A new web site for running HYSPLIT for volcanic ash

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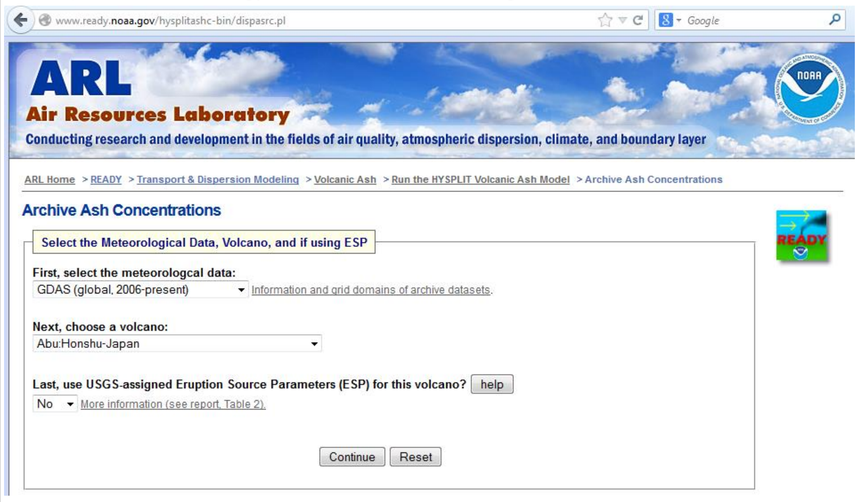
2nd IUGG-WMO workshop on Ash dispersal forecast and civil aviation, Poster #22

Background: The HYSPLIT transport and dispersion model is run operationally by the NOAA National Weather Service (NWS) to support the U.S. Volcanic Ash Advisory Centers (VAACs). For relatively large eruptions, the NWS issues a HYSPLIT output graphical product, showing discernible ash, as a supplemental product, i.e. in addition to the Volcanic Ash Advisories in text and graphical format (VAA/VAG). The supplemental product has 8 maps per page (4 layers in the vertical by 2 valid times).

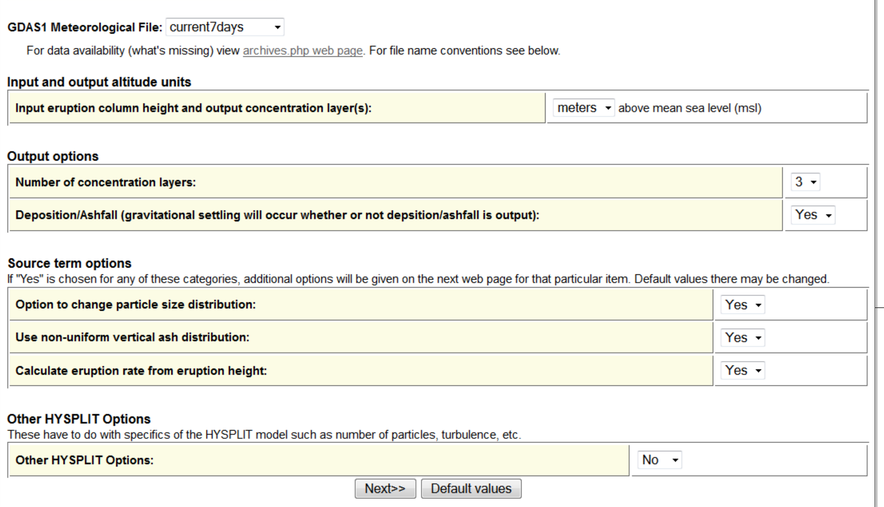
A new web interface to run HYSPLIT in a non-operational setting is available on the ARL website http://www.ready.noaa.gov/hysplitashc-bin/dispasrc.pl. Output graphics are one map per page, allowing improved graphical depiction at individual output layers / times compared to the NWS-issued product. In addition, there is more flexibility in terms of model input eruption source parameters and output layers. This new web capability currently only allows simulation of transport and dispersion from historical eruptions. Our plan is to convert this web interface to be consistent with that for non-volcanic ash HYSPLIT ARL web applications (http://www.ready.noaa.gov/HYSPLIT_disp.php) and then add real-time forecast capability. This volcanic ash forecast capability may be transferred to operations at the NWS.

