

OTHER NATURAL HAZARDS

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Forest fires





Via Severiana

Pine forest of Castel Fusano

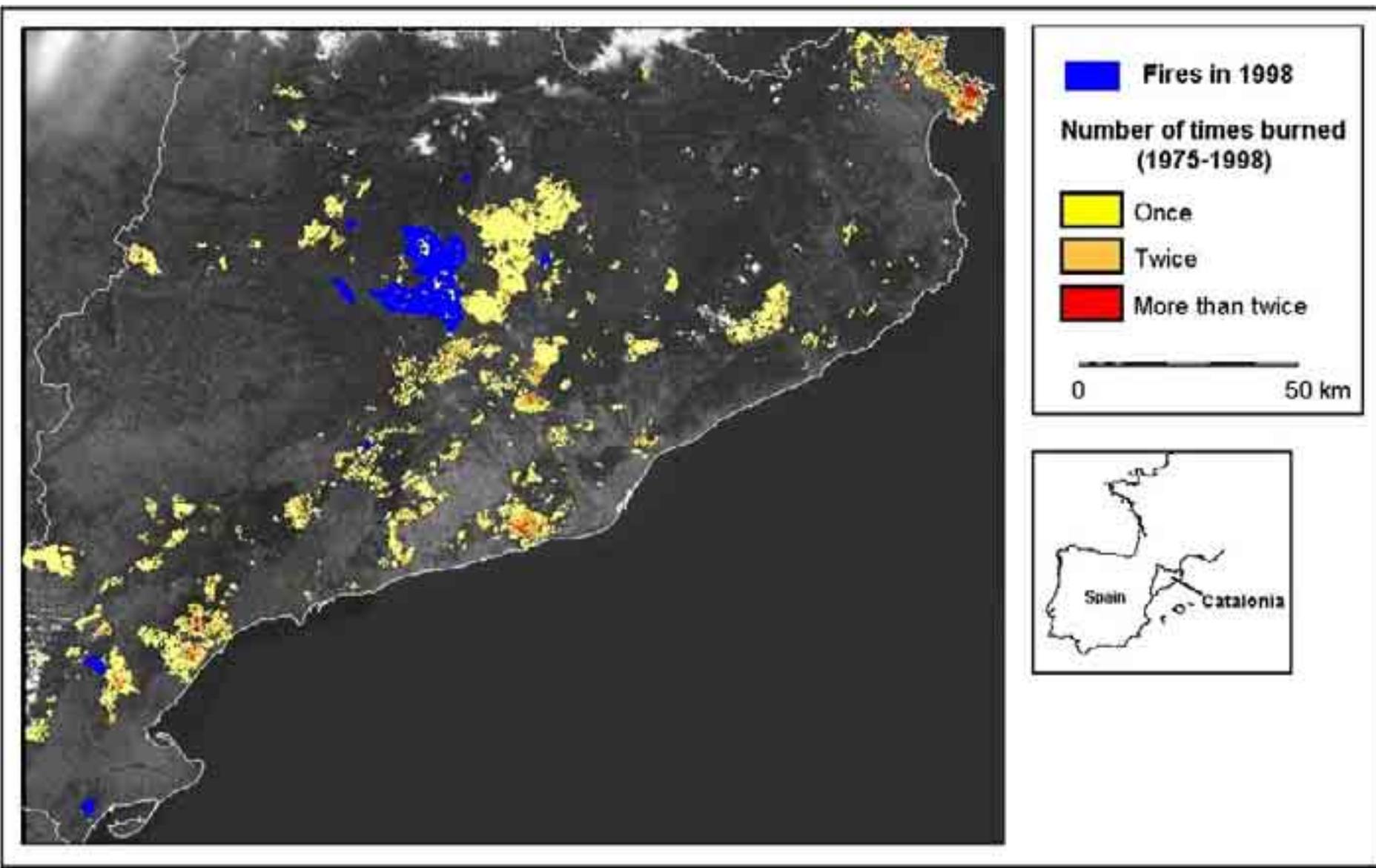


Villa of Pliny. Area not burnt



Fires in Greece during summer 2007

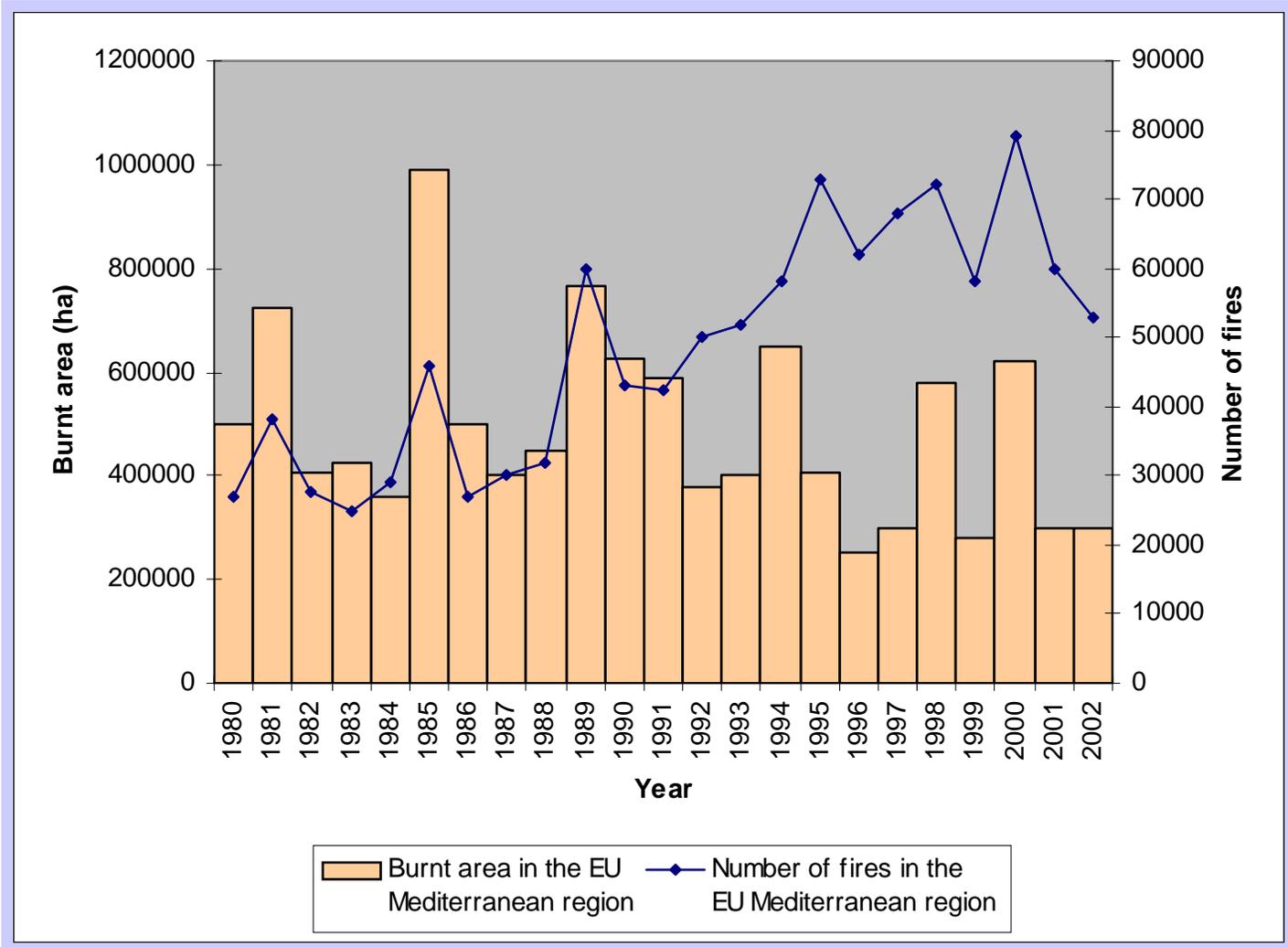


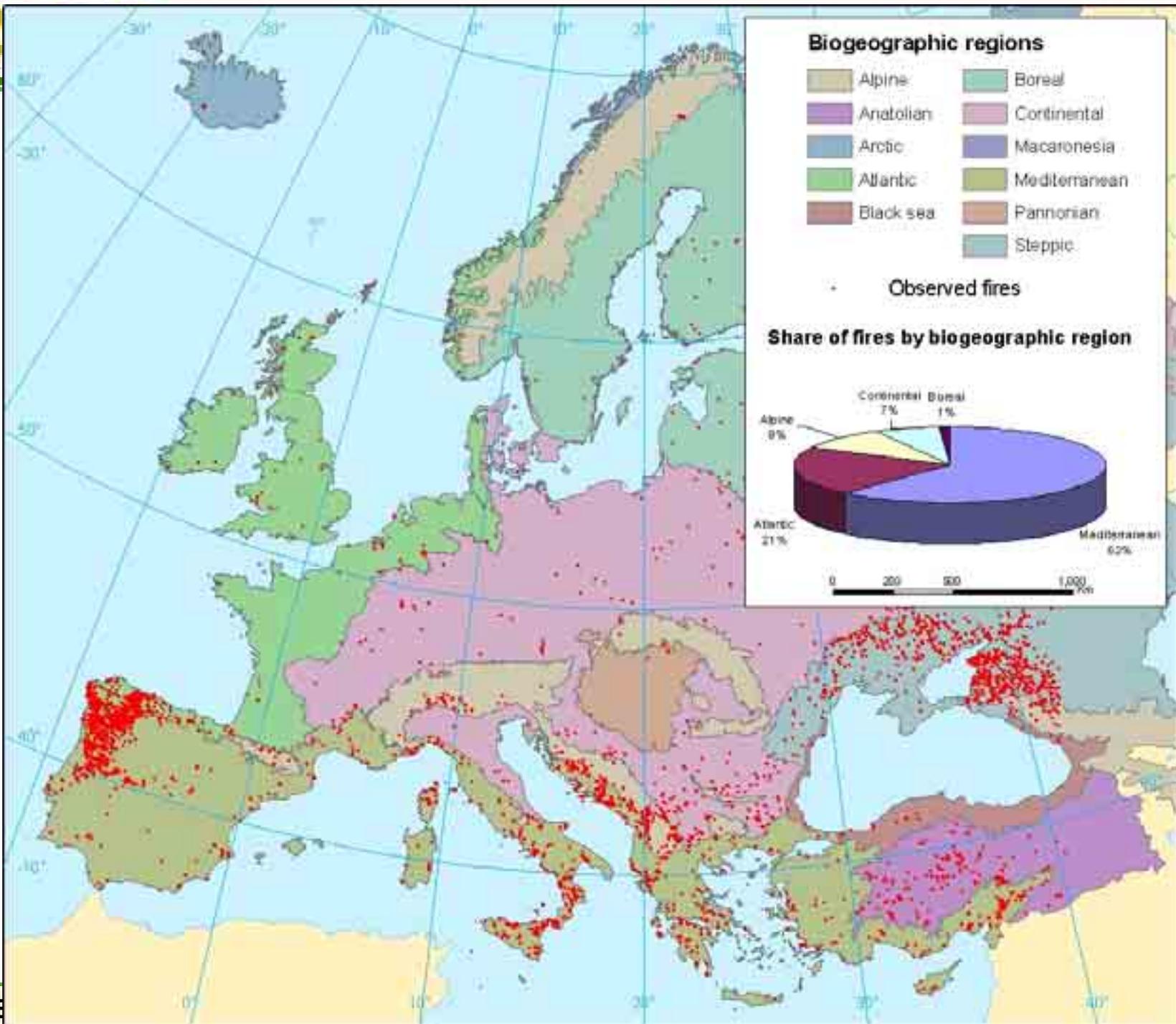


Forest fires

Date of event	Location	Impact
July 1998	Catalonia (Spain)	Ca. 27 000 hectares burnt and 600 people affected.
July 1999	Sardaigne, Calabre, Ligurie (Italy)	More than 32 000 hectares burnt.
Jan-Aug 2000	Galicia, Castilla-León, Catalonia (Spain)	More than 60 000 hectares burnt from 1 January until 20 August.
July 2000	Samos Isl., Corinthia, Achaia (Greece)	About 11 500 hectares burnt, two people killed, 90 homeless.
July 2000	Haskovo, Yambol, Bourgas, Stara Zagora, Plovdiv (Bulgaria)	About 27 000 hectares burnt, seven people killed, 17 injured, 150 homeless.
August 2000	Split, Metkovic, Omis (Croatia)	About 20 000 hectares burnt, one person killed.
August 2000	FYR of Macedonia	About 16 000 hectares burnt.
September 2001	Northern and central Portugal	More than 40 000 hectares burnt.

Number of fires and burnt surfaces from 1980 to 2002 in the 5 Mediterranean countries of EC (France, Portugal, Spain, Italy, Greece)

