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

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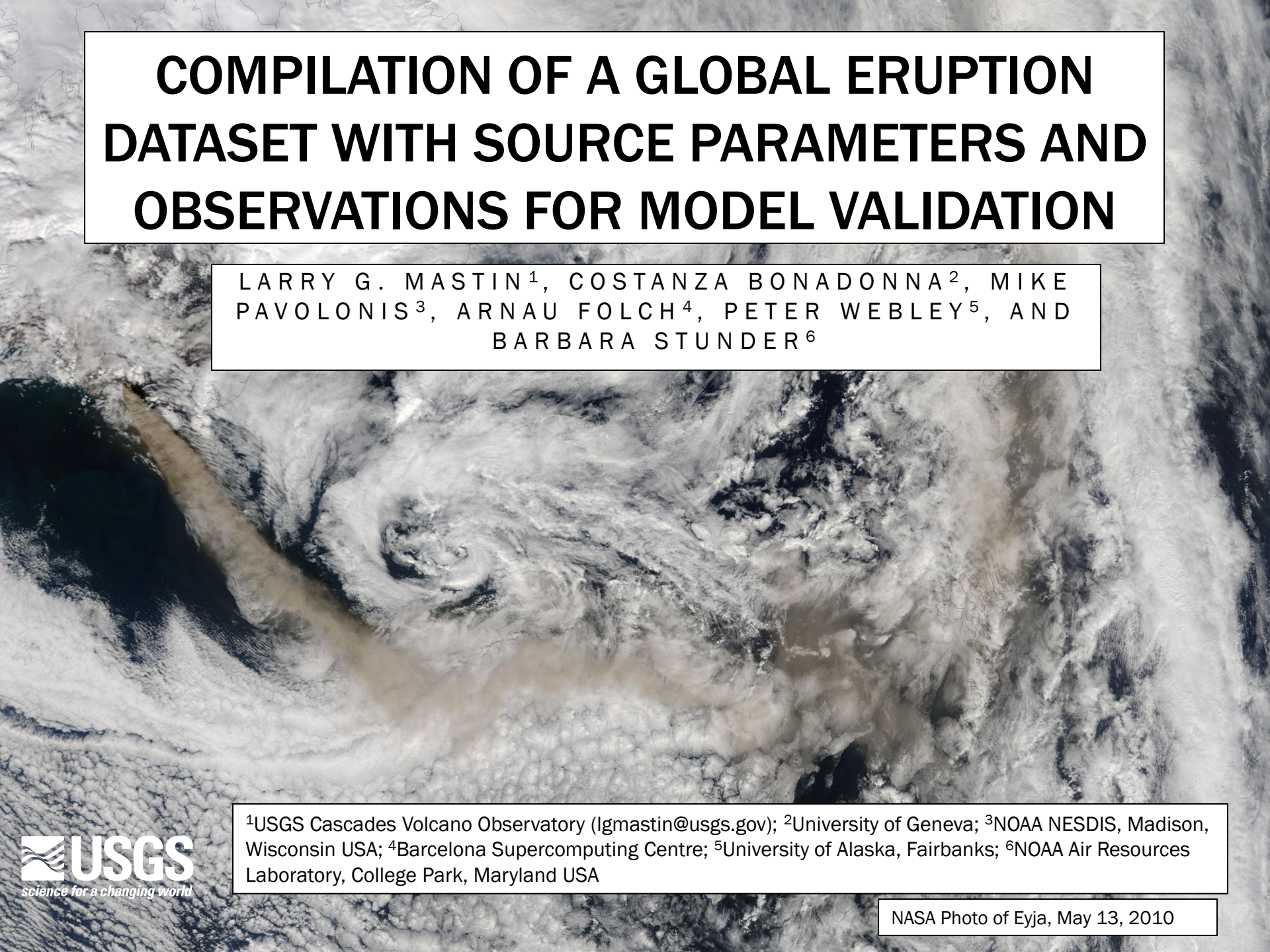

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NASA Photo of Eyja, May 13, 2010

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"

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*http://www.wmo.int/pages/prog/amp/aemp/documents/VAAC_WKSP-2012_FINAL_V3.pdf

