The Global Eruption Source Parameter Database

Where do we go from here?

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Eruption Source Parameters

- Prior to and during the initial stages of an eruption, commonly not enough observations to define eruption source parameters (ESPs), for example plume height

- Accurate quantification of ESPs crucial for reliable application of ash dispersion models

Eyjafjallajökull eruption, 2010. Photo credits: Thorvaldur Karl Helgason (CC BY-NC 2.0)

Database History

2004:

Limitations in accuracy of ash-cloud model forecasts associated with uncertainties in ESP noted during the 1st IAVWOPSG meeting

2005:

At the 2nd IAVWOPSG meeting, the US member tasked to devote a year to improve quality of ESP used in VAAC forecast models

2007:

USGS organised a workshop on ESPs at the Cascade Volcano Observatory, and a dedicated session organised at AGU

2009:

Database published to provide source parameters for simulations in cases where no observations available

The Database 1

Type	Magma type	Historical eruption characteristics
M0	Basalt or other mafic	Insufficient historical data to characterize
M1		$H \leq 5$ km or VEI≤2
M2		H=5-8 km or VEI=3
M3		>8 km or VEI≥4
S0	Andesite, dacite, rhyolite, or other explosive composition	Insufficient historical data to characterize
S1		$H \leq 6$ km or VEI≤2
S2		H=6-12 km or VEI=3
S3		$H \geq 12$ km or VEI ≥ 4
S8		Major pyroclastic flows, with an elutriated column rising primarily above the flows.
S9		Active lava dome is present
U0	All magma types	Submarine vent with a water depth ≥50 m

1. Volcanoes characterised in terms of type and historical activity, with 9 eruption types defined based on magma type and eruption size

Eruption type	Example (Date as M/D/Y)	H, km above vent	D hr	$\dot{M}$ kg/s	V km^3	m_{63}
Mafic, standard (M0)	Cerro Negro, Nicaragua, 4/9-13/1992	7	60	1×10^5	0.01	0.05
Small (M1)	Mount Etna, Italy, 7/19-24/2001	2	100	5×10^3	0.001	0.02
Medium (M2)	Cerro Negro, Nicaragua, 4/9-13/1992	7	60	1×10^5	0.01	0.05
Large (M3)	Fuego, Guatemala, 10/14/1974	10	5	1×10^6	0.17	0.1
Silicic, standard (S0)	Mount Spurr, USA, 8/18/1992	11	3	4×10^6	0.015	0.4
Small (S1)	Mount Ruapehu, New Zealand, 6/17/1996	5	12	2×10^5	0.003	0.1
Medium (S2)	Mount Spurr, USA, 8/18/1992	11	3	4×10^6	0.015	0.4
Large (S3)	Mount St. Helens, USA, 5/18/1980	15	8	1×10^7	0.15	0.5
Co-ignimbrite cloud (S8)	Mount St. Helens, USA, 5/18/1980 (pre-9 AM)	25	0.5	1×10^8	0.05	0.5
Brief (S9)	Soufrière Hills, Montserrat (composite)	10	0.01	3×10^6	0.0003	0.6
Submarine (U0)	None	0	--	--	--	

2. For each eruption type, key inputs for tephra dispersal models identified based on well known examples

The Database 2

NUMBER	NAME	LOCATION	STATUS	LATITUDE	NS	VF	LONGITUDE	EW	ELEV	TYPE	TIME FRAME	ERUPTION TYPE
0201-041	Dallol	Ethiopia	Historical	14.242	N		40.30	E	-48	Explosion craters	D2	S0
0201-04=	Alid	Ethiopia	Holocene	14.88	N		39.92	E	904	Stratovolcano	U	S0
0201-05=	Gada Ale	Ethiopia	Holocene	13.975	N		40.408	E	287	Stratovolcano	U	M0
0201-06=	Alu	Ethiopia	Holocene	13.825	N		40.508	E	429	Fissure vents	U	M0
0201-071	Borale Ale	Ethiopia	Holocene	13.725	N		40.60	E	668	Stratovolcano	U	M0
0201-07=	Dalaffilla	Ethiopia	Historical	13.792	N		40.55	E	613	Stratovolcano	D1	M0
0201-08=	Erta Ale	Ethiopia	Historical	13.60	N		40.67	E	613	Shield volcano	D1	M1
0201-091	Hayli Gubbi	Ethiopia	Holocene	13.50	N		40.72	E	521	Shield volcano	U	M0
0201-09=	Ale Bagu	Ethiopia	Holocene	13.52	N		40.63	E	1031	Stratovolcano	U	M0
0201-101	Nabro	Ethiopia	Holocene?	13.37	N		41.70	E	2218	Stratovolcano	?	S0
0201-102	Mallahle	Ethiopia	Holocene?	13.27	N		41.65	E	1875	Stratovolcano	?	S0
0201-103	Sork Ale	Ethiopia	Holocene?	13.18	N		41.725	E	1611	Stratovolcano	?	M0
0201-104	Asavyo	Ethiopia	Holocene	13.07	N		41.60	E	1200	Shield volcano	U	M0
0201-105	Mat Ala	Ethiopia	Holocene	13.10	N		41.15	E	523	Shield volcano	U	M0
0201-106	Tat Ali	Ethiopia	Holocene	13.28	N		41.07	E	700	Shield volcano	U	M0
0201-107	Borawli	Ethiopia	Holocene	13.30	N		40.98	E	812	Stratovolcano	U	M0
0201-10=	Dubbi	Ethiopia	Historical	13.58	N		41.808	E	1625	Stratovolcano	D3	M0
0201-111	Ma Alalta	Ethiopia	Holocene	13.02	N		40.20	E	1815	Stratovolcano	U	S0
0201-112	Alayta	Ethiopia	Historical	12.88	N		40.57	E	1501	Shield volcano	D2	M0
0201-113	Dabbahu	Ethiopia	Historical	12.60	N		40.48	E	1442	Stratovolcano	D1	S0
0201-114	Dabbayra	Ethiopia	Holocene	12.38	N		40.07	E	1302	Shield volcano	U	M0
0201-115	Manda Hararo	Ethiopia	Historical	12.17	N		40.82	E	600	Shield volcanoes	D1	M0
0201-116	Groppo	Ethiopia	Holocene	11.73	N		40.25	E	930	Stratovolcano	U	S0
0201-11=	Afderà	Ethiopia	Holocene?	13.08	N		40.85	E	1295	Stratovolcano	?	S0