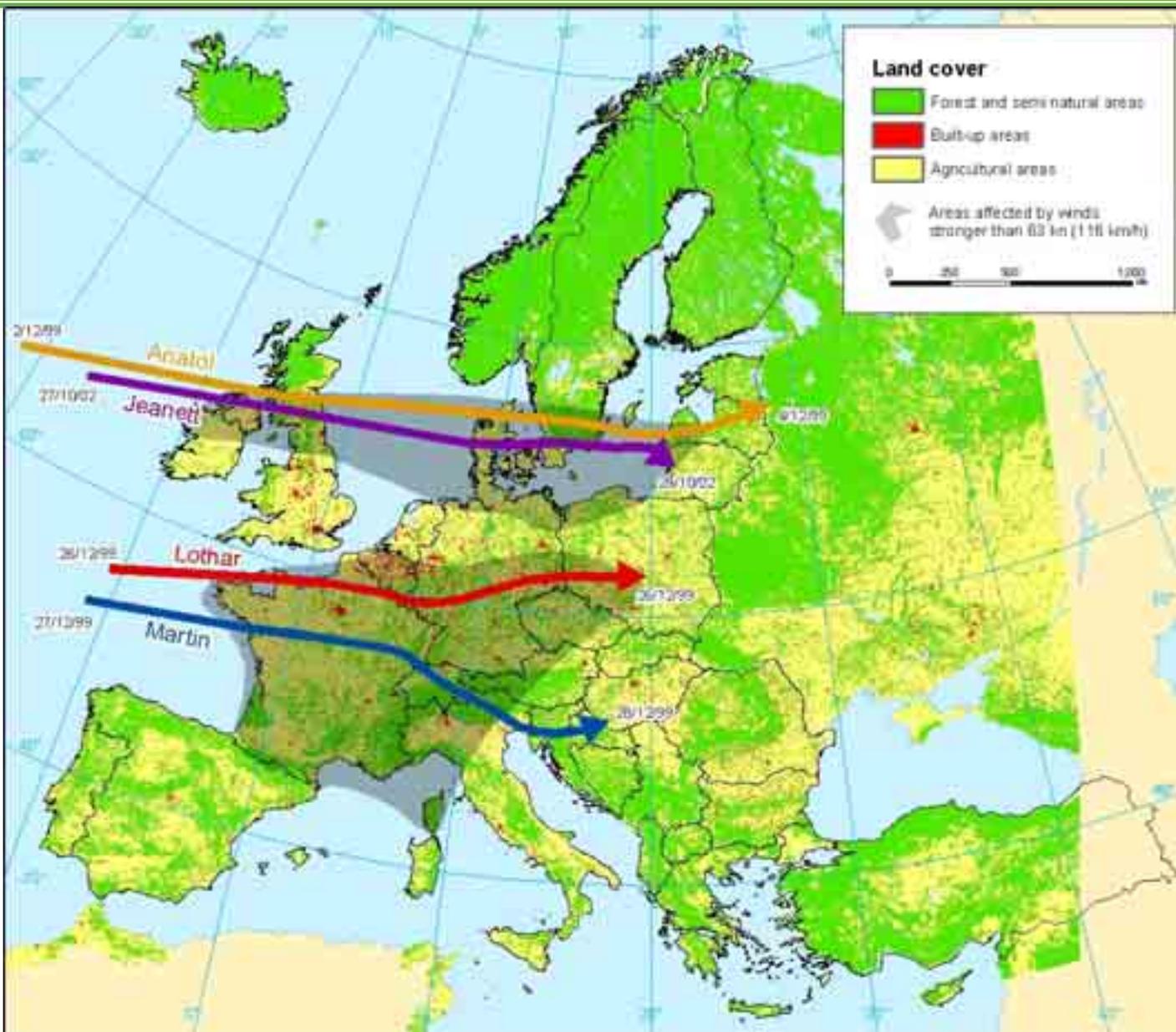


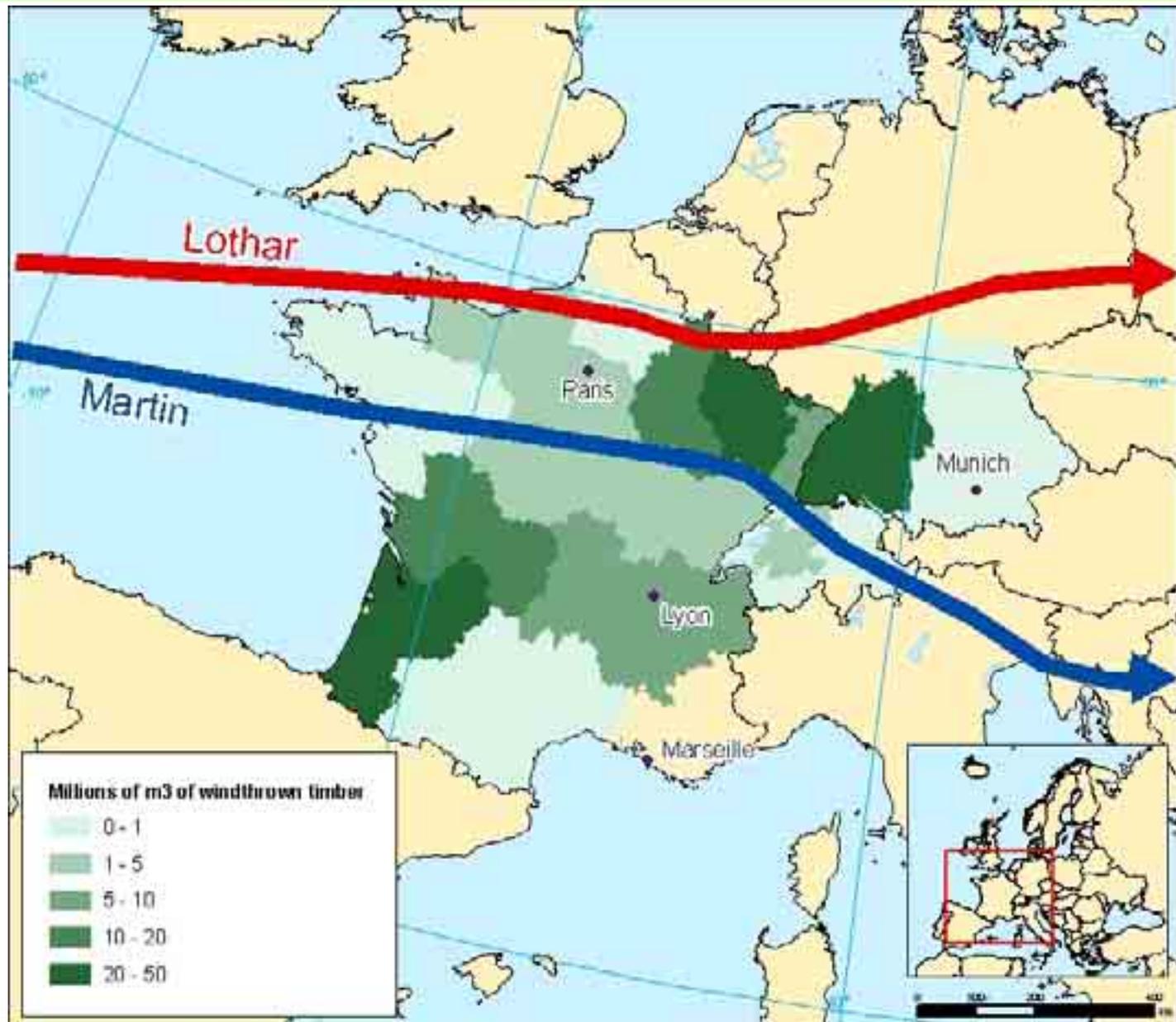


WIND BLOWS



Name of event (s)	Date of the event (1998–2002)	Location	Impact
Cilly, Désirée and Fanny	January 1998	Bretagne, w. France, S. Wales & Midlands (UK). Also touching Germany, Belgium, Netherlands, Switzerland, Portugal, Spain, Austria and Poland	Violent winds, more than 1 200 homes damaged affecting more than 3 500 people and killing about 15. High economic losses (more than € 500 m).
–	February 1999	Hungary	Snowstorm affecting about 250 000 hectares, 200 villages isolated, 40 dead.
Anatol	December 1999	Germany, southern Denmark, southern Sweden, Poland, Estonia, Latvia, Lithuania	Power shortage for about 160 000 homes, considerable damages to constructions, roofs, forests. About 17 people killed, more than € 500 m in economic losses. Almost 4 000 000 people affected, 125 dead, overall damage in houses, infrastructure such as electrical distribution systems and transportation and communications lines. Millions of m ³ of wind thrown timber, mainly in France, Switzerland and Germany, huge economic impact (insured losses of about € 6.7 bn). Other environmental impacts, mainly within forest ecosystems.
Lothar, Martin	December 1999	France, Switzerland, Germany, Denmark, Sweden, Poland, Lithuania, Austria and Spain	Huge economic losses (about € 1.5 bn of insured losses), thousands of trees uprooted, many power lines, roads and railways damaged. More than 30 people dead, more than 60 000 affected.
Jeanett	October 2002	Austria, Belgium, Denmark, France, Germany, Netherlands, Poland, Sweden, UK	Huge economic losses (about € 1.5 bn of insured losses), thousands of trees uprooted, many power lines, roads and railways damaged. More than 30 people dead, more than 60 000 affected.





DUST STORMS

Mar. 10, 2002



May 6, 2007

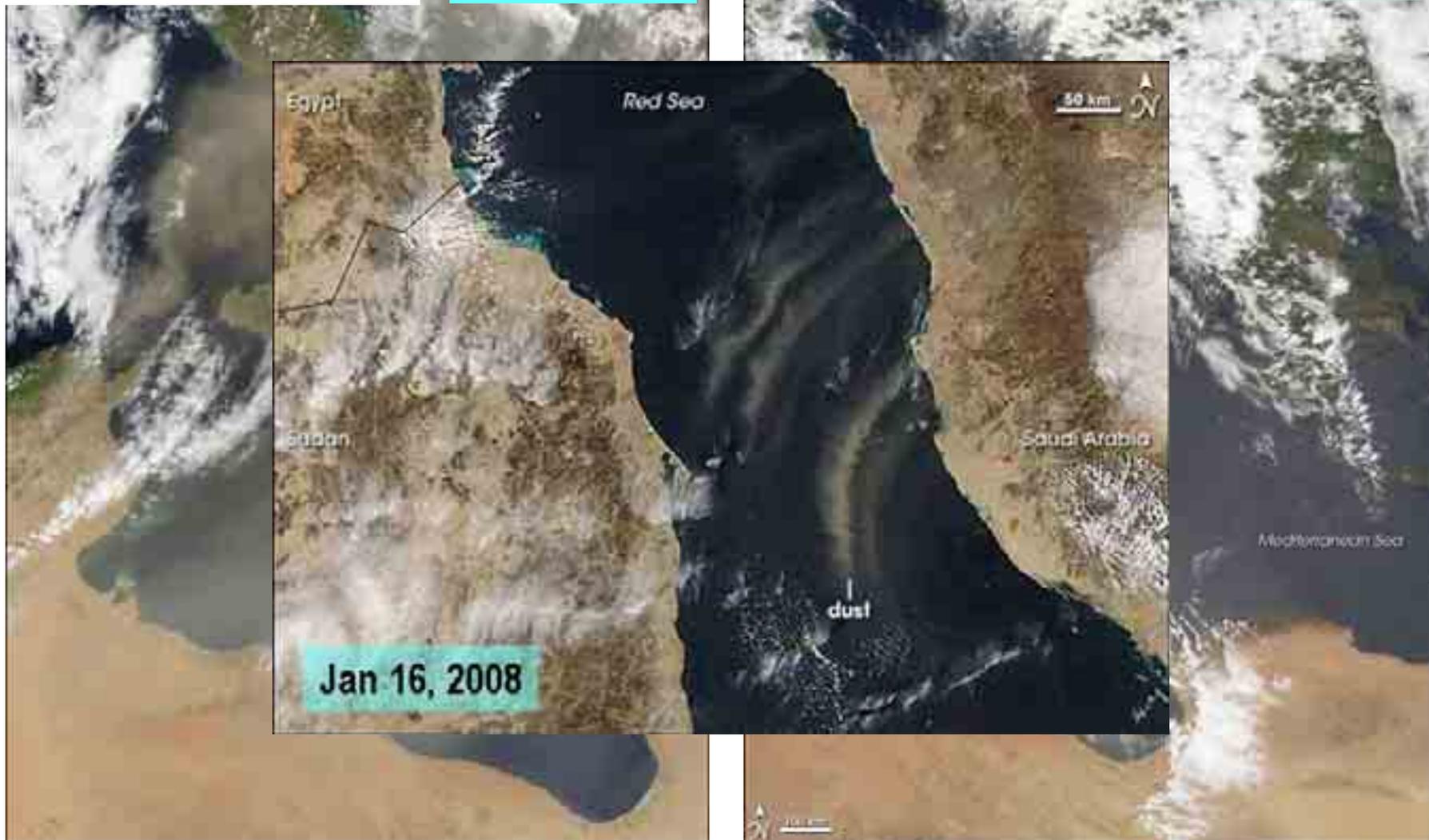


Moderate Resolution Imaging Spectroradiometer ([MODIS](#))

