

NAME III (v1.3) Validation: Etna October 2002 Eruption

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Introduction

This note briefly records the comparison of results from NAME III version 1.3 with those from NAME and from satellite imagery of the Etna October 2002 eruption.

The eruption, starting at 02:00 UTC 27/10/02, was modeled as a continuous release over the entire prediction period. The source was represented as a vertical line extending from 1975 m up to 4725 m above model ground level. The pollutant was inert and neutrally buoyant. The complete NAME III input file has been included in Annex A.

Results

NAME III predicted concentrations covering the period from 12:00 on 27/10/02 to 00:00 on 31/10/02 can be seen in figures 1 and 2. The plots present the total air concentrations over a depth of 3000 m centered at 4500 m above ground level. A complicated structure to the plume over this depth can be seen to develop. By looking at the UM 0000z analysis charts in Figure 5 the dispersion results can clearly be seen to shadow the flow as indicated by the mean sea level pressure contours and fronts present during this period.

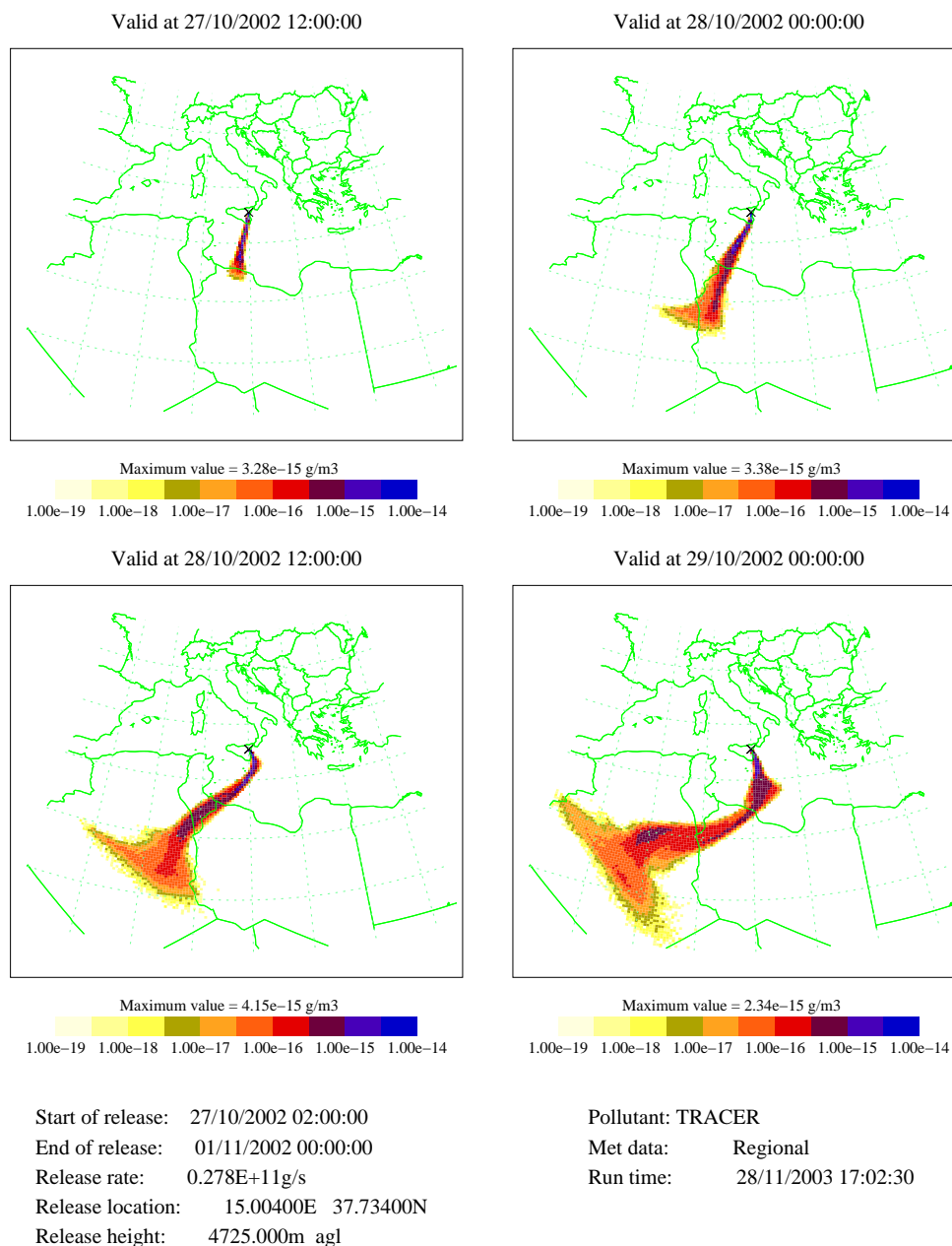
Comparison with NAME output (Figures 3 and 4), distribution only as source strengths differ between the two simulations, shows that the models produce similar but different results. Some of these differences seem to indicate that NAME III is resolving smaller structures in the atmosphere than are seen in NAME. This could be due to the fact that NAME III uses u, v, T etc. on their native UM grids whilst NAME interpolates these on to a common grid.

