

VOLCANO MONITORING USING MODIS

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UNIVERSITY *of* HAWAI'I®

MĀNOA



http://modis.higp.hawaii.edu

Index of /~wright/m/ x MODVOLC x

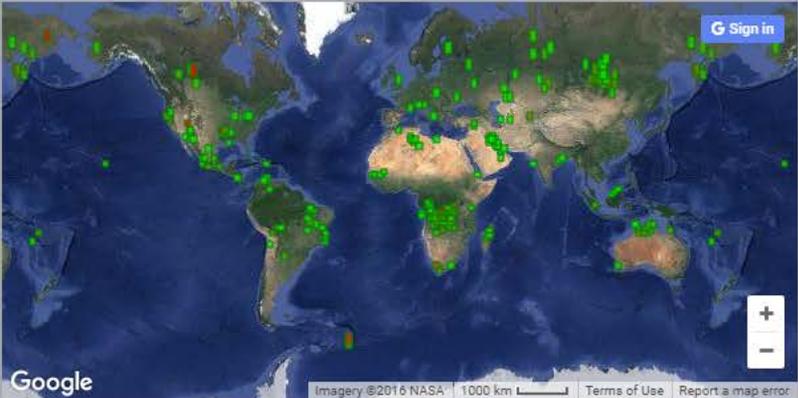
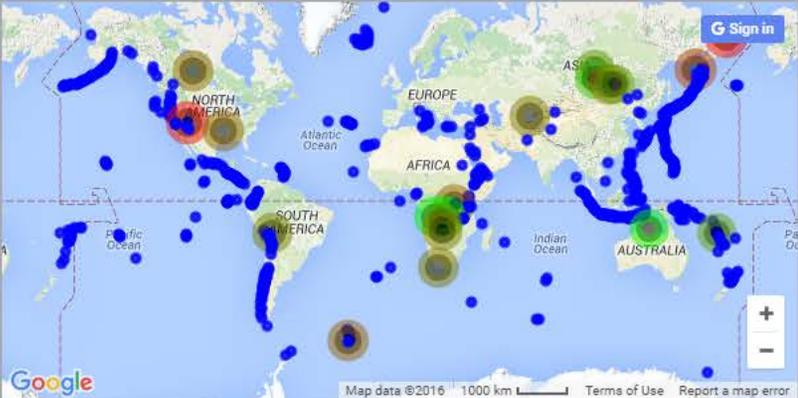
modis.higp.hawaii.edu/new/

MODVOLC

near-real-time satellite monitoring of global volcanism using MODIS



MODVOLC uses infrared satellite data acquired by NASA's MODIS instrument to monitor Earth's surface for the thermal emission signature of volcanic eruptions, wildfires, and anthropogenic heat sources (e.g. gas flares). Two MODIS sensors, one on the Terra satellite, one on the Aqua satellite, allow the entire Earth to be monitored every 48 hours. If an eruption is detected, its details are reported here, usually within 12-18 hours of the satellite passing over the volcano. You can search, plot, and download the data using the tools below. If you are unsure as to what you are looking at, [this page](#) provides links to published papers and other information that describe the data, and this website.



1. Which volcano are you looking for?

Volcano name:

Lat/Long/Center: 0.000 0.000 143.931

Volcano ID: 1025

2. What period of time?

Start date: 6/8/2016

End date: 6/8/2016

3. Which MODIS sensor?

Terra

Aqua

4. What time of day?

Daytime

Nighttime

5. Observation geometry?

Sun glint angle: 12

Scan angle:

6. Which variable would you like to plot?

Number of hot-spot pixels Radiant flux 3.959 μ m spectral radiance

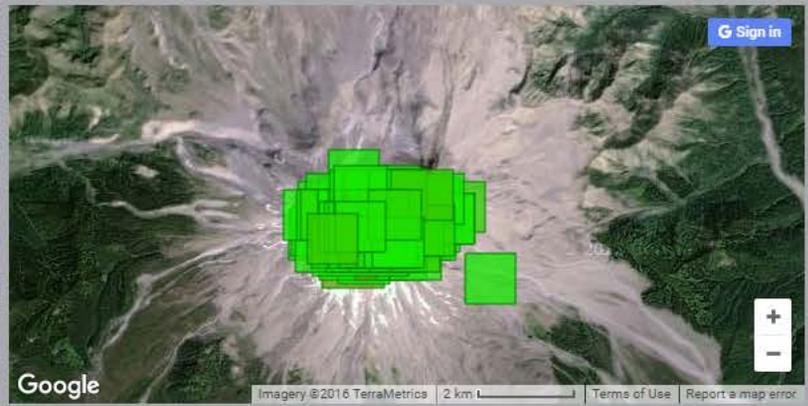
7. Progress 8. View/Save data

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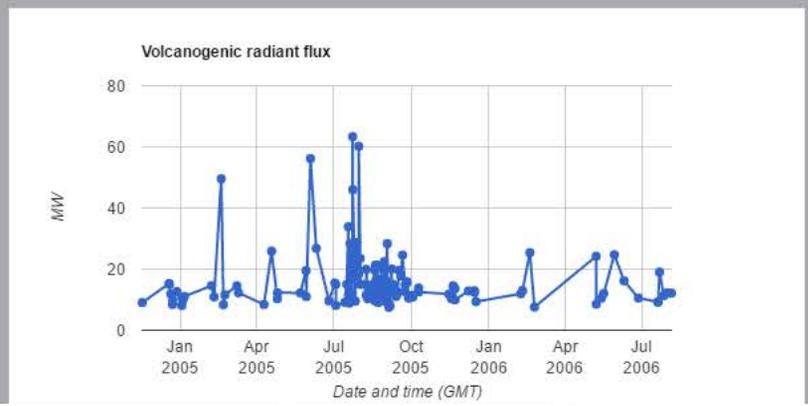
3. Which MODIS sensor?
 Terra
 Aqua

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 Daytime
 Nighttime

5. Observation geometry?
 Sunlint angle:
 Scan angle:

6. Which variable would you like to plot?
 Number of hot-spot pixels
 Radiant flux
 3.959µm spectral radiance

7. Progress 8. View/Save data





MODVOLC uses infrared satellite data to detect anthropogenic heat sources. When an eruption is detected, its location is shown on the tools below. If you are using...



