

Methods for annotating GLOBE dust observations

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Summary

This document describes the quality-assured GLOBE observations of dust events.

Data files

2012-2019_GLOBE_dust_data_v1-0.csv

2020_GLOBE_dust_data_v1-0.xlsx

Citations

For 2012-2019 dataset:

Amos, H.M., T.M. Rogerson, M. Colón Robles, J.E. Taylor, 2020, GLOBE Dust Events 2012-2019 Dataset v1, NASA Langley Research Center, <https://observer.globe.gov/get-data/dust-data>

For 2020 dataset:

Welsh, J., Amos, H.M., T.M. Rogerson, M. Colón Robles, J.E. Taylor, 2021, GLOBE Dust Events 2020 Dataset v1, NASA Langley Research Center, <https://observer.globe.gov/get-data/dust-data>

Description of the data

The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and citizen scientists the opportunity to contribute Earth observations (globe.gov). Participants collect observations following strict step-by-step protocols (a.k.a., standard operating procedures or SOPs). The [GLOBE Clouds protocol](#) asks participants to observe their local sky conditions, including percent (%) cloud cover, cloud type, visibility, and presence of obscurations (e.g., dust, smoke, ash). By definition then, all GLOBE dust observations come through the GLOBE Clouds protocol. All dust data are georeferenced with the observation time, latitude, longitude, and elevation.

This dust dataset includes all incidences of dust events reported to GLOBE between 2012-01-01 and 2020-12-31 (in two separate files) for which dust was reported (i.e., dust == TRUE). Participants submitted their through either [GLOBE's traditional channels of data entry](#) (2012-2020) or through the [GLOBE Observer mobile app](#) (2016-2020). Here we use the [satellite-matched GLOBE Clouds data](#) as our base dataset [Colón Robles et al., 2019; Rogerson et al., 2019]. That dataset is then filtered for observations where [dust is reported](#) (i.e., dust == TRUE). This dataset includes two additional variables that communicate the trustworthiness of an individual dust observation (**Table 1**). Each dust observation was individually scrutinized and labeled as TRUE, FALSE, or UNKNOWN (**Table 1**). In some instances, the dust observation was TRUE but the photo was not able to capture the dust storm event (i.e., Is_Dust=TRUE and Dust_QA_comment=CDP). Observations that did not include photograph(s) were automatically labeled UNKNOWN. Observations that included photograph(s) were evaluated and labeled according to the following criterion:

- observation location and time
- visual inspection of submitted photographs
- Aqua/MODIS, Terra/MODIS, Suomi NPP/VIIRS Corrected Reflectance True Color images and Aqua/AIRS Dust Score (L2/Day) on NASA WorldView [\[link\]](#)
- Terra/MODIS Fire and Thermal anomalies on NASA WorldView to check for proximity of fires and smoke [\[link\]](#)
- consistency with seasonality of dust events based on *Ginoux et al.* [2012]
- logical consistency of the observation
- satellite-match information [*Colón Robles et al.*, 2019]
- quality of the observer's other observations, if available

Table 1. Quality assurance variables for GLOBE dust data

Is_dust	Dust_QA_comment	Description
UNKNOWN	no photos	Photo(s) not provided
	CDP	Presence/absence of dust event cannot be confidently determined from photo(s) provided CDP == Cannot Determine from Photo(s)
TRUE (YES)		Dust event confirmed
	CDP	CDP == Cannot Determine from Photo(s)
FALSE		Not a dust event
	OVR	Overcast skies misreported as obscuration

References

Colón Robles, M., T. M. Rogerson, and J. B. Dodson (2019), NASA GLOBE Clouds: Documentation on How Satellite Data is Collocated to Ground Cloud Observations (v1.0) *Rep.*, NASA Langley Research Center.

Ginoux, P., J. M. Prospero, T. E. Gill, N. C. Hsu, and M. Zhao (2012), Global-scale attribution of anthropogenic and natural dust sources and their emission rates based on MODIS Deep Blue aerosol products, *Reviews of Geophysics*, 50(3), doi:10.1029/2012rg000388.

Rogerson, T. M., M. Colón Robles, and J. E. Taylor (2019), GLOBE Clouds Dataset v1, NASA Langley Research Center, <https://observer.globe.gov/get-data/clouds-data>