

COMPILATION OF A GLOBAL ERUPTION DATASET WITH SOURCE PARAMETERS AND OBSERVATIONS FOR MODEL VALIDATION

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WHY DO WE NEED A DATASET?

To validate eruption models!

Plus, we keep saying we're going to do this . . .

- Geneva 2010 meeting, Executive Summary (item 4), says
- “Coupling of VATDM with observations and measured data is crucial to assimilation and model validation
- WMO VAAC “Ins & Outs” workshop (Nov. 2012), Recommendation 12* recommends:
- “Formation of a group to explore the establishment of a volcanic eruption observational database for model validation purposes”

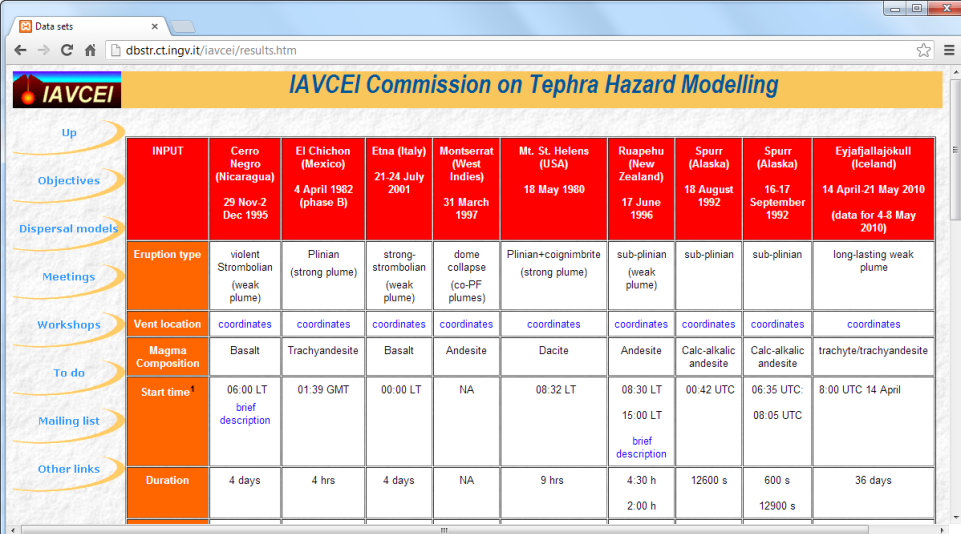
DON'T DATASETS ALREADY EXIST?

Datasets are also being created by:

- The IAVCEI Commission on Tephra Hazard Modeling (<http://dbstr.ct.ingv.it/iavcei/>)
- NEMOH (www.nemo.itn.eu)
- VAST at NILU, Norway (<http://vast.nilu.no>)

Ours is distinct in that it:

- Includes both source parameters & observations
- Is tailored toward modeling ash clouds.



IAVCEI Commission on Tephra Hazard Modelling

INPUT	Cerro Negro (Nicaragua) 29 Nov-2 Dec 1995	El Chichon (Mexico) 4 April 1982 (phase B)	Etna (Italy) 21-24 July 2001	Montserrat (West Indies) 31 March 1997	Mt. St. Helens (USA) 18 May 1980	Ruapehu (New Zealand) 17 June 1996	Spurr (Alaska) 18 August 1992	Spurr (Alaska) 16-17 September 1992	Eyjafjallajökull (Iceland) 14 April-21 May 2010 (data for 4-8 May 2010)
Eruption type	violent Strombolian (weak plume)	Plinian (strong plume)	strong-strombolian (weak plume)	dome collapse (co-PF plumes)	Plinian+coignimbrite (strong plume)	sub-plinian (weak plume)	sub-plinian	sub-plinian	long-lasting weak plume
Vent location	coordinates	coordinates	coordinates	coordinates	coordinates	coordinates	coordinates	coordinates	coordinates
Magma Composition	Basalt	Trachyandesite	Basalt	Andesite	Dacite	Andesite	Calc-alkalic andesite	Calc-alkalic andesite	trachyte/trachyandesite
Start time	06:00 LT brief description	01:39 GMT	00:00 LT	NA	08:32 LT	08:30 LT 15:00 LT brief description	00:42 UTC	06:35 UTC: 08:05 UTC	8:00 UTC 14 April
Duration	4 days	4 hrs	4 days	NA	9 hrs	4:30 h 2:00 h	12600 s	600 s 12900 s	36 days



VOLCANIC ASH STRATEGIC INITIATIVE TEAM (VAST)

The ESA project VAST has been established involving teams from four European countries to improve the quality and use of EO based observations in numerical atmospheric dispersion models for the purpose of assisting global aviation.

