1. PROJECT

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Title: Radar-supported Next-Generation Forecasting of Volcanic Ash Hazard (R4AsH)

Dates: February 2019 - February 2022

Funding organisation: NERC

Grant no.: NE/S005218/1

2. DATASET

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Title: Outputs from a volcanic ash transport and dispersion model (NAME), plume model (ATHAM), source inversion system (InTEM) and Himawari satellite retrievals for phase 7 of the 2019 Raikoke eruption

Description: This dataset contains (1) the output of a volcanic ash transport and dispersion model (Numerical Atmospheric-dispersion Modelling Environment - NAME) simulations of phase 7 of the 2019 Raikoke eruption used in the UK Met Office volcanic ash source inversion system (InTEM), (2) Himawari satellite retrievals provided by kind permission of the UK Met Office that were used in InTEM inversion system, (3) output from the InTEM system for phase 7 of the 2019 Raikoke eruption, (4) output from a plume model (ATHAM) simulation of phase 7 of the Raikoke 2019 eruption, (5) output of volcanic ash transport and dispersion model simulations used for comparison to the ATHAM simulation.

The use of this data is outlined in Harvey, N. J., Herzog, M., Dacre, H. F. and Webster, H. N. (2025) A comparison of volcanic ash source term characteristics estimated by source inversion and plume rise modelling methods: Raikoke 2019*.* Journal of Volcanology and Geothermal Research, 462. 108304. ISSN 1872-6097 doi: [10.1016/j.jvolgeores.2025.108304](https://doi.org/10.1016/j.jvolgeores.2025.108304)

Publication Year: 2024

InTEM and NAME Simulation data

Creator: Natalie Harvey and Helen Webster

Organisation: University of Reading and UK Met Office

Rights-holder: University of Reading and UK Met Office

ATHAM Simulation data

Creator: Michael Herzog

Organisation: University of Cambridge

Rights-holder: University of Cambridge

3. TERMS OF USE

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InTEM and NAME Simulation data: (C) University of Reading and UK Met Office 2024. This dataset is licensed by the rights-holder under a Creative Commons Attribution 4.0 International Licence: https://creativecommons.org/licenses/by/4.0/.

ATHAM Simulation data: (C) University of Cambridge 2024. This dataset is licensed by the rights-holder under a Creative Commons Attribution 4.0 International Licence: https://creativecommons.org/licenses/by/4.0/.

Satellite data: (C) Crown Copyright 2024. This dataset is licensed by the rights-holder under the Non-commercial Government Licence 2.0: http://www.nationalarchives.gov.uk/doc/non-commercial-government-licence/version/2/.

4. CONTENTS

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File listing

name\_runs\_intem\_raikoke\_phase7\_hr.tar.gz contains concentration output at hourly resolution from NAME simulations using a nominal release rate (1 g/s) from each possible source term component (1km height range and hourly time period). These files are hourly .txt files. The posterior emissions determined by InTEM using linear combinations of these nominal simulations are described in Harvey et al. (In prep.).

intem\_runs\_raikoke\_phase7\_only\_hr.tar.gz contains the output files from the InTEM inversion with wet deposition represented for each member of the meteorological ensemble. Note to produce these files the associated Himawari satellite data is required. This is available in Harvey, Natalie and Saint, Cameron (2021): Outputs from a volcanic ash transport and dispersion model (NAME), source inversion system (InTEM) and Himawari satellite retrievals for the 2019 Raikoke eruption. University of Reading. Dataset. <https://doi.org/10.17864/1947.000335>

raikoke\_phase7\_inverted\_source.tar.gz contains .txt concentration and wet deposition output at hourly resolution from NAME simulations using the inverted posterior source term determined by InTEM. Data from this simulation is used to compare to output from the ATHAM model.

atham\_raikoke\_netCDF\_MOV\_420.tar.gz contains output 120 minutes into a simulation of phase 7 of the 2019 Raikoke eruption performed using the ATHAM model. The file contains the mixing ratio of the 9 ash categories used in the simulation on a 3D grid, along with bulk density.

5. METHOD and PROCESSING

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The method and processing used to create this data are described in Natalie Harvey et al. A comparison of volcanic ash distribution predicted by a plume rise model and source inversion model: Raikoke 2019.(202X): (In prep). The dispersion model data was created using NAME III Version 7.2.

Full details of the NAME model can be found here:

Jones, A., Thomson, D., Hort, M., Devenish, B. The UK Met Office’s next-generation atmospheric dispersion model, NAME III. In Air Pollution Modeling and its Application XVII; Springer, 2007; pp. 580-589. https://doi.org/10.1007/978-0-387-68854-1

Full details of the InTEM system can be found here:

Pelley, R.E., Cooke, M.C., Manning, A.J., Thomson, D.J., Witham, C.S., Hort, M.C. Initial implementation of an inversion technique for estimating volcanic ash source parameters in near real time using satellite retrievals. Forecasting Research Technical Report No. 604;Met Office, 2015. https://library.metoffice.gov.uk/Portal/Default/en-GB/RecordView/Index/212804

Full details of the ATHAM model can be found here:

M. Herzog, J. M. Oberhuber, H.-F. Graf, A prognostic turbulence scheme for the nonhydrostatic plume model ATHAM, Journal of the Atmospheric Sciences 60 (2003) 2783 – 2796. Doi: [https://doi.org/10.1175/1520-0469(2003)060<2783:APTSFT>2.0.CO;2](https://doi.org/10.1175/1520-0469%282003%29060%3C2783%3AAPTSFT%3E2.0.CO;2)

J. M. Oberhuber, M. Herzog, H.-F. Graf, K. Schwanke, Volcanic plume simulation on large scales, Journal of Volcanology and Geothermal Research 87 (1998) 29–53. URL:https://www.sciencedirect.com/science/article/pii/S0377027398000997.
https://doi.org/10.1016/S0377-0273(98)00099-7