DUST STORMS

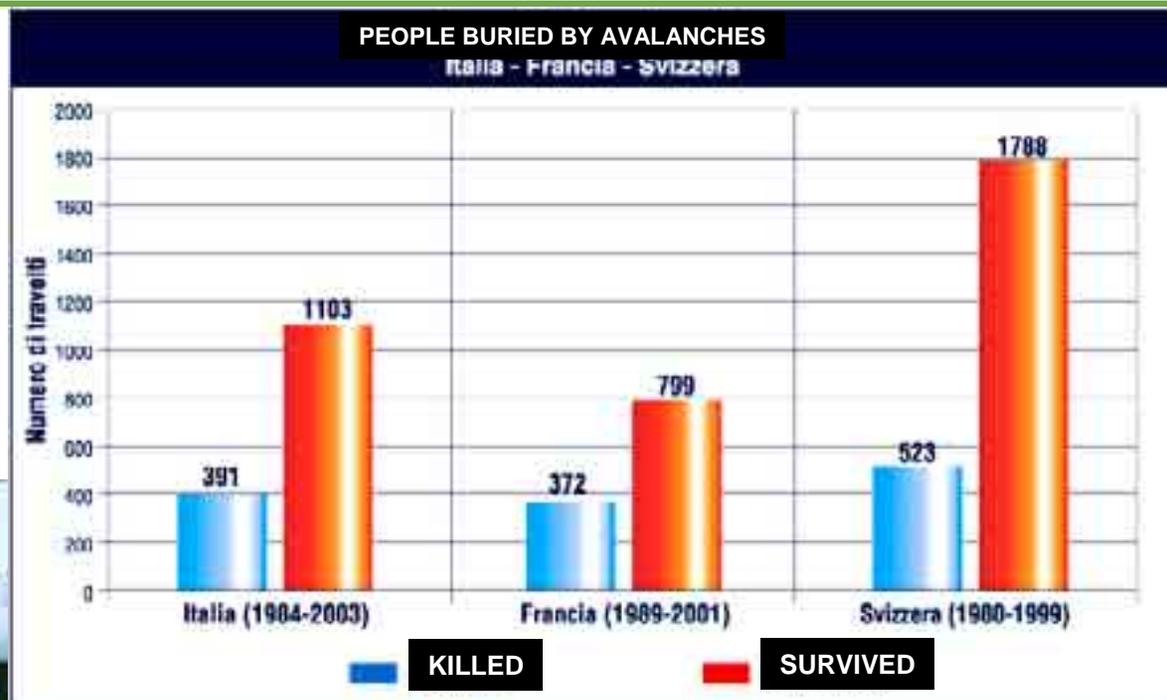
Mar. 10, 2002

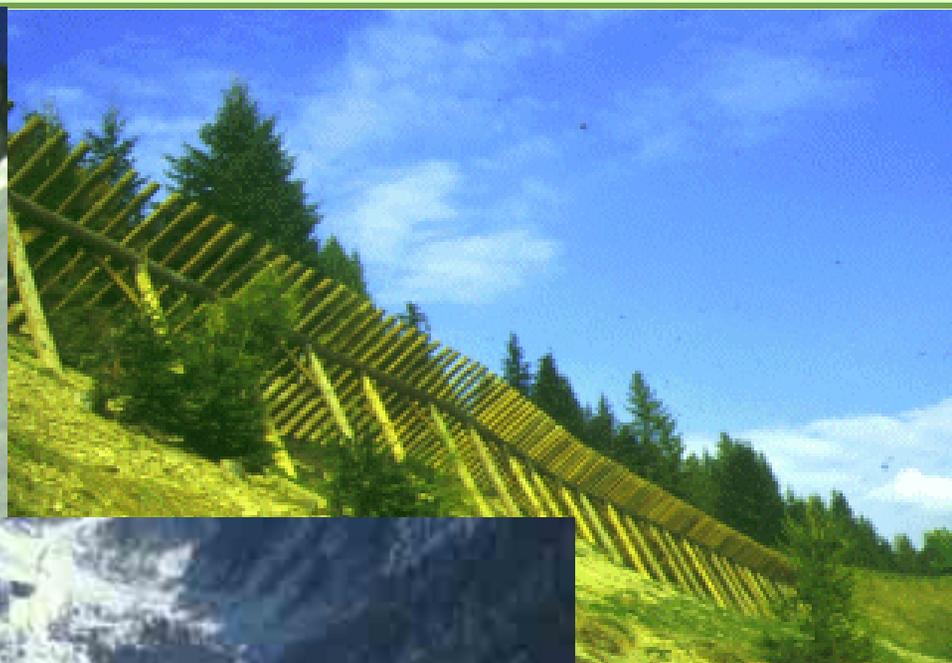
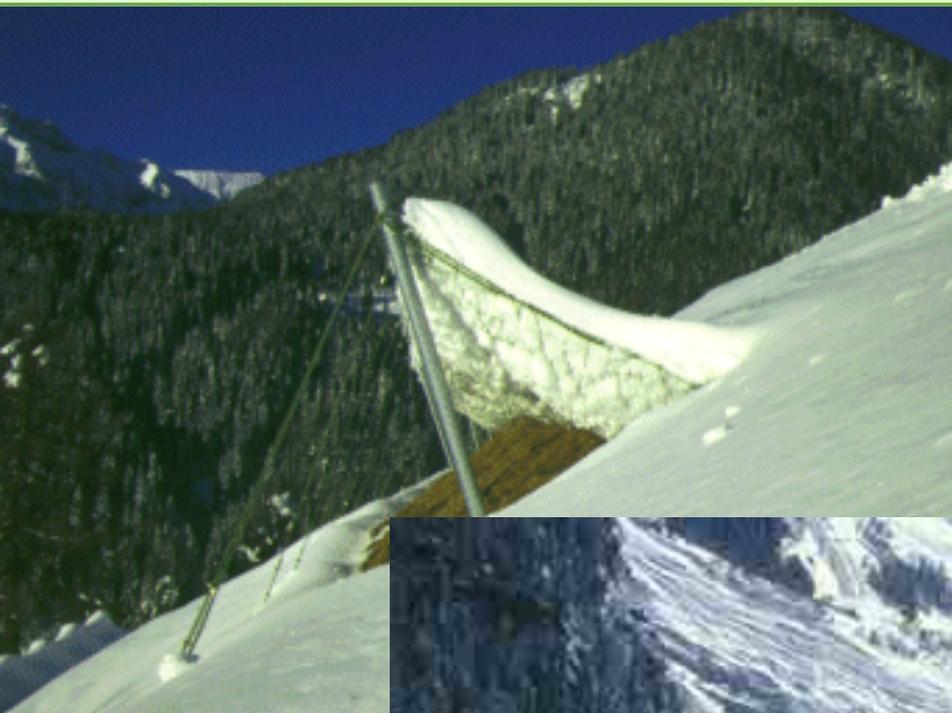
May 6, 2007



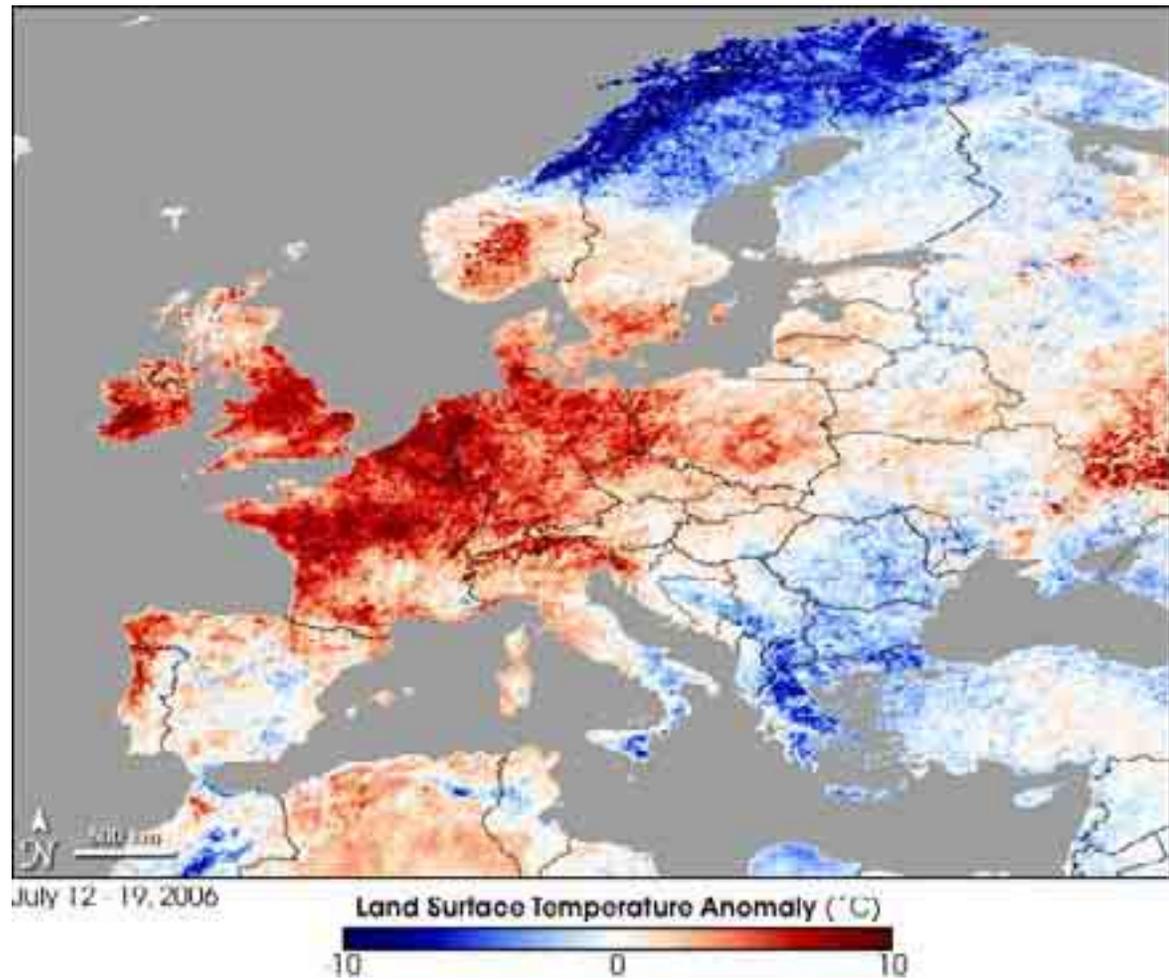
Moderate Resolution Imaging Spectroradiometer ([MODIS](#))

AVALANCHES



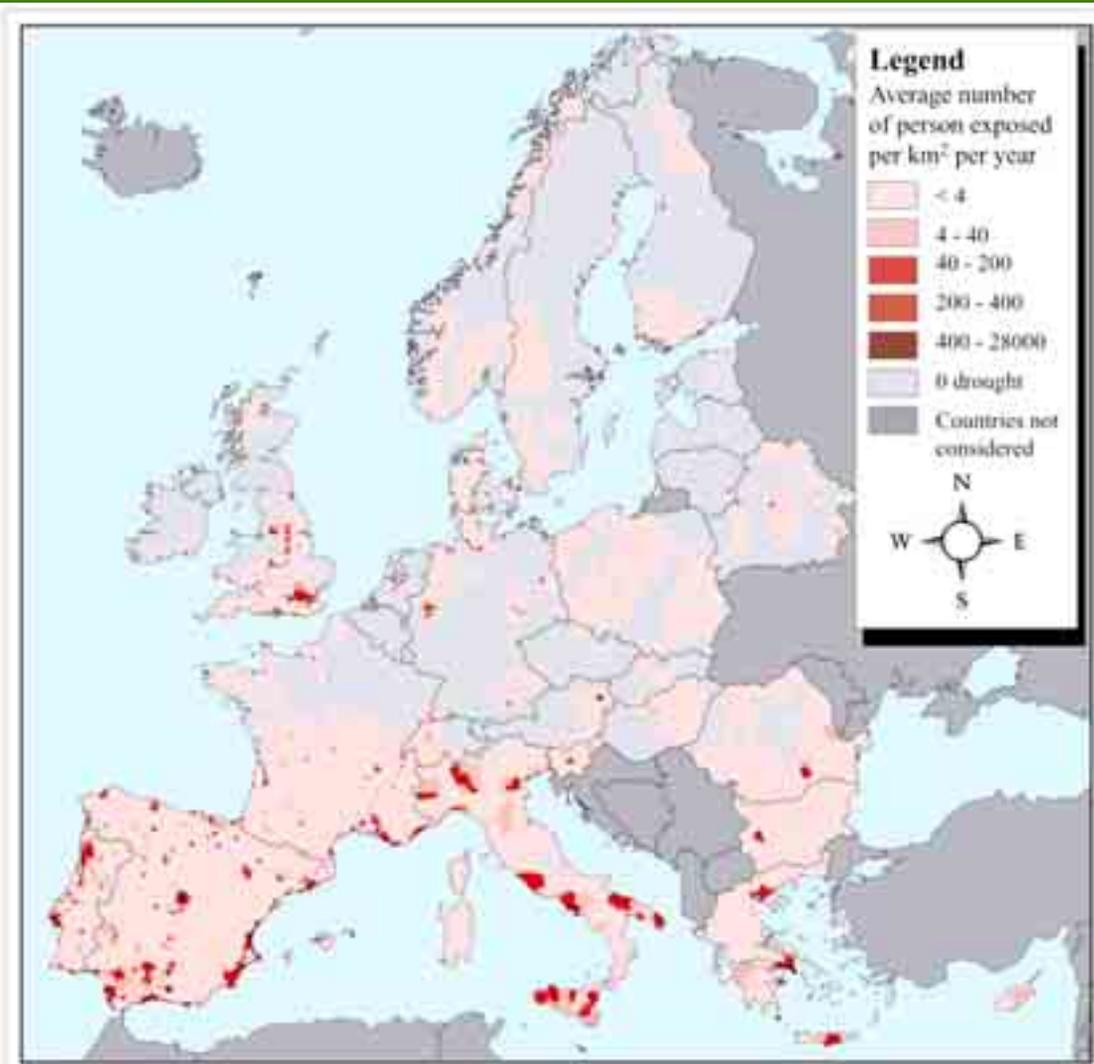


HEAT WAVES



DROUGHT

Date of the event (1998–2002)	Location	Impact
September 1999	Andalucía, Extremadura, Castilla, Murcia, Valencia, Aragón and Catalonia (Spain)	All cultivations touched after one year of drought, huge economic losses (more than €3 bn).
March 2000	Cyprus	Worst drought in 30 years.
June 2000	Dolj, Mehedinti, Teleorman, Olt, Constanta, Braila, Vaslui, Botosani (Romania)	About 26 000 km ² affected, 40 % of agricultural production at risk, worst drought in at least 50 years, more than €500 m of economic losses.
August 2000	Bosnia and Herzegovina	About 60 % of agricultural production affected, worst drought in 120 years.
May 2002	Sicily, Basilicate, Pouilles, Sardaigne (Italy)	State of emergency declared by the Italian Government.






