Satellite and Field Remote Sensing of Low-Level Degassing of Volcanoes: Preliminary Results from Kilauea and Masaya Volcanoes

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Through their persistent activity, basaltic volcanoes such as Kilauea (Hawaii) and Masaya (Nicaragua) contributes significant amounts of sulfur dioxide and other gases to the lower troposphere. Although primarily of local rather than regional impact, the continuous nature of these eruptions means that they can have a major impact on the atmosphere. Since mid-1986, Kilauea has emitted about 2,000 tonnes per day, while between 1995 and 2000 Masaya has emitted about 1,000 - 1,500 tonnes per day (Duffell et al., 2001, GRL 28: 3131-3134; Delmelle et al., 2001, EOS Trans. 80, 575 - 581). These emissions have a significant effect on the local environment. The volcanic smog ("vog") that is produced affects the health of local residents, impacts the local ecology via acid rain deposition and the generation of acidic soils, and is a concern to local air traffic due to degradation of visibility.

Until recently, most measurements of sulfur dioxide and the vog plumes have been made from the ground or from small aircraft. However, a new interdisciplinary science investigation has been funded by the National Aeronautics and Space Administration (NASA) to develop space-based methods for studying these inputs to the atmosphere and their impact on the environment. These satellite data are being used to monitor temporal changes in gas emission, and to tie these results in with ongoing field-based geophysical measurements (e.g., gas flux and composition, aerosol production rate, thermal flux, micro-gravity, ground deformation, and infra-sound). Observations are being made of both Kilauea and Masaya using NASA's Terra, Landsat 7 and EO-1 spacecraft, as well as the geostationary GOES weather satellites. The MODIS, ASTER, ETM+ and Hyperion instruments are particularly useful for this analysis, and our plans also include the use

of the AIRS/AMSU instrument on NASA's Aqua platform once it is launched. Innovative field measurements using light-weight UV-spectrometers and lidars (Horton et al., this volume), as well as hyperspectral imaging and continuous thermal radiometry, are being developed to provide a regional view of gas emission and dispersion. One of our ultimate goals is to have predictive atmospheric dispersion models using real-time MODIS data to calculate aerosol optical depths that will then provide advance warning (a day or two) for vog plumes that may impact down-wind centers of population such as Honolulu and Kona (Kilauea), and El Crucero (Masaya). This paper describes our integrated approach to monitoring the degassing of Kilauea and Masaya using these new satellite and field-based methods.