



VAST
Database

Reference: NILU-ESA-VAST-DB-3
Version : 4.0
Date : February 24, 2016



ESA-ESRIN Contract No. 4000105701/12/I-LG

Volcanic Ash Strategic-initiative Team

VAST

DATABASE

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DOCUMENT STATUS SHEET

	Role/Institution	NAME	Date	SIGNATURE
PREPARED BY	NILU	Kerstin Stebel	30.09.2015	
CONTRIBUTIONS	NILU NILU	Nina Iren Kristiansen Espen Sollum		
CHECKED BY				
APPROVED BY	Technical officer (ESA)			
ISSUED BY	Project manager			



EXECUTIVE SUMMARY

The objective is to prepare a benchmark test dataset for – seven - historic volcanic eruptions. The VAST, the SACS-II, the SMASH teams, individual researchers, as well as research networks provided datasets (see readme files for data originators). The database contains satellite, model and *in situ* data and plots from the following eruptions: Eyjafjallajökull, Iceland (April-May 2010), Grímsvötn, Iceland (May 2010), Kasatochi, Alaska, USA (August-September 2008), Etna, Italy (various dates, 2011), Puyehue-Cordón Caulle, Chile (June 2011), Chaitén, Chile (May 2008), and Mount Kelut, Indonesia (February 2014).

The database is accessible via the vast.nilu.no website for registered users. Users can search and download datasets and plots (zip-files).

In case more datasets will be made available to us, we will update the database. In 2016/17, all suitable datasets will be transferred to the ESA Validation Data Centre (EVDC), for long-term data access and archiving.

DOCUMENT REVISION

Issue	Date	Modified Items / Reason for Change	Lead Author
1.0	29.04.2013	Version 1: data from Eyafjallajökull	A. Durant / NILU
2.0	29.05.2013	Version 2: additional data from Eyafjallajökull, Grímsvötn, Kasatochi added database re-structured	G. Hansen / NILU
3.0	30.09.2015	Version 3: added data from SACS-2/SMASH, data from Chaiten, PCC, Etna and Kelut added, web-based access	K. Stebel / NILU
4.0	24.02.2016	Version 4: Updated and completed according to the web-based database.	K. Stebel/ NILU

References

Applicable Documents

- [AD1] Statement of Work, “StrIn – Enhancing Use of EO in Volcanic Ash Monitoring and Forecasting” – VAST (ESRIN/Contract No. 4000105701/12/I-IG), EOEP-STRI-EOPS-SW-11-0002, September 2011.
- [AD2] Prata et al., Volcanic Ash Strategic-initiative Team, Financial, Management and Administrative Proposal.Revision2, NILU, Kjeller, Norway, 14 June 2012
- [AD3] Zehner, Ed. (2010). Monitoring Volcanic Ash from Space. Proceedings of the ESA-EUMETSAT workshop on the 14 April to 23 May 2010 eruption at the Eyjafjoll volcano, South Iceland. Frascati, Italy, 26-27 May 2010. ESA-Publication STM-280. doi:10.5270/atmch-10-01

Reference Documents

- [RD1] Aas et. al., VAST User Requirement Document, v0.4, NILU-ESA-VAST-URD-v0.4, Oslo, Norway, 17 December 2012.