Untitled - Google Chrome

about:blank

UNIX Time	Sat	Year	Mo	Dy	Hr	Mn	Longitude	Latitude	B21	B22	B6	B31	B32	SatZen	SatAzi	SunZen	SunAzi	Line	Samp	Ratio	GIIn	Excess	Temp	Err
1154757600	T	2006	08	05	06	00	-122.192352	46.195908	0.930	0.961	168.305	7.178	6.851	1.43	89.55	110.18	-34.37	1246	693	-0.75	109.122	12.153	282.6	3.4
1154339399	A	2006	07	31	09	50	-122.181595	46.193722	0.896	0.947	177.043	6.247	6.006	36.27	97.52	111.78	24.37	1577	281	-0.73	117.559	12.259	281.2	5.5
1153980299	T	2006	07	27	06	05	-122.190880	46.193359	0.924	0.917	168.304	7.540	7.181	9.00	-103.88	108.63	-32.38	1698	578	-0.77	110.927	11.341	282.5	4.5
1153547400	T	2006	07	22	05	50	-122.188164	46.193882	1.299	1.324	168.304	7.343	7.001	21.14	75.29	105.94	-35.26	331	911	-0.68	97.672	19.033	282.5	4.5
1153390199	A	2006	07	20	10	10	-122.187767	46.201702	0.809	0.784	177.351	7.069	6.806	9.45	101.18	108.12	28.29	836	572	-0.79	110.836	9.178	281.2	5.5
1153375200	T	2006	07	20	06	00	-122.193939	46.194756	0.738	0.808	168.304	7.069	6.736	1.49	99.69	106.74	-32.86	1239	693	-0.79	105.498	9.280	282.5	4.5
1151387700	T	2006	06	27	05	55	-122.194435	46.196301	0.729	0.794	168.305	7.347	6.977	11.69	76.95	104.05	-32.07	743	807	-0.80	99.862	10.546	276.2	6.5
1149916200	T	2006	06	10	05	10	-122.191696	46.200439	1.069	1.092	168.316	6.342	6.148	58.10	69.16	100.38	-40.85	1645	1291	-0.70	78.767	16.178	276.2	6.5
1148926800	T	2006	05	29	18	20	-122.183136	46.192348	1.837	2.017	9.773	6.562	6.274	58.61	93.45	32.14	129.85	1483	59	-0.59	86.015	24.701	280.8	9.7
1147845600	T	2006	05	17	06	00	-122.198647	46.199787	0.864	0.826	168.316	6.661	6.379	1.89	92.07	108.86	-30.96	1078	698	-0.77	107.654	12.044	271.6	7.1
1147599600	A	2006	05	14	09	40	-122.173256	46.200085	0.691	0.699	177.203	6.166	5.928	49.22	95.05	111.67	24.45	69	148	-0.79	118.315	9.649	271.5	7.5
1147599600	A	2006	05	14	09	40	-122.179535	46.200600	0.750	0.790	177.203	6.242	5.983	49.22	95.05	111.67	24.44	72	148	-0.77	117.707	11.384	271.4	8.2
1147083300	A	2006	05	08	10	15	-122.178894	46.195301	0.556	0.591	177.175	5.482	5.235	0.63	-73.91	118.07	33.35	767	684	-0.80	109.950	7.623	271.4	8.2
1147083300	A	2006	05	08	10	15	-122.191574	46.197182	0.664	0.688	177.175	5.491	5.339	0.52	-73.22	118.07	33.33	767	683	-0.77	109.993	9.456	271.4	8.2
1147068299	T	2006	05	08	06	05	-122.180977	46.195560	1.179	1.085	168.316	5.630	5.908	8.82	-101.01	111.50	-30.66	1563	580	-0.67	113.950	16.939	271.6	7.1
1147068299	T	2006	05	08	06	05	-122.193993	46.193840	1.856	-10.000	168.316	5.905	5.607	8.71	-101.01	111.50	-30.67	1563	581	-0.50	113.917	31.511	271.6	7.1
1140761400	T	2006	02	24	06	10	-122.190430	46.193443	0.575	0.533	168.176	4.832	4.723	18.62	-101.30	134.36	-47.55	1858	472	-0.80	142.639	7.571	264.6	5.3
1140294300	A	2006	02	18	20	25	-122.196136	46.195362	1.645	1.619	2.235	5.044	4.929	49.22	71.85	57.70	-178.75	1748	1206	-0.53	55.853	25.312	271.1	10.5
1140294300	A	2006	02	18	20	25	-122.198914	46.193840	1.582	1.626	2.187	5.058	4.938	49.22	70.99	57.70	-178.76	1751	1206	-0.53	55.227	25.483	271.1	10.5
1139551200	T	2006	02	10	06	00	-122.192200	46.198936	0.641	0.822	168.176	5.919	5.705	1.89	70.07	136.65	-54.53	860	698	-0.75	135.593	13.033	264.6	5.3
1139379000	T	2006	02	08	06	10	-122.192345	46.193699	0.694	0.765	168.176	5.787	5.562	18.45	-100.21	138.88	-52.12	1754	474	-0.76	148.368	11.956	264.6	5.3
1134798900	T	2005	12	17	05	55	-122.197479	46.197803	0.666	0.626	168.151	5.578	5.392	10.89	79.41	145.47	-59.37	488	798	-0.79	136.891	9.369	264.2	9.0
1134641700	A	2005	12	15	10	15	-122.188805	46.195354	0.605	0.780	177.260	5.392	5.231	0.74	-131.44	145.02	60.85	140	682	-0.74	144.043	12.408	263.2	11.6
1134626699	T	2005	12	15	06	05	-122.188858	46.194897	0.773	0.814	168.150	5.704	5.562	9.80	-100.90	147.36	-55.76	1403	569	-0.74	153.236	12.922	264.2	9.0
1134021600	T	2005	12	08	06	00	-122.193336	46.197868	0.864	0.810	168.144	5.737	5.546	0.74	116.77	146.51	-55.74	978	684	-0.75	145.699	12.846	264.2	9.0
1132653900	A	2005	11	22	10	05	-122.191139	46.195442	0.677	0.678	177.208	6.124	5.889	9.68	101.64	142.21	57.10	1725	570	-0.79	148.835	9.967	267.1	9.4
1132639200	T	2005	11	22	06	00	-122.188232	46.193882	0.937	0.871	168.132	6.374	6.150	0.92	109.49	145.30	-51.16	1008	686	-0.75	144.273	13.556	267.5	10.0
1132482000	A	2005	11	20	10	20	-122.186668	46.194931	0.667	0.892	177.206	6.119	5.878	11.06	-80.04	139.97	61.17	600	799	-0.74	130.910	14.011	267.1	9.4
1132467000	T	2005	11	20	06	10	-122.195145	46.199116	0.855	0.923	168.132	6.300	6.086	19.42	-101.36	146.56	-47.11	1929	463	-0.74	153.049	14.539	267.5	10.0
1132309000	A	2005	11	18	10	30	-122.187553	46.197826	0.733	0.707	177.024	5.592	5.370	29.34	-74.94	137.68	63.55	1505	999	-0.77	113.714	10.515	267.1	9.4
1132295099	T	2005	11	18	06	25	-122.191238	46.195293	0.691	0.697	168.132	6.010	5.754	36.38	-98.09	147.71	-40.96	817	280	-0.78	148.458	10.267	267.5	10.0
1132034100	T	2005	11	15	05	55	-122.195824	46.196068	0.694	0.779	168.132	5.283	5.119	11.17	79.81	143.30	-50.77	550	801	-0.74	135.337	11.817	267.5	10.0

1. Which volcano are you looking for?
 Volcano name: Start date:
 Lat/Long/Center: End date:
 Volcano ID:

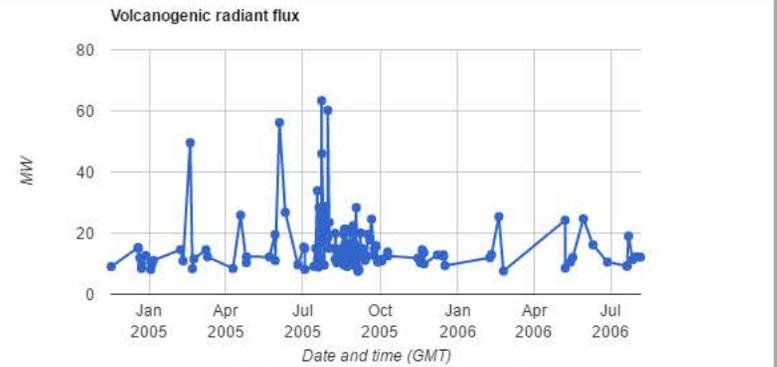
3. Which MODIS sensor?
 Terra
 Aqua

4. What time of day?
 Daytime
 Nighttime

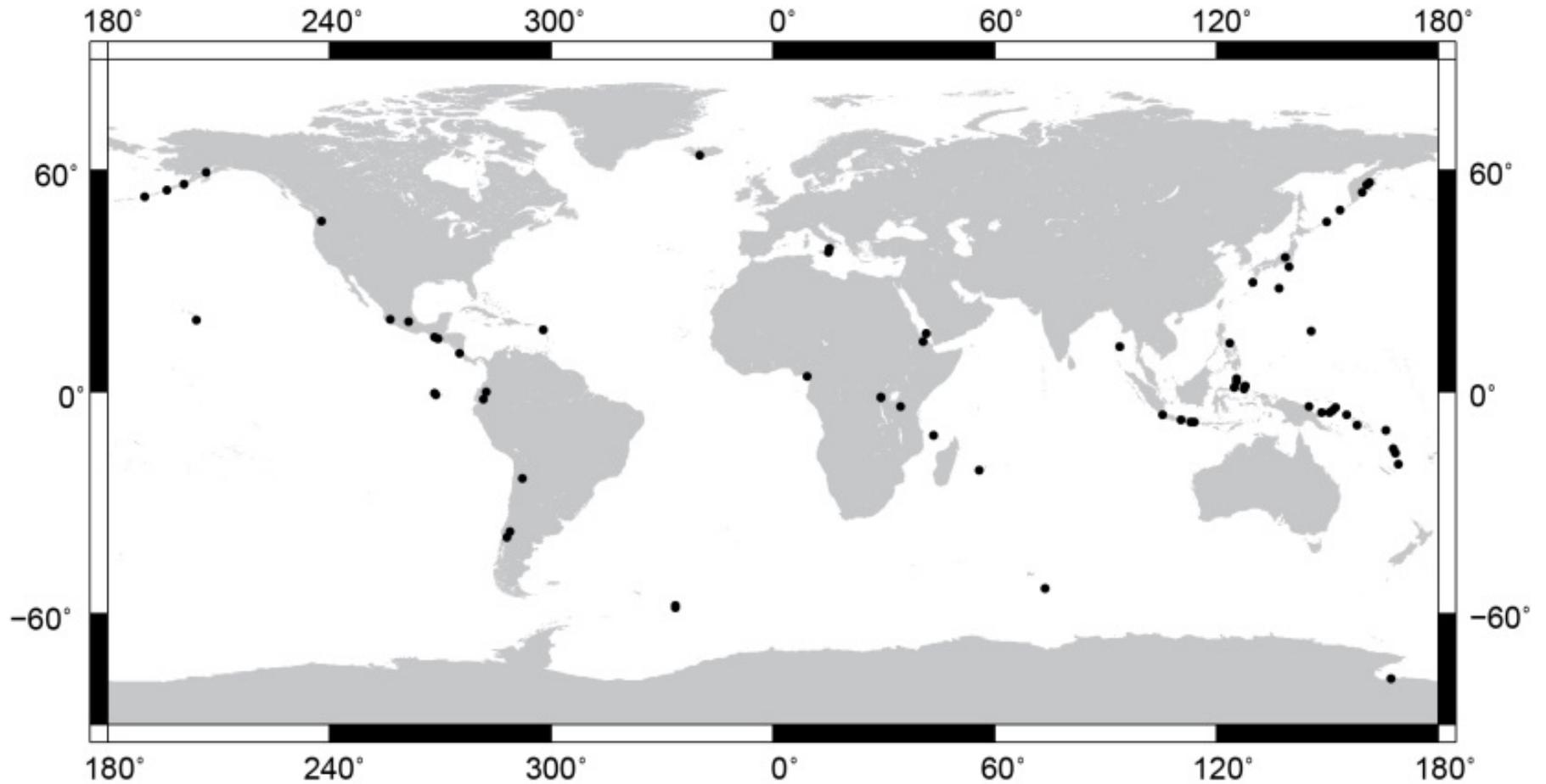
5. Observation geometry?
 Sun glint angle:
 Scan angle:

6. Which variable would you like to plot?
 Number of hot-spot pixels
 Radiant flux
 3.959um spectral radiance

7. Progress 8. View/Save data



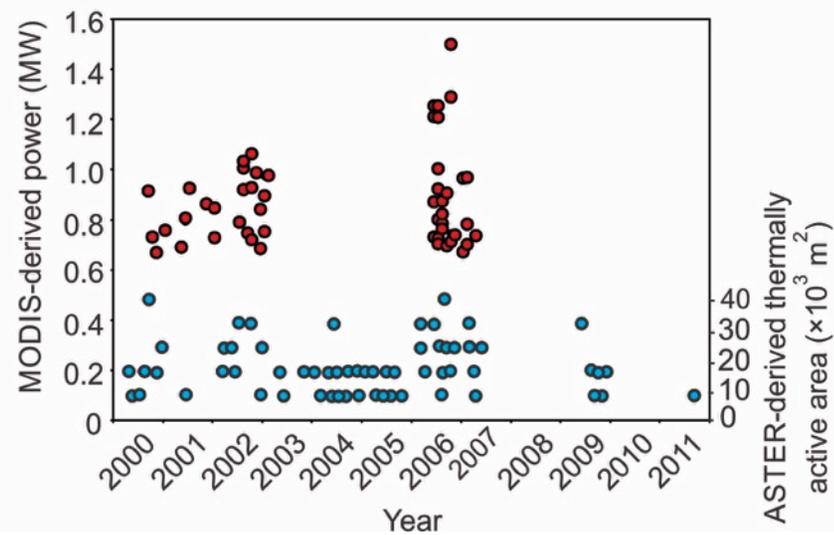
MODIS has detected volcanic thermal anomalies at over 100 volcanoes since 2000



Relatively insensitive to low temperature and hydrothermal volcanic (i.e. non-eruptive) phenomena

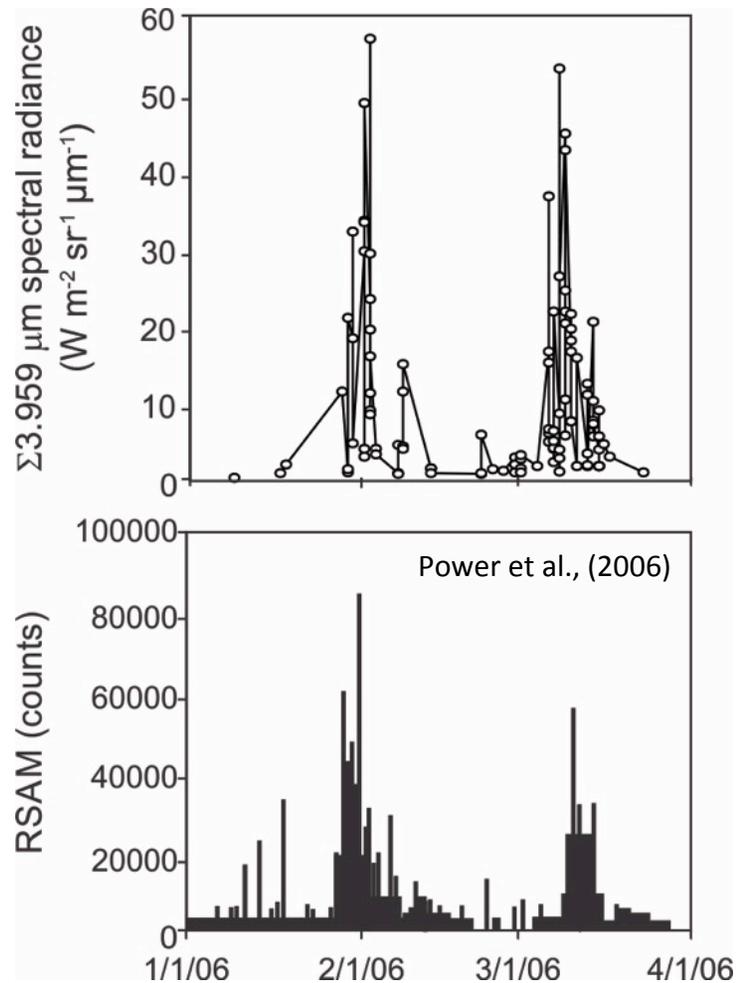


Lascar volcano, Chile, December 2004



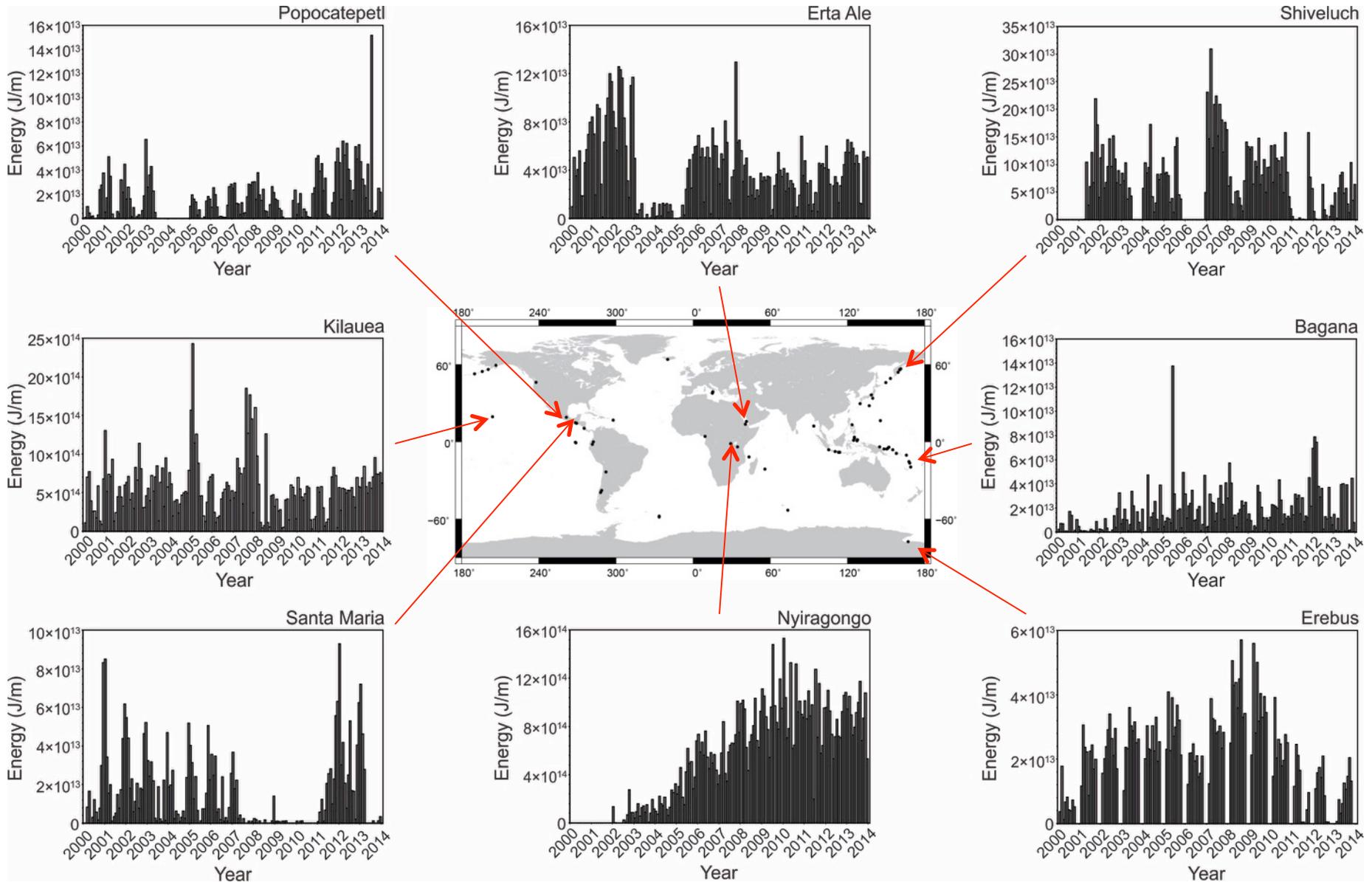
MODIS measurements of emitted spectral radiance act as an effective proxy of eruption intensity during volcanic eruptions

