Space Volcano Observatory (SVO)

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The most active volcanoes of the world during the period 1995-1998

Volcano	Altitude (m)	Country	Last strong event	Population within 20km around volcano (millions)
Etna	3350	Italy	since 1995	0.5 (Catania)
Nyamuragira	3058	Congo-K	27/10/98	0.5 (Goma)
Cerro Negro	675	Nicaragua	06/11/98	0.3 (Telica)
Popocatepetl	5465	Mexico	23/09/98	>1 (Mexico City)
Fuego	3763	Guatemala	19/11/98	0.5 (Antigua)
Guagua Pichincha	4784	Ecuador	07/10/98	>1 (Quito)
Sakura-Jima	1117	Japan	24/01/98	0.5 (Kagoshima)
Merapi	2911	Indonesia	since 1992	>1 (Jogyakarta)
Rabaul	688	New Guinea	28/05/97	0.1 (Rabaul)

Characteristics of recent active lava domes

Volcano	Dome size (m)	Topographic changes during activity	Paroxysmal effect	Typical growth rate during activity	Frequency of events	Period of activity
Montserrat	300	Important. Up to 30% destroyed	Pyroclastic flows and plinian eruptions, dome collapse	950 000 m^3/day 4.2 m/day	Several/year	Since 1995
Mount St Helens	800 (height: 300)	Up to 100%	Plinian and blast	0.1-0.5 10^6 m3/day 0.5 m/day	Several/year at the beginning	1980-90
Unzen	200	Up to 30%	Pyroclastic flows	?	Several tens during activity	1991-94
Merapi	300	Up to 75%	Pyroclastic flows Avalanches, dome collapse	20 000 m^3/day 0.9 m/day	Several tens /year	Active

SVO - Scientific Objectives

- Goals for volcano monitoring
  - To monitor morphological changes.
  - To monitor changes in the pattern of thermal radiance.

- Method
  - High resolution stereo imagery with 1.5m pixel size.
  - High resolution thermal mapping of areas above ~ 450°C.
  - 6 x 6km image size.
  - One day minimum return time.

Characteristics of existing or planned satellites used for Earth imagery

Satellite	SPOT 4	LANDSAT TM	ERS	ALOS	SVO
Dynamic resolution [bit/pixel]	8	8	8-12		11
Coverage	Global	Global	Good	Global	Regional
Image size (km)	60 x 60		100 x 100		6 x 6
Repeat pass on a given area (days)	5-26	16	35		1-3
Pixel size (m)	10/20	10/30	8x20	5	1.5
IR capability	Y	Y	N	Y	Y
Vertical DEM accuracy (m) versus DEM pixel size (m)	10/20m *vs* 20/40m	?	5/10m *vs* 40m		1.5m *vs* 1.5m 0.15m *vs* 20m

SVO - Applications on volcanoes

	Lava domes	Lava flows	Glaciers	Faults
Aspect changes	**X**	**X**	**X**	**X**
Growth of instabilities and topographic changes	**X**		**X**	**X**
Maps and volume of eruptive products		**X**		
Thermal changes	**X**	**X**		

Visibility of some volcanoes

Volcano	Altitude (m)	Percentage of year without clouds	Country
Etna	3350	69	Italy
Grimsvotn	1725	53	Iceland
Nyamuragira	3058	33	Africa-C
St. Helens	2549	40	USA
Soufriere Hills	915	70	W Indies
Popocatepetl	5465	56	Mexico
Pacaya	2552	61	Guatemala
Arenal	1657	48	Costa Rica
Guagua Pichincha	4784	39	Ecuador
Sakura-Jima	1117	50	Japan
Merapi	2911	47	Indonesia
Rabaul	688	35	New Guinea
Krakatau	813	38	Indonesia
Fogo	2829	70	Cape Verde
Fournaise (Piton)	2631	65	France
Cerro Azul	1690	85	Ecuador
Kilauea	1222	74	USA
White Island	321	64	New Zealand
Ruapehu	2797	59	New Zealand

SVO - Other applications

- Landslides monitoring
- Fault mapping
- Tectonic deformation
- Earthquake faulting
- Damage to buildings and man-made structures
- Comparative planetology
- Forest fires

Possible location of data acquisition stations

Observatory	**Code**	**Country**	**Longitude**	**Latitude**
IPG Paris	IPG	France	5° E	47° N
Universidade dos Açores	UAC	Portugal	25° W	38° N
Obs. Volcanologique Antilles	ANT	France	61° W	15° N
Obs. Volcanologico y Sismologico	COL	Columbia	77° W	1° N
Popocatepetl Volcano Obs.	POP	Mexico	100° W	20° N
Long Valley Caldera Obs.	LVO	USA	122° W	48° N
Alaska Volcano Obs.	AVO	USA	153° W	60° N
Hawaiian Volcano Observatory	HVO	USA		
Univ. Aukland	AUK	New Zealand	175° E	40° S
Usu Volcano Obs.	USU	Japan	141° E	43° N
Sakurajima Volcano Res. Center	SAK	Japan	131° E	32° N
Volcanological Survey of Indonesia	VSI	Indonesia	107° E	7° S
Philippines Volcano Observatory	PHV	Philippines	121° E	15° N
Southern Andes Volcano Observatory	SAV	Chile	72° W	39° S
Obs. Volc. Piton Fournaise	OPF	France	56° E	21° S
Istituto Internazionale di Vulcanologia	IIV	Italy	15° E	37° N

Recent and future remote sensing mission useful for volcanology

Mission Name	Country	Description	Date of activities	Web reference
NOAA AVHRR	USA	Primarily meteorology, Secondary use for volcano ash plume and hotspot alert	since 1960s	http://www.arl.noaa.gov/ready-bin/vaftad.pl
SPOT	France	EO, stereo capability allows DEM generation	Since 1986	http://www.spot.com/
Landsat	USA	Terrestrial resources monitoring	since 1972	http://geo.arc.nasa.gov/sge/landsat/landsat.html
JERS	Japan	SAR and optical. Low data quality makes IR data of qualitative value only	1992	
Meteosat	Europe	Meteorology	Present	http://www.esa.int/
ERS	Europe	EO , SAR capable of DEM generation and deformation monitoring, ATSR capable of thermal monitoring	Present	http://www.esa.int/
GOES	USA	Primarily meteorology, Secondary use for volcano hotspot alert	Present	http://rsd.gsfc.nasa.gov/goes/
Radarsat	Canada	EO, SAR penetration of clouds useful for volcanoes.	1995 - 2000	http://radarsat.space.gc.ca/
EOS	USA	long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans Inderdisciplinary Science team for volcanology	1999-	http://eospso.gsfc.nasa.gov/ http://www.geo.mtu.edu/eos/
ALOS	Japan	Visible, IR and radar EO	2002 ?	
Envisat	Europe	Earth observation, as for ERS	May 2000	http://envisat.estec.esa.nl/