Supporting Information for

The 2024 Release of the Global Heat Flow Database (GHFDB): Quality Assessment, Metadata Standards, and a Century of Geothermal Data

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Criterion for extracting data from the global HF database

Some Global Heat Flow Database data reflect local observations at extreme locations. For example, Wheat et al. (2004) presented measurements directly on the Juan de Fuca hydrothermal system, where the maximum reaches up to 489,000 mW/m^2. Measurements at Ijen Volcano, Indonesia (Afandi et al., 2021) show a scatter of heat-flow values ranging from -6,120 to 109,480 mW/m^2. Including these extreme heat flow values in the global analysis can significantly affect the overall statistics. To avoid this, we consider the data within -1,000 to 1,000 mW/m^2 and calculate the main statistical parameters. The median value (64 mW/m^2) best approximates the peak maximum of the heat flow distribution histogram (Fig.S1). Values for standard deviations σ, 2σ, and 3σ are 198.9, 303.5, and 408 mW/m^2, respectively. For the global interpolation of the data, we will use the interval from 0 to 3σ (99.7% of all measurements) i.e., 0–408 mW/m^2, as it is more appropriate for the geothermal heat flow, excluding most extreme local surface effects.

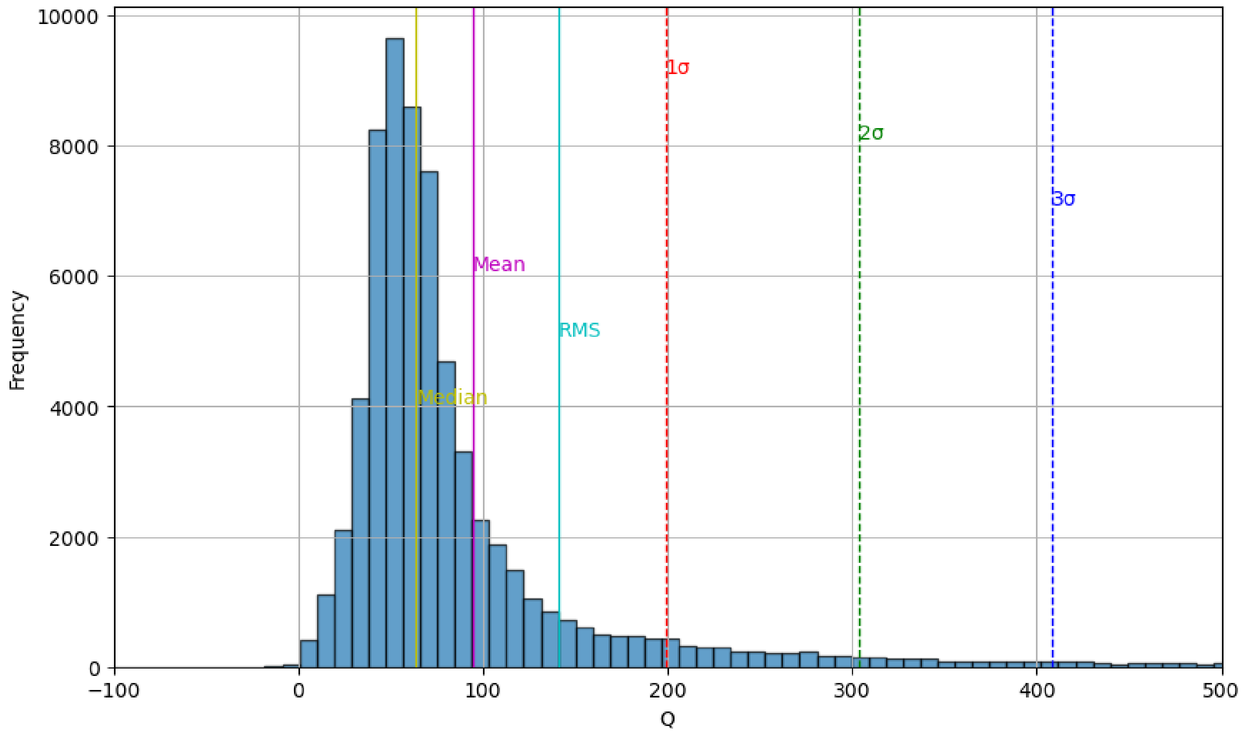

Fig. S1 Heat flow (q, mW/m^2) distribution with major statistical parameters (median, mean, root mean square (RMS), and standard deviation σ). Considered data range: -1,000 to 1,000 mW/m^2.

