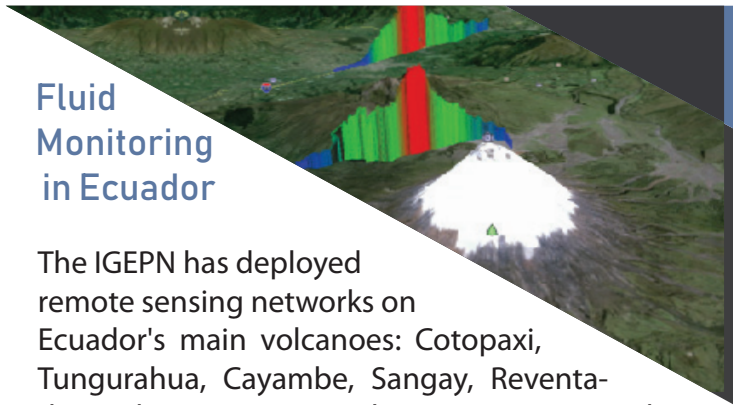


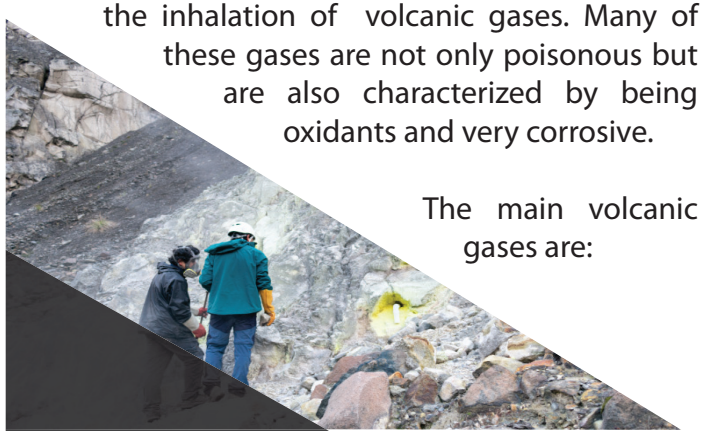
Fluid Monitoring in Ecuador

The IGEPN has deployed remote sensing networks on Ecuador's main volcanoes: Cotopaxi, Tungurahua, Cayambe, Sangay, Reventador and Sierra Negra. It also carries out periodic campaigns measuring and sampling hot springs and gases in at least 40 water springs and crater lagoons. Periodic overflights and measurement campaigns are also carried out with electrochemical sensors, which guarantee an adequate monitoring of the volcanic activity.

Associated Hazards

Most of the time, volcanic fluids do not represent danger to the safety of people. Volcanic gases in low concentrations (such as volcanic clouds dispersed in the atmosphere) are harmless, but they can be dangerous if we get too close to the emission center.

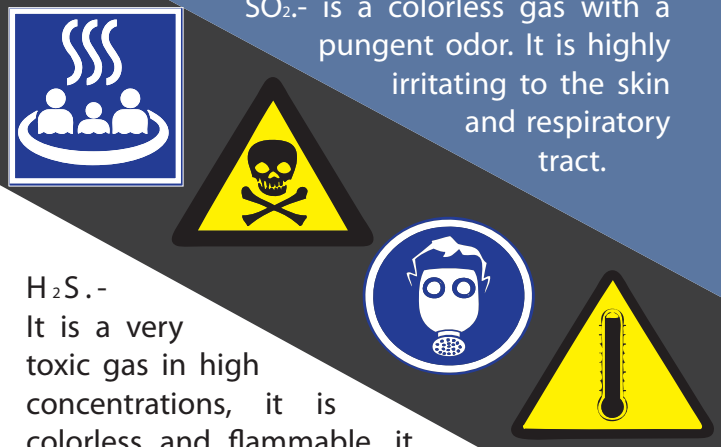
There have been multiple cases were people have died in Ecuador and the rest of the world due to the inhalation of volcanic gases. Many of these gases are not only poisonous but are also characterized by being oxidants and very corrosive.



