The IMAA satellite direct readout station: twenty years of research activity
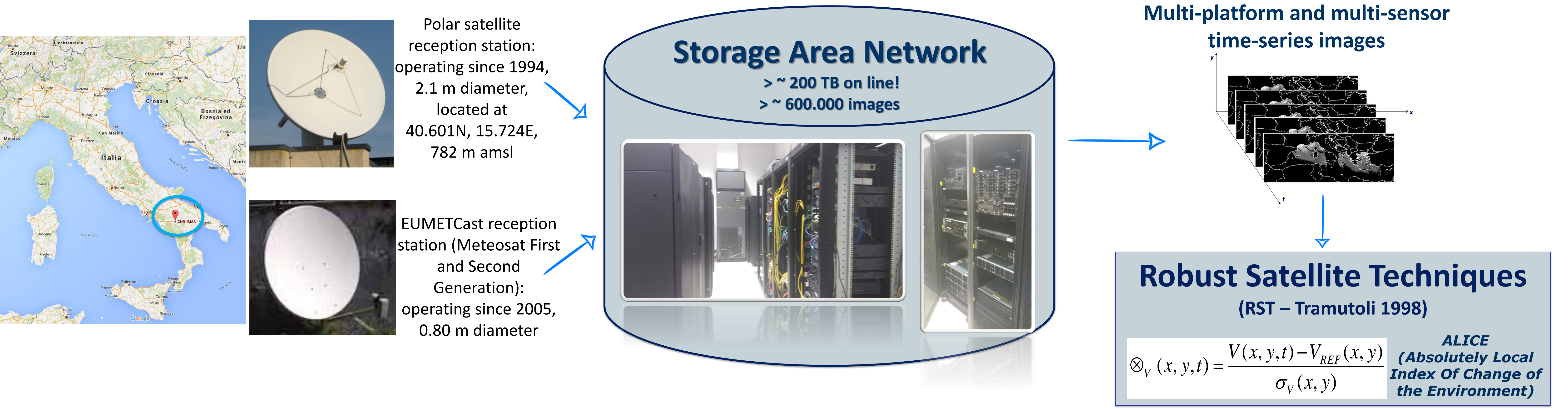
T. Lacava[(1)]*, E. Ciancia[(2)], I. Coviello[(2)], C. Di Polito[(2)], N. Genzano[(2)], A. Falconieri[(1)], M. Faruolo[(1)], C. Filizzola[(1)], F. Marchese[(1)], G. Mazzeo[(1)], M. Lisi [(2)], R. Paciello[(1)], N. Pergola[(1)], C. Pietrapertosa[(1)], V. Satriano[(2)], V. Tramutoli[(2)]

1) IMAA-CNR (Institute of Methodologies for Environmental Analysis – National Research Council of Italy, Tito Scalo (PZ), Italy
2) University of Basilicata, School of Engineering, Potenza, Italy

Polar satellite reception station: operating since 1994, 2.1 m diameter, located at 40.601N, 15.724E, 782 m amsl

EUMETCast reception station (Meteosat First and Second Generation): operating since 2005, 0.80 m diameter

Storage Area Network
> ~ 200 TB on line!
> ~ 600.000 images

Multi-platform and multi-sensor time-series images

Robust Satellite Techniques
(RST – Tramutoli 1998)