Other R&D includes promoting global harmonization to minimize differences in the provision of volcanic ash information to the aviation community, improving quantitative ash forecasts, both in terms of eruption source parameters (ESP) and inverse modeling, and participating in the development of a volcanic ash dispersion model evaluation database (see Mastin et al, this workshop) to enhance confidence levels in the model output. *This research is in response to requirements and funding by the Federal Aviation Administration (FAA).*

First, choose meteorology, volcano, and whether using ESP



Second, set altitude units, number of output layers, ashfall, GSD, non-uniform vertical distribution, and eruption rate calculation. These choices affect subsequent inputs (see middle column).



Basic info (heights in meters or feet)

Source Term Parameters

Start time (UTC):	help	year 13	month 09	day 22	hour 00
Source latitude:		34.5 degrees			
Source longitude:		131.6 degrees (West is negative)			
Ash column top:	help	10000 meters, msl			
Ash column bottom:	help	640 meters, msl (summit=640 m)			
Eruption duration:	help	1 hour(s)	0 minutes		

Graphics formats

Output Parameters

Concentration Output Units	help	kg per cubic meter (deposition per square meter, unless chose ashfall (mm))				
Plot projection:	help	Default	Polar	Lambert	Mercator	Cyl. Equidistant
Plot resolution (dpi):	help	96				
Zoom factor:	help	70				
U.S. county borders?	help	Yes	No			
Google Earth output of contours?	help	Yes	No			
Postscript file?	help	Yes	No			
Create PDF file of graphics?	help	Yes	No			

Runtime parameters (number of layers)

Runtime Parameters

Total duration:	help	3 hour(s)		
Sampling Type	help	Average	Snapshot	1-Hour "Snapshot"
Averaging period/Snapshot interval:	help	3 hour(s)		
Concentration Grid Resolution (decimal degrees):	help	-1		
Concentration Grid Domain Size (decimal degrees):	help	-1 latitude	-1 longitude	
Top of Layer 3:	help	18000 meters MSL (must be >= 100m)		
Top of Layer 2:	help	12000 meters MSL (must be >= 100m)		
Top of Layer 1:	help	6000 meters MSL (must be >= 100m)		
Bottom of Layer 1:	help	0 meters MSL		

GSD

Advanced Source Term - Particle (grain) size distribution (GSD)

help	4-character ID	mass fraction (sum must equal 1)	diameter (um)	density (g/cc)	shape factor
Bin 1:	par1	0.008	0.6	2.5	1.0
Bin 2:	par2	0.067	2.0	2.5	1.0
Bin 3:	par3	0.257	6.0	2.5	1.0
Bin 4:	par4	0.668	20.0	2.5	1.0

Vertical distribution

Advanced Source Term - Vertical ash distribution

Vertical ash distribution: help — Near-uniform (k=2) (Near-uniform (k=2); Umbrella, full column (k=8); Umbrella, partially elevated (k=15); Umbrella, elevated (k=35))

Eruption rate calculation*

Advanced Source Term - Ash eruption rate

Ash eruption rate (kg/s) =	help	0.03	x	55	x	ash column top	^	4.5
		m63 (fraction)		constant		(km)		exponent

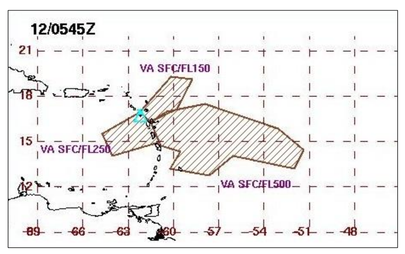
*Mastin et al., 2009: A multidisciplinary effort to assign realistic source parameters to models of volcanic ash-cloud transport and dispersion during eruptions, *Journal of Volcanology and Geothermal Research*, 186:10-21.