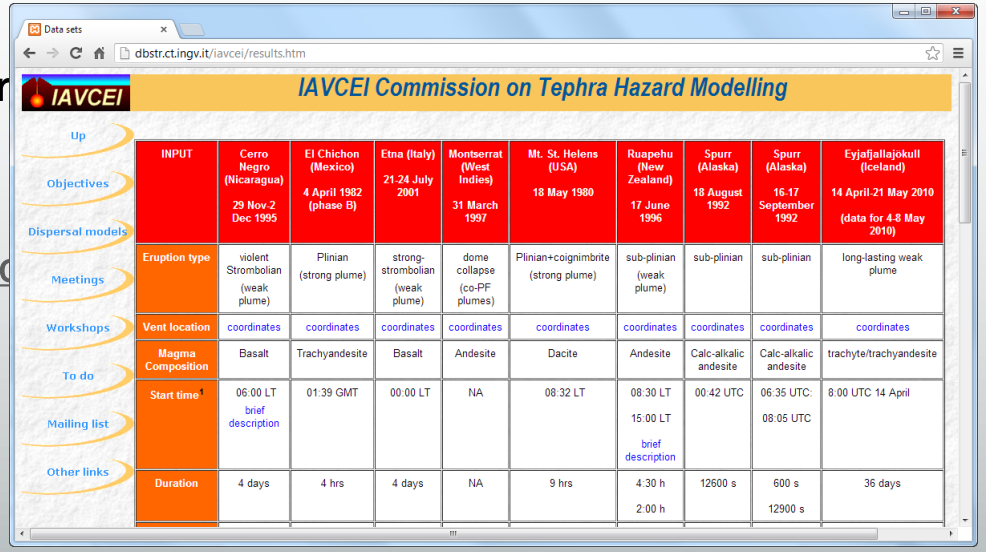
DON'T DATASETS ALREADY EXIST?

Datasets are also being created by:

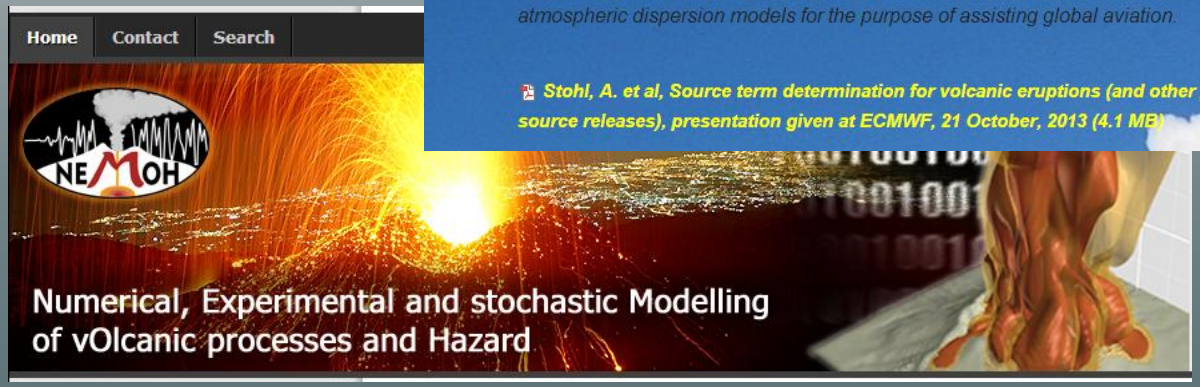
- The IAVCEI Commission on Tephra Hazar Modeling (http://dbstr.ct.ingv.it/iavcei/)
- NEMOH (www.nemo.itn.eu)
- VAST at NILU, Norway (http://vast.nilu.no

Ours is distinct in that it:

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



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[1]	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