$$\otimes_V (x, y, t) = \frac{V(x, y, t) - V_{REF}(x, y)}{\sigma_V(x, y)}$$

ALICE
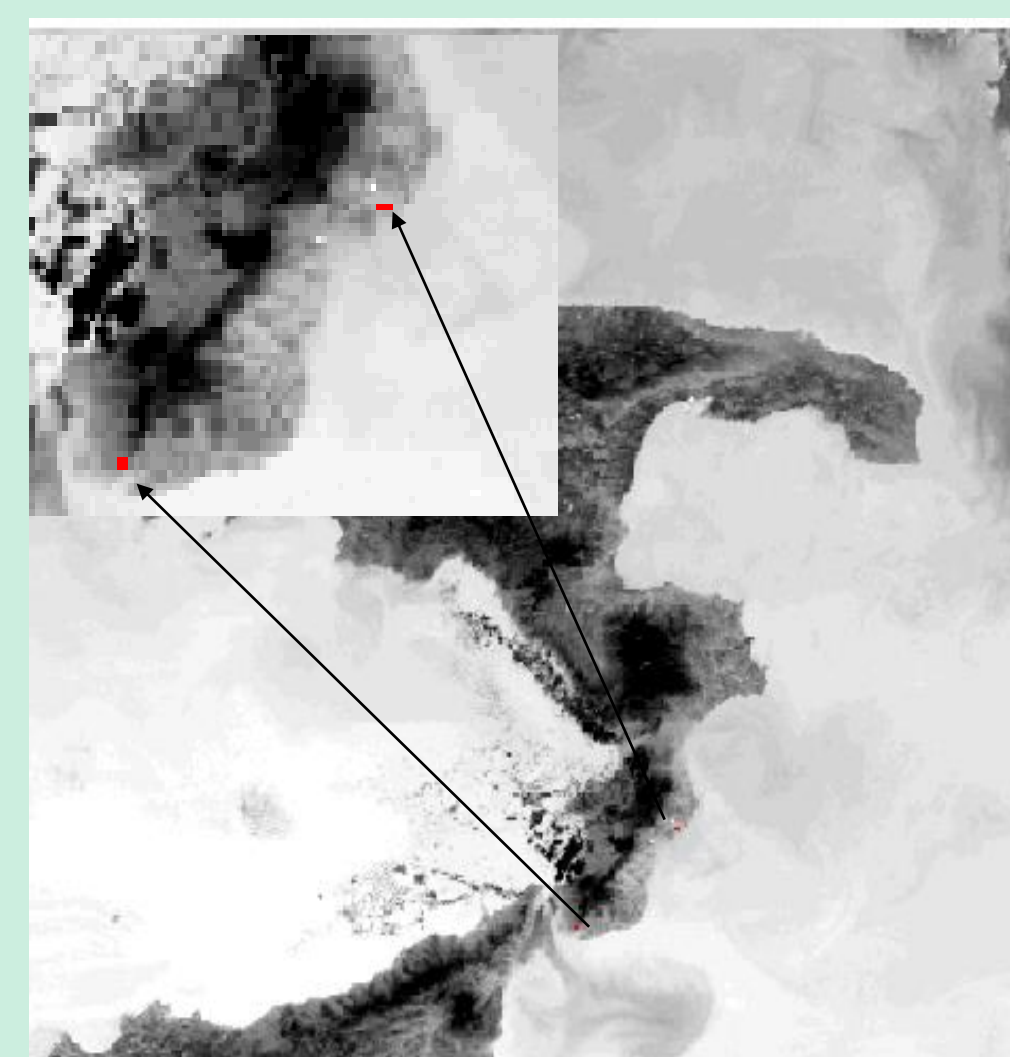(Absolutely Local Index Of Change of the Environment)

The direct readout satellite receiving and archiving system of the Institute of Methodologies for Environmental Analysis (IMAA) has been working since 1994. Located in Tito Scalo (Basilicata Region, Southern Italy), it started collecting TIROS-N/NOAA 9 data by a 2.1 m diameter antenna; after that, thanks also to a constant updating program, the system has been operational up to now almost without any interruption. The whole NOAA constellation satellites as well as data acquired by the EOS-NASA, Met-Op, FengYun, and the Suomi NPP satellite/s have been directly acquired. Furthermore, the installation of a EUMETCast reception station in 2005 has allowed us to manage Meteosat First and Second Generation data.

All the acquired data are archived, at different processing levels, in a dedicated storage system, which has fostered the development of the Robust Satellite Techniques (RST) approach [8;9], a general methodology for multi-temporal satellite data series analysis. RST has been applied to the analysis of different natural hazards, such as flooding, volcanic eruptions, forest fires, sand storms, etc. Different anthropic risks, such as oil spill, gas flaring, pipeline accidents, have been also investigated. The availability of direct broadcast data has also allowed us the implementation of near-real time services, assessed even in collaboration with end-users.

