Geophysical Research Abstracts
Vol. 17, EGU2015-6134, 2015
EGU General Assembly 2015

Reactive plume chemistry and links to mercury deposition at Masaya volcano, Nicaragua

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Volcanoes are known to emit significant quantities of gases and trace metals including mercury. Some of these gases are involved in very fast reaction cycles in the atmosphere. This is especially true for chlorine and bromine which destroy ozone catalytically and also oxidise elemental gaseous mercury. Oxidised mercury is soluble and can be taken up by particles which can potentially increase the deposition of toxic mercury near the volcano. In order to quantify these processes we conducted a field campaign at Masaya volcano, Nicaragua in March/April 2011. We measured gaseous S, F, Cl, Br, I, total gaseous mercury and particulate mercury and particle size distributions near the crater rim and at a site $\sim$ 2.5 km downwind fumigated by the plume. We also measured BrO and SO_2 near the crater rim and at two distances downwind by U.V. spectroscopy. The BrO/SO_2 ratio was clearly elevated downwind compared to near-crater showing that reaction cycles to produce BrO are efficient on timescales of less than 10min. Changes in the mercury speciation (i.e., increased proportions of particulate Hg) were also observed at the downwind site, consistent with the links between reactive halogens and mercury discussed above. A one-dimensional model was used to simulate the evolution of the volcanic emissions in the atmosphere, the comparison with the field data showed good model skill at reproducing the chemical processes. Details of the field data and the model results will be discussed.