List of acronyms

AIRS	Atmospheric InfraRed Sounder (aboard EOS-Aqua)
AATSR	<u>Advanced Along-Track Scanning Radiometer</u>
ASCII	<u>American Standard Code for Information Interchange</u>
ASDC	<u>NASA Atmospheric Science Data Center, USA</u>
AVHRR	<u>Advanced Very High Resolution Radiometer</u>
BADC	<u>British Atmospheric Data Centre, UK</u>
BIRA	<u>Belgian Institute for Space Aeronomy, Belgium</u>
CALIPSO	<u>Cloud-Aerosol Lidar and Infrared Pathfinder Sattelite Observations</u>
CALIOP	<u>Cloud-Aerosol Lidar with Orthogonal Polarization</u>
CNES	<u>Centre National d'Etudes Spatiales, France</u>
ESA	<u>European Space Agency</u>
ENVISAT	<u>Environmental Satellite (ESA)</u>
EOS-Aqua	<u>Earth Observing System -Water mission (NASA)</u>
EOS-Aura	<u>Earth Observing System -Chemistry & Climate Mission (NASA)</u>
EOS-Terra	<u>Earth Observing System -Land mission (NASA)</u>
EUMETSAT	<u>European Organisation for the Exploitation of Meteorological Satellites, Germany</u>
GOME-2	<u>Global Ozone Monitoring Experiment -2 (aboard MetOp-A)</u>
GVP	<u>Global Volcanism Program (at the Smithsonian Institute)</u>
HDF	Hierarchical Data Format
HIRS	<u>High Resolution InfraRed Sounder</u>
IASI	<u>Infrared Atmospheric Sounding Interferometer (aboard MetOp-A)</u>
IR	Infra-red
LIDAR	Light Detection and Ranging
OMI	<u>Ozone Monitoring Instrument (aboard EOS-Aura)</u>
MetOp	<u>Meteorological Operational Satellite (Eumetsat)</u>
MODIS	<u>Moderate-resolution Imaging Spectroradiometer</u>
MSG	<u>Meteosat Second Generation (Eumetsat)</u>
NASA	<u>National Aeronautics and Space Administration</u>
NASA GES DISC	<u>Goddard Earth Sciences Data and Information Services Center, USA</u>
NetCDF	<u>Network Common Data Form</u>
NRT	Near-real time
SACS	<u>Support to Aviation Control Service</u>
SCIAMACHY	<u>Scanning Imaging Absorption Spectrometer for Atmospheric Cartography (aboard ENVISAT)</u>
SEVIRI	<u>Spinning Enhanced Visible and Infrared Imager (aboard MSG)</u>
SO ₂	Sulphur dioxide
ULB	Free University of Brussels, Brussels
UV	Ultra-violet
VAAC	Volcanic Ash Advisory Centre
VAA	Volcanic Ash Advisories
VAG	Volcanic Ash Graphic
VAST	<u>Volcanic Ash Strategic-initiative Team</u>

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1 Short description of database

A core deliverable of the “Volcanic Ash Strategic-Initiative Team” (VAST) project is the establishment of a test database for a specified number of volcanic eruptions, including appropriate documentation. The VAST Statement of Work (contract with ESA) states:

“3.1.1 TASK 1: Test-Database Generation (AD-1: R1.5, R1.6)

- Prepare a test-database for several (at least 6) historic eruptions (e.g. Eya – Merapi, Etna, Grimsvotn) including satellite, in-situ and modelling data describing these historic eruptions. This database shall be public and include information on source information, ash properties, fall out maps and the movement of the ash clouds.
- Prepare Documentation about the test-data base (description of the database content, data format description, and user manual. “

The VAST, the SACS-II, the SMASH teams, individual researchers, as well as research networks provided datasets (see readme files for data originators). The database contains satellite, model and *in situ* data and plots from following eruptions: Eyjafjallajökull, Iceland (April-May 2010), Grímsvötn, Iceland (May 2010), Kasatochi, Alaska, USA (August-September 2008), Etna, Italy (various dates, 2011), Puyehue-Cordón Caulle, Chile (June 2011), Chaitén, Chile (May 2008), and Mount Kelut, Indonesia (February 2014).

The database has been developed in collaboration between S[&]T (VAST website is a python-based web development framework Django and its related content management system Django-CMS) and NILU (Data management and content). The website/database is hosted and maintained by NILU. Search functionality is available to find all files containing the search term in their name.

2 Data access and data usage protocol

The database is accessible via the vast.nilu.no website for registered users. Users have to accept the following data usage protocol. They can then search and download the results, data, plots, and readme files, as a compressed archive (zip). More details of the individual data sets are given in the respective readme files.

1. Requests for data must comply with the data products sought and their intended use.
2. The Data Provider’s ownership rights and that data ownership remains with the data originator.
3. Data Providers are not liable for consequences of the use or misuse of provided data.
4. Provided data will be stored in the VAST database accessible for registered users only.
5. The data user must not redistribute these data to third parties, unless approved by the Data Provider.

6. If data are used in a publication, joint authorship must be offered and intellectual input must be discussed with the data owner. This implies that the lead author should inform the Data Provider/Owner about planned publications early in their preparation, and at least one month before submission. In addition, correct use and interpretation of data must be cleared with the Data Provider in advance of any form of publication, whether peer-reviewed or not.
7. Data Providers reserve the right to refuse to allow their work to be used in another publication prior to its own publication of the work or if the data owners disagree with the manner that the data is used.

3 Database content and future

In the following, an overview of the database content is given. In 2016/2017 all suitable datasets will be transferred to the ESA Validation Data Centre (EVDC), for long-term data access and archiving.

