
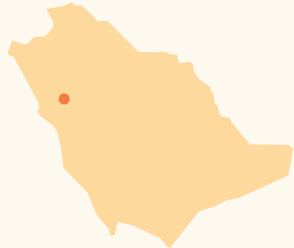


Volcanic Ash Trajectories and their Environmental Impacts, Study for the Al Ays Region – MicroStep-MIS Success Story

Tender:	Volcanic Ash Trajectories and their Environmental Impacts, Study for the Al Ays Region
Client:	Presidency of Meteorology and Environment, Saudi Arabia
Contractor:	EOCL



Presidency of Meteorology and Environment (PME)
is responsible for environmental protection, pollution control, and establishing environmental quality standards.



Saudi Arabia: Al Ays region, volcano site

Between April and June 2009 more than 30,000 earthquakes occurred beneath the Harrat Lunayyir lava fields of Saudi Arabia. The magnitude 5.4 earthquake on May 19th, 2010 damaged buildings in the town of Al Ays and prompted the Saudi Arabian government to order evacuations and 40,000 people had to leave their homes.

All these events forced the Presidency of Meteorology and Environment to prepare the ash dispersion and impact study for Al Ays region. MicroStep-MIS as a company with vast experience in seismology, meteorology and modeling was chosen to conduct the study.

The project “Study of Volcanic Ash Trajectories and its Environmental Impact” was aimed to provide ash dispersion and impact study for Al Ays region in different seasons of year. The study was structured into several parts:

- [Ash and Gas Source Characteristics – Volcanological Expertise](#)
- [Climatology of the Studied Region](#)
- [Detailed Weather Modeling of the Studied Region](#)
- [Volcanic Ash Transport](#)
- [Selected Gases Dispersion](#)
- [Summary and Recommendations](#)

Detailed Weather Modeling

Detailed weather modeling is necessary to get the wind flows of the region, which are necessary for ash trajectory

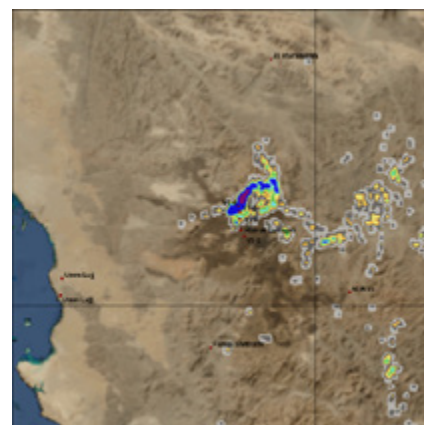
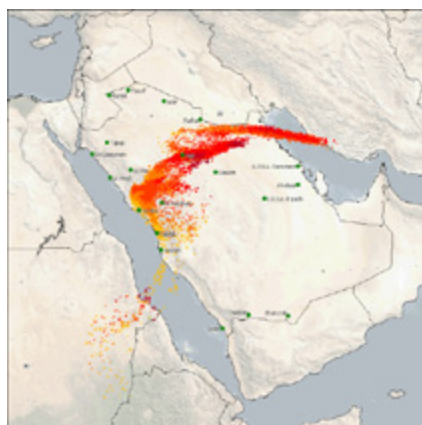
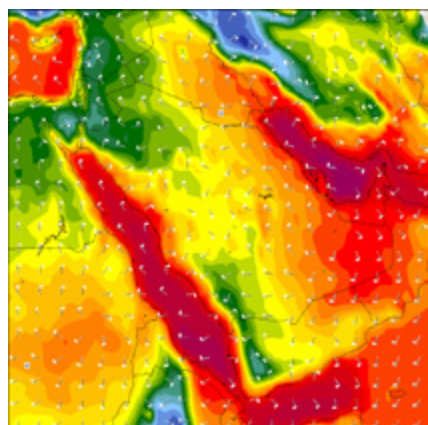
ries modeling. In addition, the weather modeling provides other parameters, such as temperature, humidity, pressure, surface fluxes, etc., which influence ash trajectories, height of capping inversion and ash deposition to the ground.

Twenty years of analyzed weather data from period 1990-2009 were used for creation of wind flows and monthly weather patterns in the region.