Figure 6 presents a MODIS enhanced satellite image from 09:45 29/10/02 which clearly shows some of the plume. It is clear, by comparing this with the 00:00 29/10/02 and 12:00 29/10/02 NAME III plots that the model has captured the plume direction and the distinct 'meso scale' kink just north of the 34° latitude line in the satellite image.

NAME III (version 1.3)

NAME III

Air Concentration: Output at 4500.000m agl



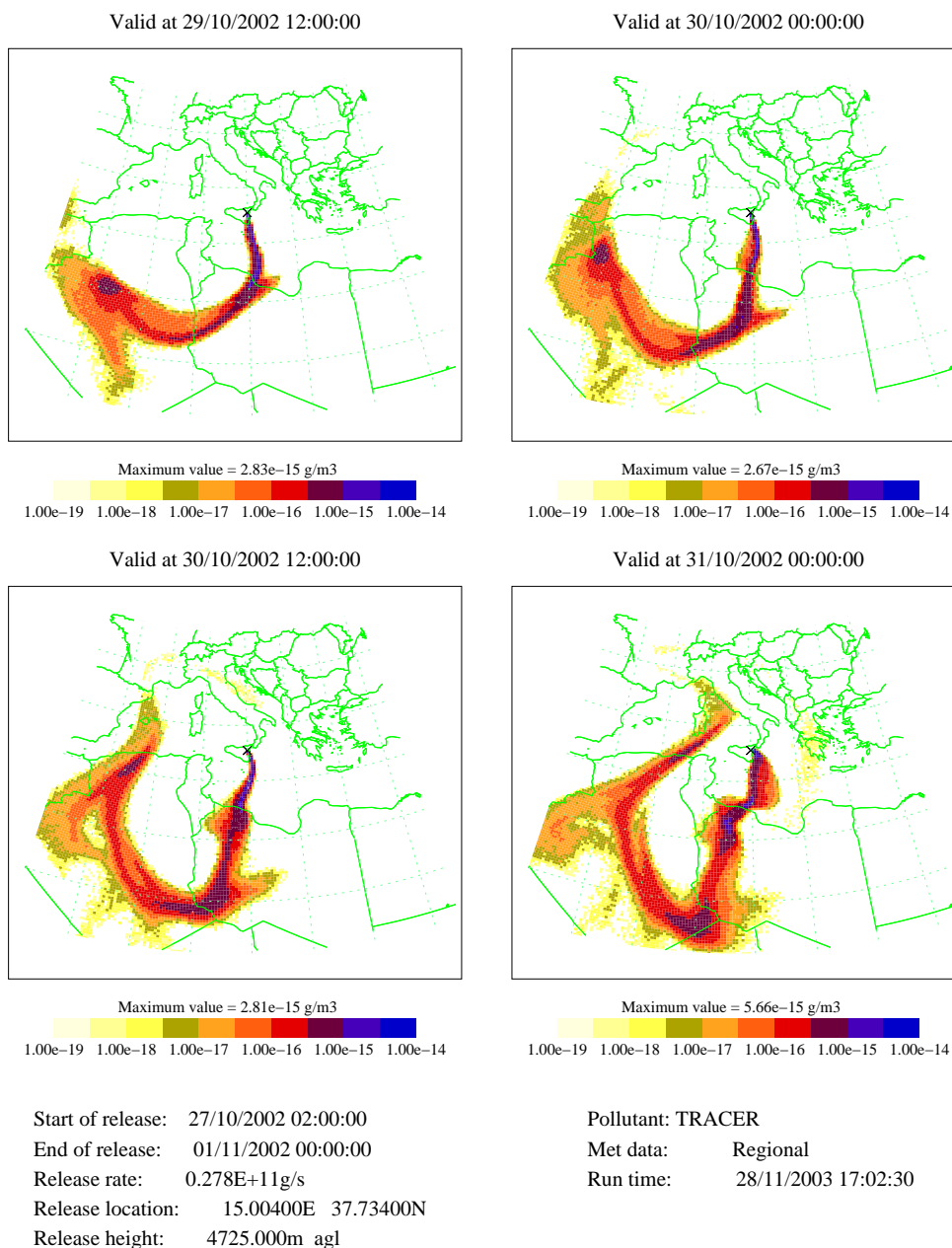
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Figure 1: NAME III output. Continuous Etna eruption.