We select only parent and unique data in the filtered dataset, ensuring that each measurement corresponds only to a single coordinate and heat flow value. Then, we divide the Earth's surface into a regular grid 0.5 by 0.5 degrees and calculate a median heat flow value for each grid cell containing data (Fig. S2). This approach reduces the impact of outliers providing more consistent data for further analysis.

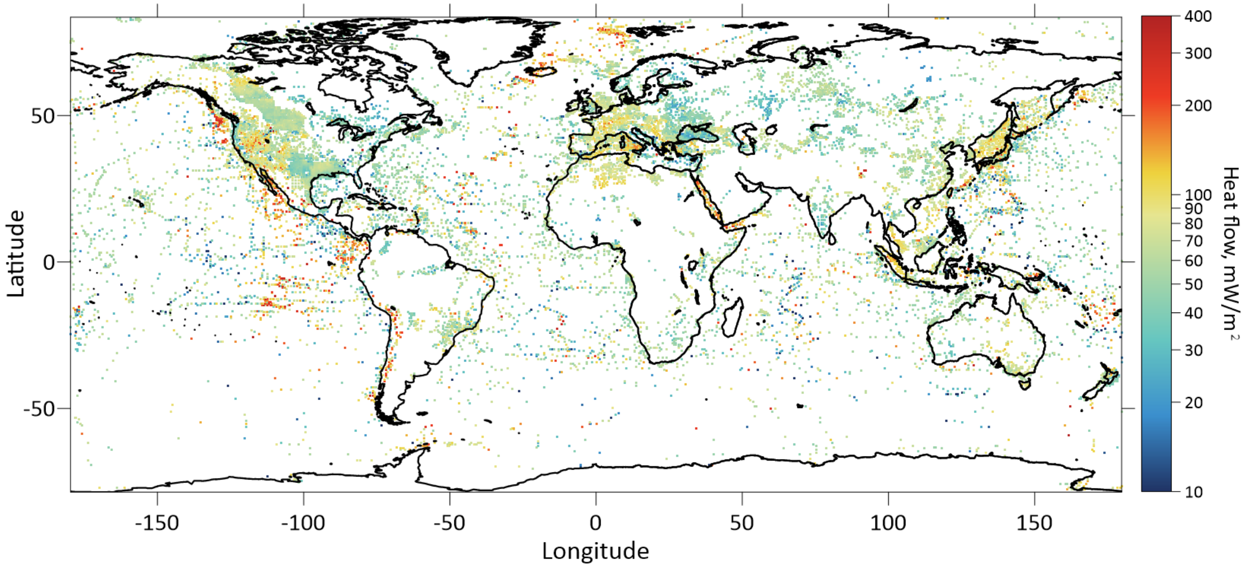

Fig. S2 Distribution of median heat flow values averaged 0.5×0.5 degrees. The data is provided in files IHFC_2024_GHFDB_05x05_median_3_sigma.csv and IHFC_2024_GHFDB_05x05_median_3_sigma.kml

Figure S3 represents the density of heat flow measurements within a specific geographic region. Each cell on the grid corresponds to a 0.5 by 0.5 degree latitude and longitude area. The color indicates the concentration of heat flow measurements within the particular grid cell. Thus, the figure shows regions where heat flow measurements are more abundant, sparse, or absent. According to Fig. 3, most dense measurements (up to 400 for the grid cell) are in North America and Europe.

