Using GES DISC Data to Study Kilauea Volcano of 2018

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Summary

The eruption of Kilauea volcano in Hawaii in early May 2018 injected massive amounts of SO_2 and ash into the atmosphere. The effusive lava flow during this eruption destroyed many homes and entire neighborhoods. Here, the SO_2 plume from the eruption of Kilauea volcano is analyzed from May to August 2018 using multiple satellite data products, such as Level 2 data from the TROPOspheric Monitoring Instrument (TROPOMI) and Level 3 data from the Ozone Monitoring Instrument (OMI), acquired from the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC).

The GES DISC hosts multi-disciplinary Earth science data sets that can be used to analyze natural disasters such as the Kilauea eruption. Additionally, the GES DISC's Giovanni tool can be used to visualize these data. We acquired OMI data through the subsetting function, which is processed by GES DISC in-house developed backend software, the Level3/4 Regridder and Subsetter (**L34RS**), and TROPOMI data using OPeNDAP.

L34RS allows users to subset the data by 1) time, 2) spatial extent, and 3) variables. The variables can be remapped using different interpolation techniques onto user specified grids while preserving the original file structure, metadata, data types, and attributes. The subset file can be converted and downloaded as a netCDF file.

Data Access Services:

- ❑ Subsetting service
- ❑ Direct download (HTTPS)
- ❑ OPeNDAP
- ❑ GDS (GrADS Data Server)
- ❑ TDS (THREDDS Data Server)
- ❑ ArcGIS Image Service, WMS, WCS
- ❑ Giovanni: online visualization
- ❑ Data How-to
- ❑ News Articles

Satellite / Model Data

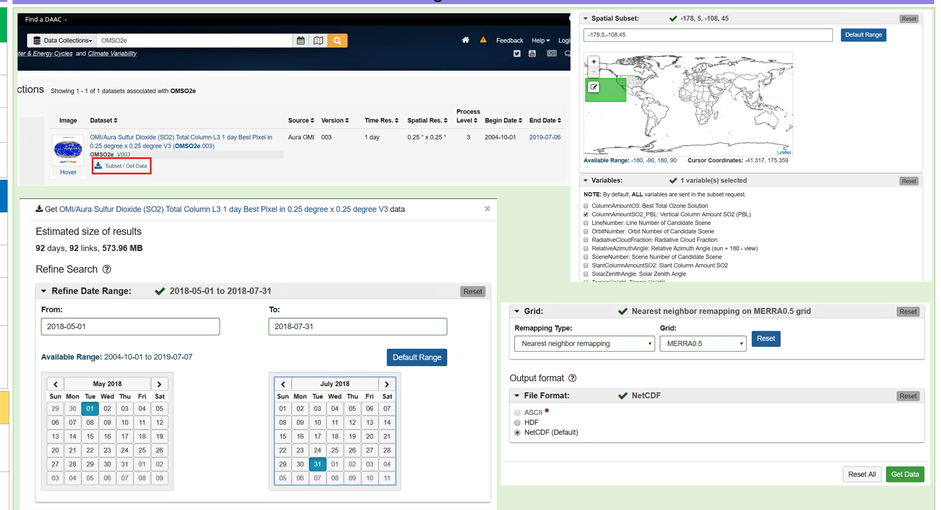
Measurements	Instrument	Data Collections	Description
Sulfur dioxide	OMI	OMSO2e	Level 3, 0.25° x 0.25°, daily, Total Column
Formaldehyde	OMI	OMHCHOd	Level 3, 0.25° x 0.25°, daily, Total Column
Aerosol Index	OMI	OMAEROe	Level 3 daily global gridded, 0.25° x 0.25°, VIS Aerosol Index
Sulfur dioxide	TROPOMI	S5P_L2__SO2___	Level 2, 7 km x 3.5 km, 101.5 minutes, Total vertical column