NAME III (version 1.3)

NAME III

Air Concentration: Output at 4500.000m agl



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Figure 2: NAME III output. Continuous Etna eruption.

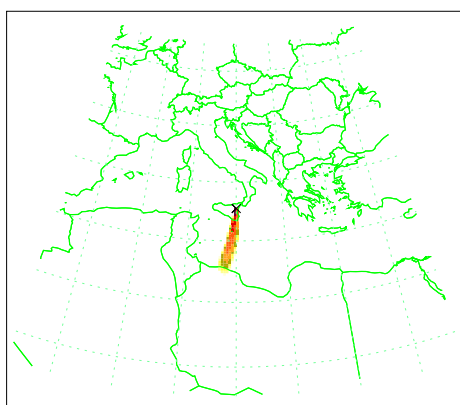
NAME version 807

Etna 2002

From 3000 – 6000m asl Air concentration



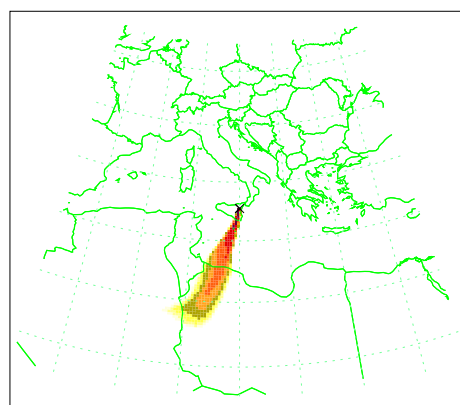
Valid at 1200UTC 27/10/2002



Maximum value = 3.58×10^{-14} g/m³

1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

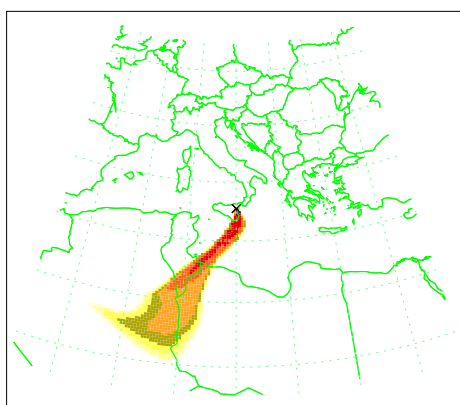
Valid at 0000UTC 28/10/2002



Maximum value = 7.13×10^{-14} g/m³

1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

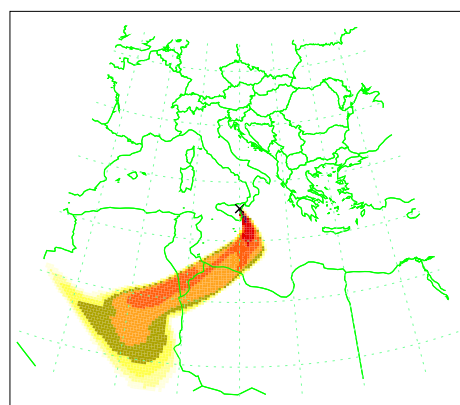
Valid at 1200UTC 28/10/2002



Maximum value = 7.88×10^{-14} g/m³

1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

Valid at 0000UTC 29/10/2002



Maximum value = 7.17×10^{-14} g/m³

1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

Start of release: 0200UTC 27/10/2002
End of release: 0000UTC 01/11/2002
Release rate: 0.463×10^{-4} g/s
Release location: 15.0040E 37.7340N
Release height: 3350 to 6100m asl

Pollutant: INERT-TRACER
Met data: Regional
Run time: 1545UTC 28/11/2003

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Figure 3: NAME output. Continuous Etna eruption.