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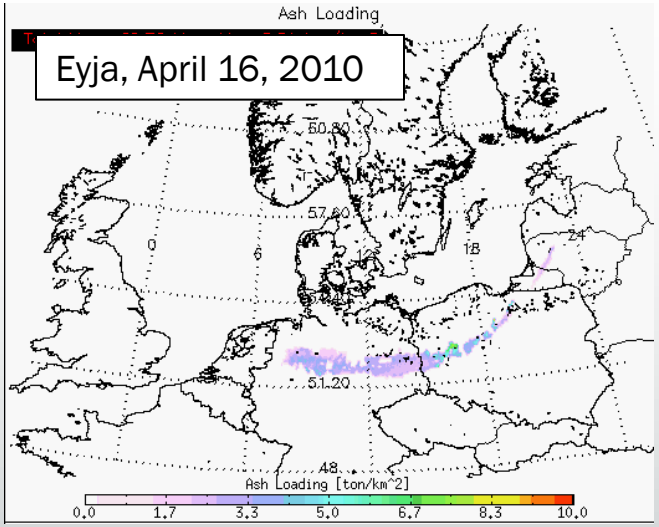
REQUIRED INFORMATION

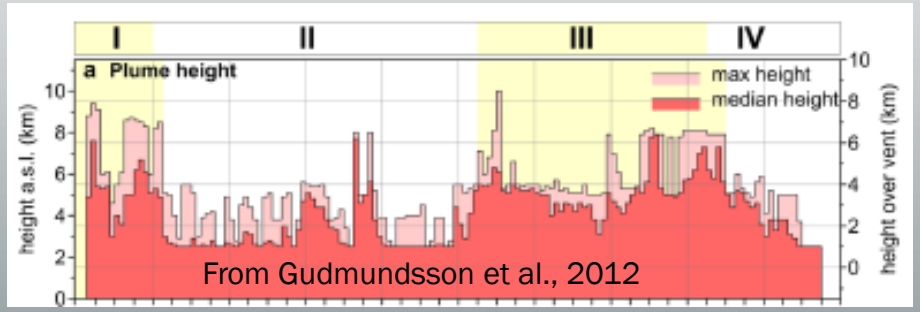
Good source parameters:

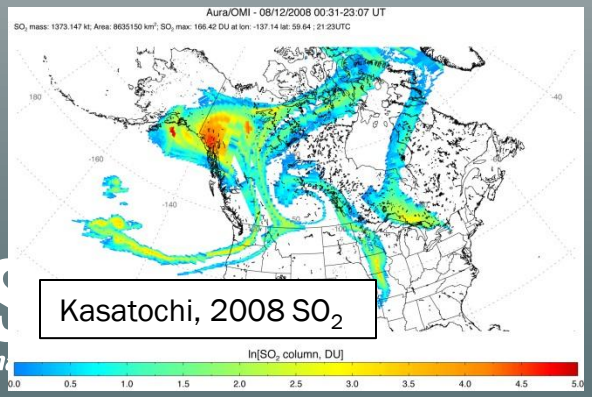
- Plume height or height time series
- Mapped deposits (to estimate erupted mass)
- Accurate duration

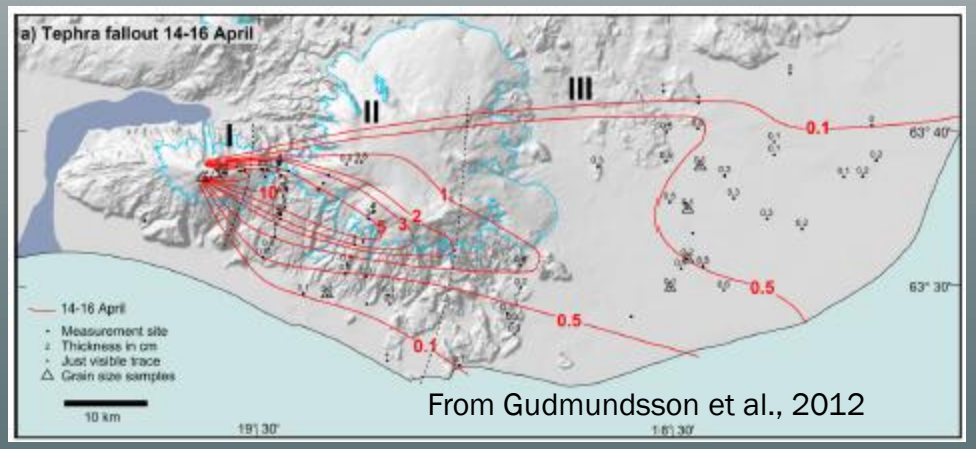
Good observations & measurements of the ash cloud

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









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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.

