

Resum de Tesi Doctoral



UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Escola de Doctorat

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Títol de la tesi	Modeling strategies for volcanic ash dispersal and management of impacts on civil aviation
Unitat estructural	Departamento de Proyectos de Ingeniería
Programa	Ingeniería Ambiental
Codis UNESCO	250621 330800 330801 330804

(Mínim 1 i màxim 4, podeu veure els codis a <http://doctorat.upc.edu/gestio-academica/impresos/tesi-matricula-i-diposit/codis-unesco>)

Resum de la tesi de 4000 caràcters màxim (si supera els 4000 es tallarà automàticament)

During April-May 2010, the eruption of Eyjafjallajkull volcano in Iceland caused the larger breakdown of civil aviation after World War II. Although the eruption was weak in intensity, the dispersal of volcanic ash clouds over northern and central Europe resulted in more than 100.000 flights canceled and caused over USD 1.7 billion economical losses. This event and its unexpected effects raised many questions amongst the affected communities and stakeholders. How could volcanic eruptions cause severe disruptions at continental scales? Were these impacts totally unexpected? What could have been done to improve preparedness of aviation sector and reduce societal impacts of disruptions?

The harmful effects of volcanic ash on aircrafts components have long been recognized, and volcanic ash dispersal patterns can be forecasted thanks to sophisticated numerical models. However, the procedures to be implemented in case of ash-contaminated airspace where applied only in few occasions, due to the relatively low frequency of explosive eruptions events. The 2010 Eyjafjallajkull crisis revealed a low preparedness of society to direct and indirect impacts of volcanic eruptions, and pointed out some flaws to be improved for mitigating impacts of explosive eruptions on aviation operations.

The issues pointed out by the 2010 crisis are the starting point of this PhD research, which aims at offering new methods for improving aviation management during explosive volcanic eruptions. This manuscript describes the novel contributions developed during a 4-year period of research. The adoption of new techniques is proposed in order to improve current tephra dispersal modeling strategies and produce results focused on aviation needs. This research develops the first methodology to assess vulnerability of air traffic system and its elements to volcanic tephra dispersal. In addition, an impact assessment methodology has been designed to estimate expected impacts of explosive volcanic eruptions on the air traffic network and its elements. The impact assessment methodology has been implemented into a map-based tool to automatically assess expected impacts of volcanic eruptions based on real ash dispersal and air traffic data. Results of the vulnerability and impact assessment can support the stakeholders involved in the definition of risk-management strategies.

Contributions of this research have been applied to case-studies and specific results have been published in a collection of journal papers. Main outcomes of the research are discussed identifying further work to be done in this rapidly evolving field. This research provides useful insights to reduce impacts of volcanic eruptions on civil aviation and, eventually, on the whole society.

Signa Chiara Scaini

Barcelona, 19 gener 2015