Stohl, A. et al, Source term determination for volcanic eruptions (and other point-source releases), presentation given at ECMWF, 21 October, 2013 (4.1 MB)



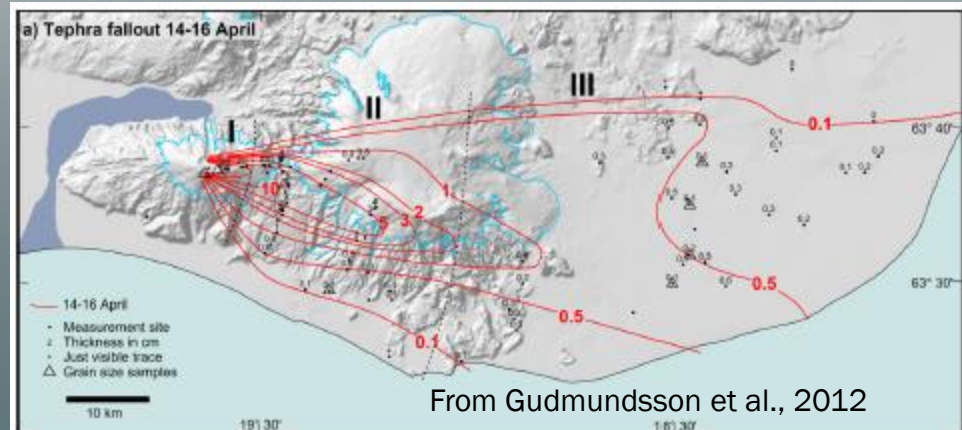
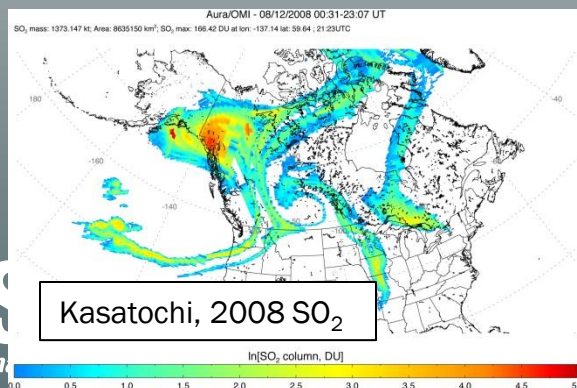
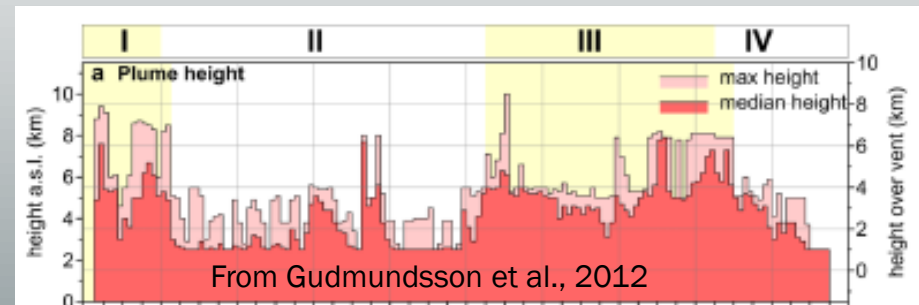
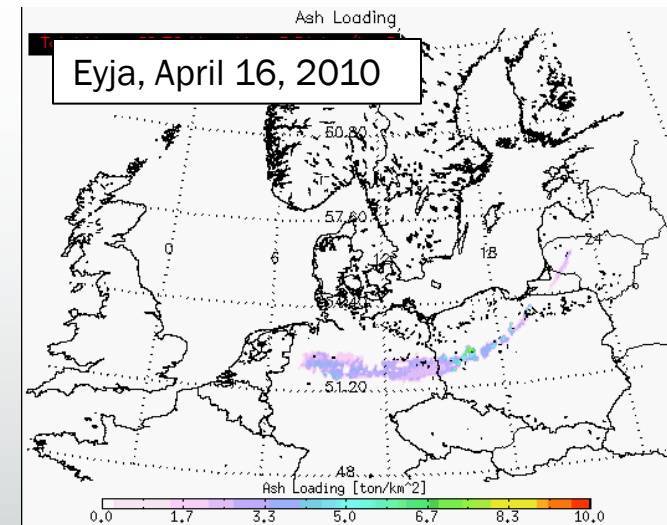
REQUIRED INFORMATION

Good source parameters:

- Plume height or height time series
- Mapped deposits (to estimate erupted mass)
- Accurate duration

Good observations & measurements of the ash cloud

- Satellite retrievals (especially with mass loading)
- Any other data we can find (In situ measurements, Lidar, radar etc.)