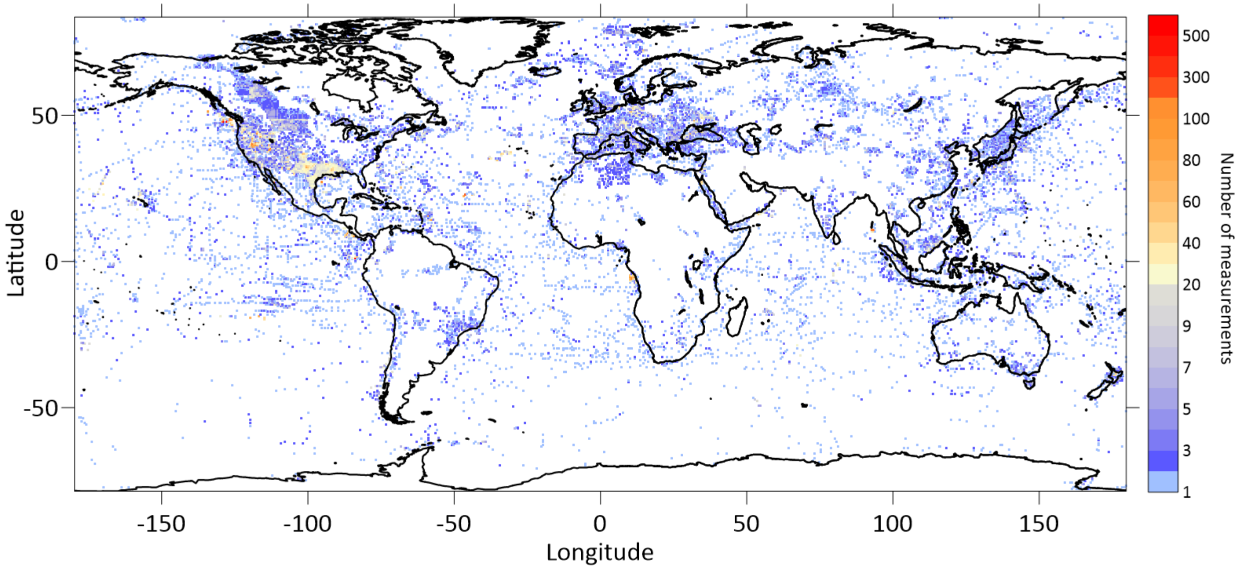

Fig. S3 Density of the heat-flow measurements within each 0.5 by 0.5-degree grid cell. The data is included in files IHFC_2024_GHFDB_05x05_median_3_sigma.csv and IHFC_2024_GHFDB_05x05_median_3_sigma.kml

References

Wheat, C. G., Mottl, M. J., Fisher, A. T., Kadko, D., Davis, E. E., & Baker, E. (2004). Heat flow through a basaltic outcrop on a sedimented young ridge flank. Geochemistry, Geophysics, Geosystems, 5(12).

Afandi, A., Lusi, N., Catrawedarma, I. G. N. B., & Zaman, M. B. (2021, February). Identification of gradient temperature and heat flow area of geothermal Ijen Volcano Indonesia. In IOP Conference Series: Materials Science and Engineering (Vol. 1034, No. 1, p. 012072). IOP Publishing.

Data formats description

Scattered data:

IHFC_2024_GHFDB_unique.csv: Comma Separated Values (csv) file containing unique heat flow values for every measurement point.

Columns:

Q:	heat flow value in mW/m^2
Name:	name of the measurement's site
Lat:	latitude (-90°S:90°N)
Lon:	longitude (-180°W:180°E)
Reference:	referenced source
ID:	unique child ID

IHFC_2024_GHFDB_unique.kml: KML (Keyhole Markup Language) file containing unique heat flow values for every measurement point.

Description:

Latitude:	latitude (-90°S:90°N)
Longitude:	longitude (-180°W:180°E)
Heat flow:	heat flow value in mW/m^2
Name:	name of the measurement's site
Reference:	referenced source
ID:	unique child ID

IHFC_2024_GHFDB_filtered_3_sigma.csv: Comma Separated Values (csv) file containing heat flow value filtered with 3σ (standard deviations from a mean) interval (derived from the data IHFC_2024_GHFDB_unique.xlsx).

