EGU2020-405, updated on 22 Jan 2021
https://doi.org/10.5194/egusphere-egu2020-405
EGU General Assembly 2020

Spatial and temporal variations in ambient SO2 and PM2.5 levels influenced by Kīlauea Volcano, Hawai'i, 2007 - 2018

Rachel Whitty[1], Evgenia Ilyinskaya[1], Emily Mason[2], Penny Wieser[2], Emma Liu[3], Anja Schmidt[4,5], Tjarda Roberts[6], Melissa Pfeffer[7], Barbara Brooks[8], Tamsin Mather[9], Marie Edmonds[2], Tamar Elias[10], David Schneider[11], Clive Oppenheimer[5], Adrian Dybwad[12], Patricia Nadeau[10], and Christoph Kern[13]

[1]The University of Leeds, Institute of Geophysics and Tectonics, School of Earth and Environment, Leeds, United Kingdom of Great Britain and Northern Ireland (eercww@leeds.ac.uk)
[2]Department of Earth Sciences, Faculty of Earth Sciences & Geography, University of Cambridge, United Kingdom
[3]Department of Earth Sciences, Faculty of Mathematical and Physical Sciences, University College London, United Kingdom
[4]Department of Chemistry, Faculty of Physics and Chemistry, University of Cambridge, United Kingdom
[5]Department of Geography, Faculty of Earth Sciences and Geography, University of Cambridge, United Kingdom
[6]Centre National de la Recherche Scientifique (CNRS), France
[7]Icelandic Meteorological Office, Iceland
[8]National Centre for Atmospheric Science, United Kingdom
[9]Department of Earth Sciences, Mathematical, Physical and Life Sciences Division, University of Oxford, United Kingdom
[10]Hawaiian Volcano Observatory, Volcano Disaster Assistance Program (USGS), United States
[11]Alaska Volcano Observatory (AVO), United States
[12]PurpleAir LLC, 110 West 13775 South STE 4 Draper, UT, United States
[13]Cascades Volcano Observatory, Volcano Disaster Assistance Program (USGS), United States

The 2018 eruption of Kīlauea volcano, Hawai'i, resulted in enormous gas emissions from the Lower East Rift Zone (LERZ) of the volcano. This led to important changes to air quality in downwind communities. We analyse and present measurements of atmospheric sulfur dioxide (SO_2) and aerosol particulate matter < 2.5 µm ($PM_{2.5}$) collected by the Hawai'i Department of Health (HDOH) and National Park Service (NPS) operational air quality monitoring networks between 2007 and 2018; and a community-operated network of low-cost $PM_{2.5}$ sensors on the Island of Hawai'i. During this period, the two largest observed increases in Kīlauea's volcanic emissions were: the summit eruption that began in 2008 (Kīlauea emissions averaged 5 – 6 kt/day SO_2 over the course of the eruption) and the LERZ eruption in May-August 2018 when SO_2 emission rates likely reached 200 kt/day in June. Here we focus on characterising the airborne pollutants arising from the 2018 LERZ eruption and the spatial distribution and severity of air pollution events across the Island of Hawai'i. The LERZ eruption caused the most frequent and severe exceedances of Environmental Protection Agency 24-hour-mean $PM_{2.5}$ air quality thresholds in Hawai'i since 2010. In Kona, for example, there were eight exceedances during the 2018 LERZ eruption, where there had been no exceedances in the previous eight years as measured by the HDOH and NPS networks. SO_2 air pollution during the LERZ eruption was most severe in communities in the south and west of the

island, with maximum 24-hour-mean mass concentrations of 728 μg/m^3 recorded in Ocean View (100 km west of the LERZ emission source) in May 2018. Data from the low-cost sensor network correlated well with data from the HDOH $PM_{2.5}$ instruments (Kona station, R^2 = 0.89), demonstrating that these low-cost sensors provide a viable means to rapidly augment reference-grade instrument networks during crises.