RST APPLICATIONS

FOREST FIRES [7]
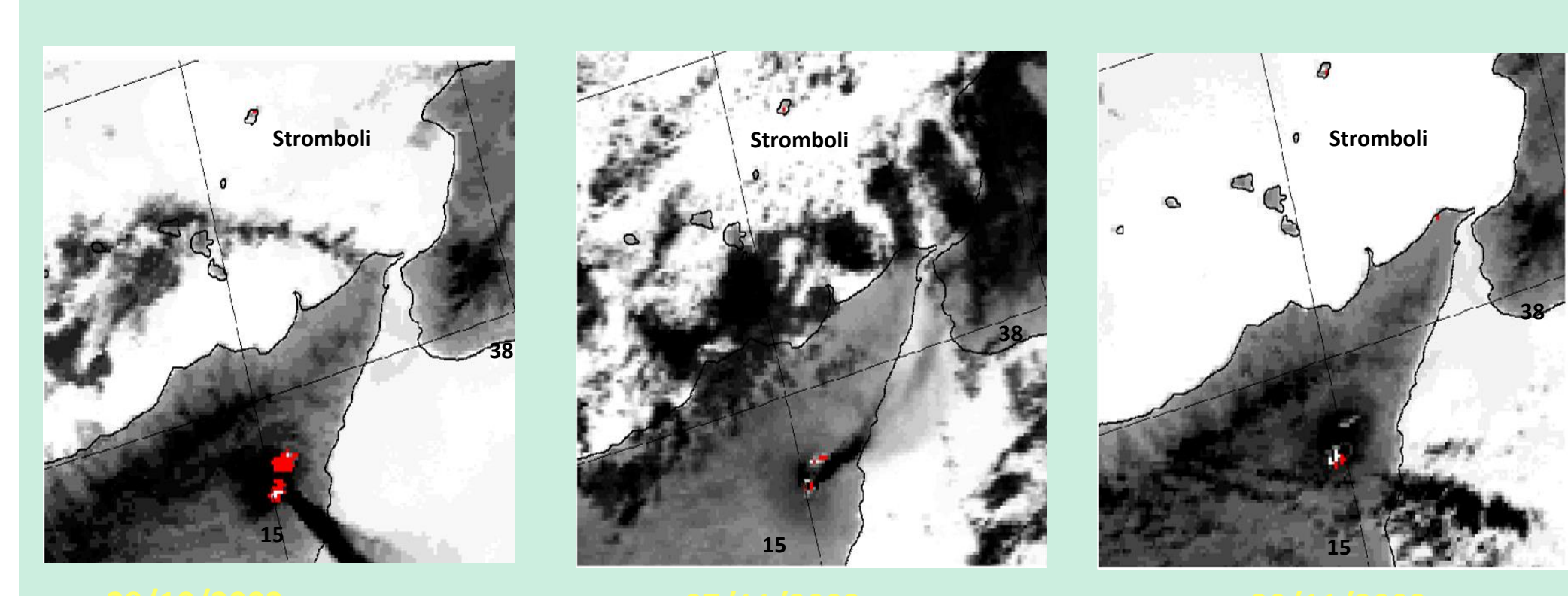
Example: July, 27th 2003 fires in Calabria region

Red pixels indicate hot spots detected by RST in correspondence with forest fires occurred in the Calabria (Southern Italy) Region. Note as no false alarm is present in the image.

■ Forest fires

Applied on:
AVHRR; MODIS; VIIRS
SEVIRI.

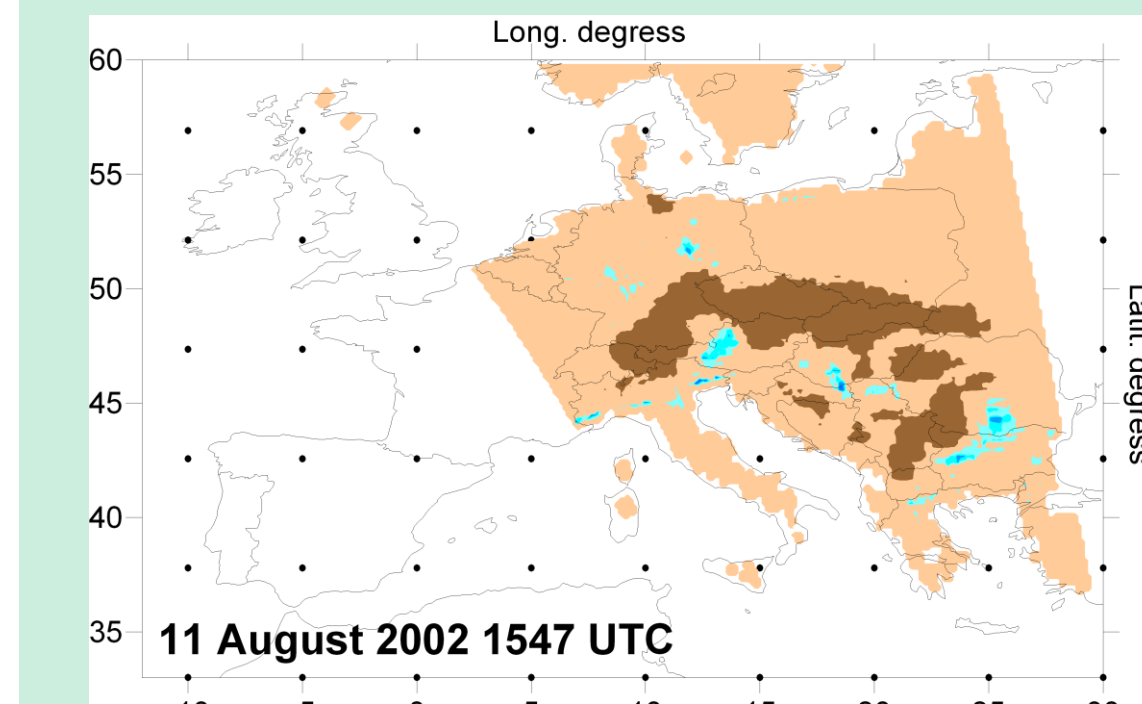### VOLCANIC HOTSPOT [5]