3.1 Eyjafjallajökull, Iceland (April – May 2010)

Platform	Period	Instrument	Main product	Species	Project/ Institution	Contact	Data	Plots	Readme
Satellite									
MSG	15.04 - 16.05.2010	SEVIRI	ash	mass loading, error, radius, OD	VAST /NILU	F. Prata fp@nicarnicaaviation.no	nc	no	yes
MSG	13.04 - 23.05.2010	SEVIRI	ash	mass loading, error, radius, OD, BTD	NVAP /NILU	A. Kylling arve.kylling@nilu.no	nc	no	yes
Aura	14.04. - 20.05.2010	OMI	SO ₂	total column	SACS-2 /IASB-BIRA	N. Theys Nicolas.Theys@aeronomie.be	he5	yes	yes
CALIPSO	15.04 - 18.05.2010	CALIOP	aerosol	backscatter coefficient	NASA	eosweb.larc.nasa.gov	hdf	yes	yes
Aqua	15.04 - 24.05.2010	AIRS	SO ₂	partial column	VAST /NILU	F. Prata fp@nicarnicaaviation.no	nc	yes	yes
ENVISAT	15.04 - 18.05.2010	AATSR	ash	AOD, AOD uncertainty, column mass, effective radius, height, BTD	VAST /FMI	T. Virtanen timo.h.virtanen@fmi.fi	nc	yes	yes
Metop-A	14.04. - 31.05.2010	IASI	ash	total column, flag	SACS-2 /ULB	L. Clarisse clarisse@ulb.ac.be	nc	no	yes

Platform	Period	Instrument	Main product	Species	Project/ Institution	Contact	Data	Plots	Readme
Model									
FLEXPART	14.04. - 24.05.2010	FLEXPART source term	ash	emission flux	VAST/NILU	N. Kristiansen nik@nilu.no	txt	yes	yes
FLEXPART	14.04. - 24.05.2010	FLEXPART a-priori	ash	total column	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes
FLEXPART	14.04. - 24.05.2010	FLEXPART a- posteriori	ash	total column	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes
WRF- Chem	14.04. - 24.05.2010	WRF-Chem a- posteriori	ash	total column	VAST/NUIG	R. Radulescu razvan.radulescu@nuigalway.ie	nc	no	yes
In situ									
Aircraft	20.04, 15.05, 19.05.2010	report CARIBIC, Falcon	diverse	info, flight track	MPIC, DLR	D. Scharffe scharffe@mpch-mainz.mpg.de, A. Minikin andreas.minikin@dlr.de	nc, txt	no	
Aircraft	17.04- 19.04.2010, 18.05.2010	MetAir DIMO	aerosol	aerosol number concentrations	PSI	Nicolas Bukowiecki nicolas.bukowiecki@psi.ch	csv, xls	no	yes
Ground- based	16.04 - 25.05.2010	LIDAR	aerosol	backscatter, extinction profile	EARLINET	www.earlinet.org	nc	no	yes
Ground- based	14.04 - 05.06.2010	Filter, PC	aerosol	PM10, PM2.5 concentration, grain size	Univ. Iceland	T. Thorsteinsson throsthurth@gmail.com	xls	yes	yes
Ground- based	01.04- 25.05.2010	OPC	aerosol	Size distribution	PSI	Nicolas Bukowiecki nicolas.bukowiecki@psi.ch	xls	no	yes

Platform	Period	Instrument	Main product	Species	Project/ Institution	Contact	Data	Plots	Readme
Ground-based	14.04. - 23.05.2010	RADAR	aerosol	plume altitude	IMO	P. Arason arason@arason.redur.is	txt	yes	yes
Ground-based	14.04. - 23.05.2010	WEBCAM	aerosol	plume altitude	IMO	P. Arason arason@arason.redur.is	txt	no	yes
Ground-based	14.04. - 16.04.2010	SEISMIC	tremor	onset eruption	IMO	www.vedur.is	no	yes	no
Auxillary									
Reports	24.04. - 15.06.2010	report			GVP, IMO	volcano.si.edu, www.vedur.is	pdf		
VAAC	14.04., 22.04, 26.04.10	analysis	ash	VAA, VAG	VAAC London	www.metoffice.gov.uk/aviation/vaac	txt	yes	yes

