Geophysical Research Abstracts
Vol. 16, EGU2014-466, 2014
EGU General Assembly 2014


# Orographic Flow over an Active Volcano

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Orographic flows over and around an isolated volcano are studied through a series of numerical model experiments. The volcano top has a heated surface, so can be thought of as "active" but not erupting. A series of simulations with different atmospheric conditions and using both idealised and realistic configurations of the Weather Research and Forecast (WRF) model have been carried out. The study is based on the Soufriere Hills volcano, located on the island of Montserrat in the Caribbean. This is a dome-building volcano, leading to a sharp increase in the surface skin temperature at the top of the volcano – up to tens of degrees higher than ambient values. The majority of the simulations use an idealised topography, in order for the results to have general applicability to similar-sized volcanoes located in the tropics. The model is initialised with idealised atmospheric soundings, representative of qualitatively different atmospheric conditions from the rainy season in the tropics.
The simulations reveal significant changes to the orographic flow response, depending upon the size of the temperature anomaly and the atmospheric conditions. The flow regime and characteristic features such as gravity waves, orographic clouds and orographic rainfall patterns can all be qualitatively changed by the surface heating anomaly. Orographic rainfall over the volcano can be significantly enhanced with increased temperature anomaly. The implications for the eruptive behaviour of the volcano and resulting secondary volcanic hazards will also be discussed.