Example: October, 27th 2002 Etna's Eruption

Applied on:
AVHRR; MODIS;
SEVIRI; MTSAT

Stromboli

■ Hotspot

AVHRR automatic detection of hotspot during the last Etna eruption and the first phases of Stromboli Volcano activity. The original algorithm developed at IMAA is highly sensitive and reliable (no false alarm is recognized on all the images), as required by an operational scenario.

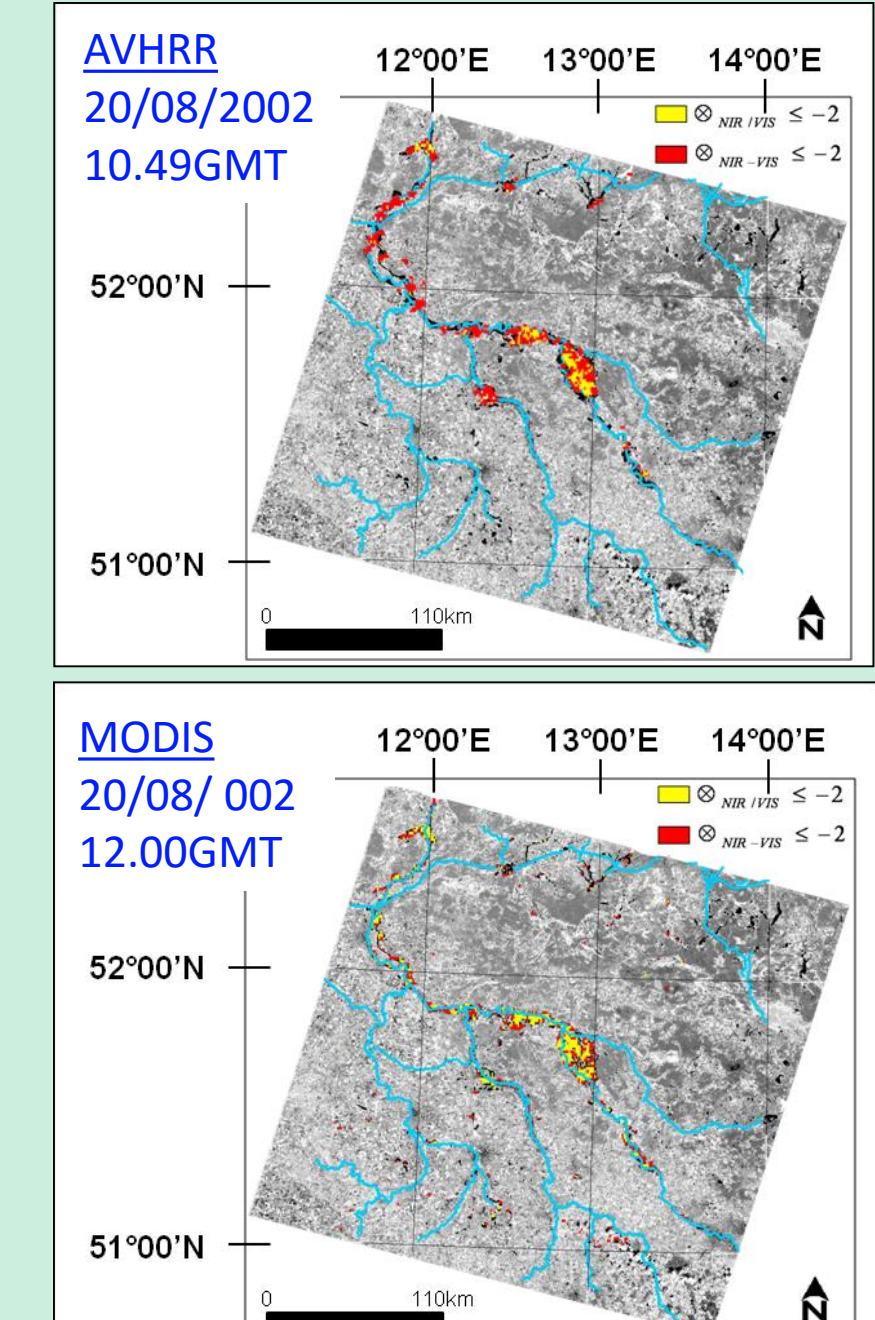### FLOODS [1;3]