3.2 Grímsvötn, Iceland (May 2011)

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Satellite									
Aqua	22.05-29.05.2011	AIRS	SO2	partial column	VAST/NILU	F. Prata fp@nicarnicaaviation.no	nc	yes	yes
ENVISAT	22.05-24.05.2011	AATSR	ash	AOD, AOD uncertainty, column mass, effective radius, height, BTD	VAST/FMI	T. Virtanen timo.h.virtanen@fmi.fi	nc	yes	yes
Metop-A	21.05-10.06-2011	IASI	SO2	total column	ULB	L. Clarisse clarisse@ulb.ac.be	nc	no	yes
Metop-A	22.05-25.05.2011	IASI	ash	mass loading, flag	ULB	L. Clarisse clarisse@ulb.ac.be	nc	yes	yes
Aura	20.05.-11.06.2011	OMI	SO2	total column	SACS-2/IASB-BIRA	N. Theys Nicolas.Theys@aeronomie.be	he5	no	yes
MSG	21.05 - 27.05.2011	SEVIRI	ash	total column	NVAP/NILU	Arve Kylling arve.kylling@nilu.no	nc	no	yes
MetOp	22.05-23.05. 2011	GOME-2	SO2	plume height, total column	SACS-2/IASB-BIRA	J. van Gent Jeroen.vanGent@aeronomie.be	nc	no	yes

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Model									
FLEXPART	21.05. - 25.05.2011	FLEXPART source term	SO2	emission flux	VAST/NILU	N. Kristiansen nik@nilu.no	txt	yes	yes
FLEXPART	21.05. - 07.06.2011	FLEXPART a-priori	SO2	total column	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes
FLEXPART	21.05. - 10.06.2011	FLEXPART a-posteriori	SO2	total column	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes
FLEXPART	21.05. - 25.05.2011	FLEXPART source term	ash	emission flux	VAST/NILU	N. Kristiansen nik@nilu.no	txt	yes	yes
FLEXPART	21.05. - 26.05.2011	FLEXPART a- priori	ash	total column concentration deposition	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes
FLEXPART	21.05. - 26.05.2011	FLEXPART a-posteriori	ash	total column concentration, deposition	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes
SILAM	21.05. - 30.05.2011	SILAM a- posteriori	ash	total column	VAST/FMI	J. Vira julius.vira@fmi.fi	nc	yes	yes
SILAM	21.05. - 10.06.2011	SILAM a- posteriori	SO2	total column	VAST/FMI	J. Vira julius.vira@fmi.fi	nc	yes	yes
SILAM	21.05. - 28.05.2011	SILAM ensemble	SO2	total column, mean, std	VAST/FMI	J. Vira julius.vira@fmi.fi	nc	yes	yes
WRF-Chem	21.05. - 24.05. 2001	WRF-Chem	ash	total column	VAST/NUIG	R. C. Radulescu razvan.radulescu@nuigalw ay.ie	nc	no	yes

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
In situ									
Ground-based	01.05. - 30.05.2011	PM filter, monitor	aerosol	PM10	AirBase, lufkvalitet.info	M. Johnsrud Mona.Johnsrud@nilu.no	.xlsx	yes	yes
Ground-based	24.05. - 25.05.2011	LIDAR	aerosol	ash mass profile	Stockholm Univ.	M. Tesche m.tesche@herts.ac.uk	origin .opj	yes	yes
Ground-based	24.05. - 28.05.2011	LIDAR	aerosol	backscatter profile	EARLINET	www.earlinet.org	nc	yes	yes
Ground-based	21.05. - 25.05. 2011	RADAR	aerosol	plume altitude	IMO	P. Arason arason@arason.redur.is	txt	no	yes
Auxillary									
VAAC	21.05. – 29.05. 2011	analysis	ash	VAAC, VAG	VAAC London			yes	yes
Reports	21.05. – 25.05. 2011	report			GVP, IMO	volcano.si.edu, www.vedur.is	pdf, doc, txt		

3.3 Kasatochi, Aleuten Island, Alaska, USA (August 2008)

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Satellite									
Aqua	12.07. – 28.08.08	AIRS	SO2	partial column	VAST/NILU	F. Prata fp@nicarnicaaviation.no	nc	yes	yes
ENVISAT	08.08. - 09.08.08	AATSR	Ash	AOD, AOD uncertainty, column mass, effective radius, height, BTD	VAST/FMI	T. Virtanen timo.h.virtanen@fmi.fi	nc	yes	yes
MetOp	07.08. - 10.08.2008	GOME-2	SO2	column density	SAVAA/U. Bremen	A. Richter Andreas.Richter@iup.physik.uni- bremen.de	txt	yes	yes
CALIPSO	08.08. – 09.08.08	CALIOP	aerosol	backscatter coefficient	NASA	eosweb.larc.nasa.gov	hdf	yes	yes
Aura	06.08. - 30.09.2008	OMI	SO2	total column	SACS-2/ BIRA- IASB	N. Theys Nicolas.Theys@aeronomie.be	he5	no	yes