The main volcanic gases are:

CO_2.- is the dominant volcanic gas, after water vapor. It is colorless and acts as an asphyxiant in high concentrations as it reduces the amount of oxygen in the air.

SO_2.- is a colorless gas with a pungent odor. It is highly irritating to the skin and respiratory tract.



H_2S.- It is a very toxic gas in high concentrations, it is colorless and flammable, it has an oddor of rotten eggs. Although our sense of smell can detect it easily, it becomes odorless and highly toxic in high concentrations.

HF, HCl, HBr (Halides) .- are strong and very soluble acids. They can injure the respiratory tract.

RECOMENDATIONS

- Keep away from the fumarolic fields or gas emission zones.
- Do not enter caves or holes when you are in a volcanic active zone.
- Do not enter to hot springs or pools outside the scheduled times for visits, especially if they present intense bubbling.
- Do not ignore the danger signs.

For more information, please visit:

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Volcanic Fluids
(Hot Springs and Gas)

Instituto Geofísico

ESCUELA POLITÉCNICA NACIONAL

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Translation: Daniel Sierra, Elisabeth Gaunt

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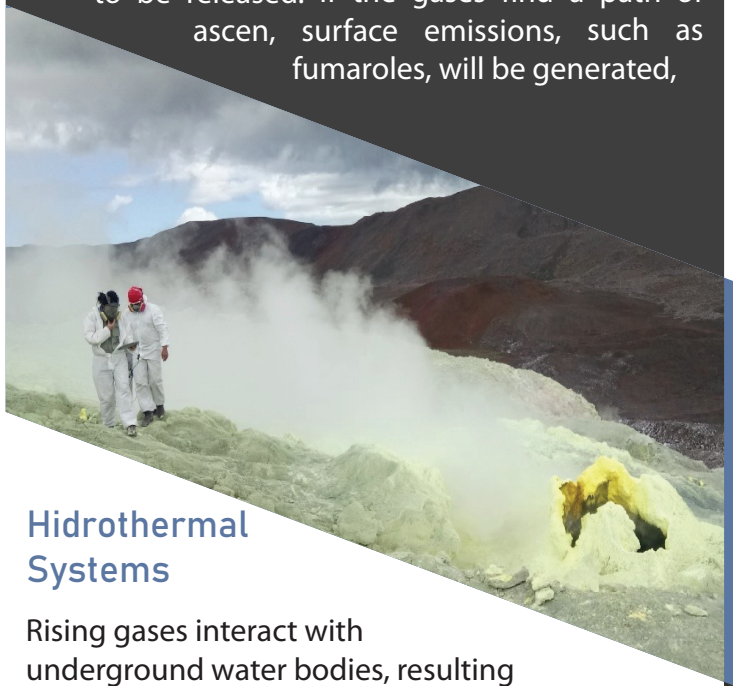
Volcanic Gases

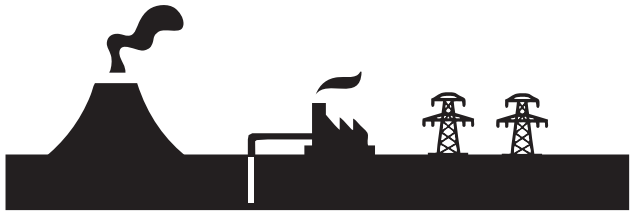
Magmas (partially molten rock) contain dissolved gases, which are one of the main drivers of volcanic eruptions.
When the magmas approach the surface, the pressure that confines them decreases, allowing them to be released. If the gases find a path of ascen, surface emissions, such as fumaroles, will be generated,