Example: August 2002, Central Europe Flood

Long. degress
Lat. degress

11 August 2002 1547 UTC

Swath Area   Raining Clouds
light wet   moder. wet   wet   extremely wet

The integration of microwave (AMSU) and optical band (AVHRR and MODIS) data allowed a full characterization of the event.

Applied on:
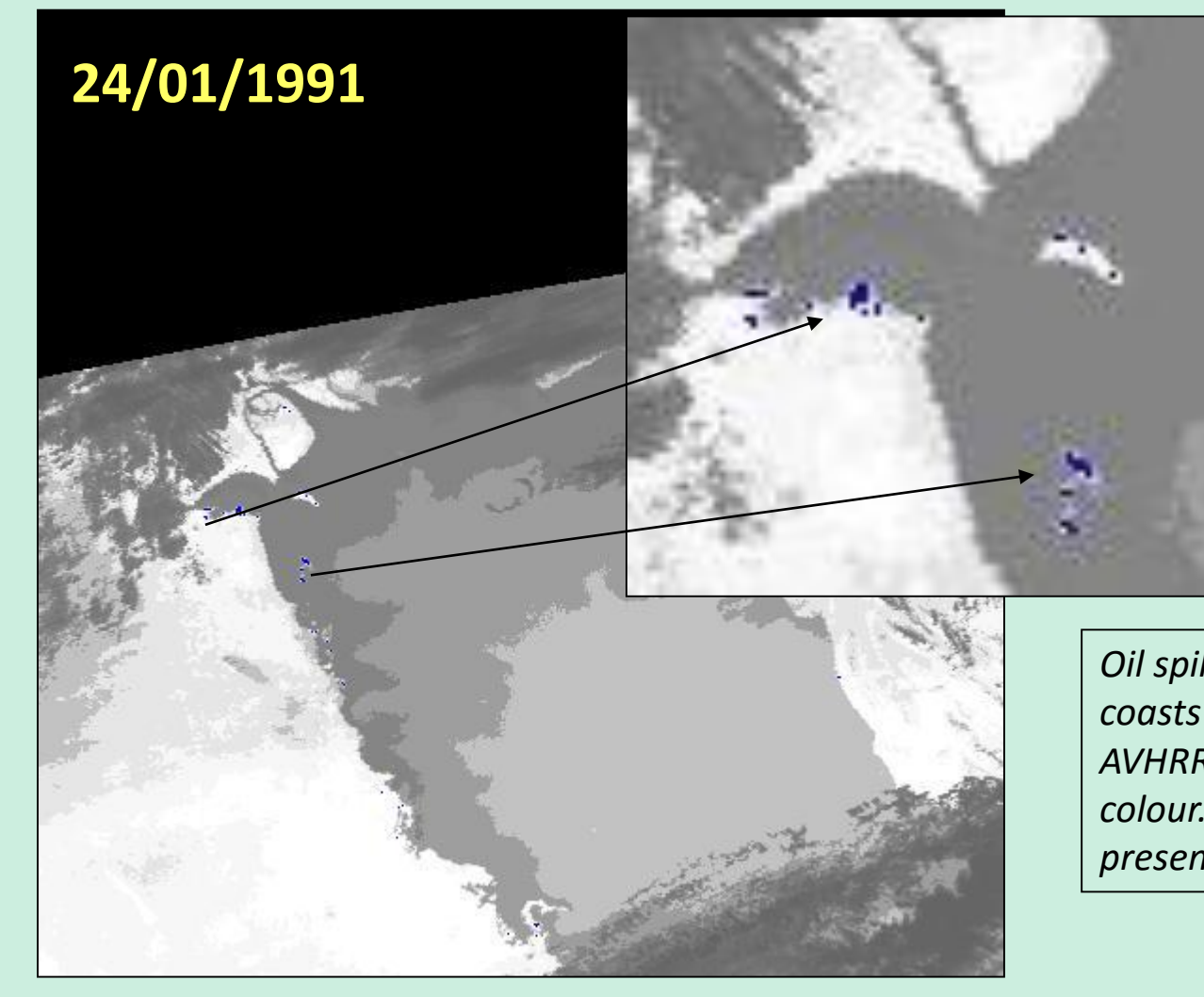AVHRR; MODIS; SEVIRI
AMSU; AMSR-E