Characterisation of some example volcanoes

Grey indicates volcanoes with historical eruptions

The Database 3

- Current parameters for each volcano:
  - Plume height
  - Eruption duration
  - Erupted volume
  - Mass fraction of fine ash

Can be updated by observations during an eruption

Defined based on previous eruptions at a volcano

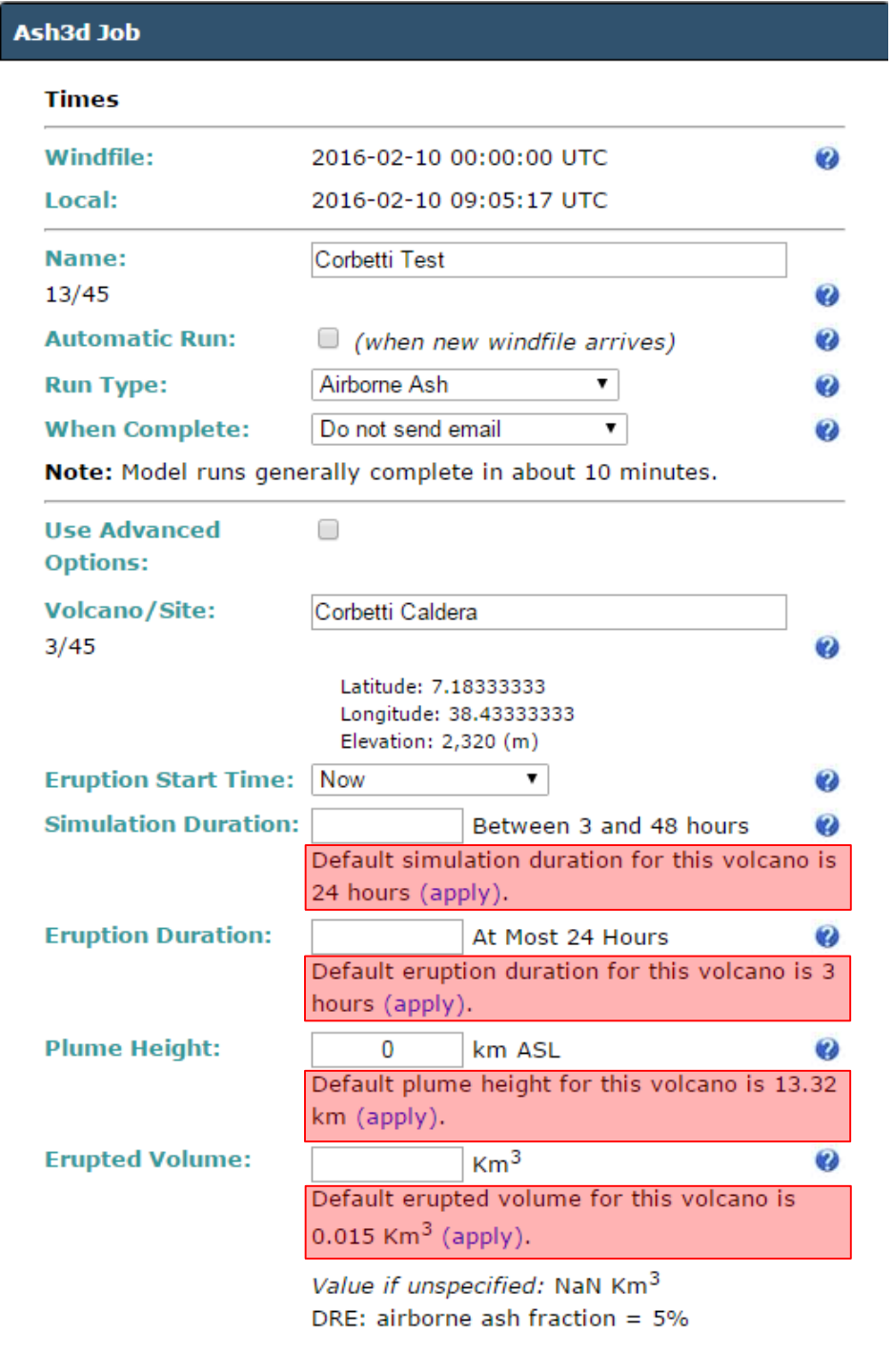
Potential Improvements

Database modification:

- Greater number of input parameters, e.g. total grainsize distribution
- Options for multiple scenarios or probability distributions for inputs at a given volcano
- Make source parameters customisable such that they are tailored to specific volcanoes

Accessibility:

- Post database online
- Allow qualified users to update database
- Develop streamlined integration with operational models



Integration with operational models

Enables fast application of models using default parameters

Feedback

- Keen to gather feedback from VAACs on:
  - Is the database currently being used? How and by whom? And if not, where is ESP information gathered from?
  - In examples when there are no observations, how is plume height estimated?
  - Are there ways in which the database can be made more accessible?
  - What other inputs would could be incorporated?