2

The National Norwegian Ash Project

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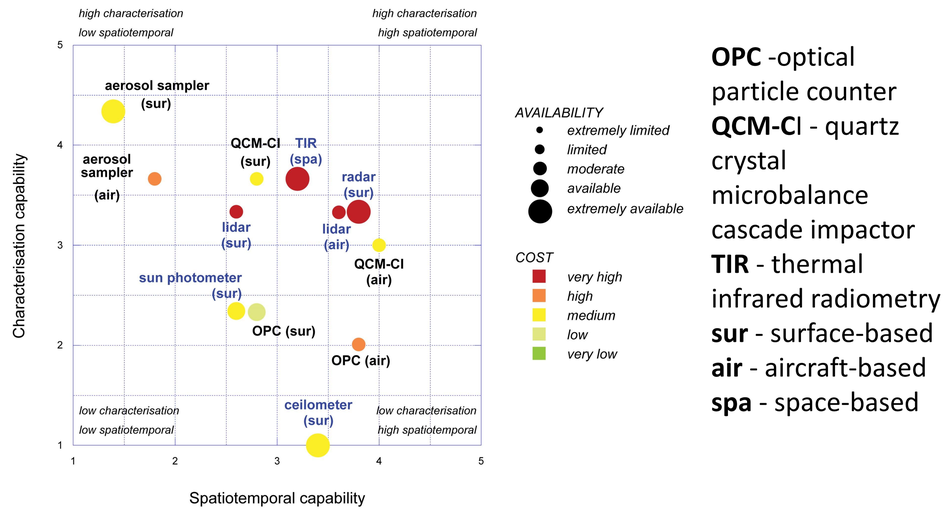
The national Norwegian ash project aims to improve observations and modeling of volcanic ash in the Norwegian airspace. The project is organized into three parts, the first one is to facilitate and further develop **observation data**, e.g. satellite observations and ground-based data. The second part is to improve the **modeling of ash transport** and the last part is to develop **visualization tools** for the end-users needs. A version of the EMEP model called the eEMEP (emergency EMEP) model is already running operationally twice a day at the Norwegian Meteorological Institute (MET Norway) simulating potential eruptions of European volcanoes. By the end of the project, source term determination (inversion) techniques developed at NILU will be tested in an operational setting at the Norwegian Meteorological Institute for improved volcanic ash forecasts.
The project will go over three years and started in October 2012, this poster shows results of our work up to now.

Observation data / Assessment of ash measurement techniques
To improve the emission estimate from volcanic eruptions quickly, observations from satellites are especially important. The Spinning Enhanced Visible and Infrared Imager (SEVIRI) satellite instrument provides high temporal and spatial coverage for the observation of volcanic ash in Norwegian and the surrounding airspace (up to 70N). Work has been done to improve the ash detection from SEVIRI data, and a study on the possible use of (Infrared Atmospheric Sounding Interferometer) IASI satellite observations is planned. MET Norway has also installed a ceilometer for testing its capabilities in measuring aerosols. A report on evaluation of infrastructure for measurement of volcanic ash from ground or air has been written.



OPC -optical particle counter
QCM-Cl - quartz crystal microbalance cascade impactor
TIR - thermal infrared radiometry
sur - surface-based
air - aircraft-based
spa - space-based

Figure 1 Ash characterization capability plotted against spatiotemporal capability, marker size corresponds availability and marker color corresponds to the cost. Blue text indicate remote sensing and in situ in black.

Some caution should be taken when interpreting the results from the evaluation shown in Figure 1. There is no single technique that has the capability to measure every characteristic of volcanic ash clouds at desired temporal and spatial resolutions. In general term, the suitability of a given technique to the measurement of ash increases towards the upper right corner of the plot

Modeling of ash transport / Finding the right vertical resolution
Two transport models are used for modeling the transport of volcanic emission clouds: MET Norway's model eEMEP and NILU's FLEXPART model. A decision on will be made on which model to be set as operational at Met Norway at the project end. Work to improve the EMEP model includes extending the top of the eEMEP from around 16 km to 30 km and increasing the resolution in the higher layers of the model. For testing the model with the Eyjafjallajökull and Grímsvötn eruptions, the hindcast version of the ECMWF-IFS model is used which only has 60 layers. However testing for the best number of data for the operational runs that use the 137 layers are being studied, see Figure 2.

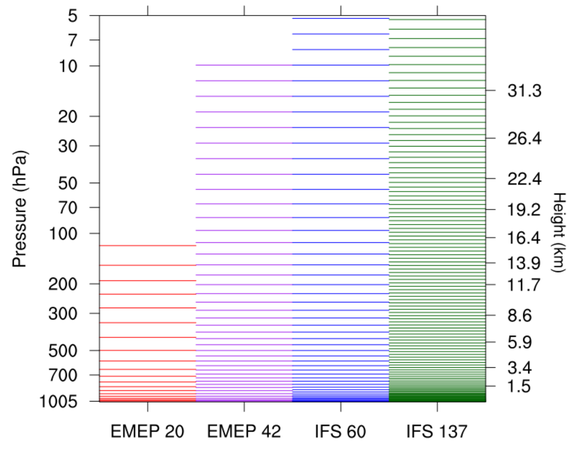


Figure 2 The resolution of vertical layers. The 20 original EMEP layers (red), the 42 layers using the IFS 60 model layers (in blue) and the vertical layers for the IFS forecast model (green).

