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VOLCANIC ASH RISK MAP AND MITIGATION PLANS ON INDONESIAN AVIATION SERVICE USING GEOSPATIAL TECHNIQUE: A CASE STUDY OF BALI AIRSPACE

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INTRODUCTION

Volcanic ash can significantly impact aviation services, as it can remain in the air for several hours or days. When volcanic ash is detected around airports or along flight routes, airports may need to alter or close their operations as a safety measure (Guffanti, M., et.al. 2009; FAA, 2022 and WMO, 2022).

METHODS/DATA

Combining rainfall data from 4 (four) meteorological stations in Bali as well as 24 Rain gauge, 30 years of wind data in various elevations or Flight Level (FL), Flight route data, and Volcanic ash trajectory data from Mount Raung, Agung, and Rinjani.

START

RESULTS

The result provides valuable information on the risk levels associated with volcanic ash hazards caused by Raung, Agung, and Rinjani Volcanoes. Moreover, it showed a strong correlation of the prevailing wind direction, rainfall as well as volcanoes location to the transport direction of volcanic ash. Also, it emphasize the significant impact of Risk management strategies need to be developed for handling the impacts from the volcanic eruption which can be affecting air transport

CONCLUSION

The risk map shows that Raung, Agung, and Rinjani Volcanoes pose significant risks to aviation, particularly during certain months, and the prevailing wind direction as well as the rainfall insensity can also impact the spread of volcanic ash. This information is critical for designing effective flight plans and airport hazard mitigation plans to minimize the potential impact of volcanic ash hazards on aviation safety in the affected areas.

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Introduction and Objective

Introduction:

Volcanic ash can significantly impact aviation services, as it can remain in the air for several hours or days. When volcanic ash is detected around airports or along flight routes, airports may need to alter or close their operations as a safety measure (Guffanti, M., et.al. 2009; FAA, 2022 and WMO, 2022). I Gusti Ngurah Rai Airport (Bali Airport) is one of the busiest airports in Indonesia that served a total of 24,666,621 passengers in 2018. The airport also handled 196,142 aircraft movements (takeoffs and landings) during the same year (PT Angkasa Pura I, 2019). Unfortunately, it is surrounded by three active volcanoes which have recently erupted and spewed volcanic ash. Even though the ability to predict volcanic ash movements has been improving in the past decades, volcanic eruptions can still have unforeseen impacts, such as flight delays or cancellations, resulting in significant economic losses (FAA, 2022 and USGS, 2022). This occurred because of the lack of preparedness and mitigation plans in dealing with this threat.

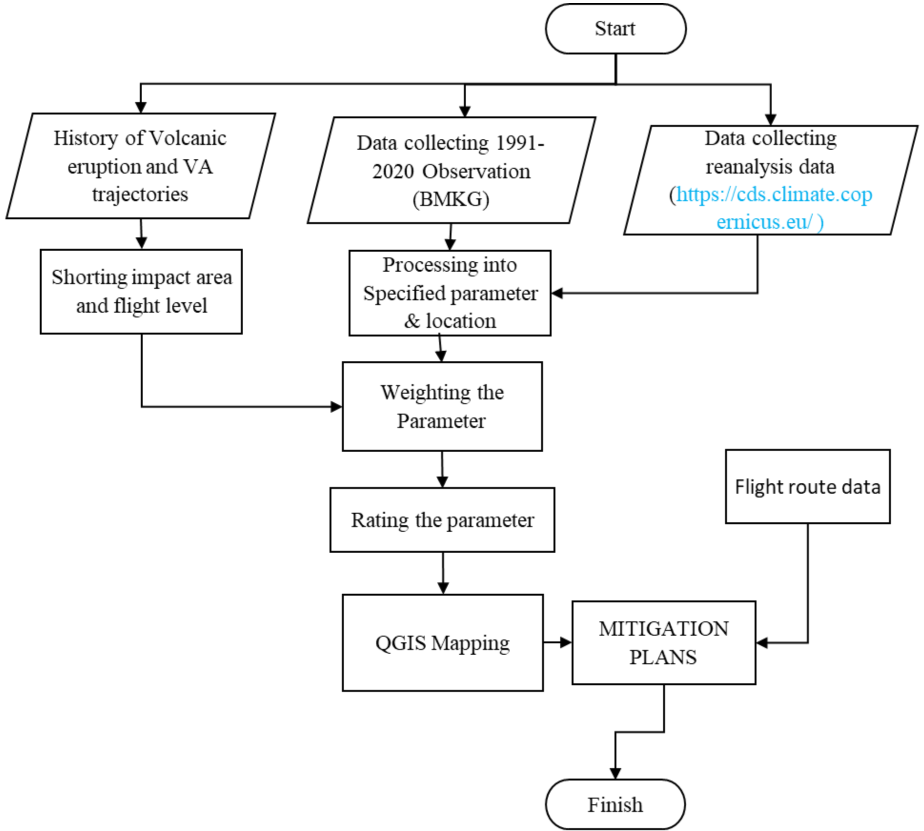
Objective:

- Generating a volcanic ash risk map on Bali flight area
- Developing the risk maps were used to develop an effective, efficient, and appropriate flight plan, as well as a robust airport hazard mitigation plan.

