Policy recommendations

The improvement of the MSP and its preparation is crucial as the mishandling of an eruption threatens entire economies (Sammonds et al., 2010), can send companies to bankruptcy (Alexander, 2013) and seriously affect lives, for example in case of medical emergencies such as air transport of organs. The estimated future probability of the occurrence of an event similar to the eruption in April 2010 is every 7 years given climate change (Schmidt et al., 2013) which puts additional economic value on the profound importance of the development of crisis management infrastructure and the successful work of the MSP. To create a noteworthy mitigation of the financial and social impacts of a more intense volcanic eruption, enhanced communication and cooperation is key.

Established communication processes are fundamental to the successful cooperation of a partnership. Despite many improved communication streams within and between institutions, like e.g. between the information providers, a lot is still to be desired in that field, with ample opportunity for improvement. **The following improvements are recommended**:

Single point of information

While information is important in times of crisis, the amount of information and scattered sources of information can cause confusion and hinder efficient management. The MSP would benefit from a designated single point of information. Managing the network, EUROCONTROL suggested the establishment of a website platform as an acknowledged single point of information. The use and content can be discussed, tested and evaluated during VOLCEX planning exercises, and improved in connection to the EVITA tool. It is to be discussed whether this single point of information should also serve for public information. The call for more awareness of the public as a stakeholder was strongly voiced during the stakeholder workshop, e.g. aircraft operators giving more detailed and expansive information to passengers. The use of social media should be planned. The channel and depth of information need, however, to be chosen carefully as overly extensive warnings can be an economic blunder as shown by previous examples of mass cancellations of flights following a warning. In 2014, a warning issued about an eruption of the Bárðarbunga volcano caused flight cancellations and led to a decrease of new holiday bookings in Iceland (Juskis, 2014).

Communication on aligning products with end-user needs

In the present study, Icelandair served as an interview partner and stakeholder representative for the aircraft operator sector. As an aircraft operator with longstanding experience in volcanic threats, Icelandair has in-house experts for modelling volcanic ash forecasts. The involvement and recognition of experts in reacting to the transboundary threat of an Icelandic volcanic eruption, appears to be a crucial point in smooth cooperation (Reichardt, 2011). The missing direct communication with the VAAC may be reflected in the aircraft operators' scepticism to the accuracy of forecasts provided by the VAAC as well as the stated divergence between needs and supply. Presently, communication between airline operators

and the VAAC foremost takes place with the International Air Transport Association (IATA) as a mediator. A similar problem is reflected in the flight level categorisation of the ash distribution forecasts which air traffic controllers would like to see adapted to their needs (Interview with ISAVIA, 21th October 2015). While it may be helpful to interact with one single point of contact in general, a platform where the information provider and the end-user can interact directly helps to create trust and a common effort to align the product to the needs.

Input to the aircraft operators' Self Risk Assessment (SRA)

The process of the Self Risk Assessment (SRA) appears to be mostly disconnected from the institutions that provide the information on which the SRAs are based. While the significance of the ash concentration charts has been debated amongst the information providers and other stakeholders, they cannot be easily replaced as they form the basis for the airlines' SRA. Again, direct and transparent communication as well as the inclusion of the information providers is advised to combine effort in improving the process.

Communication of uncertainties

A further communication issue evolves around delivering the message of uncertainties that accompany, e.g., the susceptibility of the jet engines to volcanic ash, the input parameters for the ash modelling, and forecasts. It was discussed whether or not to include a level of confidence. Though a confidence rating can be problematic to put into practical use, especially if it indicates large uncertainty, airlines would benefit from a transparent communication of detailed information on the uncertainty of data – to then trust the pilots to make the right decisions.

Additional Research

Various research projects have been initiated to determine input parameters and the set-up of models to improve forecasts for volcanic ash dispersion (see Bonadonna et al, 2014). This research and multi-disciplinary collaborations need to be pursued to approximate the models closer to real-life conditions (FutureVolc, 2015) and meet the needs of the aircraft operators and other users. The research for on-board detection equipment is to be extended.

The stakeholder workshop and expert interviews stressed the need for a more detailed understanding of the impact of different ash concentrations on jet engines as a basis to better manage a volcanic ash incident in the European airspace. This is in line with the recommendations of the International Volcanic Ash Task Force (IVATF) that was set in place in 2010 to develop recommendations after the Eyjafjallajökull eruption (ICAO, 2012b). Given the variety of ash compositions, engine types, operating temperatures, speed and altitude, the call for more than one project to conduct tests on this issue appears to be clear. This is all the more important as discussions showed that ongoing improvements of the modelling environment and research on the volcanological input parameters seem of limited effect as long as the baseline understanding of effects to the engines remains poor. Testing the engines' reaction to ash would therefore also strengthen the impact of efforts in other contributing fields.