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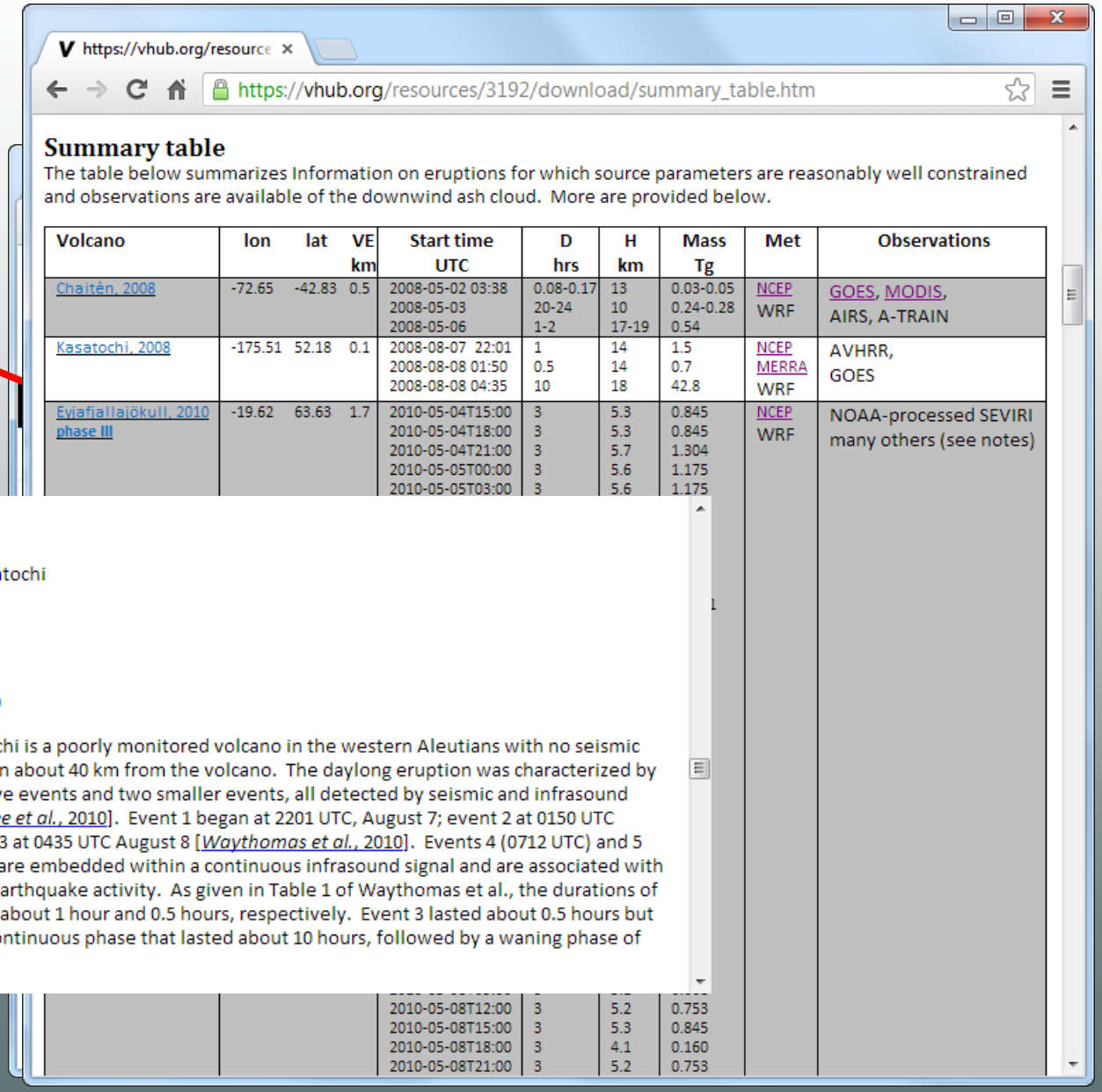
HOW TO ACCESS THE DATA

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



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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	Meteorology	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	
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	
Eyjafjallajökull, 2010 phase III	-19.62	63.63	1.7	2010-05-04T15:00	3	5.3	0.845	NCEP	NOAA-processed SEVIRI
				2010-05-05T09:00	3	5.5	1.056		
				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.		