AVHRR 20/08/2002 10.49GMT

MODIS 20/08/ 002 12.00GMT

OIL SPILL [2]

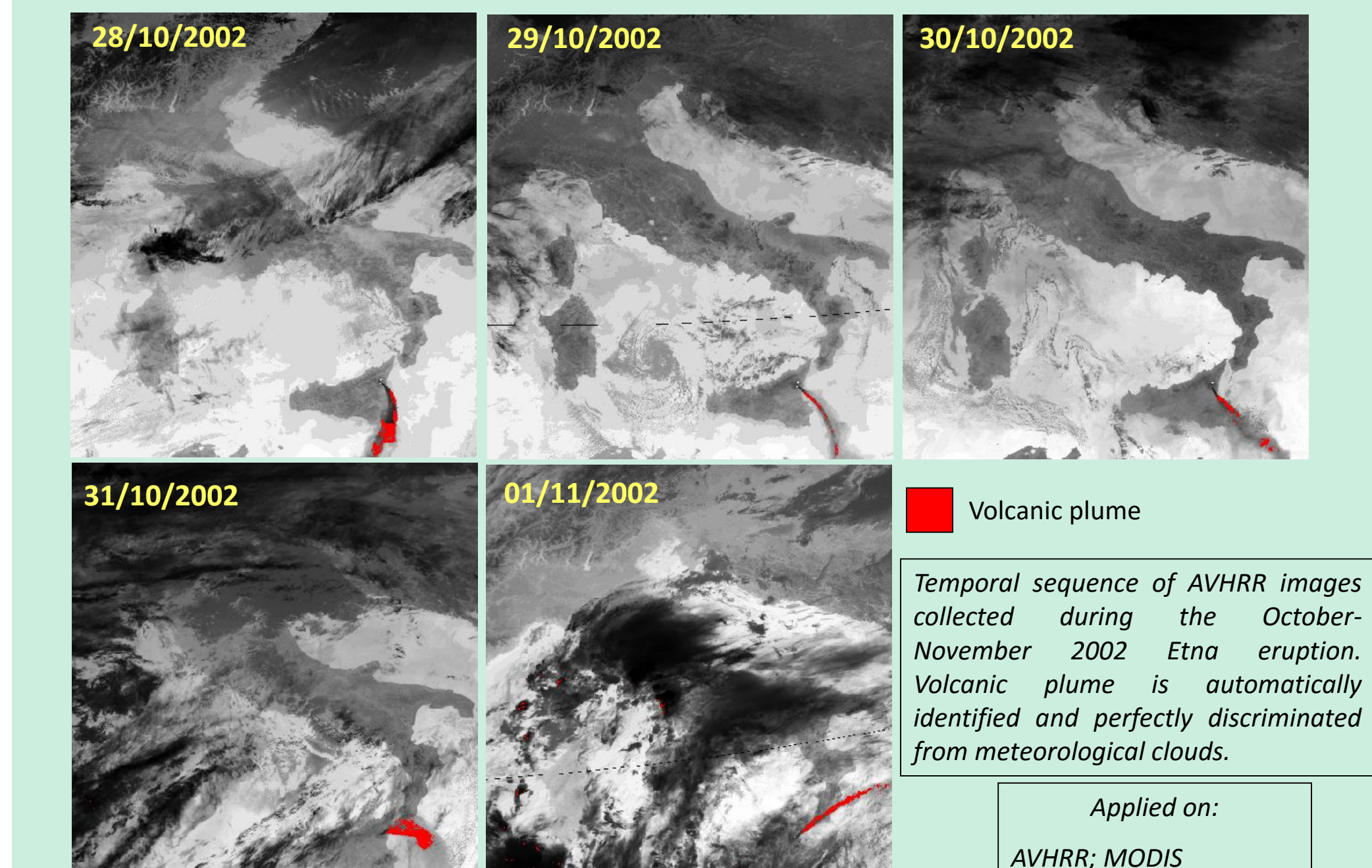Example: January 1991-oil spill near Kuwait-Saudi Arabia coasts

