SYLLABUS for Volcano Monitoring GEOL 471 (3 semester credits)

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Sub-sections of the course will be taught by experts in various sub-fields.

Prerequisites: previous college credit in geology, mathematics, or other physical science

Course Format: The course is taught in a compressed format, meeting 8:00-5:00 five days a week for three weeks. The course includes lectures, field work, and laboratory work.

Grading: There are five sections to the course. Grade is based on a two-hour final exam (80%) covering the first four sections and an oral report (20%) for the fifth section.

Content

1. GROUND DEFORMATION MONITORING

Theory: Sources of volcano deformation, magnitude of the deformation signal, sources of error, environmental and atmospheric corrections

Basic Skills: Basic map reading, installation of benchmarks, setting up and levelling instrumentation, reading theodolites, distomats, and spirit levels, micro-computer data recordation and reduction, GPS and space based deformation monitoring

2. SEISMOLOGY

Basic Seismology: Sources: Earthquakes and tectonic events, origin and characteristics of tremor, seismotectonics of active volcanoes; Propagation and velocity structure: local methodology, attenuation, 3D velocity structures, site response, seismic noise sources.

Setup and operation of telemetered seismic networks: Seismometers: selection and characteristics, installation and maintenance, establishing recording sites, use of solar power; Telemetry; Routine processing: record keeping, earthquake counts, timing and event location, amplitude and magnitude determination.

3. PHYSICAL VOLCANOLOGY

Principles of physical volcanology: Properties of magmas: viscosity, rheology, gas content, density; Forms and structures of lava extrusions; Explosive eruptions involving water of external origin; Volcanic collapse, subsidence, and caldera formation

4. GAS GEOCHEMISTRY

Background geochemistry of volcanic systems: Rock types; Volatiles: source of magmatic volatiles, association of volatiles with rock types, role in the eruption process

Surface processes: Transport; Interaction with surface volatiles

Volcanic hazards: Eruptive discharges; Acute events; Composition of gases and ash; Impacts of discharge on local ecology: acid rain, fluoride poisoning, sulfite poisoning

Eruption forecasting: Fumarole gas chemistry; Crater lake chemistry; Radon monitoring; Hydrogen monitoring