Deposition/Ashfall

Deposition/Ashfall Parameters

Wet deposition of particle: In-cloud (L/L) and below-cloud (1/s):	help	3.2E+05	5.0E-05
Sum deposition over total run time?:	help	Yes	No
Ash bulk density:	help	2.5 grams / cubic cm	
Deposition/Ashfall Output Units	help	mass per area	

Example VAG – Soufriere Hills observation valid 0545 UTC Feb. 12 ash at 3 levels
http://www.ssd.noaa.gov/VAAC/ARCH10/archive.htm



Example – Soufriere Hills, model results
eruption start, 17 UTC February 11, 2010
model results valid 06 UTC February 12

Model Results (Concentrations)

HYSPLIT VOLCANIC ASH MODEL RESULTS FOR JOB NUMBER 46664

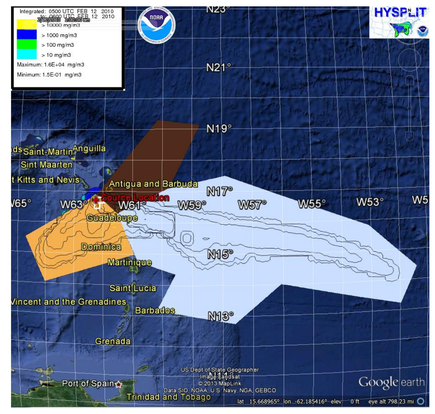
Model Status:
```
Mon Sep 30 09:06:26 EDT 2013
The model and graphics are now complete.
Finished generating graphics for job 46664.
ls: cannot access *.swf: No such file or directory
  adding: VMSDIST.46664 (deflated 44%)
  adding: SETUP.46664 (deflated 24%)
  adding: OUTPUT_INFO.46664 (deflated 39%)
```

OVERALL RESULTS	Click on text link or dropdown menu to view images.			
	GIF Plots	Animated GIF Plots	Google Earth Plots	Google Maps
Ash Concentration	13 Go	GIF	KMZ	KMZ
Mass loading	-- Go	GIF	KMZ	KMZ
Particle Positions	-- Go	GIF	-	-
Time of Arrival	GIF	-	-	-

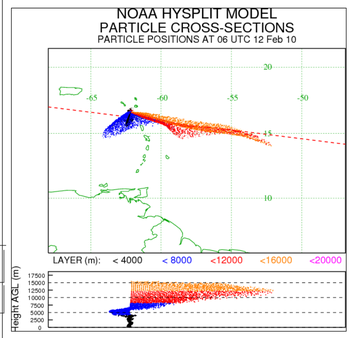
ASH CONCENTRATION RESULTS BY SUB-LAYER	Click on text link or dropdown menu to view images.			
	GIF Plots	Animated GIF Plots	Google Earth Plots	Google Maps
Layer 3 - 60000 ft, msl	-- Go	GIF	KMZ	KMZ
Layer 2 - 25000 ft, msl	-- Go	GIF	KMZ	KMZ
Layer 1 - 15000 ft, msl	-- Go	GIF	KMZ	KMZ

Links to other output files and programs
- Zipped file of all graphics and diagnostics
- Redraw the ash concentration graphics without rerunning the model.
- HYSPLIT Binary concentration file.
- HYSPLIT SETUP file.
- HYSPLIT CONTROL file.
- HYSPLIT MESSAGE (diagnostics) file.
- MESSAGE file format help (pdf)

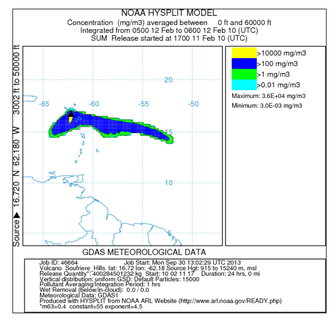
HYSPLIT output in 3 layers in Google Earth format with corresponding VAG observations (VAG below left)



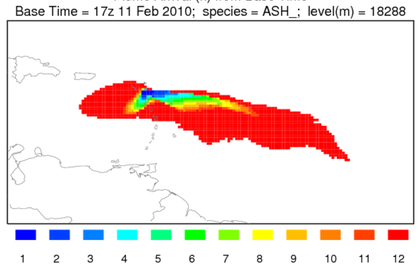
HYSPLIT 3-D particle positions



HYSPLIT concentration, all layers
- use Mastin et al (2009)* eqn.



Plume Arrival (h) from Base Time
Base Time = 17z 11 Feb 2010; species = ASH_; level(m) = 18288



Time of arrival
hours since eruption start
all layers