WHICH ERUPTIONS TO USE?

Eruption	Plume height	Erupted mass	Start time, duration	Meteorology	Satellite	TGSD
Eyja, phase III	👍	👍	👍	👍	👍	👍
Kasatochi	👍	👎	👍	👍	👍	👎
Chaitén	👉	👍	👉	👍	👍	👍
St. Helens	👍	👍	👍	👉	👎	👍
Cordon Caulle	👉	👍	👍	👍	👍 *	👍

👍 =good
 👉 =okay
 👎 =not so good

- Eyja is best in nearly all respects
- Kasatochi has good satellite & plume heights, not so good erupted mass
- Chaitén also has good satellite, but spotty plume height & durations
- St. Helens has great plume height, duration & mass, old satellite & met.
- Cordon Caulle has great satellite but duration & spatial coverage are daunting
- We start with Eyja, Kasatochi, Chaitén & will add others soon.

HOW TO ACCESS THE DATA

1. Go to Vhub.org
2. Search for “Eruption data for ash-cloud model validation”
3. Click “Download”
4. Scroll down to view the
 - 1.summary table with links
 - 2.Explanations & documentation

https://vhub.org/resource x

https://vhub.org/resources/3192/download/summary_table.htm

Summary table

The table below summarizes information on eruptions for which source parameters are reasonably well constrained and observations are available of the downwind ash cloud. More are provided below.

Volcano	lon	lat	VE km	Start time UTC	D hrs	H km	Mass Tg	Met	Observations
Chaitén, 2008	-72.65	-42.83	0.5	2008-05-02 03:38 2008-05-03 2008-05-06	0.08-0.17 20-24 1-2	13 10 17-19	0.03-0.05 0.24-0.28 0.54	NCEP WRF	GOES, MODIS, AIRS, A-TRAIN
Kasatochi, 2008	-175.51	52.18	0.1	2008-08-07 22:01 2008-08-08 01:50 2008-08-08 04:35	1 0.5 10	14 14 18	1.5 0.7 42.8	NCEP MERRA WRF	AVHRR, GOES
Eyiafiatlaikull, 2010 phase III	-19.62	63.63	1.7	2010-05-04T15:00 2010-05-04T18:00 2010-05-04T21:00 2010-05-05T00:00 2010-05-05T03:00	3 3 3 3 3	5.3 5.3 5.7 5.6 5.6	0.845 0.845 1.304 1.175 1.175	NCEP WRF	NOAA-processed SEVIRI many others (see notes)

Kasatochi, 2008

Volcano Name: Kasatochi

Latitude: 52.18

Longitude: -175.51

Vent elevation: 0.10

Description: Kasatochi is a poorly monitored volcano in the western Aleutians with no seismic instruments less than about 40 km from the volcano. The daylong eruption was characterized by three major explosive events and two smaller events, all detected by seismic and infrasound instruments [e.g., Fee et al., 2010]. Event 1 began at 2201 UTC, August 7; event 2 at 0150 UTC August 8, and event 3 at 0435 UTC August 8 [Waythomas et al., 2010]. Events 4 (0712 UTC) and 5 (1142 UTC August 8) are embedded within a continuous infrasound signal and are associated with pulses of renewed earthquake activity. As given in Table 1 of Waythomas et al., the durations of events 1 and 2 were about 1 hour and 0.5 hours, respectively. Event 3 lasted about 0.5 hours but was followed by a continuous phase that lasted about 10 hours, followed by a waning phase of about 8 hours.