 International Research Institute For Climate Prediction

GIS processing and cartography: UNEP/GRID-Geneva
 Initial method for drought identification IRI

Data sources: precipitation CRU, population CIESIN
 Projection: Lambert equal area azymutal
 Central meridian 10°E; reference latitude 50°N



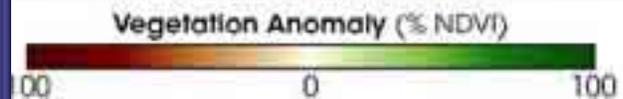
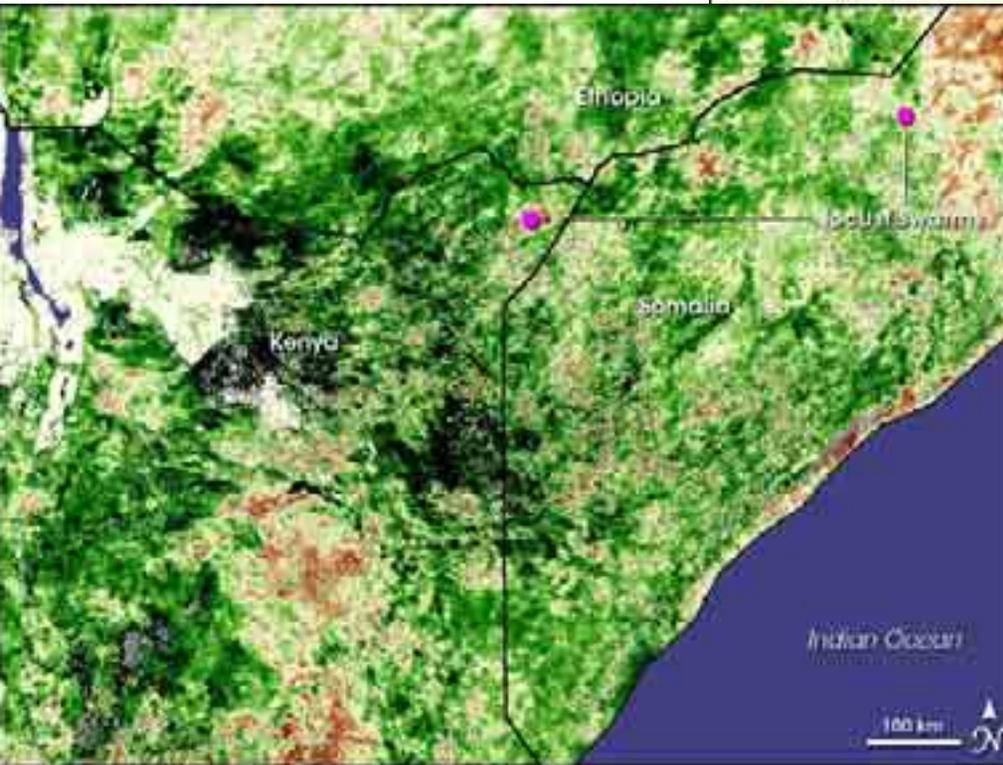
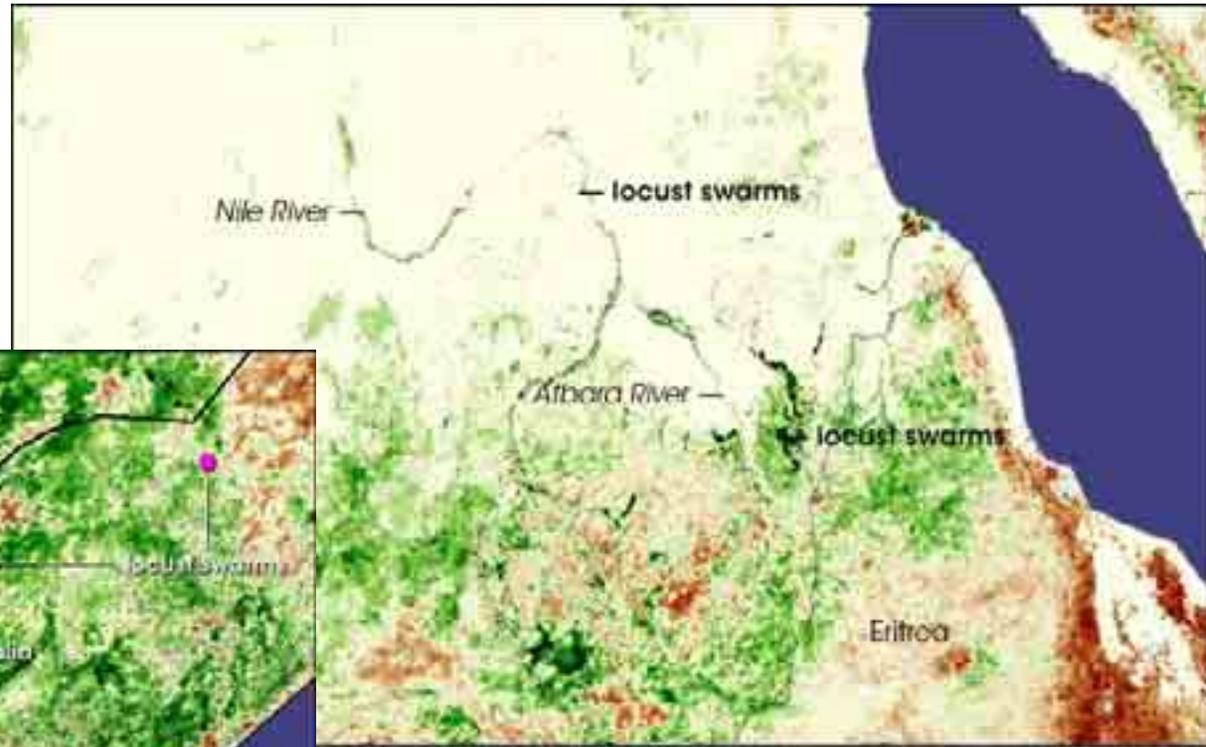
July 28 - August 12, 2007



August 29 - September 13, 2007



LOCUST SWARMS (wet anomaly...)



November 11-20, 2007



SUBSIDENCE

Bench mark S661 southwest of Mendota (S. Joaquin Valley, California). The bench mark site subsided 9m from 1925 to 1977, because of intensive withdrawal of ground water.



Causes of ground subsidence (Freeze, 2000)

<i>Type</i>	<i>Result</i>	<i>Cause</i>
Natural	Compaction of surficial soils	Hydrocompaction of wet-dry soils Compaction of drained organic soils
	Rapid local subsidence	Sinkholes in karst areas Collapses above salt deposits
	Long-term regional subsidence	Compaction of basinal sediments Tectonic movements
Anthropogenic	Rapid local subsidence due to underground excavations	Collapse of coal, salt, limestone, etc, underground mines Impact of engineering structures, e.g., tunnels
	Long-term regional subsidence Due to fluid withdrawal	Production of oil or gas, Water pumping Development of geothermal fields Dewatering in mines

Consequences of Land Subsidence and Overpumping of Groundwater

- Prolonged and extended flooding by river- and/or seawater.
- Loss of lagoonal ecosystems and habitat
- Saltwater intrusions into freshwater estuaries and aquifers
- Soil salinization
- Damage to the infrastructure such as to the foundations of buildings, roads, bridges and buried pipelines. Also protrusion above the land surface of the heads of water wells occurs.
- Disturbance and deterioration of the drainage system (canals and sewerage systems) because of the development of a subsidence bowl(s) with no natural damage.
- Coastal erosion

Several methods to measure land subsidence (USGS, 2000)

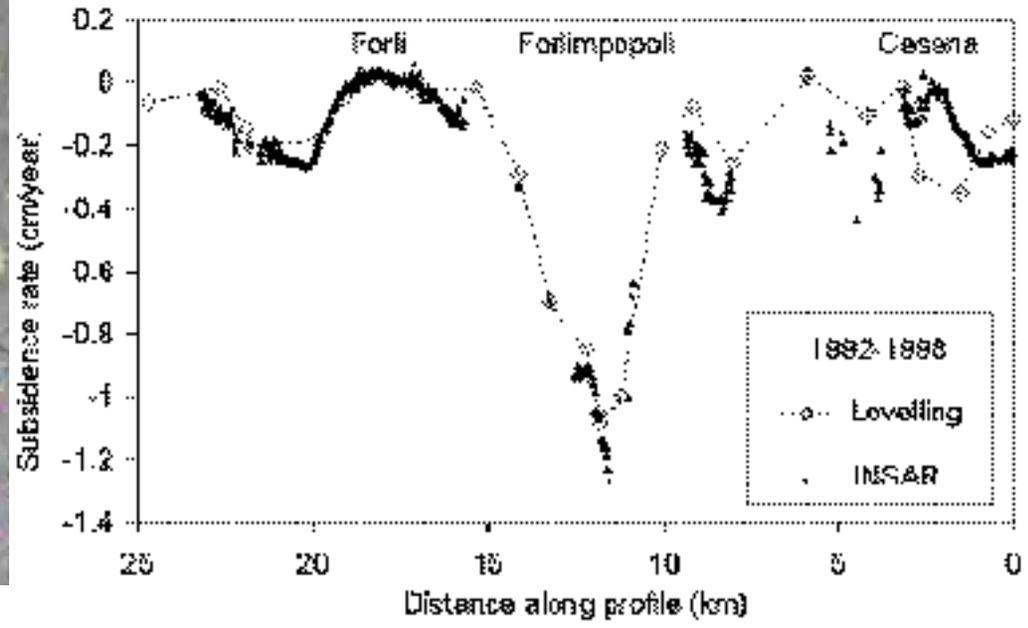
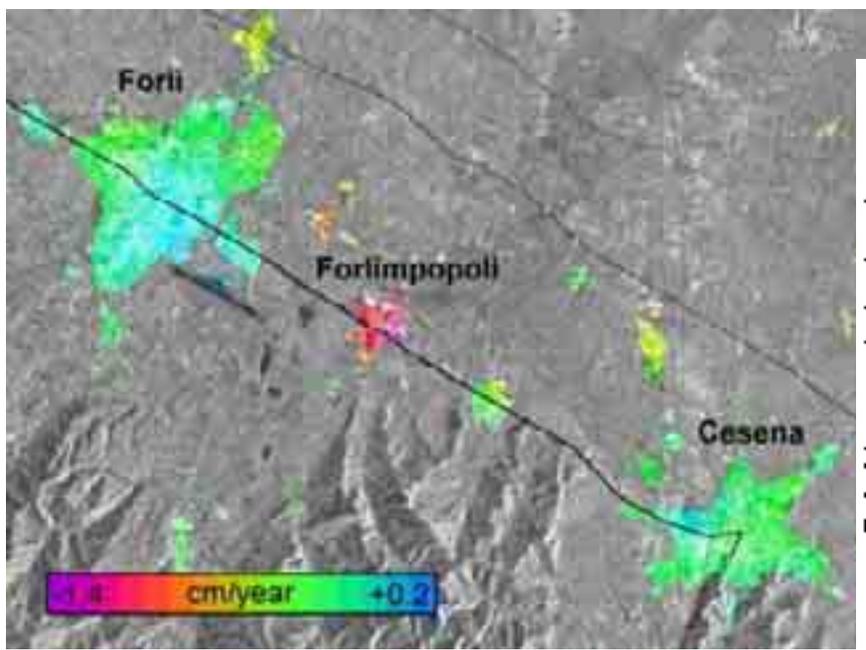
METHOD	Component displacement	Resolution ¹ (millimeters)	Spatial density ² (samples/survey)	Spatial scale (elements)
Spirit level	vertical	0.1-1	10-100	line-network
Geodimeter	horizontal	1	10-100	line-network
Borehole extensometer	vertical	0.01-0.1	1-3	point
Horizontal extensometer:				
Tape	horizontal	0.3	1-10	line-array
Invar wire	horizontal	0.0001	1	line
Quartz tube	horizontal	0.00001	1	line
GPS	vertical	20 5	10-100	network
	horizontal			
InSAR	range	5-10	100,000-10,000,000	map pixel ³