2006 eruption of Mount Augustine, Alaska

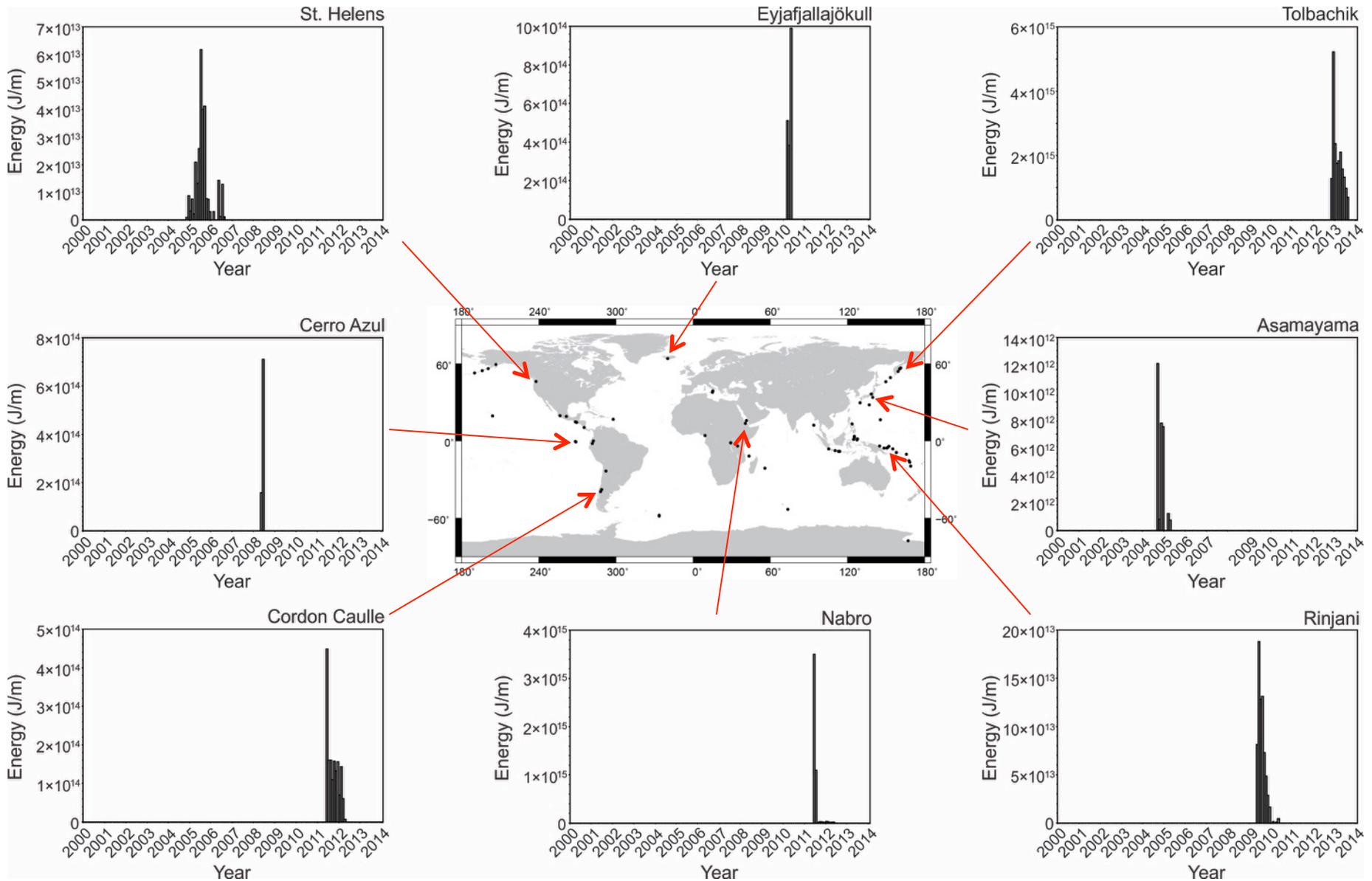


Source: USGS

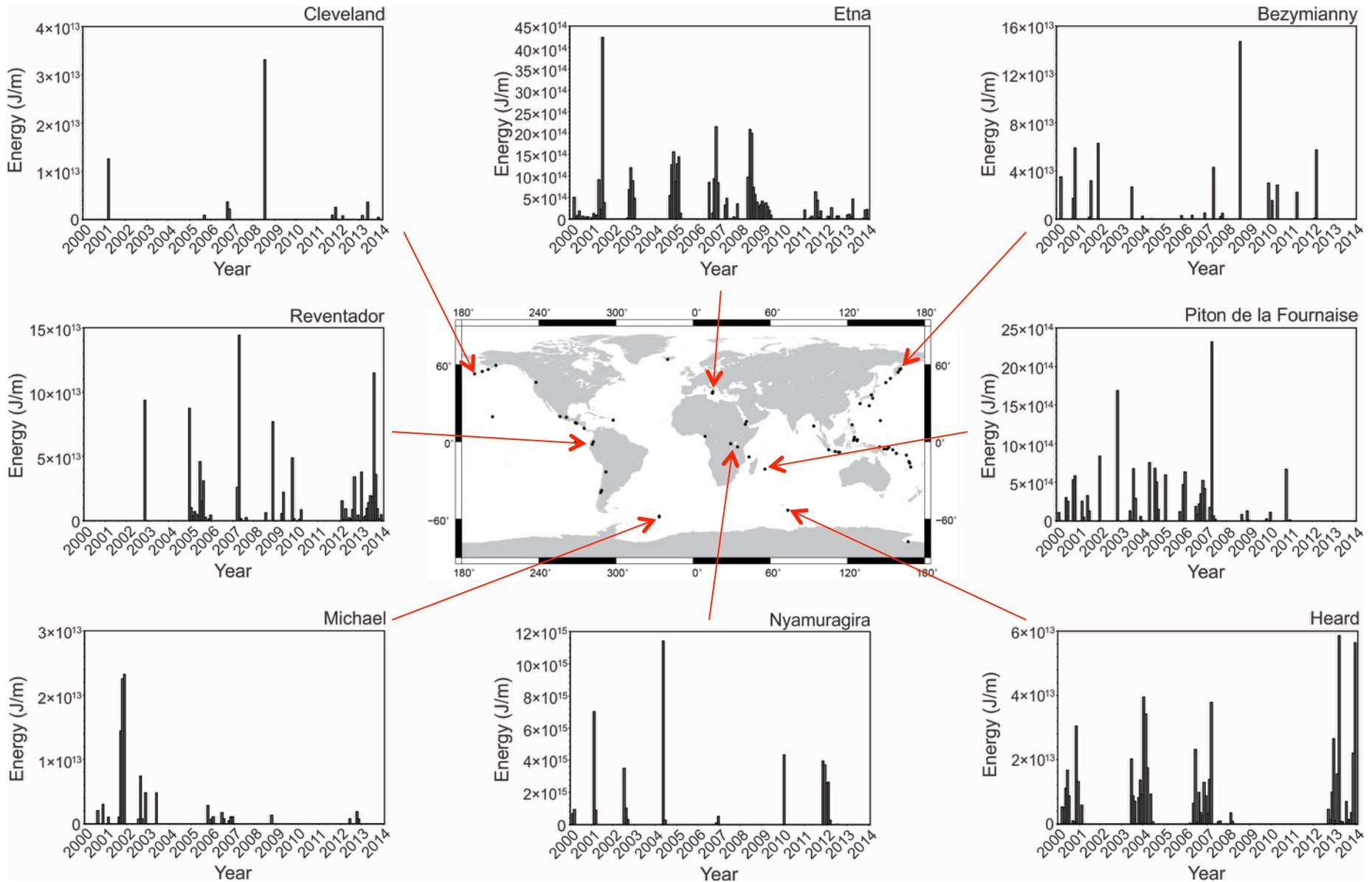
Some volcanoes have been persistently active since 2000