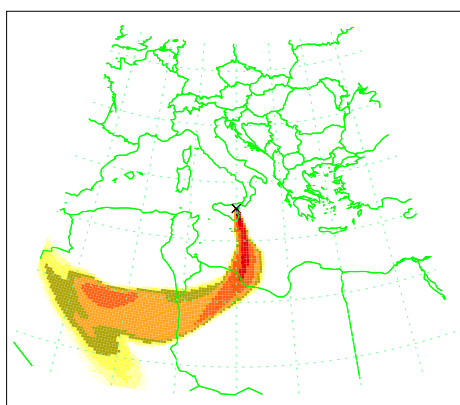
NAME version 807

Etna 2002

From 3000 – 6000m asl Air concentration

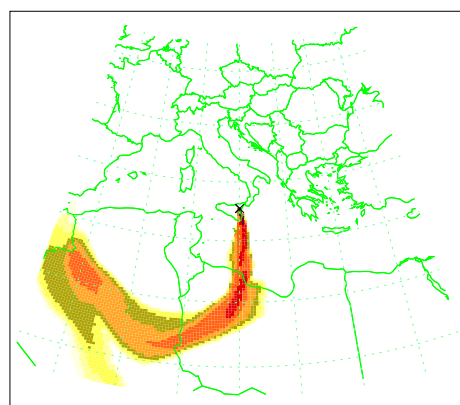


Valid at 1200UTC 29/10/2002



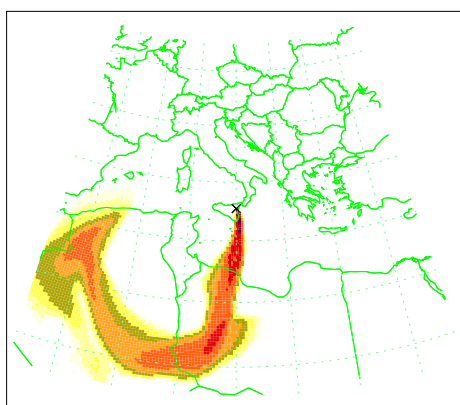
Maximum value = 4.81×10^{-14} g/m³
1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

Valid at 0000UTC 30/10/2002



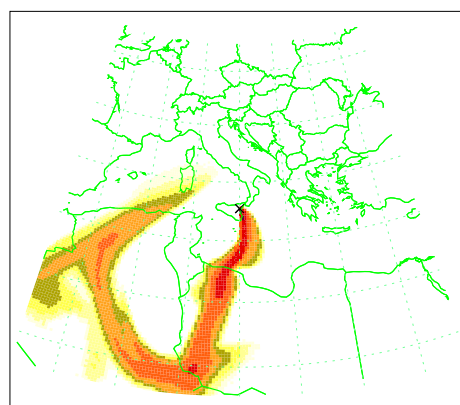
Maximum value = 6.43×10^{-14} g/m³
1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

Valid at 1200UTC 30/10/2002



Maximum value = 6.17×10^{-14} g/m³
1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

Valid at 0000UTC 31/10/2002



Maximum value = 9.01×10^{-14} g/m³
1.00e-17 1.00e-16 1.00e-15 1.00e-14 1.00e-13 1.00e-12

Start of release: 0200UTC 27/10/2002
End of release: 0000UTC 01/11/2002
Release rate: 0.463×10^{-4} g/s
Release location: 15.0040E 37.7340N
Release height: 3350 to 6100m asl

Pollutant: INERT-TRACER
Met data: Regional
Run time: 1545UTC 28/11/2003

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Figure 4: NAME output. Continuous Etna eruption.