Volcanic Ash Transport

Having detailed weather and wind flows data of the region, the Trajectory Dispersion Model IMS Model Suite is employed. The model is capable of:

- dispersion in local, regional and continental scale
- to operate with microscale, mesoscale and macroscale meteorology
- to simulate boundary layer turbulence by adding semi-random component to the large scale wind, using Monte Carlo techniques
- to use modern profile method or NWP outputs directly to categorize atmospheric stability and to assess magnitude of random component
- suitability for scientific research

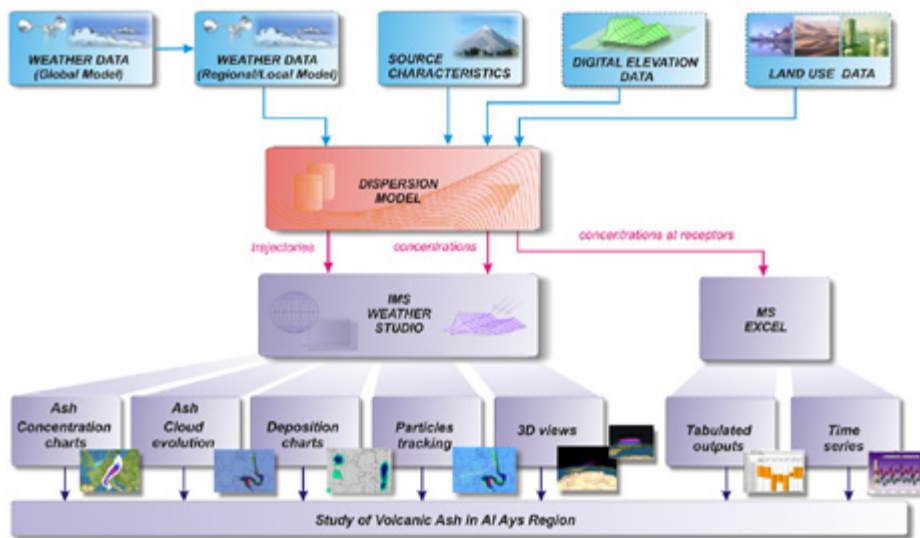
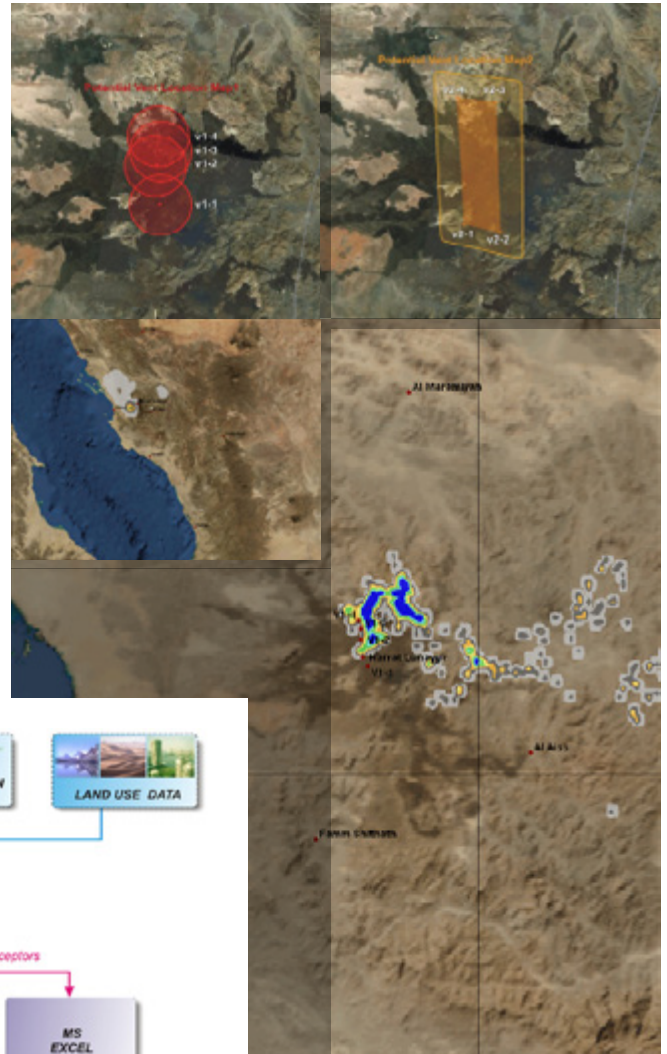


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Within this study, the model was used in close coupling with meteorological model, to simulate important phenomena:

- Advection mechanism, creation of wind fields
- Turbulence mechanism, both mechanical and thermal (buoyancy) turbulence
- Capping layers were identified, so that particles/gases are almost trapped in the boundary layer
- Transport mechanisms of ash particles, gases
- Dry deposition mechanism, using the deposition velocity concept
- Wet deposition mechanism, utilizing the rainfall amount influence to deposition

Study was professionally issued in printed copies and interactive DVD. After successful acceptance, the contractor was highly satisfied with the quality of the study and requested new edition, in order to be able to distribute the study to more organizations.



◀ Schematics of Study Components

Challenge

- Phenomena that can adversely affect inhabitants, ecosystems, agriculture, traffic
- Interdisciplinary problem - volcanology/meteorology and climatology/chemicals dispersion
- Assess areas potentially endangered by VA even before the volcano erupts

Our solution

- Volcanological research
- High performance computing
- Climatic downscaling
- Coupling of meteorological and dispersion models with special focus to ash particles

Achievements

- Genuine research results
- Comprehensive study accepted by regional environmental authority