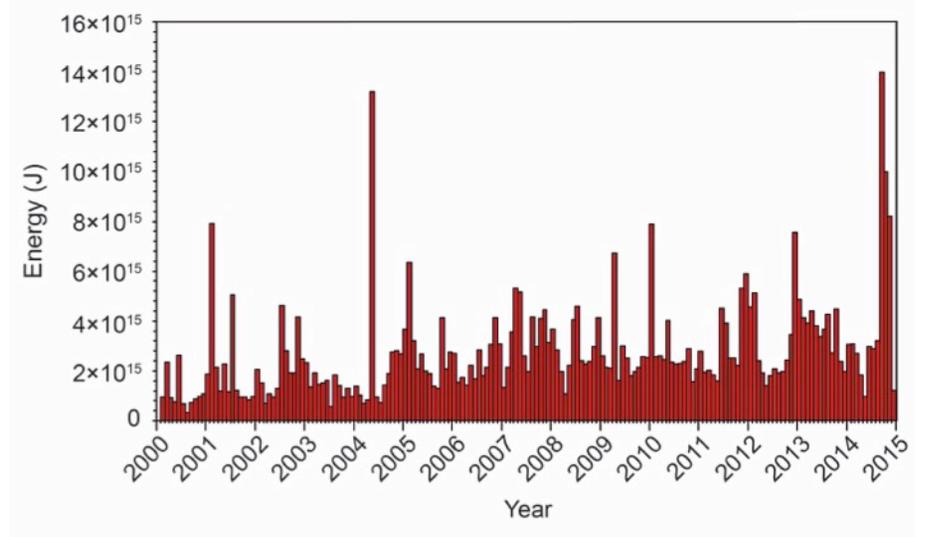
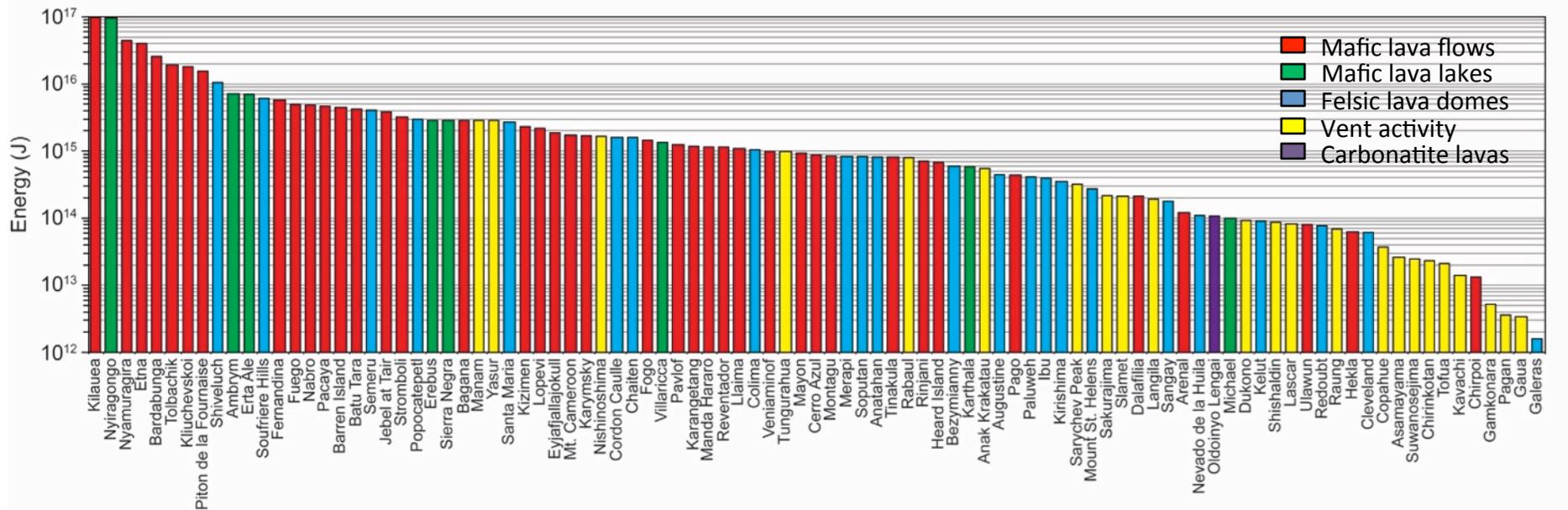
Some volcanoes have erupted only once since 2000



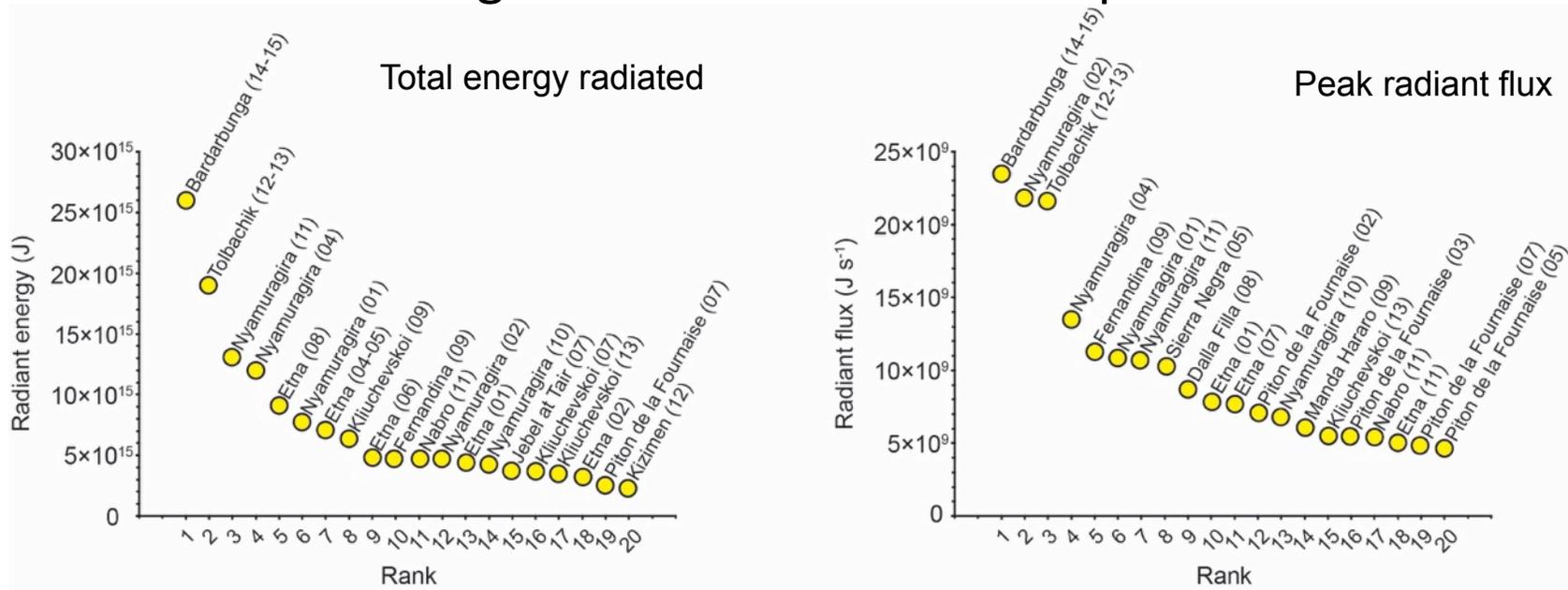
Some volcanoes have been episodically active since 2000