Photo by Johann Helgason/Shutterstock.

Improving the MSP's leverage

Improved exercises

The MSP recognises the importance of emergency training to test the processes. The VOLCEX are established exercises that invite stakeholders throughout Europe to test their procedures. The programme is commonly planned months in advance to agree on the scenario that will be tested and integrate it in the participants' day-to-day schedule. A comment by one of the stakeholders portrays the pitfalls of the set-up: 'People prepare for the disaster that already happened. The exercises take a lot of assumptions that aren't real life situations and give a false feeling of safety'. The false feeling of safety is possibly manifested in the decreased interest airlines have in participating in the exercise. After the eruption in 2010, 70 airlines participated in the VOLCEX exercise in 2011. Around 50 airlines were involved in the last exercise. For the MSP to be successful, as many stakeholders as possible should participate in the exercise and use the platform simultaneously to exchange experience, knowledge, views and opinions. To increase interest among potential participants and create additional learning value, the exercises should be novel and challenging and drive the stakeholders out of their comfort zone. Flaws in the process that can be improved are more likely to be identified if the pressure of real time situations is recreated in the exercise.

Staff funding

Most stakeholders at the workshop agreed that lack of staff would prevent the partnership from working successfully. The information providers raised particular concern on work overload that affects their services. For the IMO, the workload of staff during the Holuhraun eruption in 2014/15 revealed the need for a back-up plan for alternating working schedules. Solutions to this problem would involve staff training to prepare them for accelerated demands and restructured tasks during a crisis, which indeed is recommended for the whole MSP. Another option might be staff exchange. Specialised workers could be prepared to share shifts. The conditions could be set up beforehand and participation of the 'exchange staff' in exercises would ensure that they are up-to-date. In the case of the IMO, this could potentially be established with the Earth Science Institute of the University of Iceland. Beside core duties, media coverage also increases in crisis times. Staff is required to cover communication with journalists and other media, including social media.

Another aspect of staff funding concerns the connection between general operations and research on a daily basis. The staff at the UK Met Office that runs the volcanic ash forecasting during exercises and eruptions works on day-to-day operations within the meteorological team under normal conditions. To better accommodate user needs, it would be beneficial if some VAAC staff could work fulltime on volcanic ash related research. This would also facilitate the cooperation between scientific institutions and the VAAC to put more background science and research into its operations.

Regulatory alignment

The varying legislation regarding SRA provisions in the different countries caused concern by stakeholders, especially voiced by the air traffic managers. These variations may lead to confusion in a new crisis, on top of the new regulation regarding the decision making. A platform with authorities from all the states seems necessary to create a better understanding of how the regulations can be coordinated. A further step would be a comprehensive alignment of SRA regulation throughout the European states involved.

Long-term contingency plan

The current contingency/crisis response plans for the MSP generally do not account for more than the initial onset of a disaster, practised in the VOLCEX and VOLCICE exercise. It is planned up to a few days into the incident. However, the entire dynamics of the situation might change during a longer scenario. These exercises do not take longer durations into account, partly because eventually each scenario would take on its own characteristics, calling for a tailor made response to each case. However, as the creation of the European Aviation Crisis Coordination Cell shows, time for reorganising is costly. It is important to plan alternative transport solutions should aircrafts be grounded for an extended period of time. Fragmentation of the European sky (Alemanno, 2010) makes a pan-European approach difficult but important. Stakeholders from all walks of transportation must cooperate internationally to form a contingency plan for rerouting passengers and goods through alternative modes of transport.

Hence, the most important measure to strengthen the MSP's positive impact on society's resilience is the **creation of a comprehensive long-term contingency plan that includes an alternative if aircrafts are grounded**. Alternative transport modes—road, rail or ship— play an important role in reducing economic loss and inconvenience due to delayed or cancelled flights. A smooth transfer between transport modes requires good preparation and coordination. This means timely information flow to other transport agencies and partners in order to enable them to plan and respond to the crisis in a coordinated fashion. Broadening the MSP in such a way will enhance resilience and simultaneously strengthen trust towards the MSP and its decisions.

Further research, beyond the scope of the ENHANCE project, needs to be conducted on how coordination of trans port service providers could be improved by inviting stakeholders representing alternative transportation modes for passengers and goods to join the present MSP. Improvement measures identified by such an extended MSP will serve to further increase societies' resilience to disruptive volcanic events in the future.