2010-05-08T12:00	3	5.2	0.753
2010-05-08T15:00	3	5.3	0.845
2010-05-08T18:00	3	4.1	0.160
2010-05-08T21:00	3	5.2	0.753

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Eyjafjallajökull, 2010 phase III	-19.62	63.63	1.7	2010-05-04T15:00	3	5.3	0.845	NCEP	NOAA-processed SEVIRI

THE SUMMARY TABLE CONTAINS SOURCE PARAMETERS

Assigning them is challenging, since not all are direct observations

For example,

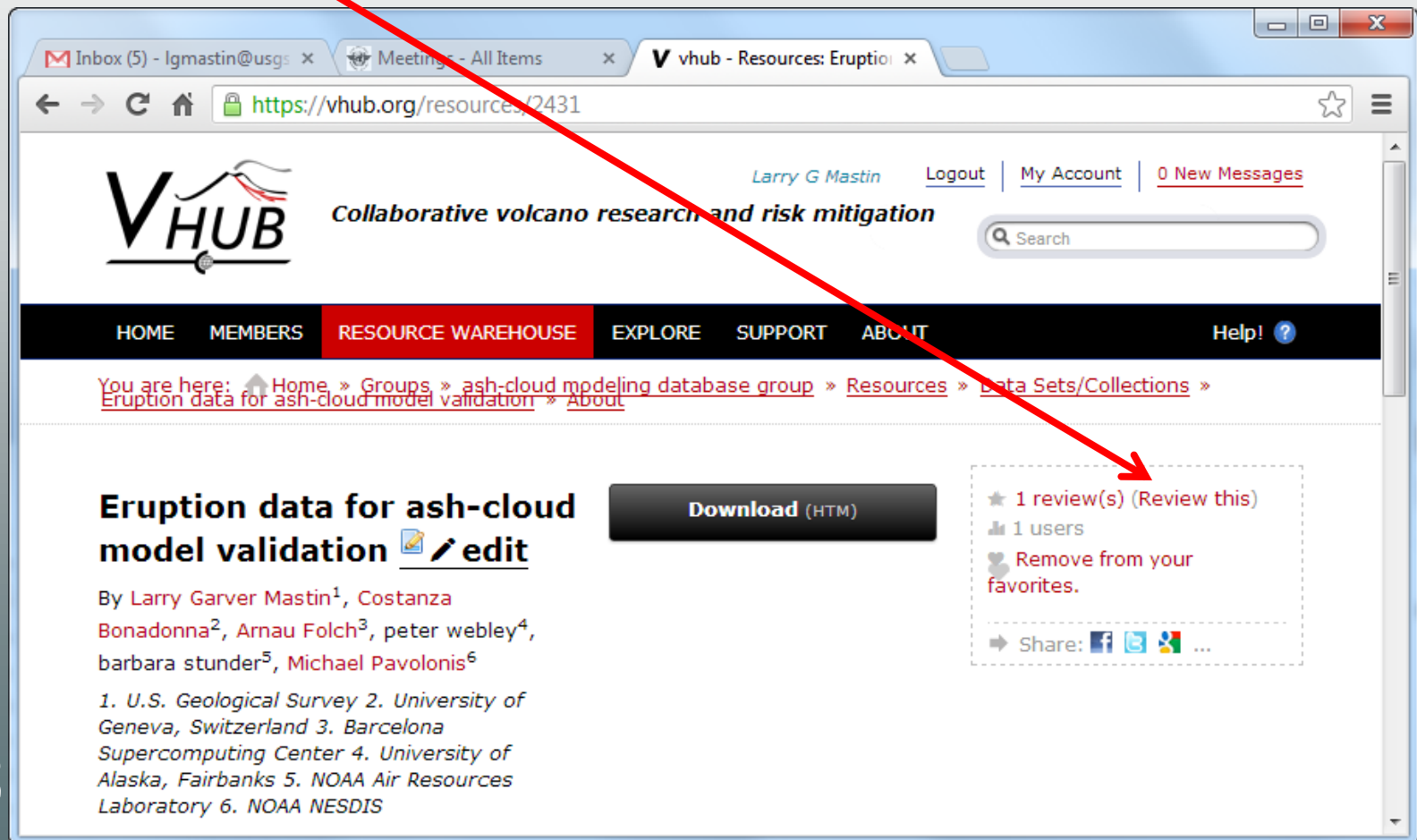
- Erupted mass Is determined for the whole eruption by mapping the deposit
 - But for shorter time periods, we must estimate from plume height & duration
 - Mass for all time periods must add up to the mapped mass. But often it doesn't so we must adjust . . .
- There may be better ways (1-D plume models, Bayesian inversion etc.)
- Discussion pages on vhub allow for comment & contributions

2010-05-07T06:00	3	5.3	0.845
2010-05-07T09:00	3	5.3	0.845
2010-05-07T12:00	3	5.3	0.845
2010-05-07T15:00	3	5.4	0
2010-05-07T18:00	3	5.4	0
2010-05-07T21:00	3	5.3	0

Table of source parameters

COMMENTING OR POSTING ALTERNATIVE SOURCE PARAMETERS . . .