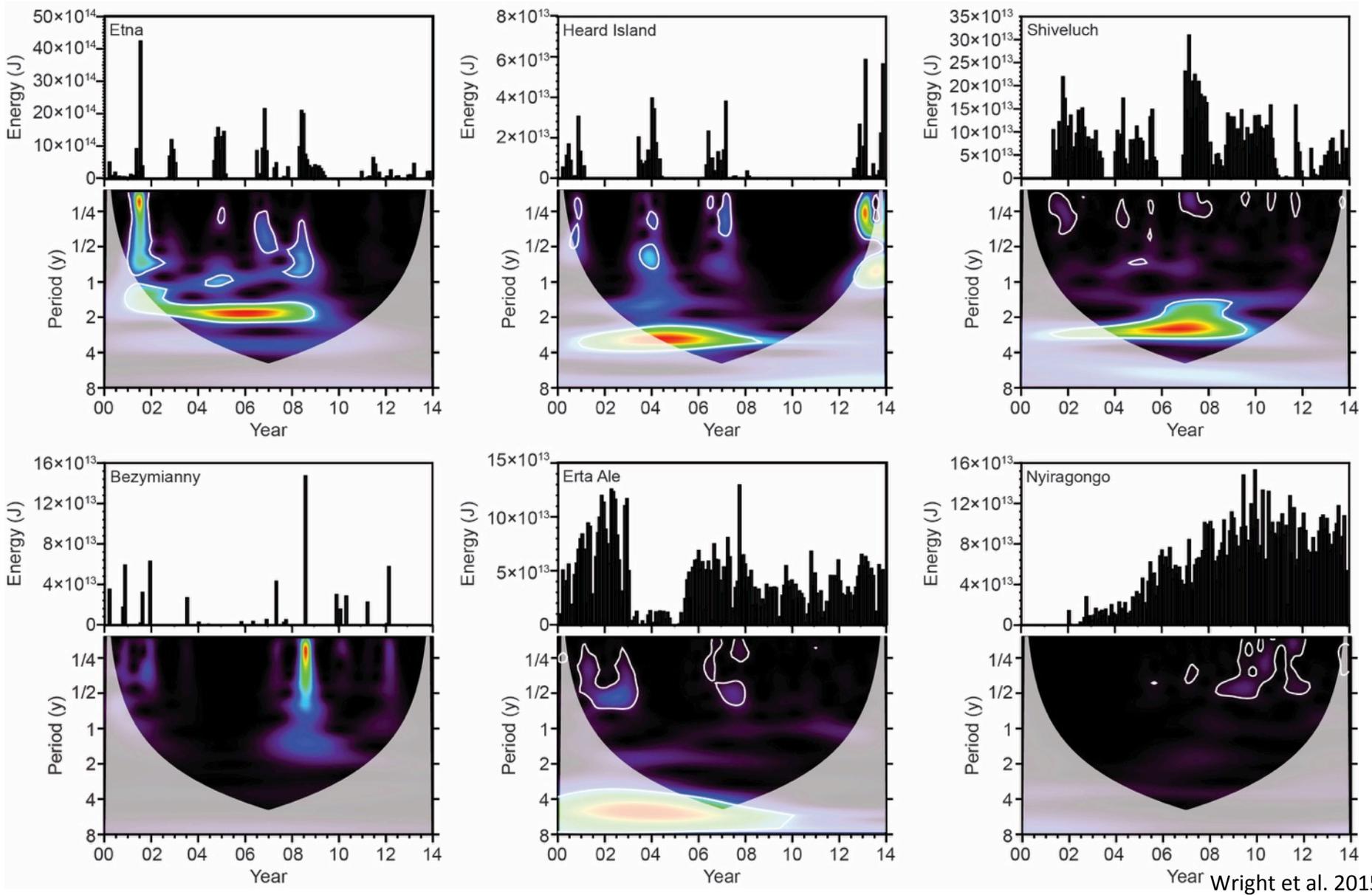
MODIS has catalogued volcanic thermal emissions at the global scale



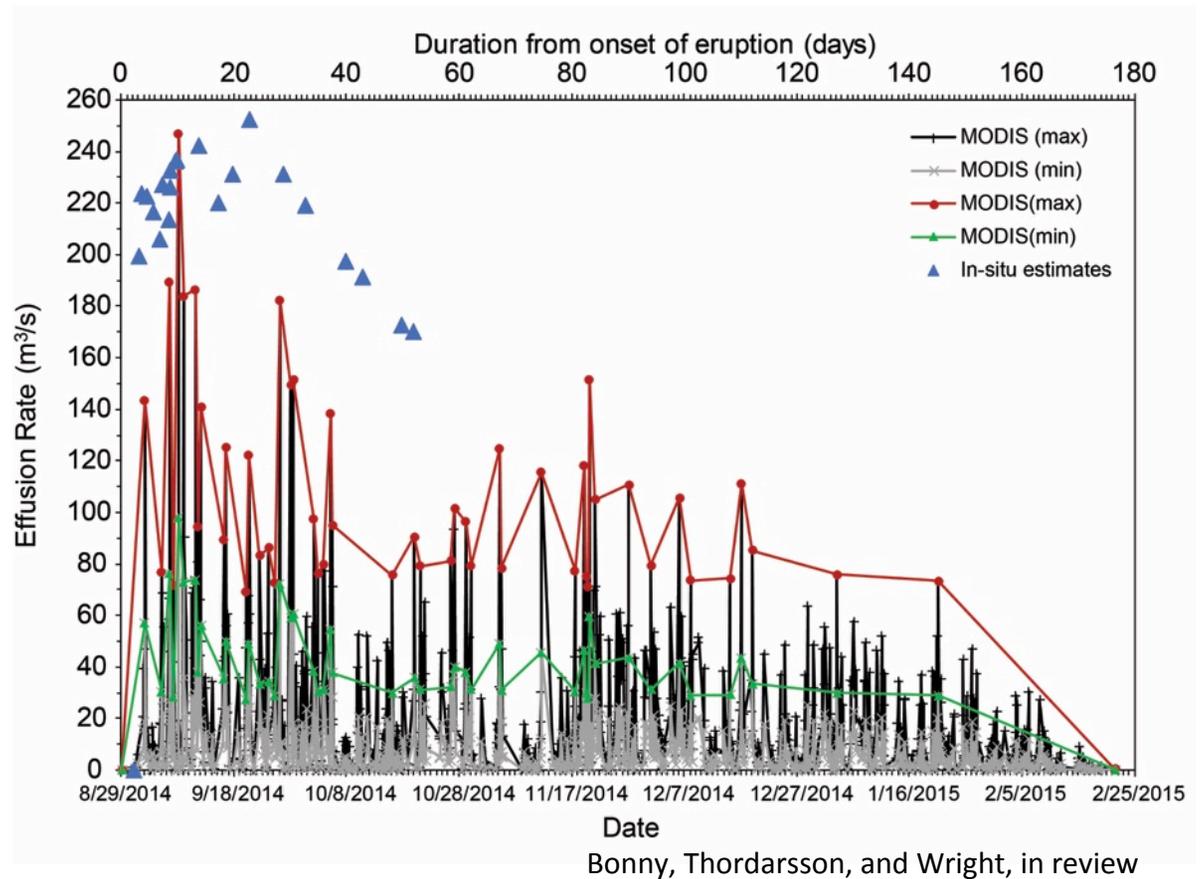
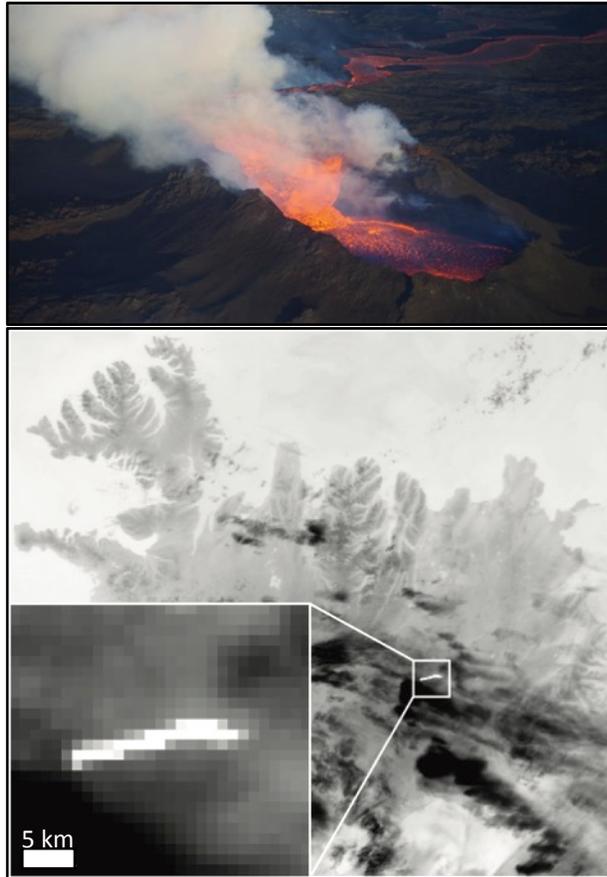
Allowing for direct quantitative comparisons of the intensities and magnitudes of terrestrial eruptions