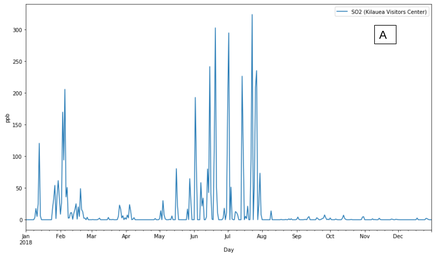
Measurements	Model	Data Collections	Description
Wind speed	MERRA2	M2I3NVASM	Level 4, 0.5° x 0.625°, 3d, 3-Hourly, Time-Averaged
Wind speed	MERRA2	M2T1NXSLV.5.12.4	Level 4, 0.5° x 0.625°, 2d, Hourly, Time-Averaged
SO_2 Column Mass Density	MERRA2	M2T1NXAER	Level 4, 0.5° x 0.625°, 2d, Hourly, Time-Averaged
Dust extinction AOT [550 nm] - PM 1.0 um	MERRA2	M2T1NXADG	Level 4, 0.5° x 0.625°, 2d,1-Hourly, Time-Averaged

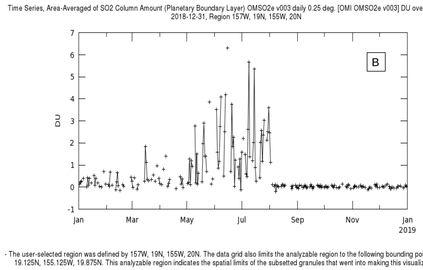
GIS Data	Source
Road / Building	Hawaii State Wide GIS Program/Microsoft/Open Street Map
Lava Flow Hazard Zone	U.S. Department of the Interior, United States Geological Survey

Ground Observations	Source
SO_2 ground concentration	Hawaii Volcanoes National Park - Kilauea Visitors Center
$PM_{2.5}$ ground Concentration Pahala Site, Hawaii	Hawaii State Department of Health

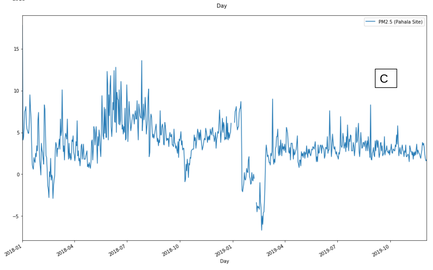
Level 3 4 Regridder and Subsetter

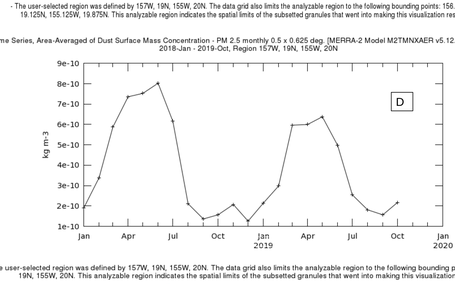






- The user-selected region was defined by 157W, 19N, 155W, 20N. The data grid also limits the analyzable region to the following bounding points: 156.875W, 19.125N, 155.125W, 19.875N. This analyzable region indicates the spatial limits of the subsetted granules that went into making this visualization result.





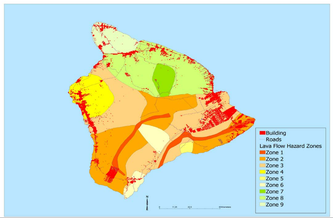
- The user-selected region was defined by 157W, 19N, 155W, 20N. The data grid also limits the analyzable region to the following bounding points: 156.875W, 19N, 155W, 20N. This analyzable region indicates the spatial limits of the subsetted granules that went into making this visualization result.

A) Ground observations at Kilauea Visitors Center shows spike in SO_2 level after the volcanic eruption from early May to late August in 2018.

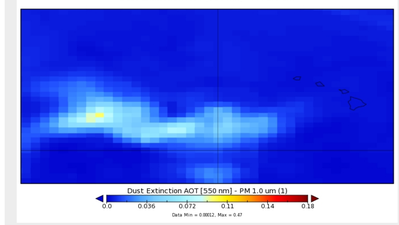
B) Similarly, area averaged SO_2 column amount (PBL) derived from OMI shows increase in SO_2 levels during the same time period.

C) Ground observations of $PM_{2.5}$ showed higher concentrations from May to July, 2018 compared to 2019.

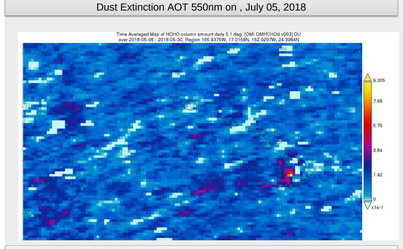
D) Time series area averaged dust surface mass concentration of $PM_{2.5}$ derived from monthly MERRA2 was higher during Feburary to July of 2018 compared to same period during 2019.