¹Measurement resolution attainable under optimum conditions. Values are given in metric units to conform with standard geodetic guidelines. (One inch is equal to 25.4 millimeters and 1 foot is equal to 304.8 millimeters.)

²Number of measurements generally attainable under good conditions to define the spatial extent of land subsidence at the scale of the survey.

³A pixel on an InSAR displacement map is typically 40 to 80 meters square on the ground.

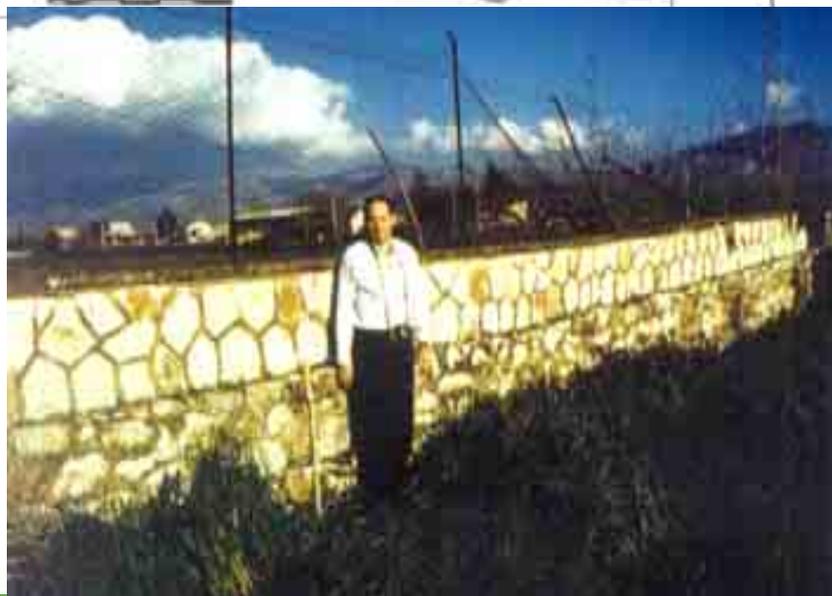
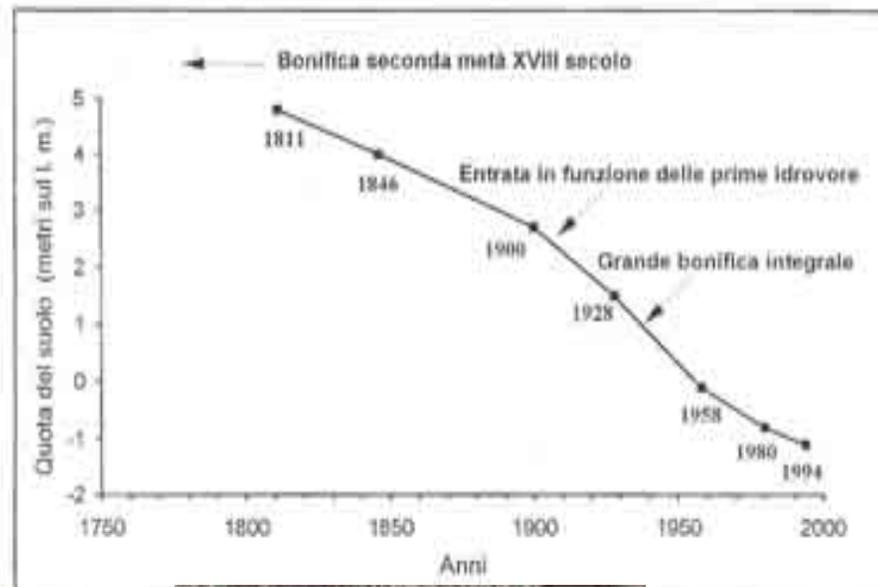
Synthetic Aperture Radar (SAR) Interferometry is a powerful technique that enables the measurement of small-scale surface deformation.



Subsidence map of the Cesena-Forli region for the time period 1992-1998. The levelling line used for validation is also shown. (ERS Data Copyright ESA 1999, Processing by GAMMA)

Comparison of the subsidence rates from levelling surveys and SAR along one levelling line. Levelling data courtesy of the Municipality of Ravenna.

Subsidence in the Pontina plain



Examples of benefits, costs and risk costs for Government Land-use Planning Agency (modified from Freeze, 2000)

Benefits	Capital Costs and Operational Costs	Risk Costs Associated with Land Subsidence
<ul style="list-style-type: none"> - Social benefits associated with land-use management policies (total economic value to industry, agriculture, tourism etc..) 	<ul style="list-style-type: none"> - Cost of construction and operation of public damage prevention works (if any) 	<ul style="list-style-type: none"> - Social costs associated with failure of management policies (total economic loss due to physical damage, loss of agricultural production, impact on tourist industry etc..)
<ul style="list-style-type: none"> - Income from permits, taxes and fines 	<ul style="list-style-type: none"> - Cost of administering management policies 	<ul style="list-style-type: none"> - Cost of compensation of impacted parties
<ul style="list-style-type: none"> - Settlements from litigation 	<ul style="list-style-type: none"> - Cost of litigation 	

APAT-ARPA environmental agency system and land subsidence problems

- The collection, validation and homogeneization of subsidence data at national and local scale is one of the main issue of an agency system like APAT – ARPA
- The database will provide the necessary data:
 - to understand the real impact of the subsidence;
 - to know the measures adopted to mitigate the subsidence risk at local scale;
 - to identify what areas prone to subsiding need to be monitored.
- Main problems are
 - a proper network between the central (APAT) and local (ARPA-ARPA) institutions is still missing;
 - available data are disseminated among a great number of local authorities (land reclamation consortia, municipalities, privates, etc).
- At present, only some regional agency (ARPA Emilia-Romagna) has prepared a specific GIS database implemented and updated with subsidence data.

Socio-economic strategies to face subsidence from fluid extraction (modified from Freeze, 2000)