MODIS reveals evidence for periodicity in thermal output at some volcanoes, but not at others

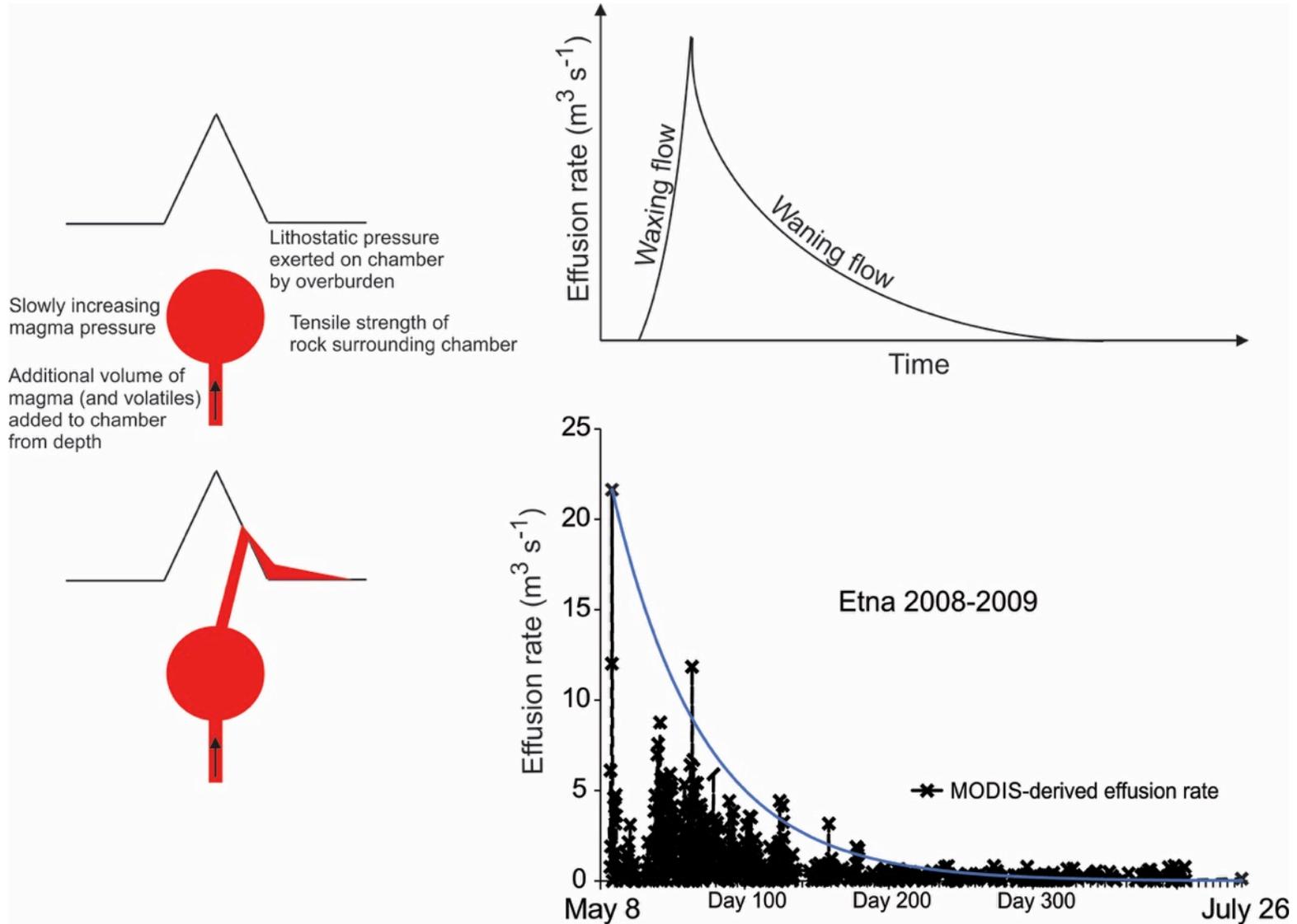


MODIS allows us to estimate the volumetric flux of lava from the vent

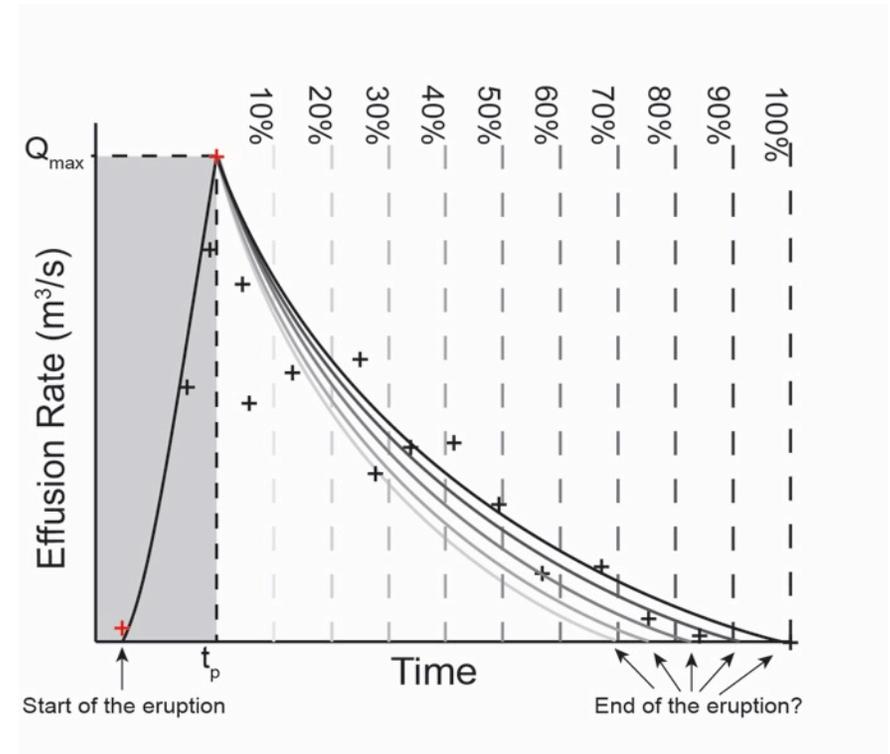
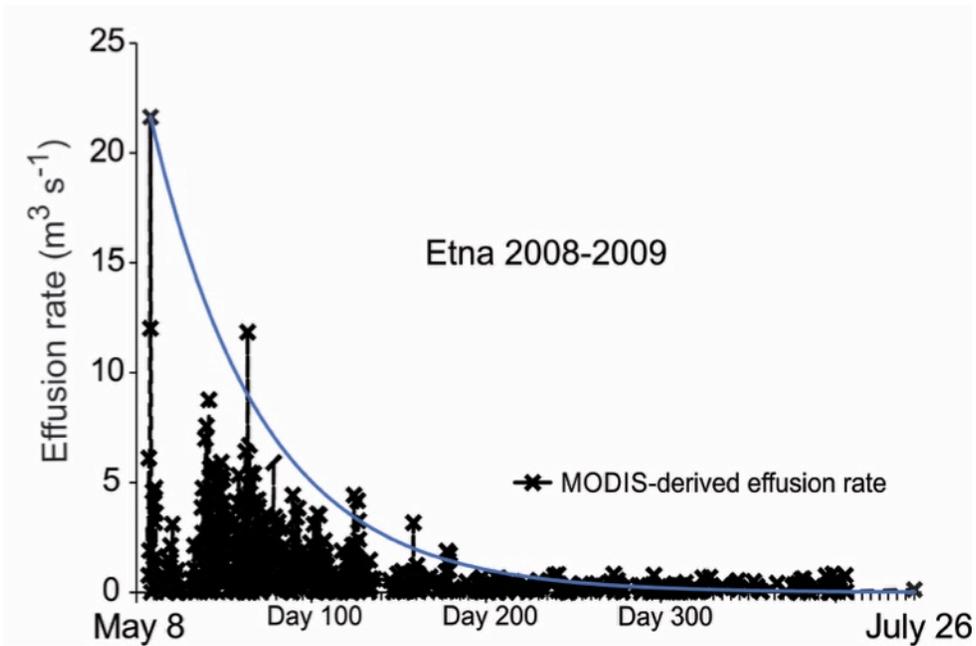


