



20 April 2010

**Replies from WMO experts in aeronautical meteorology to questions related to the spread of the ash plume from the eruption of the Eyjafjallajökull volcano in Iceland.**

***What is the authoritative source of information on volcanic ash in aviation?***

There are 9 Volcanic Ash Advisory Centers (VAAC) across the world, established by the International Civil Aviation Organization (ICAO) in close cooperation with WMO and the International Union of Geodesy and Geophysics (IUGG) They are operated by WMO Members and provide meteorological information in support of the International Airways Volcano Watch system.

***What is the line of command during such an event?***

1. The VAAC responsible for the area where the eruption has occurred (called the lead VAAC) issues a Volcanic Ash advisory based on observations, meteorological data and forecasts of transport and dispersion.
2. Based on these advisories, the designated Meteorological Watch Office(s) issue(s) significant meteorological warnings for aircraft before and in flight (called SIGMETs) covering all or part of their area of responsibility.
3. The Civil Aviation Authority of the States concerned may, based on this information and considerations of safety, take a decision on whether to close or open their air space for operations.

***For how long will the volcanic cloud remain in the atmosphere?***

The very fine ash injected into higher levels of the atmosphere, i.e. above 6km, will remain there for quite some time, as these very small particles could only be effectively removed by deep convection locally (thunderstorms), which are not expected in the next few days due to the current weather situation. The ash particles are slowly descending down to lower levels, there is evidence from measurements that most ash is now mostly between the surface and about 3000m, with some evidence of locally higher levels as reported by research flights over the United Kingdom.

***What is happening at the site of the volcano?***

We have received information today that the eruptions had changed recently, with more molten lava flow and the remaining plume is now only reaching less than 3000m. The whiteness of the plume furthermore suggested that it contains mainly steam and little ash. The Icelandic authorities continue to monitor the events closely and provide regular updates to the Volcanic Ash Advisory Centers (VAAC) established by the International Airways Volcanic watch, an ICAO system established in cooperation with WMO. However, the volcano is liable to revert to explosive eruptions at any time.

***How does the weather influence the volcanic ash cloud?***

The current High Pressure (anti-cyclonic) system with weak winds and slowly descending air in the centre of the High does not help very much to disperse the ash cloud. This situation is expected to change towards the end of the week, when a stronger low pressure system over Iceland is predicted to develop. Not only will such a low change the winds and push the ash towards the Arctic, but the rains associated with this low pressure system will result in a degree of 'wash out' of ash at lower levels.

***What do ash forecast models do?***

The models used by the Volcanic Ash Advisory Center London, the "lead VAAC" for this event, and its neighbouring VAACs in Toulouse and Montreal use highly developed atmospheric models that calculate the transport of existing aerosols (such as volcanic ash) with the prevailing winds.

They also predict how turbulent motions in the atmosphere help to disperse the ash cloud until it is considered safe to fly in.

Ash models integrate atmospheric data and initial information from sources in the vicinity of the eruption such as volcano observatories, satellite information and weather radar data. To initialize the models, information from all available sources has to be analyzed. Therefore, the model provides values of ash concentration relative to that measured or assumed at the eruption source.

***What is the size and composition of the particles?***

Small jagged pieces of rocks, minerals, and volcanic glass the size of sand and silt (less than 2 millimeters (1/12 inch) in diameter) erupted by a volcano are called volcanic ash. Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive. The smaller particles, which can stay in the atmosphere longest, could typically have a diameter of between 1 and 40 microns (1/1000 of a mm).

***Why can't planes fly in the affected areas?***

Very fine volcanic ash particles sucked into a jet engine melt at about 1,100 °C, fusing onto the blades and other parts of the turbine (which operates at about 1,400 °C). They can erode and destroy fan blades, eventually leading to engine stall. They can also "blind" pilots by sandblasting the windscreen requiring an instrument landing, and damage the fuselage.

***How are WMO and the meteorological services of its Members helping in this situation?***

The National Meteorological Services under coordination of VAACs and WMO have immediately stepped up their efforts to provide the best possible information in support of the advisories provided:

- A daily telephone conference has been organized between all concerned meteorological services in Europe to coordinate efforts in observations and forecasts.
- Contact with aircraft manufacturers was established to request a first estimate of the ash density that modern aircraft may be able to tolerate. Preliminary feedback, requiring further confirmation, appears to be consistent with thresholds used in the advisories provided so far.
- EUMETNET, representing the meteorological services of Western and Central Europe, is collecting data from a research network of LIDAR ( Laser-based instruments for detection of aerosols in the atmosphere) sites capable of detecting airborne ash (or other aerosols) which are normally only available within research projects.
- WMO Members and the VAACs are mobilizing all available research aircraft in the affected areas to provide in-situ observations to corroborate and calibrate the LIDAR and model data. This is important for progressing towards an assessment of absolute ash density values.
- The US National Oceanic and Atmospheric Organization (NOAA) is committed to provide any new and additional relevant data and model results that may become available to them from research, operational, civilian and military sources.
- Close liaison is maintained throughout this crisis between WMO, ICAO and the civil aviation authorities concerned in order to detect and use any "window of opportunity" to resume flight operations while maintaining safety.