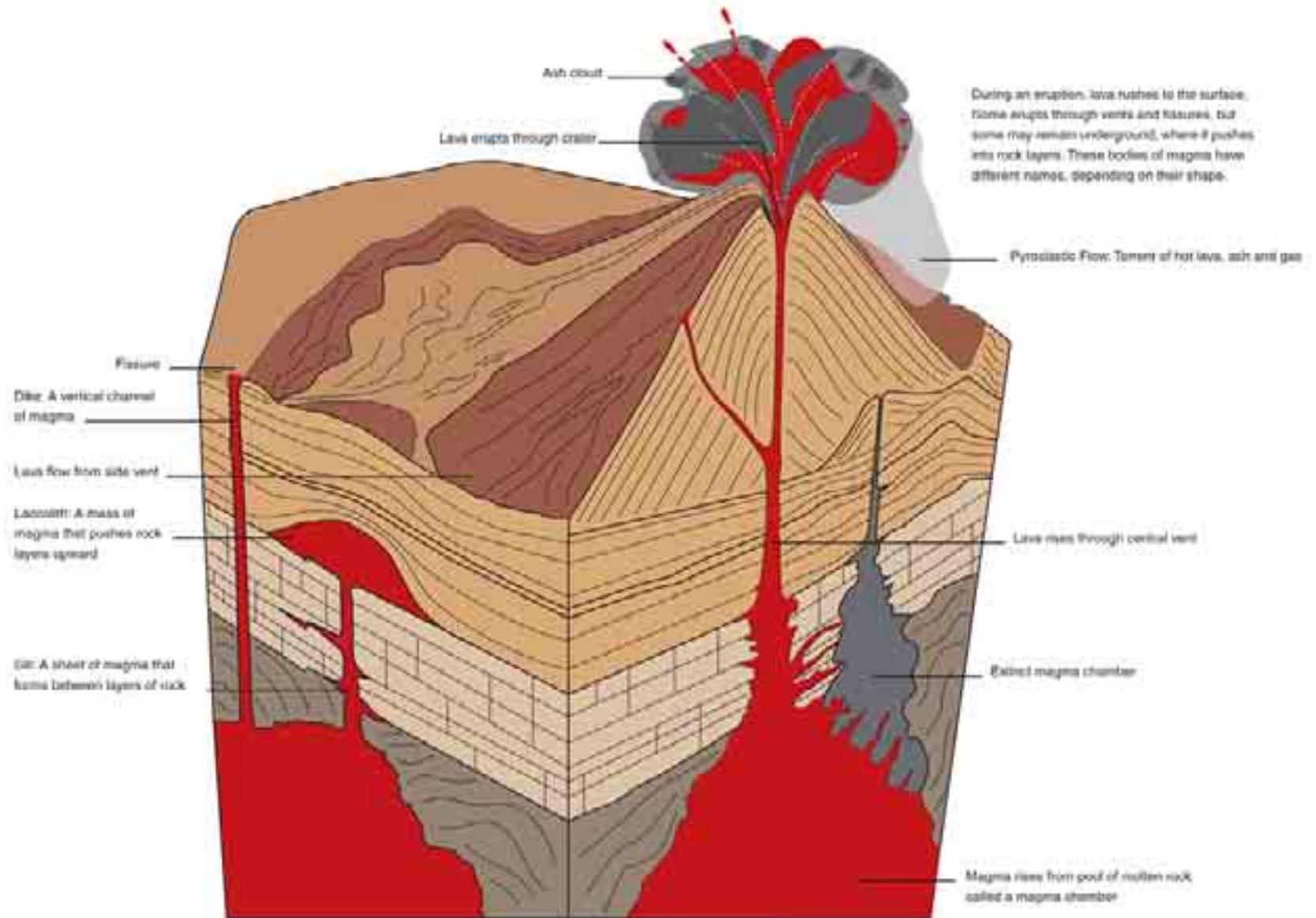
<i>Management strategies</i>	<i>Activities</i>
Reduction of pumping	<ul style="list-style-type: none"> - Development of regional strategies for water distribution - Regional Authority for management of aquifers
Increase of recharge	<ul style="list-style-type: none"> - Application of enhanced recharge techniques (management of dams and aquifers)
Land planning	<ul style="list-style-type: none"> - regional plans of expansion of farming land - relocation of: water wells; endangered buildings and structures, in particular where ground fissures and collapses appear - zoning: definition of no pumping zones; restriction to building in subsiding areas
Building regulations	<ul style="list-style-type: none"> - Guidelines to build in subsidence-prone areas

Cover collapse
sinkhole in
Winter Park, Florida,
1981



Volcanic risk



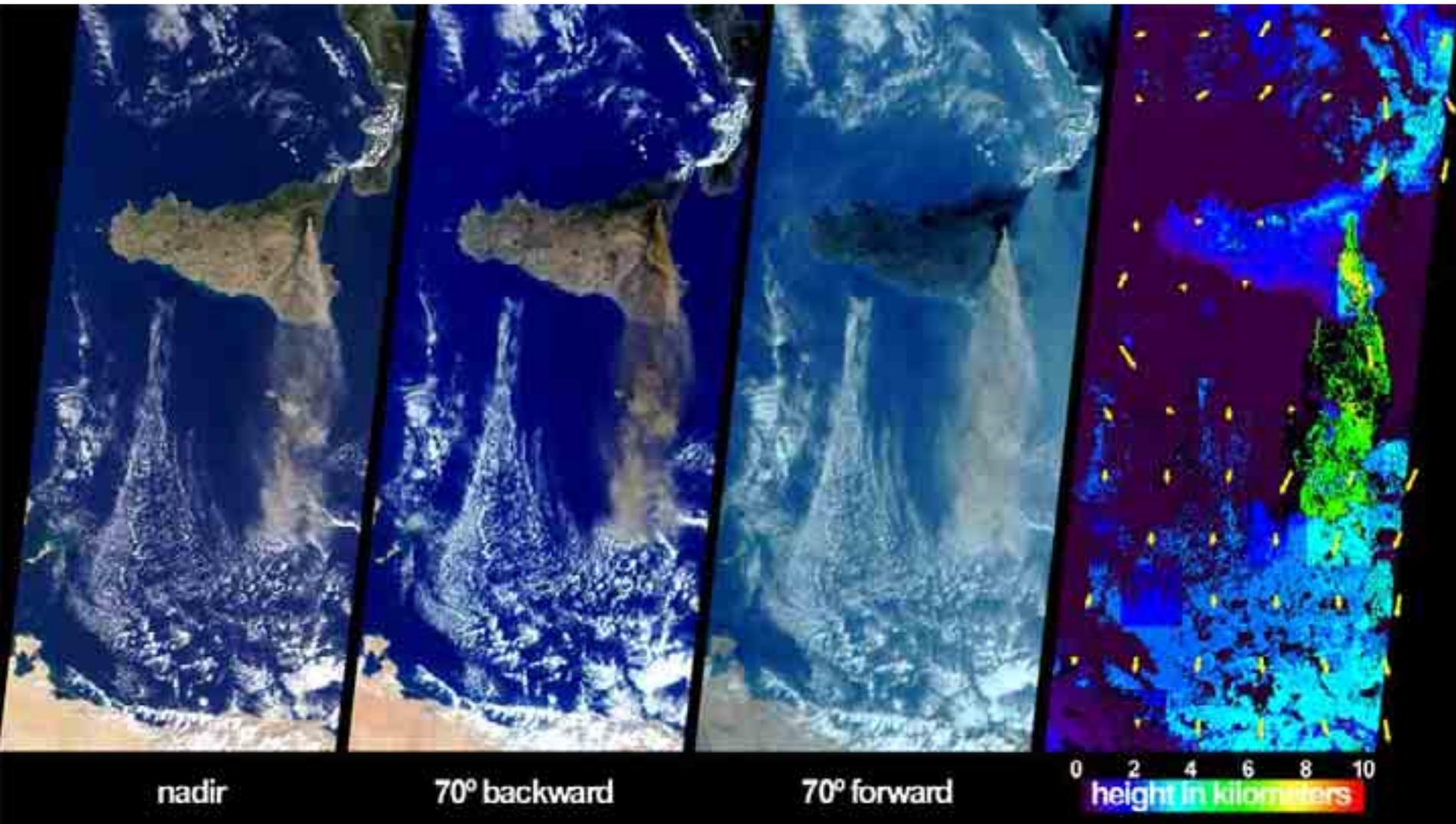




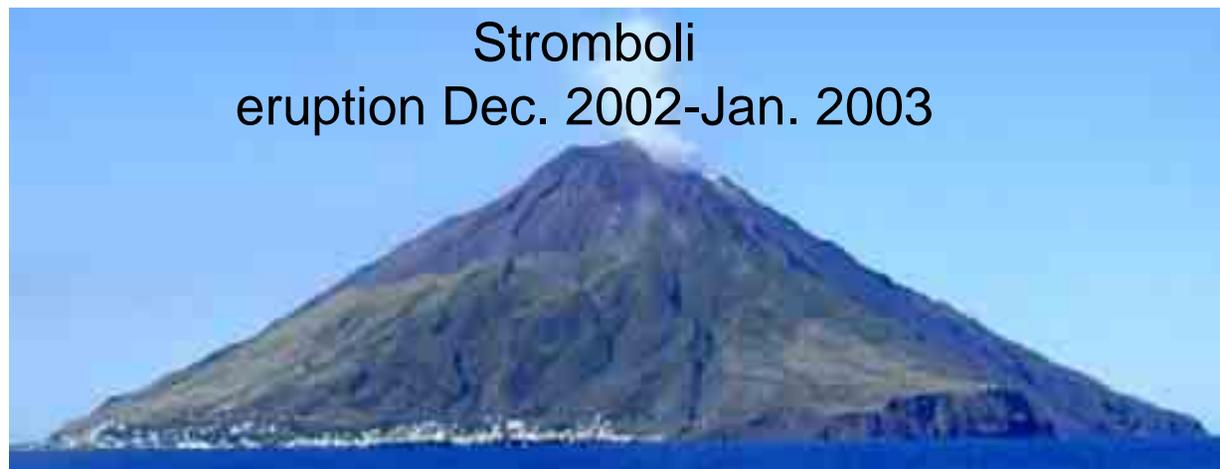
Etna volcano, Sicily







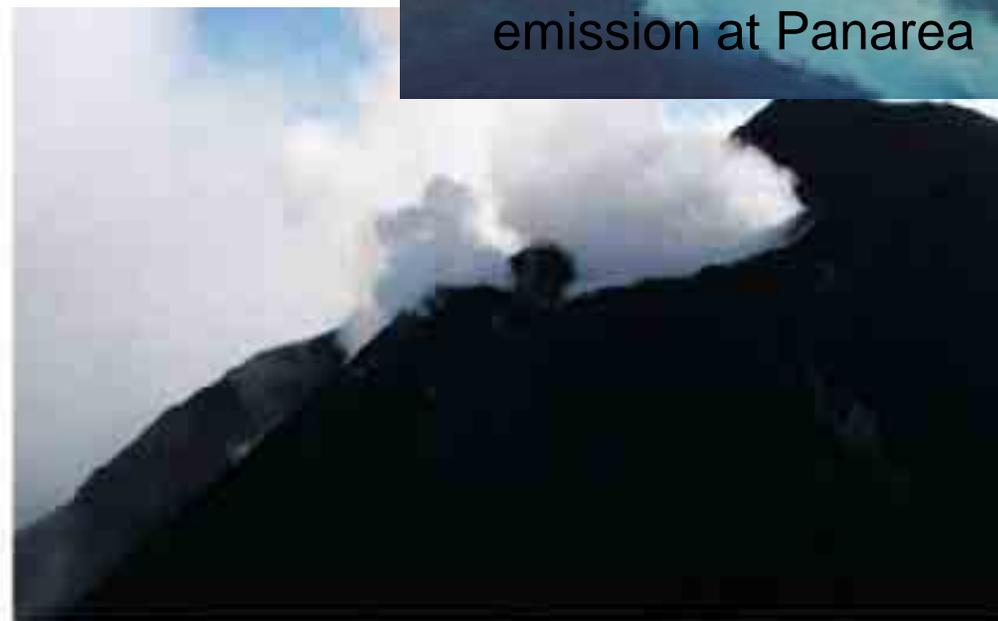
**Stromboli
eruption Dec. 2002-Jan. 2003**