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

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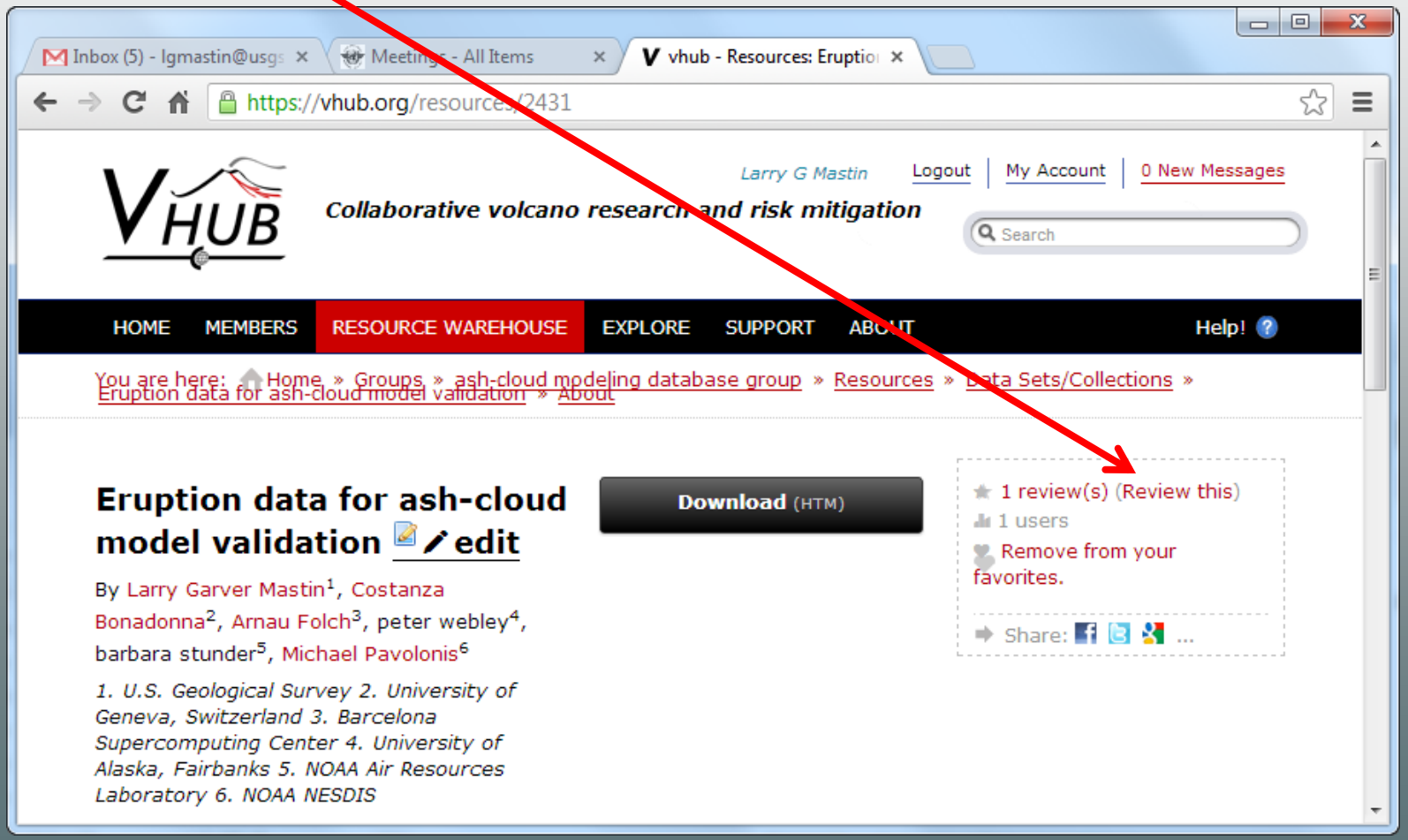
Table of source parameters

COMMENTING OR POSTING ALTERNATIVE SOURCE PARAMETERS . . .

