Geophysical Research Abstracts
Vol. 21, EGU2019-7391-1, 2019
EGU General Assembly 2019

FALLD-8.0: A computational model for atmospheric transport and deposition of tephra, dust, SO_2, and radionuclides

Antonio Costa (1), Arnau Folch (2), and Giovanni Macedonio (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy (antonio.costa@ingv.it), (2) Barcelona Supercomputing Center, Jordi Girona 29, 08034 Barcelona, Spain (arnau.folch@bsc.es), (3) Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Vesuviano, Napoli, Italy (giovanni.macedonio@ingv.it)

FALL3D-8.0 is the new release of the FALL3D model (Folch et al., 2009; doi:10.1016/j.cageo.2008.08.008), a three-dimensional time-dependent Eulerian model for atmospheric transport and deposition based on the advection–diffusion–sedimentation equation (Folch et al., 2009; doi:10.1016/j.cageo.2008.08.008). The model upgrade incorporates dramatic improvements both in terms of physics and numerical algorithms and performance. In terms of model physics, the original tephra transport model has been extended to include mineral dust, radionuclides, and chemistry of SO_2. Besides the existing models describing phenomena such as particle resuspension, volcanic plumes, gravity spreading in the umbrella region, particle size distribution, and particle aggregation, different new parameterizations have also been introduced in order to describe eddy diffusivity, dry and wet deposition, and transport of radionuclides. In terms of numerical algorithms and performance, FALL3D-8.0 uses a vertical σ-coordinate to better capture local terrain effects, a Runge-Kutta forth-order in time explicit scheme, and a much more efficient high-resolution central-upwind scheme (Kurganov and Tadmor, 2000; doi:10.1006/jcph.2000.6459). The MPI-based parallelization of the code, written in FORTRAN 90, has also been reformulated in order to dramatically increase its performance on Petascale machines, including a better domain decomposition, parallel I/O, a parallel preprocess in which coupling with multiple driving meteorological models has been made more efficient, and a better memory management to reduce communications and improve code scalability. A few examples for different kind of applications are presented and the improve in code performance discussed.