



Modeling the lava heat flux during severe effusive volcanic eruption: an important impact on surface air quality

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The April 2007 eruption of Piton de la Fournaise, one of the most active volcanoes in the world, was the strongest eruption in recent decades with 230Mm³ of lava emitted and more 300KT of SO₂ degased. The surface concentrations of SO₂ have been measured by the ORA (Air Observatory of the Reunion Island) and showed that many stations exceeded the critic threshold for health. These high concentrations led to important health issues, accompanied by environmental and infrastructure degradations.

Realized with MesoNH atmospheric model, our simulations show the transport of sulfur and his component between 2 April and 6 April 2007, with a focus on the influence of heat flow from lava.

For this purpose, we have implemented ForeFire, a surface model initially realized to simulate forest fire, by adapting it to reproduce the dynamic of a lava flow. Thus, all flows (SO₂, heat, vapor, CO₂, CO) are triggered depending on its dynamic.

With this first approach, our simulations reproduce quite faithfully the surface field observation of SO₂ provides by ORA. Various sensitivity analyzes exhibit that volcano sulfur distribution was mainly controlled by the lava heat flow. Without heat flow parameterization, the surface concentrations are multiplied by a factor 30 compared to the reference simulation.

Simulations also put in evidence that the 5 April, during the height of the eruption, changes in meteorological conditions, especially weakening of atmospheric boundary layer stability, led to various pollutants to be transported in higher altitude (8000m). The main consequence is the volcanic pollutants are transported off the east coast of Réunion Island.