Columns:

Q:	heat flow value in mW/m^2
Name:	name of the measurement's site
Lat:	latitude (-90°S:90°N)
Lon:	longitude (-180°W:180°E)
Reference:	referenced source
ID:	unique child ID

IHFC_2024_GHFDB_filtered_3_sigma.kml: KML (Keyhole Markup Language) file containing heat flow value filtered with 3σ (standard deviations from a mean) interval.

Description:

Latitude: latitude (-90°S:90°N)
Longitude: longitude (-180°W:180°E)
Heat flow: heat flow value in mW/m^2
Name: name of the measurement's site
Reference: referenced source
ID: unique child ID

IHFC_2024_GHFDB_05x05_median_3_sigma.csv: Comma Separated Values (csv) file containing median heat flow value for each non-empty 0.5×0.5 degrees grid cell (derived from the data IHFC_2024_GHFDB_filtered_3_sigma.xlsx).

Columns:

Lat: latitude (-90°S:90°N)
Lon: longitude (-180°W:180°E)
Median_Q: median value for the heat flow value in mW/m^2
Number of measurements: number of measurements in each grid cell
Assessed(average): number of assessed measurements in each grid cell

IHFC_2024_GHFDB_05x05_median_3_sigma.kml: KML (Keyhole Markup Language) file containing median heat flow value for each non-empty 0.5×0.5 degrees grid cell.

Description:

Latitude: latitude (-90°S:90°N)
Longitude: longitude (-180°W:180°E)
Median_Q: median value for the heat flow value in mW/m^2
Number of measurements: number of measurements in each grid cell

Grid data:

IHFC_2024_GHFDB_05x05_WGS1984_Kriging.csv: Comma Separated Values (csv) file containing gridded heat flow data interpolated by Kriging at a resolution of 0.5×0.5 degrees. WGS 1984 projection

Columns:

Lon: longitude (-180°W:180°E)

Lat: latitude (-90°S:90°N)
Q: heat flow value in mW/m²

IHFC_2024_GHFDB_05x05_WGS1984_STD.csv: Comma Separated Values (csv) file containing gridded standard deviation data for interpolated heat flow data. WGS 1984 projection

Columns:

Lon: longitude (-180°W:180°E)
Lat: latitude (-90°S:90°N)
Q_std: standard deviation for the interpolated data in mW/m²

IHFC_2024_GHFDB_Ortho_N.csv: Comma Separated Values (csv) file containing gridded heat flow data interpolated by Kriging at a resolution of 50×50 km. North Pole Orthographic projection

Columns:

X: X coordinate, m
Y: Y coordinate, m
Q: heat flow value in mW/m²
Lon: corresponding longitude (-180°W:180°E)
Lat: corresponding latitude (28°N:90°N)

IHFC_2024_GHFDB_Ortho_N_STD.csv: Comma Separated Values (csv) file containing gridded standard deviation data for interpolated heat flow data. North Pole Orthographic projection

Columns:

X: X coordinate, m
Y: Y coordinate, m
Q_std: standard deviation for the interpolated data in mW/m²
Lon: corresponding longitude (-180°W:180°E)
Lat: corresponding latitude (28°N:90°N)

IHFC_2024_GHFDB_Ortho_S.csv: Comma Separated Values (csv) file containing gridded heat flow data interpolated by Kriging at a resolution of 50×50 km. South Pole Orthographic projection

Columns:

X: X coordinate, m
Y: Y coordinate, m
Q: heat flow value in mW/m²
Lon: corresponding longitude (-180°W:180°E)
Lat: corresponding latitude (-90°S:-28°S)

IHFC_2024_GHFDB_Ortho_S_STD.csv: Comma Separated Values (csv) file containing gridded standard deviation data for interpolated heat flow data. South Pole Orthographic projection

Columns:

X: X coordinate, m
Y: Y coordinate, m
Q_std: standard deviation for the interpolated data in mW/m^2
Lon: corresponding longitude (-180°W:180°E)
Lat: corresponding latitude (-90°S:-28°S)