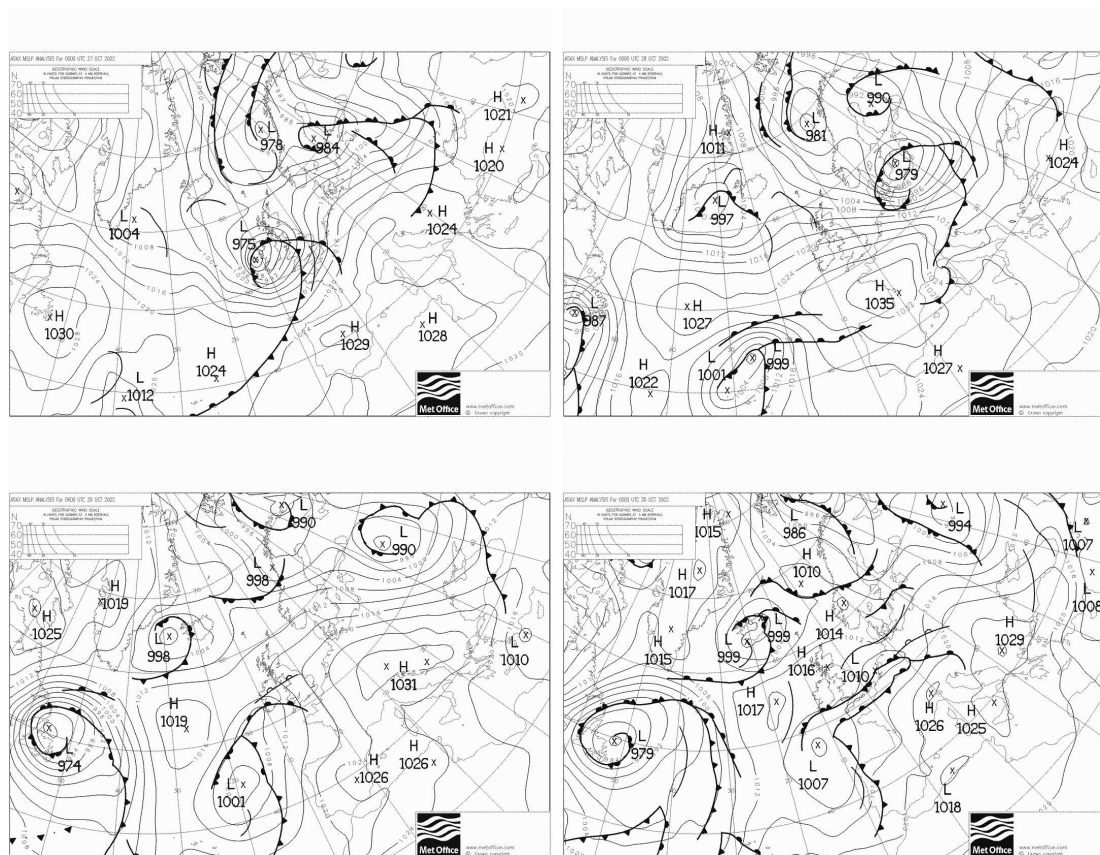


Figure 5: Met Office 0000 UTC fax charts for 27 (*top left*), 28 (*top right*), 29 (*bottom left*) and 30 (*bottom right*) Oct 2002.

