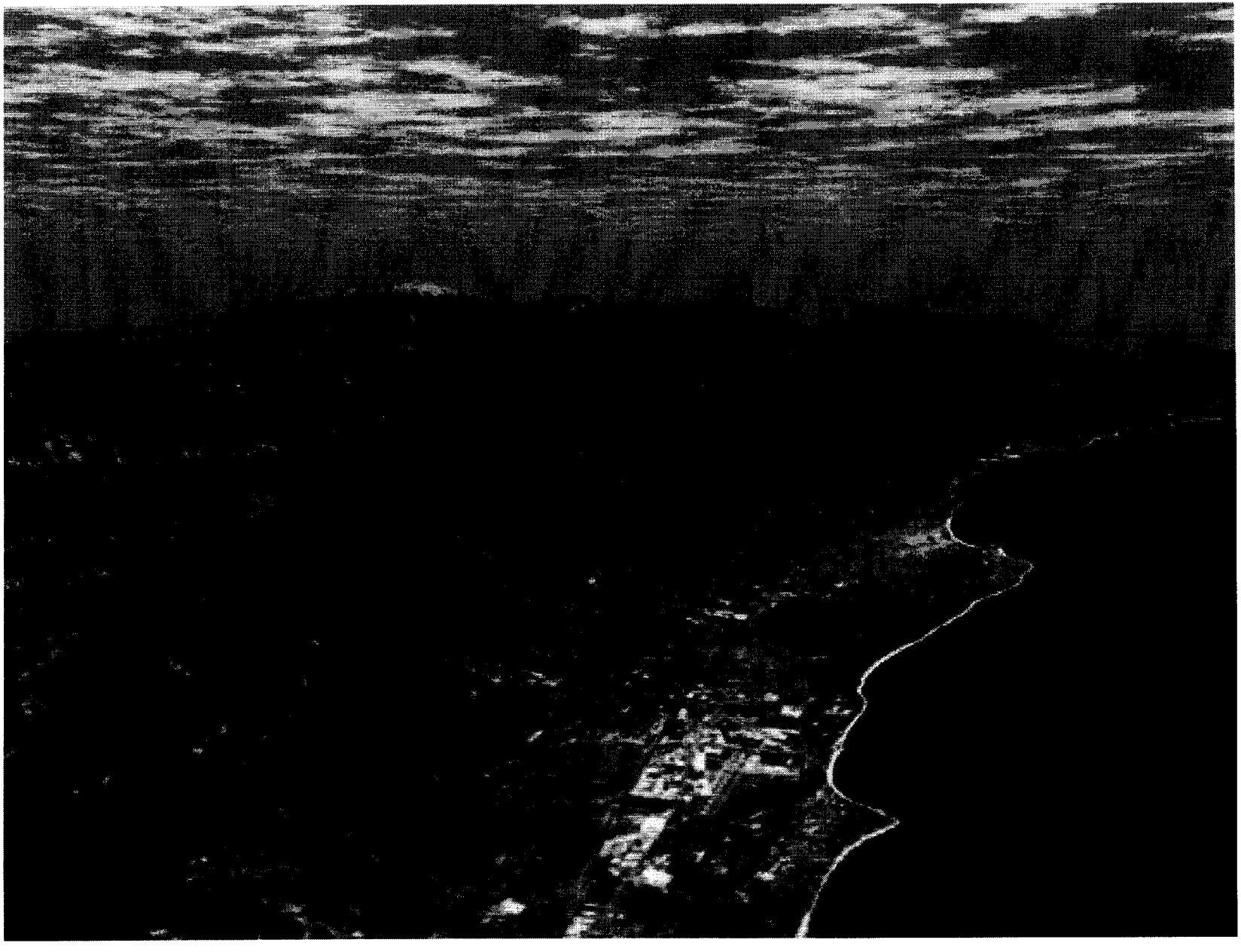


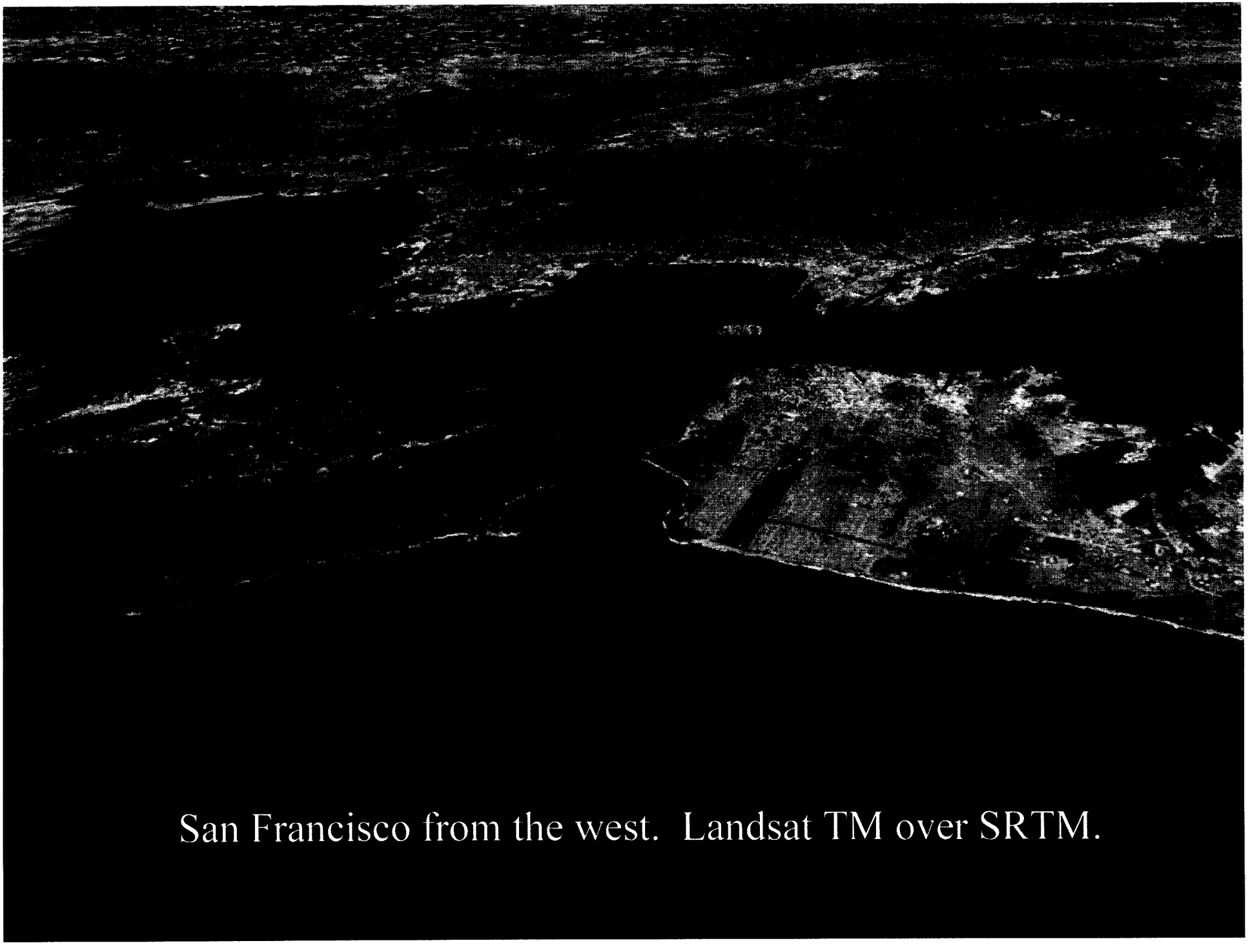
Agrigento, Sicily.
SRTM radar image overlaid on digital topography.





