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(MET SG/29)**

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Agenda Item 6: Research, development and other initiatives

**PREDICTING PROLONGED LIGHTNING ALERTS
FOR THE HONG KONG INTERNATIONAL AIRPORT**

(Presented by Hong Kong, China)

SUMMARY

This paper introduces a trial nowcasting service to predict the occurrence and duration of prolonged lightning activities at the Hong Kong International Airport. This service allows users sufficient lead time to respond accordingly and facilitate smooth resumption of airport operations.

1. INTRODUCTION

1.1 To minimise the risk of cloud-to-ground (CG) lightning strike to ground staff at the Hong Kong International Airport (HKIA), a warning system ‘Airport Thunderstorm and Lightning Alerting System (ATLAS)’ was developed by the Hong Kong Observatory (HKO) in conjunction with the Airport Lightning Warning System operated by the Airport Authority Hong Kong to provide timely warning of lightning activities for designated alerting zones at the HKIA. Utilising the lightning location data, ATLAS employs an optical flow algorithm to construct the motion field for tracking the movement of lightning clusters identified.



Figure 1 The designated lightning alerting zones ‘A’ - ‘D’ over the HKIA.

1.2 Through user consultations, it was identified that users rely on ATLAS to ensure safety and maintain operational efficiency for workers at apron. However, users expressed interest in whether HKO could provide more advanced forecasts for the duration of lightning strikes at HKIA (specifically the duration of ATLAS ‘red’ warnings), particularly those lasting longer than 20 minutes that pose significant risks to airport operations. Historical data from the past decade indicates that prolonged ‘red’ events at the HKIA occurred 4 to 14 times annually. In response to the users’ feedback, HKO developed a new nowcasting tool ‘Instant Duration Evaluation for ATLAS (IDEA)’ to facilitate Aviation Forecasters’ in evaluating the duration of lightning strikes and issuing timely weather assessments to airport operators for proactive contingency measures.

2. DISCUSSION

2.1 The concept of IDEA is to analyse whether lightning stroke occur inside the airport zones as predicted by ATLAS. Using lightning location data and ATLAS’s original algorithm, IDEA provides a minute-by-minute assessment of continuous lightning activities affecting HKIA. Given the operational impact of lightning events longer than 20 minutes and a required lead time of 15-20 minutes (based on customer survey responses) for users to take the necessary precautionary actions, IDEA predicts how long each lightning event will impact the alerting zones in the next 40 minutes (20+20). To account for lightning’s sporadic nature and pre-agreed operational protocols, IDEA smooths its output by extending predicted episodes while avoiding excessive overestimation of ‘prolonged red’ alert duration. Figure 2 illustrates IDEA’s workflow for assessing prolonged lightning events.

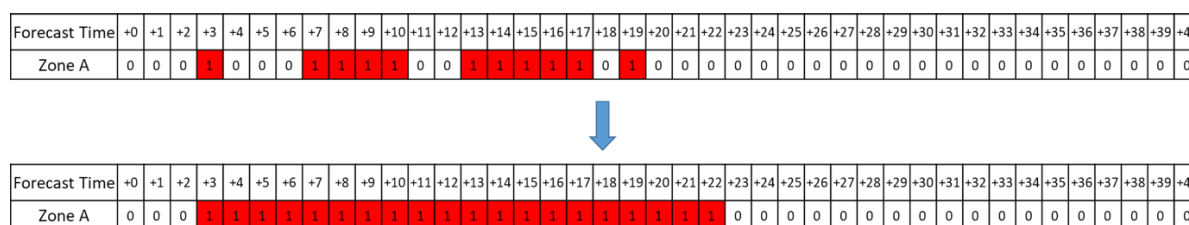


Figure 2 How IDEA works. The potential duration of ATLAS ‘red’ warning is intuitively indicated by the number of red boxes (each representing a 1-minute interval).

2.2 Following internal testing of IDEA, the trial nowcasting service to estimate the occurrence and duration of prolonged lightning activities was launched for aviation users since February 2025. HKO will monitor the performance of the new tool and compare this automated product against forecaster’s value-added judgement to refine the service quality.

2.3 By proactively engaging users, the meteorological service provider aims to address critical operational demands, even when forecasting capabilities approach their practical limits. The development of IDEA underscores the collaboration between MET services and aviation stakeholders to enhance safety and efficiency.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper.