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Model									
FLEXPART	07-08.08.2008	FLEXPART source term	SO2	emission flux	SAVAA/NILU	N. Kristiansen nik@nilu.no	txt	yes	yes
FLEXPART	07.08-20.09.2008	FLEXPART a-posteriori	SO2	total column	SAVAA/NILU	N. Kristiansen nik@nilu.no	NC	yes	yes
SILAM	07.08.08-22.08.08	SILAM Ensemble	SO2	total column, mean, std	VAST/FMI	J. Vira julius.vira@fmi.fi	NC	yes	yes
In situ									
Ground-based	15.08-05.09.2008	LIDAR	aerosol	extinction profile	AWI	C. Ritter Christoph.Ritter@awi.de	.mat		yes
Auxillary									
VAAC	08.08-12.08.2008	analysis	ash	VAA, VAG	VAAC Anchorage		txt	yes	yes
Reports		report			GVP	volcano.si.edu	pdf		

3.4 Chaitén, Chile (May 2008)

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Satellite									
ENVISAT	02.05-07.05.2008	AATSR	ash	AOD, AOD uncertainty, column mass, effective radius, height, BTD	VAST/FMI	T. Virtanen timo.h.virtanen@fmi.fi	nc	yes	yes
Auxiliary									
VAAC	07.05-09.05.2008	analysis	ash	VAA, VAG	VAAC Toulouse		txt	yes	yes
Reports		report			GVP	volcano.si.edu	pdf		

3.5 Etna, Italy (various dates in 2011)

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Satellite									
MetOp	30.01. - 21.8.2011	GOME-2	SO2	total column	SMASH/ DLR	P. Valks Pieter.Valks@dlr.de	nc	no	yes
MetOp	07.08. - 20.08.11	GOME-2	SO2	total column	SACS-2/ BIRA-IASB	J. van Gent jeroen.vangent@aeronomie.be	nc	no	yes
Metop-A	12.01. - 16.11.11	IASI	SO2	total column	SACS-2/ ULB	L. Clarisse clarisse@ulb.ac.be	nc	no	yes
Metop-A	12.01. - 16.11.11	IASI	SO2	total column	SMASH/ UniOX	E. Carboni elisa@atm.ox.ac.uk	nc	no	yes
Aqua, Terra	30.07.11,12.08.11	MODIS	ash	column amount	SMASH/ INGV	S. Corradini stefano.corradini@ingv.it	nc	no	yes
Aqua, Terra	10.04,11.30.07.11, 12.08.11,15.11.2011	MODIS	SO2	total column	SMASH/ INGV	S. Corradini stefano.corradini@ingv.it	nc	no	yes
Aura	01.08 - 31.08.2011	OMI	SO2	total column	SACS-2/ BIRA-IASB	N. Theys Nicolas.Theys@aeronomie.be	he5	no	yes

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
In situ									
Ground-based	10.04.2011	FLAME	SO2	flux	INGV	G. Salerno giuseppe.salerno@ct.ingv.it	txt	no	yes
Ground-based	10.04. - 15.11.2011	Camera	ash	altitude, layer thickness	INGV	G. Salerno giuseppe.salerno@ct.ingv.it	doc	no	yes

3.6 Puyehue-Cordón Caulle, Chile (June 2011)

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Satellite									
ENVISAT	05.06.-10.06.11	AATSR	ash	AOD, AOD uncertainty, column mass, effective radius, height, BTD	VAST/FMI	T. Virtanen timo.h.virtanen@fmi.fi	nc	yes	yes
Auxiliary									
VAAC	02.07-03.07.2011	analysis	ash	VAA, VAG	VAAC Toulouse		txt	yes	yes
Reports		report			GVP	volcano.si.edu	pdf		

3.7 Kelut, Indonesia (February 2014)

Platform	Period	Instrument	Main product	Species	Project /Institution	Contact	Data	Plots	Readme
Satellite									
MTSAT-2	13.02. - 14.02.2014	MTSAT-2 IMAGER	ash	mass loading, quality flag	VAST/NILU	F. Prata fp@nicarnicaaviation.no	txt	yes	yes
Model									
FLEXPART	13.02.2014	FLEXPART source term	ash	emission flux	VAST/NILU	N. Kristiansen nik@nilu.no	txt	yes	yes
FLEXPART	13.02. - 16.02.2014	FLEXPART a-posteriori	ash	concentration, mass loading, deposition (2 model resolutions)	VAST/NILU	N. Kristiansen nik@nilu.no	nc	yes	yes