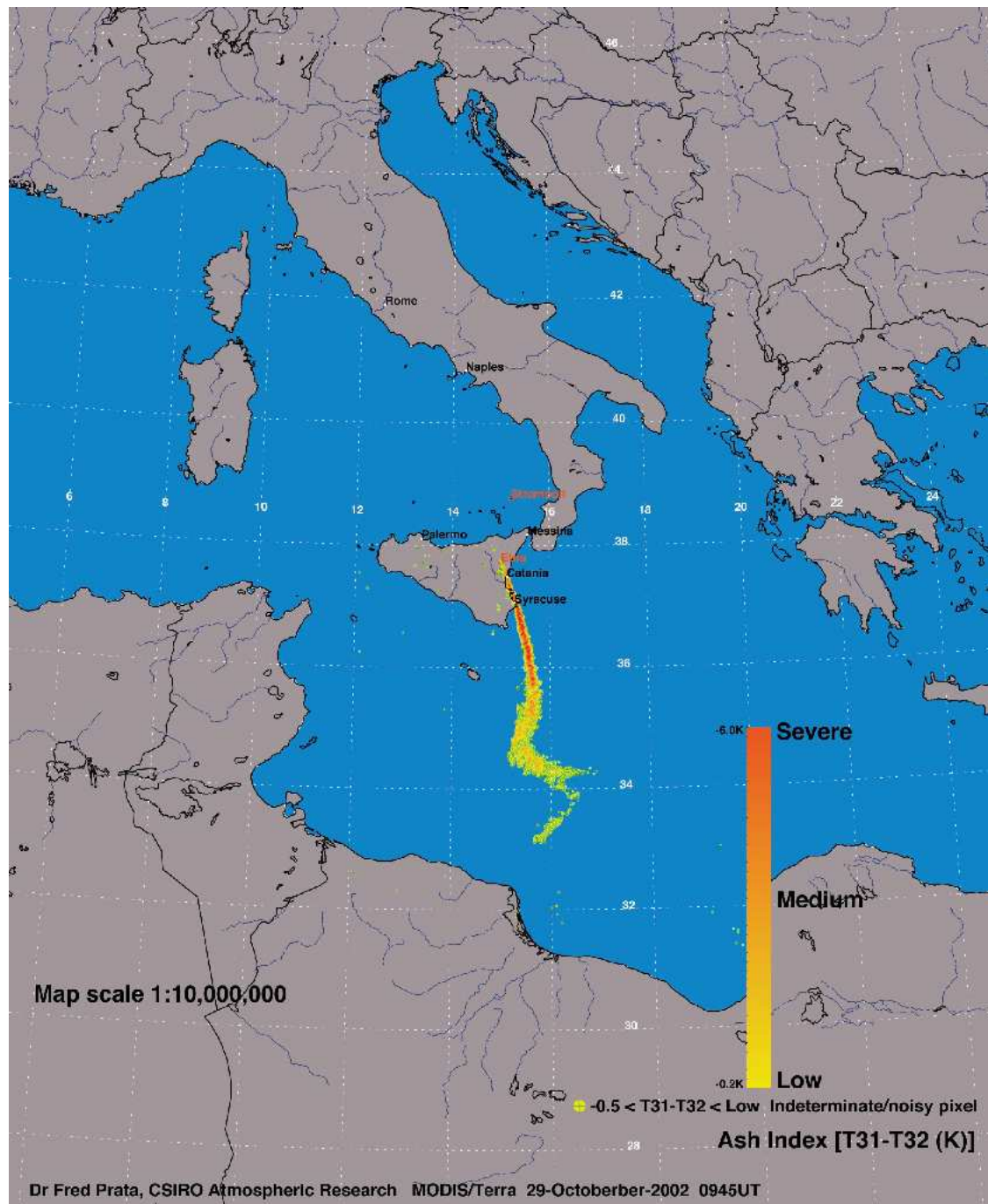


Figure 6: MODIS satellite image of Etna eruption. Image on 29/10/2002 09:45.

Annex A: NAME III input file.

Main Options:

Absolute or relative time?, Fixed met?, Time of fixed met, Flat Earth?
absolute, No, , No

Multiple Case Options:

Multiple Cases?, Multiple Sets of Dispersion Options?,
No, No,

Output Options:

Folder
.\Etna_out

Input Files:

File names
..\..\..\Met\UMMetDefnRUM5.txt

Array: ZGridArray

Array Values

250.0
500.0
750.0

Horizontal Coordinate Systems:

Name,	Type,	Pole Lat,	Pole Long,	Angle,	x-Origin,	y-Origin,	x-unit,	y-unit
HCoord1,	1,	90.0,	0.0,	0.0,	0.0,	0.0,	1.0,	1.0

Vertical Coordinate Systems:

Name,	Type,	Unit
ZCoord1,	1,	1.0

Horizontal Grids:

Name,	H-Coord,	nX,	ny,	dx,	dy,	x0,	y0
HGrid4,	HCoord1,	150,	140,	0.25,	0.2,	-5.0,	21.0

Vertical Grids:

Name,	Z-Coord,	nz,	dz,	z0
ZGrid2,	ZCoord1,	66,	25.0,	0.0
ZGrid4,	ZCoord1,	1,	3000.0,	4500.0

Temporal Grids:

Name,	nt,	dt,	t0
TGrid4.1,	11,	12:00:00,	27/10/2002 12:00:00

Domains:

