Flight-Delay Propagation Forecast—An Application of SIMMOD

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ABSTRACT

It's important for airport operators, airlines crew and air traffic controllers（ATC） to predict the flight delays in abnormal weather conditions. In this research, a SIMMOD-based multi-airport simulation model system, including both Taipei and Kaohsiung airports as well as the airspace in between, is developed, calibrated and validated using the ATC data and observed operational data. It is applied for analyzing the performance of airport operations and the flight delays due to runway direction change. The result demonstrates that because of the required transitional operations from one network configuration to the other, only two or three flights could be allowed to use the runway in the first 15 minutes after the runway direction change. As a consequence, the following flights would somehow be delayed. In addition, the simulation shows that if ATC could separate the arrivals effectively, the first departure flight could reduce delay by 21%, and the total propagation time could be shortened.

On the basis of the outputs of the simulation, a mathematical delay model is derived. To estimate the expected delays of each flight, for both runway direction change and airport closing, two kinds of delays：push-back delays due to inbound-flight delays or insufficient scheduled ground time, and departure（arrival）delays due to abnormal weather conditions are considered in the model. The departure（arrival）delays of the first flight is subject to the duration of operation transition or airport closing, and the constringency of the delays of the succeeding flights is subject to the difference between the airport capacity and accumulated scheduled flights. Compared to the outputs of the SIMMOD model, the delays derived from the mathematical formulas are rather accurate. The average error is 0.235 minute in five different scenarios. This suggests that the formulas can be used to forecast flight delays, and with this information, better decisions can be made in advance.

Key Words：Delay propagation, Abnormal weather condition, Simulation, Delay forecast