. . . Can be done by reviewing the contribution



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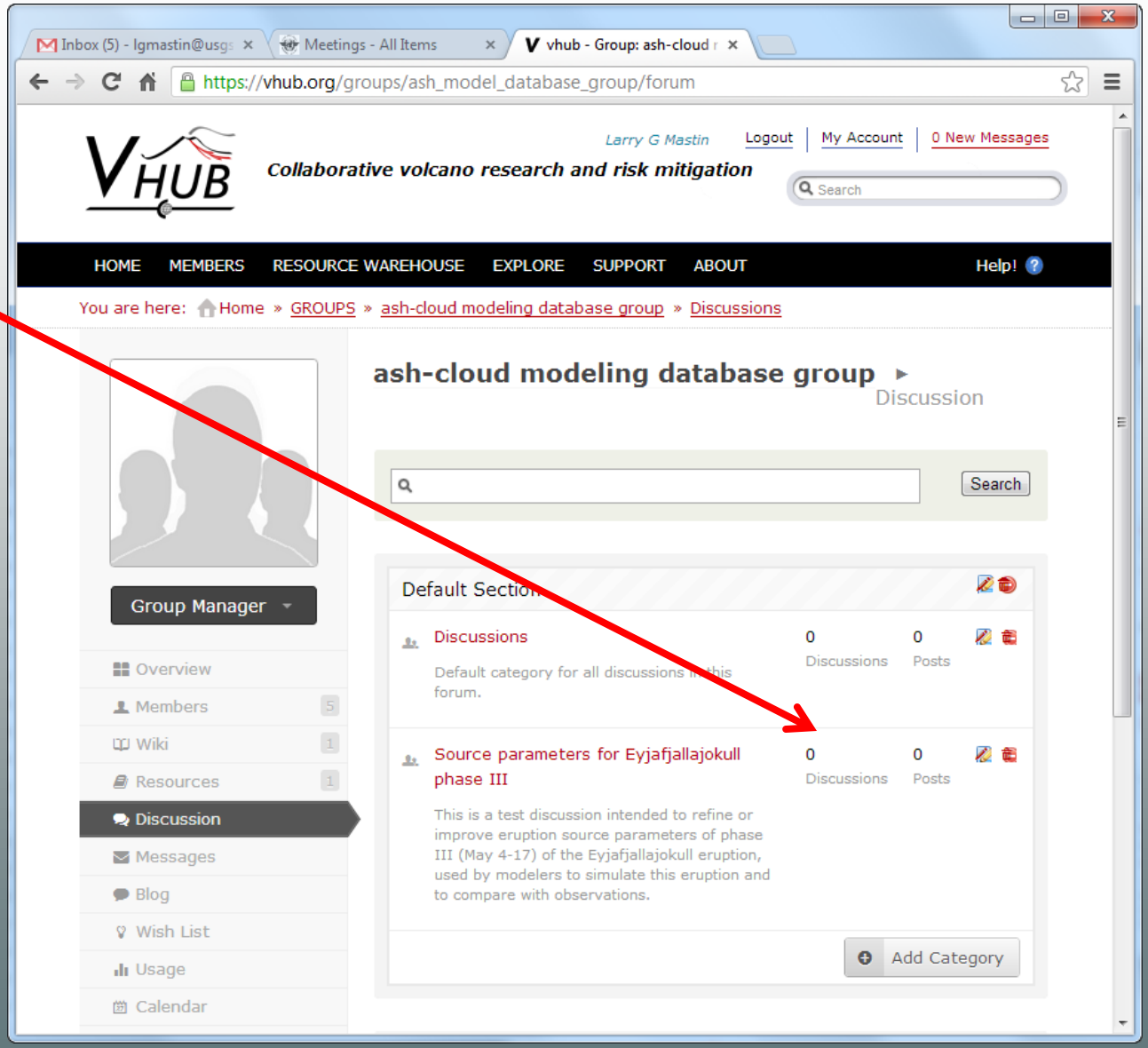
. . . Or adding to the discussion in the Ash-cloud modeling database group*



*which we will open to the public soon

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				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		
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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*

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*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)

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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.

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Lake Geneva with Eyja ash sunset, April 17, 2010, AFP / Fabrice Coffrini