Methods/data Slide

This research utilizes rainfall data from 4 (four) meteorological station in Bali as well as 24 Rain gauge, 30 years of wind data in various elevations or Flight Level (FL), Flight route data, and Volcanic ash trajectory data from Mount Raung, Agung, and Rinjani.

The location of I Gusti Ngurah Rai Airport, Raung, Agung, and Rinjani Volcanoes



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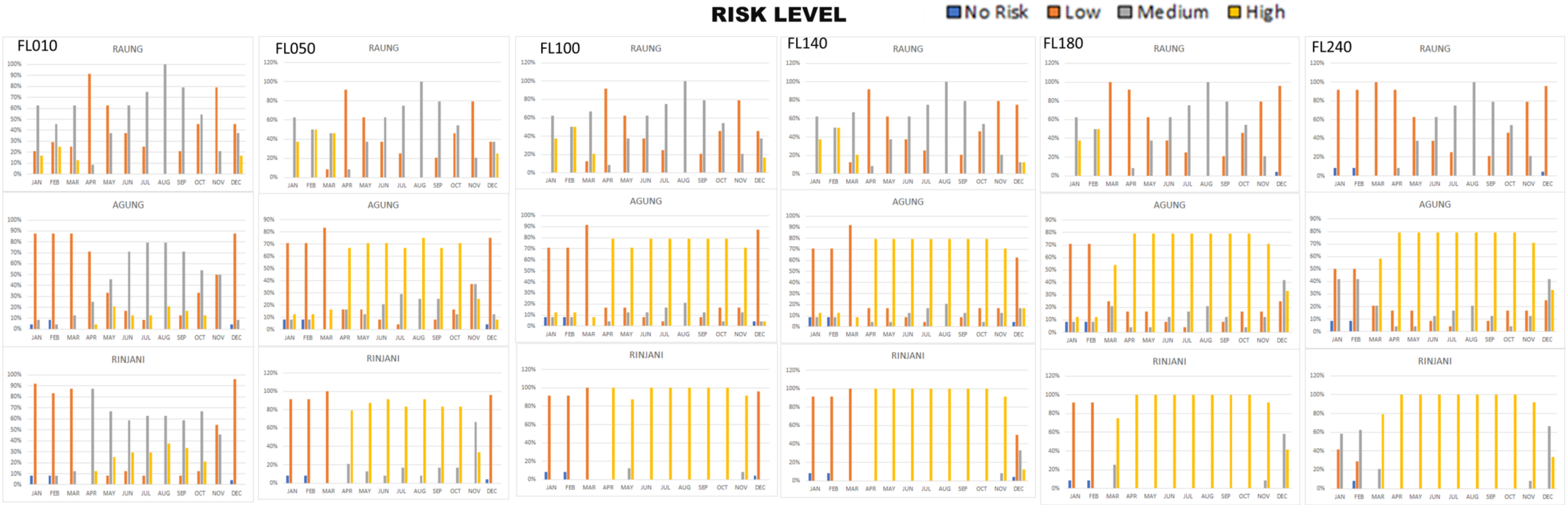
Results

- Raung Volcano eruption has a high risk of covering the airspace with volcanic ash in January, February, March, and December from FL010-FL140.
- Agung Volcano eruption has high risks in almost all months, except on FL010.
- Rinjani Volcano eruption has a high risk of covering the airspace with volcanic ash on FL010-FL140 from April-November and on FL180-240 in almost all months, except in January and February.



➢ The spread of volcanic ash during the eruption of Raung, Agung, and Rinjani volcanoes is influenced by the prevailing wind patterns in specific months. The risk of ash coverage is high during certain periods due to the direction of the prevailing winds.

INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

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Risk Level

- Low
- Medium
- High

Results

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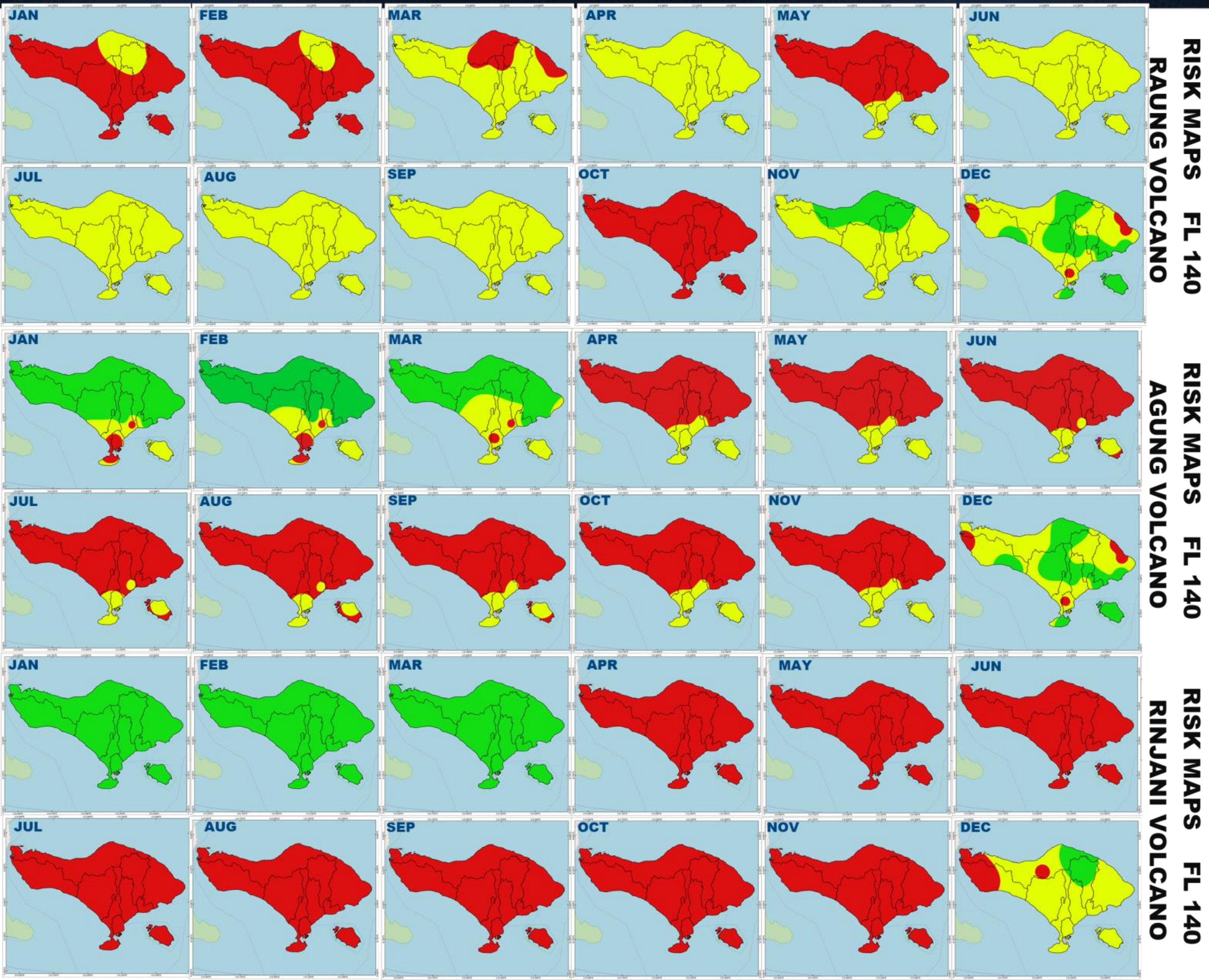

- The prevailing winds blow from the southwest to the northwest, and farther to the northeast and southeast, during the eruption of **Raung** Volcano, which normally happens in **January** and **February**. This wind pattern raises the possibility of volcanic ash spreading over a larger area.
- Regarding **Agung** Volcano, the risk of ash coverage is high from **April** to **November**. This period corresponds to the months when the prevailing winds blow from the northeast to southeast. These winds is important in the transportation of volcanic ash, possibly damaging locations from the southwest to the northwest.
- The prevailing winds blow from the northeast to the southeast during the eruption of **Rinjani** Volcano. During the months of **April** to **November**, this wind increases the possibility of ash transport, potentially damaging the southwest to the northwest area.

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Conclusion

The combination of the chart and the validation results provide useful insights into the risk levels associated with volcanic ash hazards caused by Raung, Agung, and Rinjani Volcanoes in Indonesia. The risk map shows that Raung, Agung, and Rinjani Volcanoes pose significant risks to aviation, particularly during certain months, and the prevailing wind direction as well as the rainfall intensity can also impact the spread of volcanic ash. This information is critical for designing effective flight plans and airport hazard mitigation plans to minimize the potential impact of volcanic ash hazards on aviation safety in the affected areas.

Air Navigation services should arrange the flight route according to volcanic ash occurrence in specific month, optimized meteorological data such as satellite, wind prediction to plan the flight route during volcanic ash event. The ash fall that reaches Airport can impair visibility, make runways slick, interfere with ground services, disrupt communication and electrical systems, and harm structures and parked aircraft. Measures like moving or covering parked aircraft and other equipment, executing clean-up swiftly and efficiently to limit closure duration, can all help to lessen the consequences of volcanic activity on airports (Guffanti, M.,et.al., 2008).

INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

References

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