Name,	H-Coord,	X Min,	X Max,	Y Min,	Y Max,	H Unbounded?,	Z-Coord,	Z Max,	Z Unbounded?,
D1,	HCoord1,	-1.0,	1.0,	-1.0,	1.0,	Yes,	ZCoord1,	10000.0,	No,
D2,	HCoord1,	-100000.0,	100000.0,	-100000.0,	100000.0,	No,	ZCoord1,	10000.0,	No,

Start Time,	End Time,	Max Travel Time
27/10/2002 00:00,	infinity,	240:00:01
27/10/2002 00:00,	infinity,	infinity

Species:

Name, Type, Half Life, Molecular Weight, Diameter, Density, Resistance Rc
 SO2, Gas, Stable, 28, , 1.0, 1.0

Sources:

Name, Shape, H-Coord, Z-Coord, X, Y, Z, dX, dY, dZ, Angle, Diameter,
 Etna, Rectangular, HCoord1, ZCoord1, 15.0040, 37.7340, 4725.0, 0, 0, 2750, 0.0, ,

Source Strength, Time Dependency, Plume Rise?, Temperature, Volume Flow Rate,
 SO2 1.0 g, , No, 0.0, 0.0,

Flow Velocity, NParticles, Max Age, Top Hat, Start Time, Stop Time
 , 1000000, 10000.0, No, 27/10/2002 02:00, 01/11/2002 00:00

Output Requirements - Fields:

Name, Species, Source, Group, H-Grid, Z-Grid, T-Grid, BL Average, T Average, Sync?, Graph?,
 Conc, , , , ZGrid2, TGrid4.1, No, No, No, Yes,
 Conc, , , , HGrid4, ZGrid4, TGrid4.1, No, No, No, No,
 PuffCentres, , , , ZGrid2, TGrid4.1, No, No, No, Yes,

Screen?, Disk?, Stat?, Plot Scale, Separate File, Output Group
 No, No, No, 0.01, T, F1
 No, Yes, No, 0.01, T, F2
 No, No, No, 0.01, T, F1

Output Requirements - Fields:

Name, Species, Source, Group, T-Grid, H-Coord, Z-Coord, T Average, Sync?, Graph?,
 NParticles, , , , TGrid4.1, HCoord1, ZCoord1, No, Yes, No,
 NPuffs, , , , TGrid4.1, HCoord1, ZCoord1, No, Yes, No,
 Sigma Z, , , , TGrid4.1, HCoord1, ZCoord1, No, Yes, No,
 #particle steps, , , , TGrid4.1, , , No, Yes, No,
 #puff steps, , , , TGrid4.1, , , No, Yes, No,

Screen?, Disk?, Stat?, Output Group
 Yes, No, No, F3
 Yes, No, No, F3
 Yes, No, No, F3
 Yes, No, No, F3
 Yes, No, No, F3

Output Requirements - Sets of Particle/Puff Details:

Name, Particles?, Puffs?, First Particle, Last Particle, First Puff, Last Puff, T-Grid, H-Coord,
 Set 1, No, Yes, 1, 1, 1, 1, , HCoord1,

Z-Coord, Sync?, Graph?, Screen?, Disk?
 ZCoord1, No, No, No, Yes

Sets of Dispersion Options:

Skew Time, Velocity Memory Time, Inhomogeneous Time, DeltaOpt, Puff Time, Sync Time,
 00:00, 00:00, 00:00, 1, 00:00, 00:15:00,

Computational Domain, Puff Interval, Deep Convection?, Radioactive Decay?,
 D1, 00:15, No, No,

Dry Deposition?	Wet Deposition?	Meander?
No,	No,	Yes

NWP Met Module Instances:

Name,	Min B L Depth,	Max B L Depth,	Use NWP BL Depth,	RESTOREMET,	DELETOMET,
Regional,	80.0,	4000.0,	No,	No,	No,

Met Folder,	Met Definition Name
..\..\..\Met\,	Regional

NWP Flow Module Instances:

Name,	Met Module,	Met,	Domain
Regional,	NWP Met,	Regional,	D2

Flow Order: Update
Flow Module, Flow
NWP Flow, Regional

Flow Order: Convert
Flow Module, Flow
NWP Flow, Regional

Flow Order: Flow
Flow Module, Flow
NWP Flow, Regional

Flow Attributes:
Name, Flow Order
Update, Update
Convert, Convert
Flow, Flow