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Long range transport and fate of a stratospheric volcanic cloud from Soufrière Hills volcano, Montserrat

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Abstract. Volcanic eruptions emit gases, ash particles and hydrometeors into the atmosphere, occasionally reaching heights of 20 km or more, to reside in the stratospheric overworld where they affect the radiative balance of the atmosphere and the Earth's climate. Here we use satellite measurements and a Lagrangian particle dispersion model to determine the mass loadings, vertical penetration, horizontal extent, dispersion and transport of volcanic gases and particles in the stratosphere from the volcanic cloud emitted during the 20 May 2006 eruption of Soufrière Hills volcano, Montserrat, West Indies. Infrared, ultraviolet and microwave radiation measurements from two polar orbiters are used to quantify the gases and particles, and track the movement of the cloud for 23 days, over a distance of ~18 000 km. Approximately, 0.1±0.01 Tg(S) was injected into the stratosphere in the form of SO_2: the largest single sulphur input to the stratosphere in 2006. Microwave Limb Sounder measurements indicate an enhanced mass of HCl of ~0.003–0.01 Tg. Geosynchronous satellite data reveal the rapid nature of the stratospheric injection and indicate that the eruption cloud contained ~2 Tg of ice, with very little ash reaching the stratosphere. These new satellite measurements of volcanic gases and particles can be used to test the sensitivity of climate to volcanic forcing and assess the impact of stratospheric sulphates on climate cooling.

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