. . . Can be done by reviewing the contribution



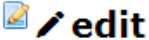
The screenshot shows a web browser window with the VHub website. The URL is <https://vhub.org/resources/2431>. The page title is "Eruption data for ash-cloud model validation". The author is Larry Garver Mastin¹, Costanza Bonadonna², Arnau Folch³, peter webley⁴, barbara stunder⁵, and Michael Pavlonis⁶. The page includes a "Download (HTM)" button and a sidebar with options to "Review this", "Remove from your favorites", and "Share". A red arrow points from the text "Can be done by reviewing the contribution" to the "Review this" link in the sidebar.

VHUB Collaborative volcano research and risk mitigation

Larry G Mastin Logout My Account 0 New Messages

HOME MEMBERS **RESOURCE WAREHOUSE** EXPLORE SUPPORT ABOUT Help!




You are here: Home » Groups » ash-cloud modeling database group » Resources » Data Sets/Collections » Eruption data for ash-cloud model validation » About

Eruption data for ash-cloud model validation  [edit](#)

By Larry Garver Mastin¹, Costanza Bonadonna², Arnau Folch³, peter webley⁴, barbara stunder⁵, Michael Pavlonis⁶

1. U.S. Geological Survey 2. University of Geneva, Switzerland 3. Barcelona Supercomputing Center 4. University of Alaska, Fairbanks 5. NOAA Air Resources Laboratory 6. NOAA NESDIS

Download (HTM)

★ 1 review(s) ([Review this](#))
1 users
Remove from your favorites.
Share:    ...

... Or adding to the discussion in the Ash-cloud modeling database group*

The screenshot shows a web browser window with the URL https://vhub.org/groups/ash_model_database_group/forum. The page features the VHub logo and the tagline "Collaborative volcano research and risk mitigation". The navigation bar includes links for HOME, MEMBERS, RESOURCE WAREHOUSE, EXPLORE, SUPPORT, and ABOUT. A search bar is located in the top right corner.

The main content area is titled "ash-cloud modeling database group" and "Discussion". It includes a search bar and a table of discussion categories. A red arrow points from the text "... Or adding to the discussion in the Ash-cloud modeling database group*" to the "Discussions" section of the forum.

Default Section			
	Discussions	0	0
	Default category for all discussions in this forum.	Discussions	Posts
	Source parameters for Eyjafjallajokull phase III	0	0
	This is a test discussion intended to refine or improve eruption source parameters of phase III (May 4-17) of the Eyjafjallajokull eruption, used by modelers to simulate this eruption and to compare with observations.	Discussions	Posts

At the bottom right of the table, there is a button labeled "Add Category".

*which we will open to the public soon

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METEOROLOGY

These are hyperlinks to repositories containing NWP model results

- NOAA NCEP Reanalysis 1 2.5 degree is available global since 1948
- For these eruptions, Arnau will post WRF model output
 - Includes wind, p, T, geopotential height, several water variables*

*contact Arnau if you'd like specific variables

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SATELLITE OBSERVATIONS

Hyperlinks here will link to NOAA repository of satellite retrievals (M. Pavolonis)

- Other data can be added (e-mail me if you have other links)

2010-05-06T03:00	3	5.2	0.753
2010-05-06T06:00	3	5.2	0.753
2010-05-06T09:00	3	5.2	0.753
2010-05-06T12:00	3	5.3	0.845
2010-05-06T15:00	3	5.5	1.056
2010-05-06T18:00	3	5.5	1.056
2010-05-06T21:00	3	5.4	0.946
2010-05-07T00:00	3	5.3	0.845
2010-05-07T03:00	3	5.2	0.753
2010-05-07T06:00	3	5.3	0.845
2010-05-07T09:00	3	5.3	0.845
2010-05-07T12:00	3	5.3	0.845
2010-05-07T15:00	3	5.4	0.946
2010-05-07T18:00	3	5.4	0.946
2010-05-07T21:00	3	5.2	0.753

AVAILABILITY

- The database is currently on a vhub site that is open only to authors while under construction
- Sometime soon (before end of the year?) the repositories containing WRF meteorological data and NOAA processed satellite retrievals will be completed.
- At that time, links will be made in the document, and it will be opened for members of the “**Ash cloud modeling database group**”.
- We will e-mail workshop participants invite them to join this group.
- Additional eruptions (Mount St. Helens, Cordon Caulle, others?) will be added with time.



The end