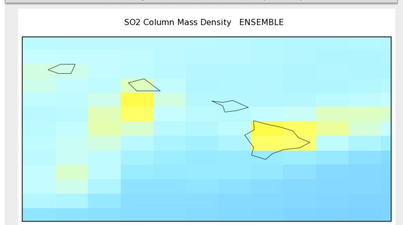
Lava Flow Hazard map showing 9 hazard zones, ranked from 1 through 9 based on the probability of coverage by lava flows. Zone 1 (bright orange) is the most hazardous which includes volcanic vents in the summits and rift zones of Kilauea and Mauna Loa and Zone 9 is considered the least hazardous region. Building footprints (red) are overlaid over the lava zone map.



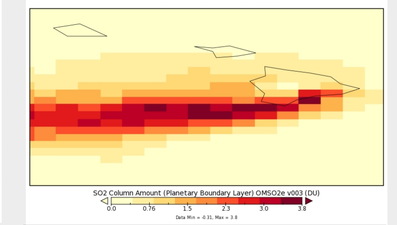
MERRA-2, M2T1NXADG
Dust Extinction AOT 550nm on , July 05, 2018



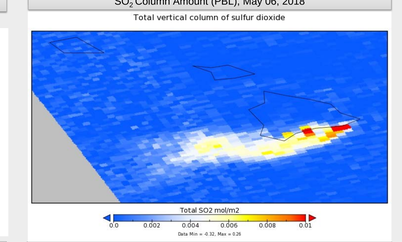
OMI, OMHCHOd
Formaldehyde, 05-06-2018 - 05-30-2018 (Giovanni)



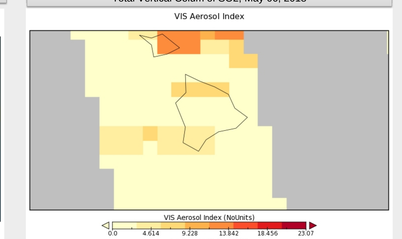
MERRA2, M2T1NXAER
SO_2 Column Mass Density, May 06 2018



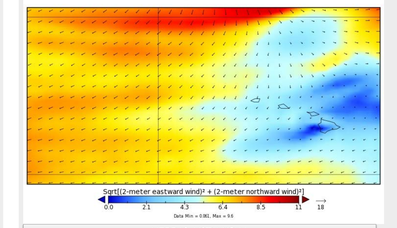
OMI OMSO2e
SO_2 Column Amount (PBL), May 06, 2018



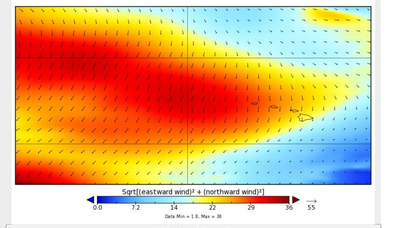
TROPOMI, S5P_L2__SO2___
Total Vertical Colum of SO2, May 06, 2018



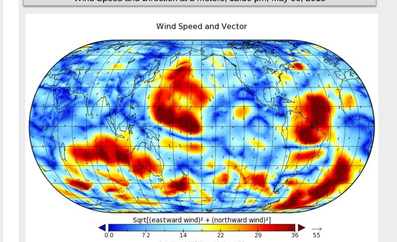
OMI, OMAEROe
Aerosol Index, May 06, 2018



MERRA2, M2T1NXSLV,
Wind Speed and Direction at 2 meters, 12:30 pm, May 06, 2018



MERRA2, M2I3NVASM,
Wind Vector at 880 hPa at 12 pm, May 06, 2018



MERRA2, M2I3NVASM,
Wind Vector at 880 hPa at 12 pm, May 06, 2018

GES DISC

GIOVANNI

Conclusion

Elevated levels of SO_2, formaldehyde, and particulate matter ($PM_{2.5}$) were observed after the volcanic eruption, which posed significant impacts on public health. The wind pushed the ashes to the west.

SO_2 poses serious threats to individuals with predisposed medical conditions, such as asthma, and people with cardiovascular disease. It can particularly impact elderly people and children. The volcanic activity forced evacuations of areas with high SO_2 concentrations.

L34RS provides easy access to earth science data for studying disaster events such as volcanic eruption.

GES DISC: https://disc.gsfc.nasa.gov

Comments and suggestions: gsfc-help-disc@lists.nasa.gov

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Goddard Earth Sciences Data Information Services Center