Test runs with ash and SO2
Comparing the emission plumes from the Grimsvötn eruption in Figure 3 shows that there are small differences, the dispersion of ash and sulfur dioxide is greater in the 42 layer model.

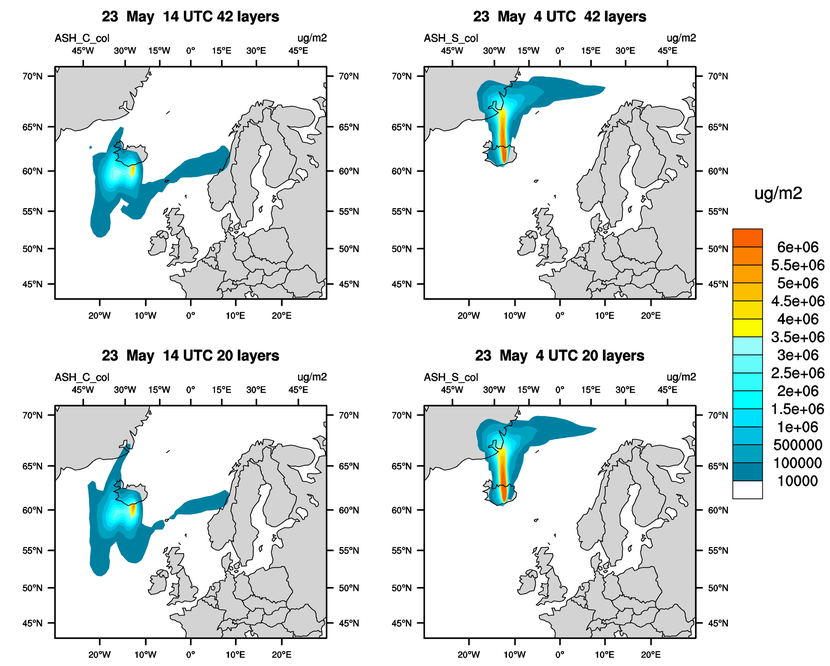


Figure 3 Ash (left) and sulfur dioxide(right) plume from the Grimsvötn eruption for 42 (top) and 20 vertical layers (below).

There is planned work improving the model's ash parameterization, study ensemble runs to estimate the uncertainty in ash concentrations given by the EMEP model and also test NILU's source term determination technique operational for the eEMEP model.

Visualization / Providing info to the MET Norway's forecasters and crisis team
DIANA is a visualization tool developed at MET Norway for viewing weather and ocean model data, and now also model result from the eEMEP model. For the project it has been further developed to plot the polygons issued by VAAC on top of both eEMEP model results and satellite images, see Figure 4. The fly meteorologist can also edit the polygons to better match the observations or model data. There is planned work for making it possible to plot cross sections of model results.

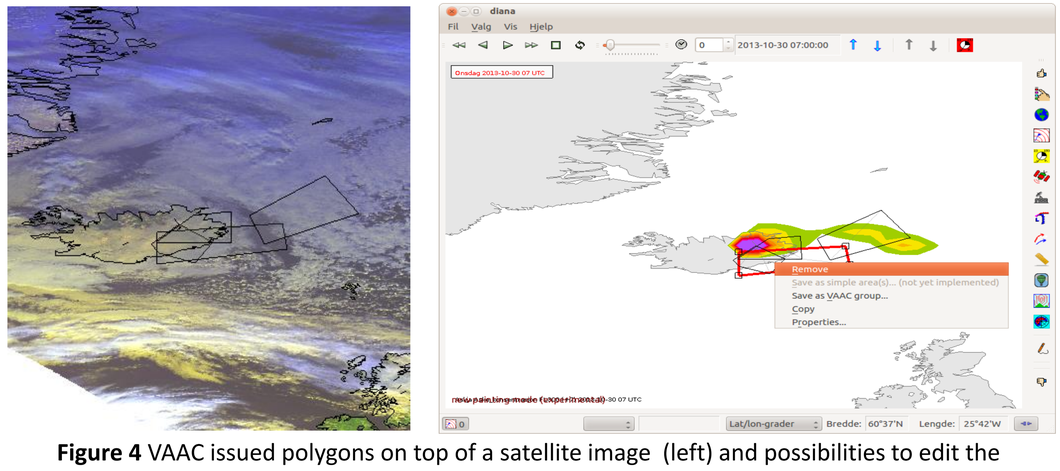


Figure 4 VAAC issued polygons on top of a satellite image (left) and possibilities to edit the polygons on top of model results(right), both shown in DIANA .

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