Integrating effusion rate over time allows the total lava output to be estimated, and MODIS-derived estimate of final volume (1.3 km^3) is consistent with in-situ estimates ($\sim 1.2 \text{ km}^3$)

The rate at which (and total amount of) lava that is erupted constraints sub-surface magma chamber conditions

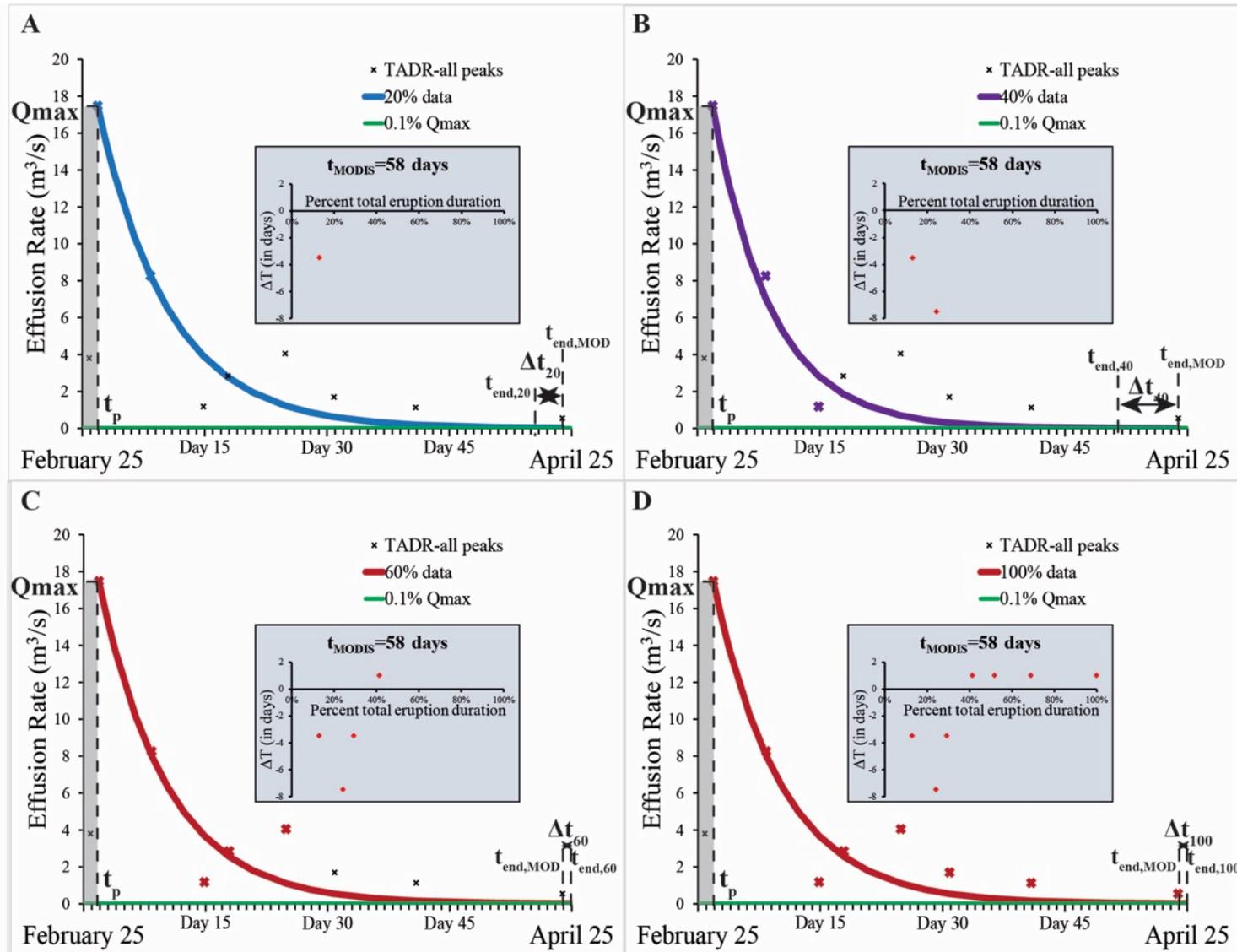


Can we use MODIS data to predict when an eruption will end?



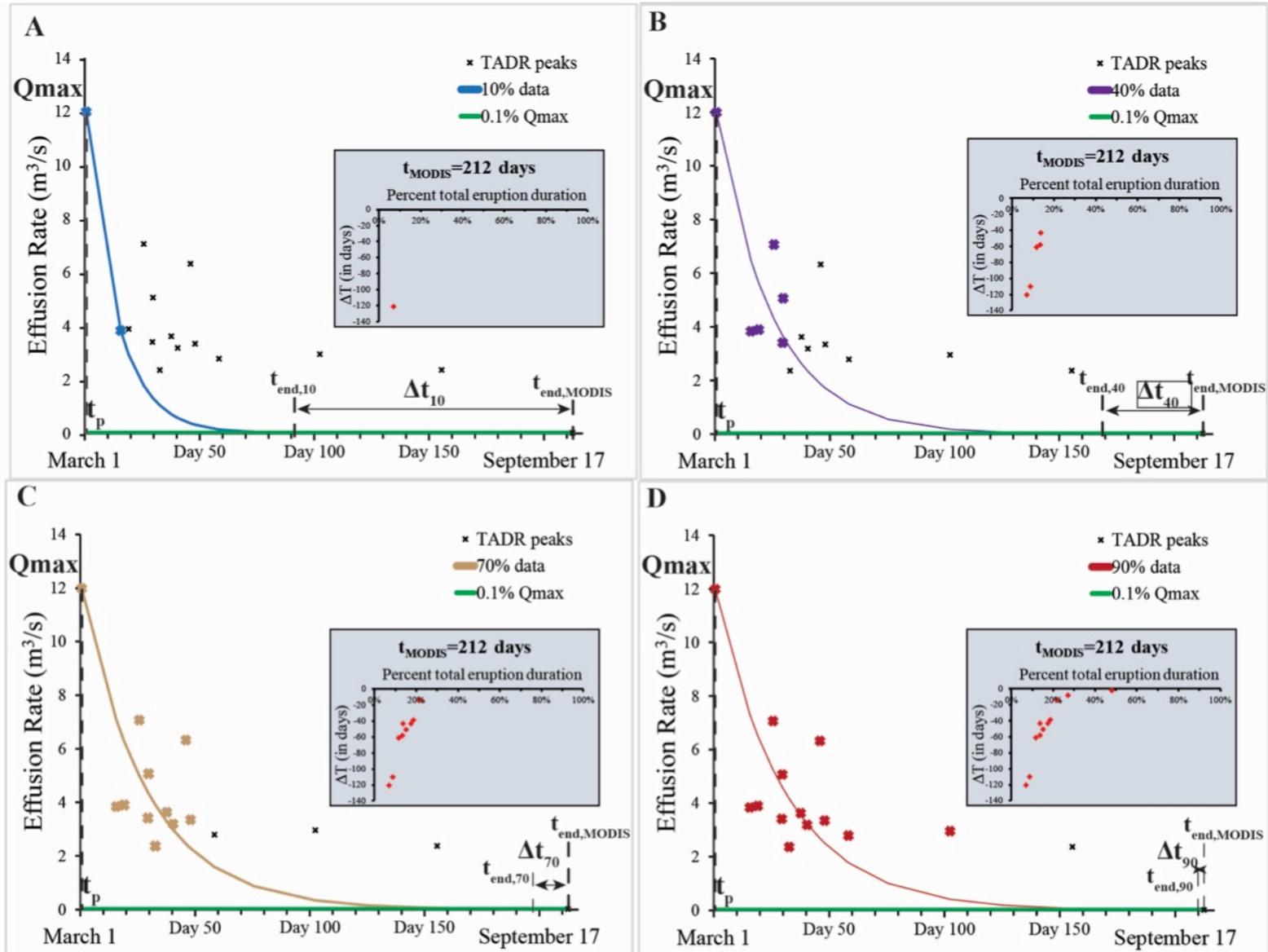
Using MODIS data to predict when an eruption will end

Nyamuragira, Democratic Republic of Congo, 2000



Using MODIS data to predict when an eruption will end

Kizimen, Russia, 2011



No reason why MODIS cannot be used to predict lava flow hazards in near-real-time