24/01/1991

Applied on:
AVHRR; MODIS
SEVIRI

Oil spills near Kuwait and Saudi Arabia coasts are automatically detected in AVHRR images and depicted in blue colour. Note as no false alarm is present in the image.

■ Oil Spill

ASH CLOUDS DETECTION AND TRACKING [6]

28/10/2002   29/10/2002   30/10/2002
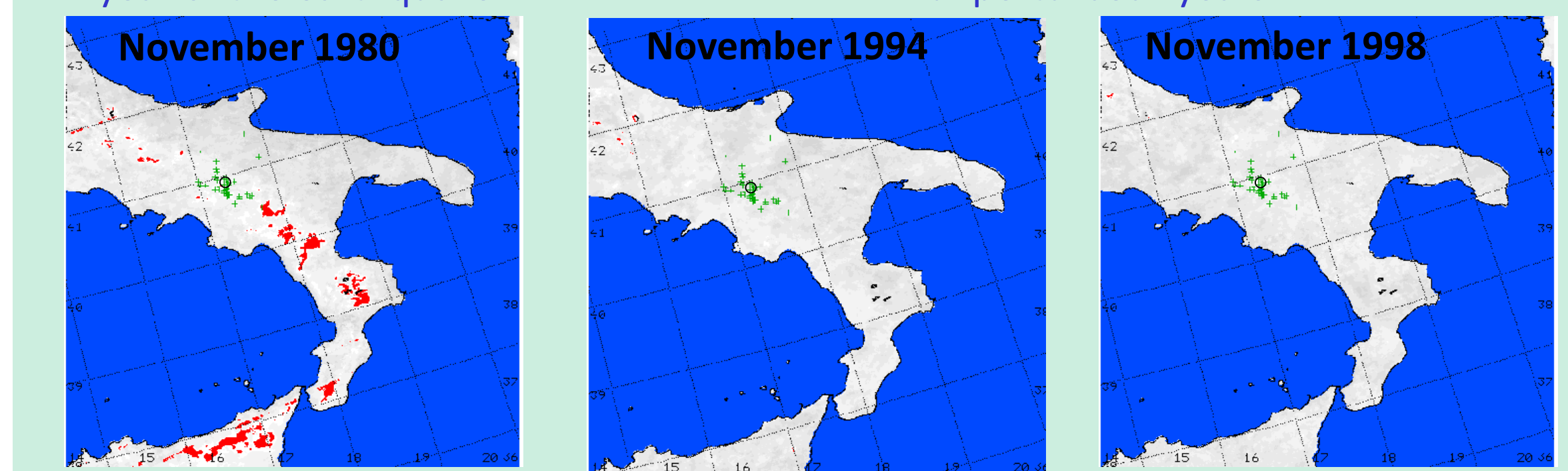31/10/2002   01/11/2002

■ Volcanic plume

Temporal sequence of AVHRR images collected during the October-November 2002 Etna eruption. Volcanic plume is automatically identified and perfectly discriminated from meteorological clouds.

Applied on:
AVHRR; MODIS
SEVIRI, MTSAT

EARTHQUAKES [4]

Example: November, 23rd 1980 Irpinia earthquake

year of the earthquake   "unperturbed" years
November 1980   November 1994   November 1998

■ Thermal anomalies
+ Aftershocks
○ Main shock

Spatial distribution of monthly averaged thermal anomalies over Southern Italy in November 1980, 1994, 1998.
During November 1980 (the year of Irpinia earthquake), thermal anomalies are detected even faraway the epicentral area. No anomaly is detected during unperturbed (no events with $M_s>4$) years.

Applied on:
AVHRR; MODIS
SEVIRI, MTSAT, GOES

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