Semimari di geologia

Dipartimento di Scienze della Terra, Università degli Studi di Torino

Mercoledì 13 Febbraio 2019

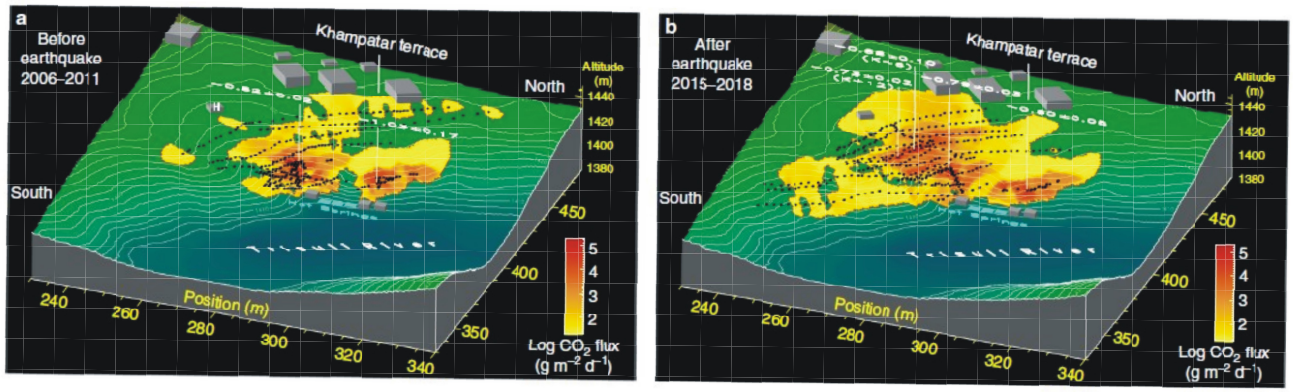
Ore 16.00 - Aula Ruffini

Dipartimento di Scienze della Terra, via Valperga Caluso 35 - Torino

Eruptions of CO_2 and hydrothermal unrest following the 2015 Gorkha earthquake in Nepal: Perspectives for the coming giant Himalayan earthquake?

Dr. Frédéric GIRAULT

Physics of Natural Sites, Institut de Physique du Globe de Paris



Fluid–earthquake interplay, as evidenced by aftershock distributions or earthquake-induced effects on near-surface aquifers, has suggested that earthquakes dynamically affect permeability of the Earth's crust. The connection between the mid-crust and the surface was further supported by instances of carbon dioxide (CO_2) emissions associated with seismic activity, so far only observed in magmatic context.

In the Main Central Thrust zone of the Nepal Himalayas, following evidence of degassing from chemical and isotopic analysis of hot springs and rivers, large CO_2 emissions were discovered near hot springs, with CO_2 fluxes at places similar to diffusive fluxes from active volcanoes. These non-volcanic CO_2 emissions are characterized by radiogenic helium, high radon content, and carbon isotopic compositions suggesting metamorphic CO_2 production at more than 5 km depth.

Recently, spectacular non-volcanic CO_2 outbursts and hydrothermal unrest have been reported at the front of the Nepal Himalayas following the deadly 25 April 2015 Mw7.8 Gorkha earthquake. The data show unambiguously the appearance, after the earthquake, sometimes with a delay of several months, of CO_2 emissions at several sites separated by more than 10 km. These first earthquake-induced gaseous changes in the absence of magmatic activity were associated with persistent changes in hydrothermal discharges, including a complete cessation.

These observations attest the presence of a large, relatively shallow, reservoir of CO_2 in the Himalayan crust, suggesting that metamorphic CO_2 produced at depth is huge, as independently shown by petrological estimates, and unlikely sequestered. Interesting pre-seismic effects, possibly observed at selected hot springs, open promising perspectives for the coming giant Himalayan earthquake. This study reveals that Himalayan hydrothermal systems are highly sensitive to co-, post- and possibly pre- seismic deformation, leading to non-stationary release of metamorphic CO_2 from active orogens.

IPGP INSTITUT DE PHYSIQUE DU GLOBE DE PARIS

cnrs

USPC Université Sorbonne Paris Cité

EARTH SCIENCES