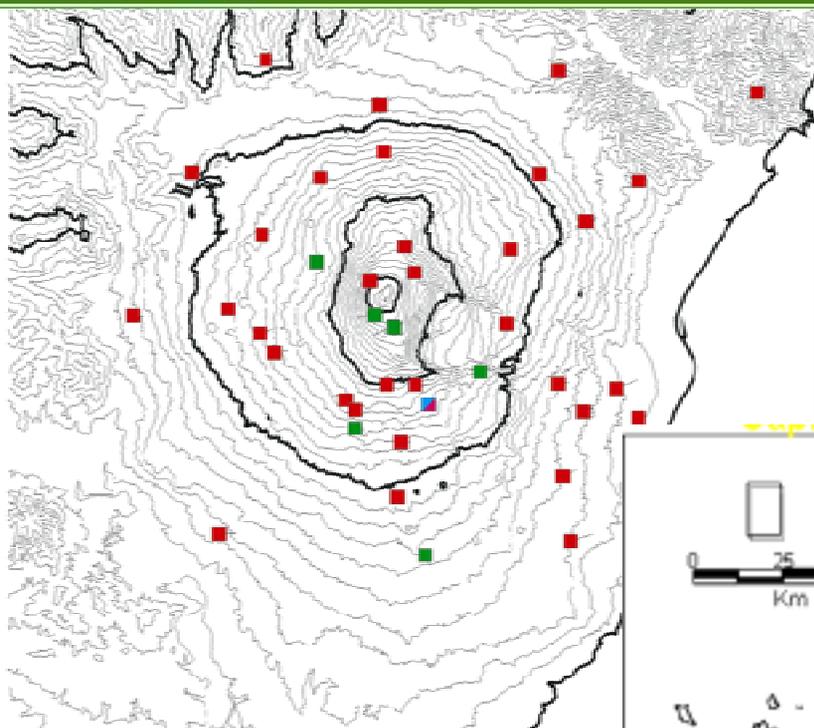
**Underwater gas
emission at Panarea**



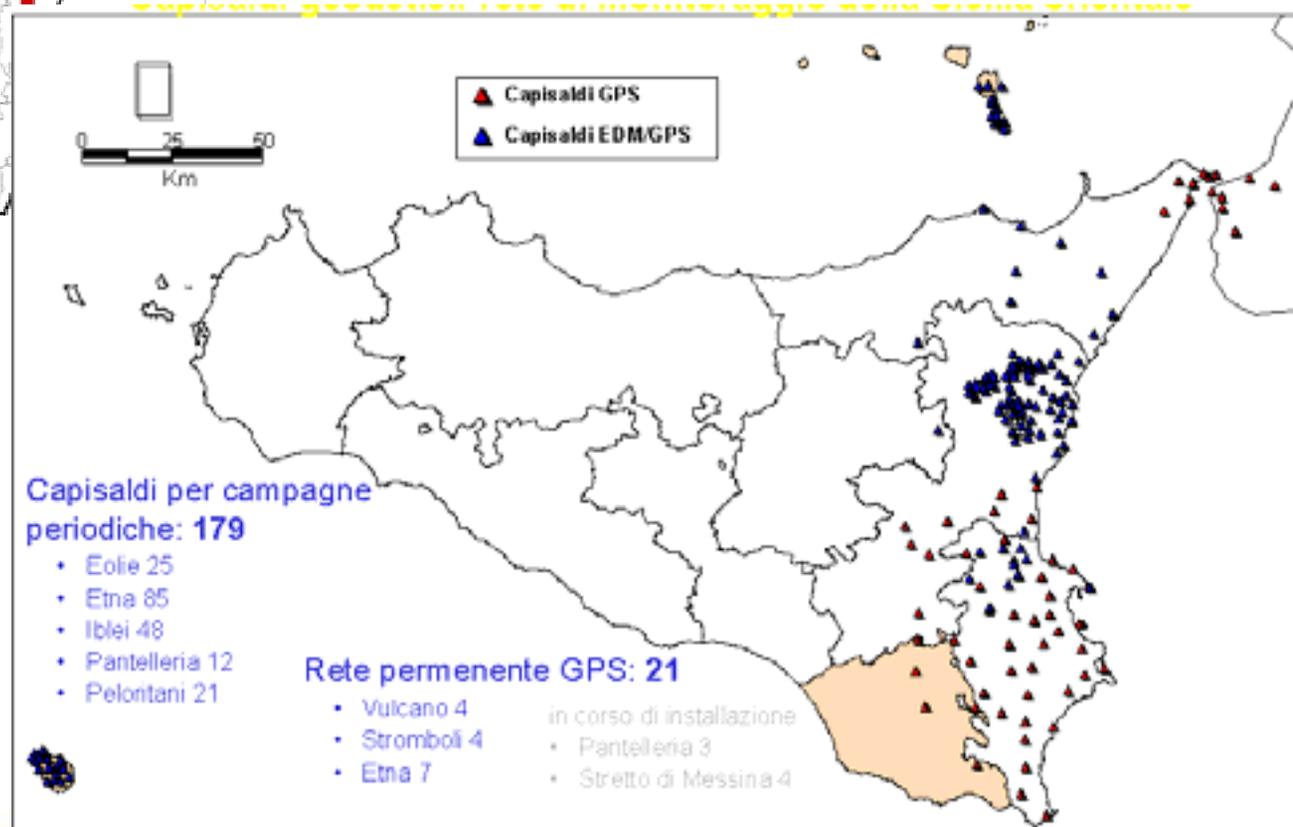
**Tipica attività stromboliana ai crateri sommitali
prima dell'eruzione in corso**



L'attività di degassamento ai crateri sommitali dopo il 28 dicembre 2002



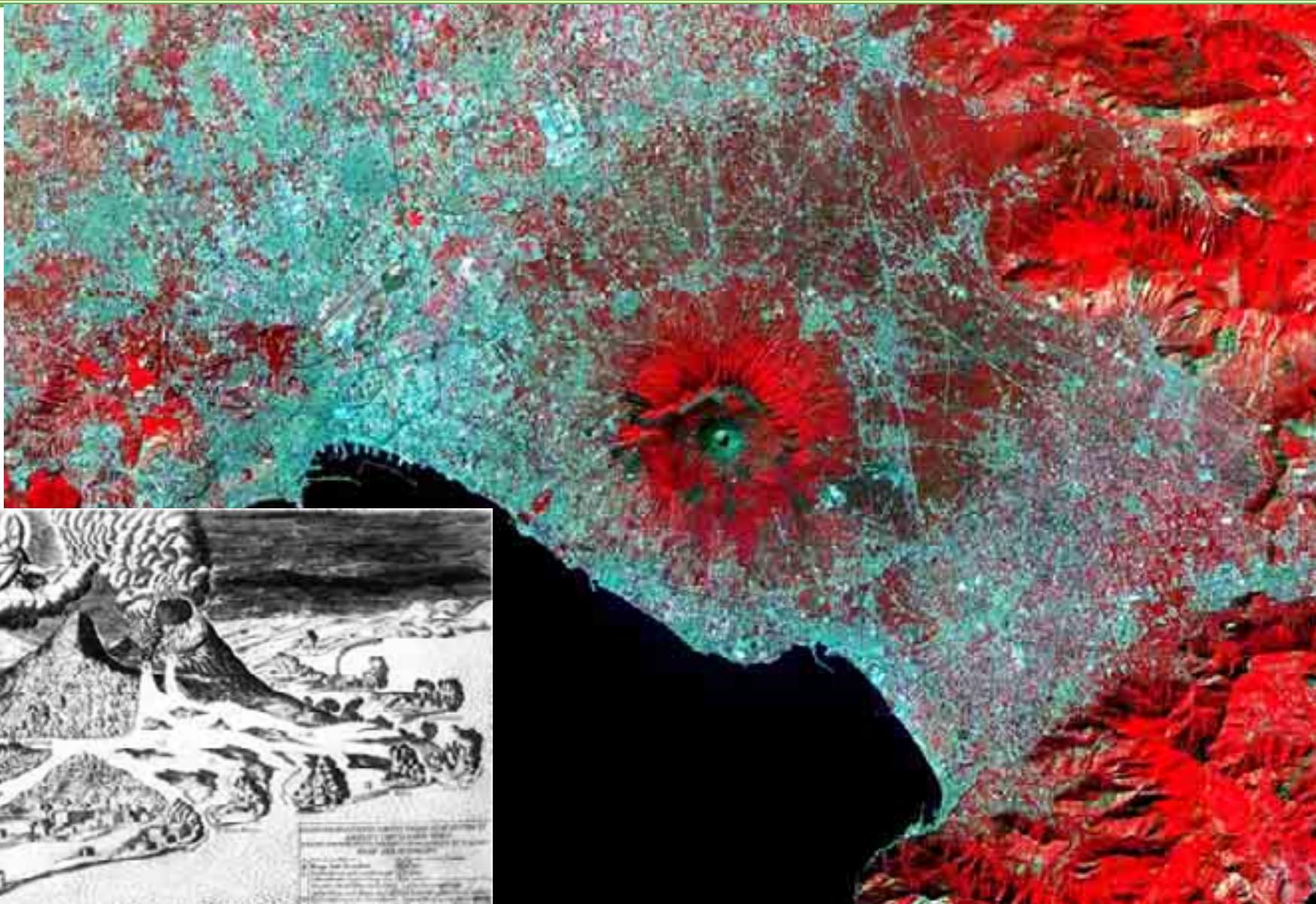
- 1-C analog station
- 3-C analog station
- 3-C digital station



Vesuvius historical eruptions



Date eruption	Main phenomena
79 (Pompeii)	Plinian eruption Collapse of Monte Somma, birth of Vesuvius cone
472 (Pollena)	Subplinian eruption 15 metres of deposits at Pollena
1631	4000 victims – very left open Reference event for Italian Civil Protection
1906-1944	Last paroxysmic phase Closed vent



Mount Saint Helens (Washington State, USA)



Hazards/negative effects from borrow pits:

- Loss of farmable land/soil
- Ground water pollution
- Lowering of water table → pumping, enhanced evaporation





- Hazards to soil and ground water due to leaks and emissions from chemical plants
- Siting methodologies





- Impact of infrastructures in coastal areas:
- Erosion/silt up
 - Pollution
 - Loss of wet habitats