Santa Barbara, California: Landsat and SRTM





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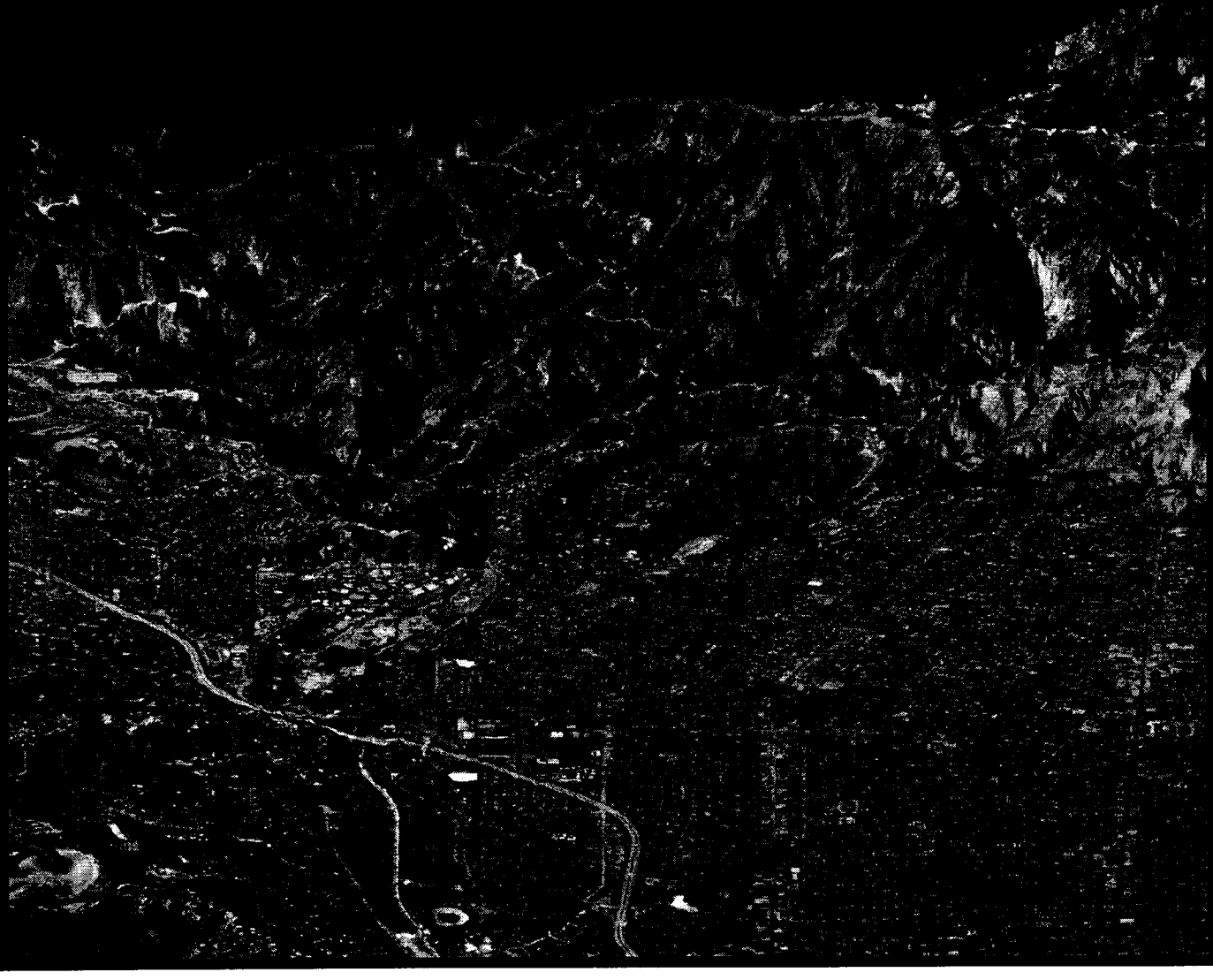
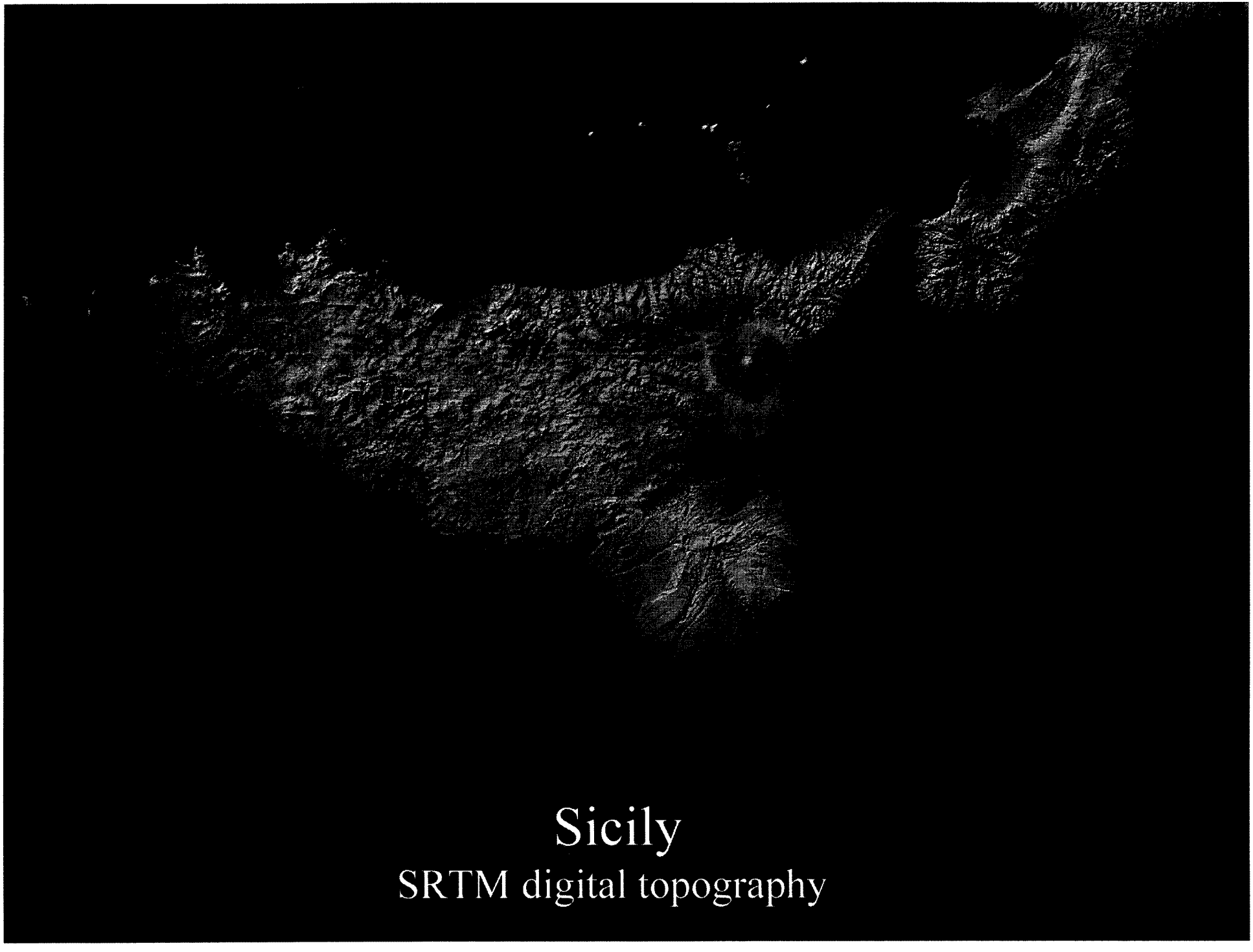
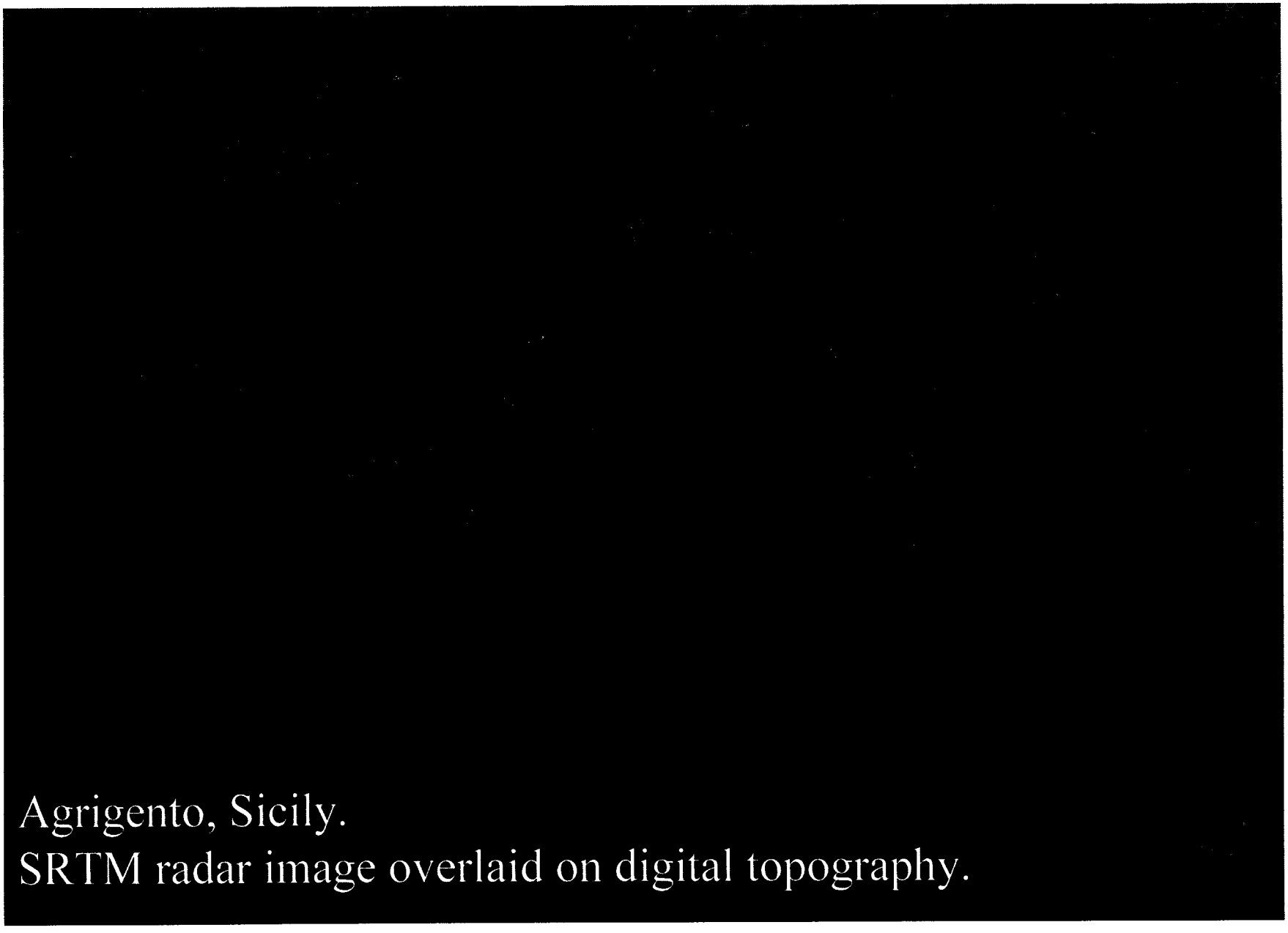




Sicily

SRTM digital topography



Agrigento, Sicily.
SRTM radar image overlaid on digital topography.