

**Volcanism seminar
for the excursion to Sicily 2004
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Geophysical Surveillance Methods of Active Volcanoes

Abstract:

Nowadays more and more people live in the direct neighbourhood of active volcanoes. So it is very important to monitor these volcanoes to be able to predict eruptions and to protect lives and infrastructure. This is mainly achieved with geophysical methods. The still important classical methods like seismic and tilt measurements are today endorsed with the so called 'remote sensing' by satellites since it allows to survey large areas without having to install a lot of equipment in the site.

References:

- Hans-Ulrich Schmincke: *Vulkanismus*, Wissenschaftliche Buchgesellschaft, Darmstadt 2000
- Jacques-Marie Bardintzeff: *Vulkanologie*, Ferdinand Enke Verlag, Stuttgart 1999
- Ollier Cliff: *Volcanoes—An Introduction to Systematic Geomorphology*, MIT Press, Cambridge MA (USA) and London (UK) 1975
- <http://vulcan.wr.usgs.gov/Monitoring>
- <http://www.educeth.ch/stromboli/beso/pdf/monitoraggio-stromboli-en.pdf>
- <http://volcanoes.usgs.gov/About/What/Monitor>
- <http://www.esa.int>
- <http://www.geo.uni-leipzig.de/~geosf/merapi/>
- <http://flir.images.alaska.edu/>

You can get the presentation and the handout at: <http://www.skriptweb.de/geo>

<i>Geophysical Parameter</i>	<i>What are the reasons?</i>	<i>How to measure it?</i>	<i>What does it tell us?</i>
<i>seismic activity</i>	<ul style="list-style-type: none"> • Several typical signals <ul style="list-style-type: none"> • Tremors • Cracking of rocks due to the pressure of magma • Landslides • Normal tectonic earthquakes 	<ul style="list-style-type: none"> • Seismometers • Acoustic flow monitors (AFM) 	<ul style="list-style-type: none"> • Tremors are one of the most important indicators for an eruption in the near future • With multiple seismometers it's possible to locate the source position of the signals and probably to track its way • Since no S-waves propagate through magma, you can locate magma chambers
<i>deformations of the surface</i>	<ul style="list-style-type: none"> • Ascending magma expands the volcano. The slopes get steeper. • After an eruption, the volcano deflates. 	<ul style="list-style-type: none"> • Tilt meters • Electronic distance measuring (EDM) with laser light • Satellite radar interferometry • GPS 	<ul style="list-style-type: none"> • An increasing tilt of the volcano slopes is a strong hint for a lot of magma flowing into the volcano, which will probably conduct to an eruption
<i>thermal variations</i>	<ul style="list-style-type: none"> • Ascending magma near the surface • Hot gases 	<ul style="list-style-type: none"> • Thermometers at the ground • Infra-red pictures <ul style="list-style-type: none"> • from satellites • from aircrafts • from ground 	<ul style="list-style-type: none"> • An increase in temperature normally is a hint of magma approaching the surface. So it is common that an eruption will occur at a hot point
<i>electrical, magnetic, gravitational variations</i>	<ul style="list-style-type: none"> • Movement of the magma in depth 	<ul style="list-style-type: none"> • Voltmeters, magnetometers, gravimeters 	<ul style="list-style-type: none"> • With numerical models one can try to reconstruct the internal structure and processes of the volcano