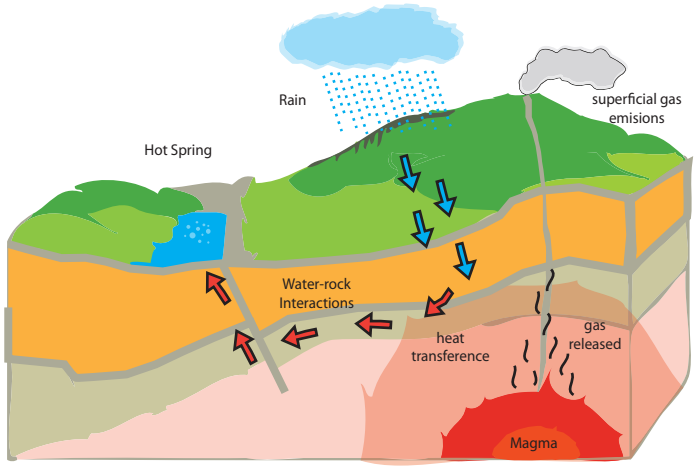


Hidrothermal Systems

Rising gases interact with underground water bodies, resulting in an increase in temperature and different chemical reactions, which change the properties of the gas, waters and the rocks that contain them.

In recent decades, they have been thought of as a source of clean energy, from which heat and electricity can be generated.



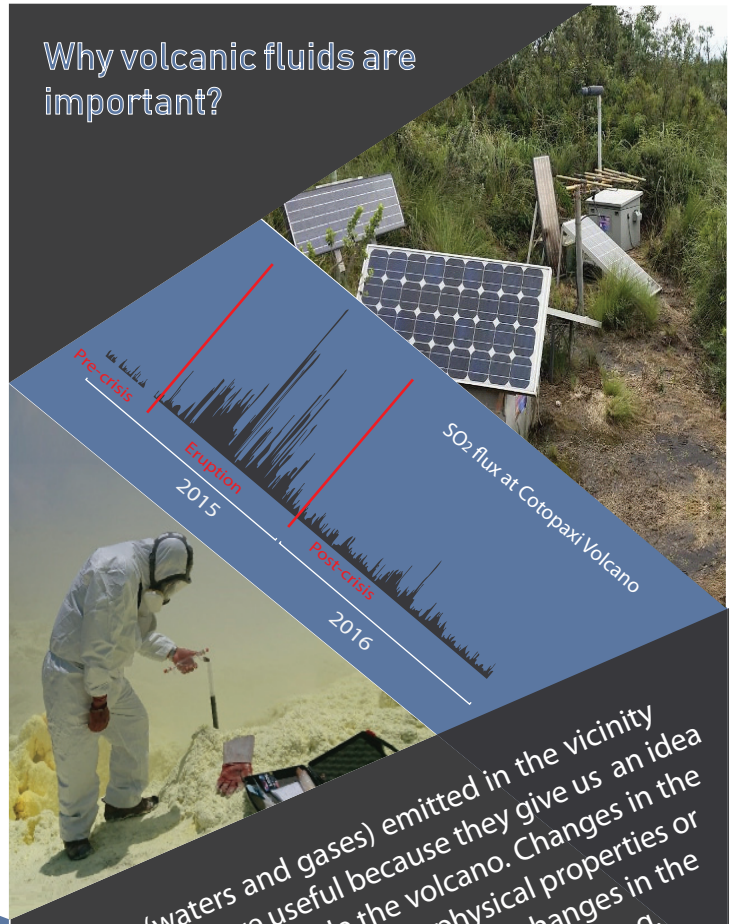


The proportions between the gas released and the amount of water available, in addition to the temperature, will define the type of surface manifestations, which may include fumaroles, thermal springs, bubbling pools, and others.

Hot Springs

Hot springs have a large amount of dissolved minerals as a result of their interaction with the rocks of the area. Due to their warm temperatures, many of them have been used as spas and therapeutic properties have been attributed to them.

Why volcanic fluids are important?



Fluids (waters and gases) emitted in the vicinity of volcanoes are useful because they give us an idea of what happens inside the volcano. Changes in the rate of emission of fluids, their physical properties or their composition can reveal internal changes in the volcano and can be used in eruption forecasting.

There are monitoring methods based on the direct sampling of fluids for further chemical analysis. But there are other methods based on the use of remote sensors. For example DOAS instruments or satellites use the changes in the sunlight spectrum generated by the gas to estimate the amount of gas emitted by a volcano from a long distance.