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Agenda Item 6： Research, development and other initiatives

PROGRESS IN QUANTITATIVE OBSERVATION AND IMPLEMENTATION OF MODERATE OR HEAVY PRECIPITATION IN EAST CHINA

(Presented by China)

SUMMARY

This paper introduces the quantitative observation and research of rainfall intensity by the East China Air Traffic Control Bureau, which has refined and formulated the "minute level" rainfall intensity quantitative judgment standard, and completed the practical guidance manual, achieving significant improvements in time accuracy, spatial accuracy, and intensity accuracy in rainfall detection.

1. INTRODUCTION

1.1 In recent years, global climate change has been significant, and the annual average and seasonal variations of precipitation and evaporation are undergoing profound changes. At the same time, the civil aviation industry is booming, and the frequency of flight takeoffs and landings continues to rise. Accurate analysis of rainy weather has become a key link in ensuring flight safety and improving operational efficiency.

1.2 Currently, both domestically and internationally, the civil aviation industry generally adopts the "hourly level" standard for determining rainfall intensity. However, this standard has obvious limitations and is difficult to reflect the instantaneous changes in rainfall intensity in real time and accurately. It cannot provide accurate and timely reference for core scenarios such as flight takeoff and landing decisions and runway airworthiness assessments.

2. DISCUSSION

Quantitative determination criteria for rainfall intensity

2.1 37 meteorological service agencies in East China have obtained statistical values for quantifying the intensity of rainfall measured by automatic rain gauges based on historical rainfall data from 2021-2023. After verification through operation from June to September 2024, the quantitative judgment standard verification values were obtained, as shown in Table 2.1.

	Light rain	moderate rain	Heavy rain
Statistical value （mm/3min）	≤0.3	（0.3,1.3]	＞1.3
Verification value （mm/3min）	≤0.3	（0.3,1.3]	＞1.3

Table 2.1 Comparison of Verification Criteria for Quantifying Rainfall Intensity of Automatic Observation Rain Gauge

2.2 Hangzhou Xiaoshan International Airport and Hefei Xinqiao International Airport have obtained statistical values for quantifying rainfall intensity using laser raindrop spectrometers based on historical rainfall data from 2022 to 2024. After verification through operation from June to September 2024, the quantitative judgment standard verification values were obtained, as shown in Table 2.2.

	Light rain	moderate rain	Heavy rain
Statistical value （mm/min）	≤0.1	（0.1,0.3]	＞0.3
Verification value （mm/min）	≤0.1	（0.1,0.3]	＞0.3

Table 2.2 Comparison of Verification Criteria for Quantitative Determination of Rainfall Intensity of Laser Raindrop Spectrometer

2.3 Based on historical rainfall data from 2023-2024, Shanghai Hongqiao International Airport, Shanghai Pudong International Airport, Xiamen Gaoqi International Airport, and Hangzhou Xiaoshan International Airport have obtained statistical values for phased array radar rainfall intensity quantification criteria. After verification through operation from June to September 2024, the quantitative judgment standard verification values were obtained, as shown in Table 2.3.

	Light rain	moderate rain	Heavy rain
QPE Statistical value （mm/min）	≤0.1	（0.1,0.3]	＞0.3
QPE Verification value（mm/min）	≤0.1	（0.1,0.3]	＞0.3

Table 2.3 Comparison of Verification Criteria for Quantitative Determination of Rainfall Intensity of Phased Array Radar.

2.4 At the beginning of 2025, the East China Air Traffic Control Bureau has collaborated with 8 airlines to carry out quantitative observation and verification of rainfall intensity. The research team compiled relevant automatic observation rain gauge data based on the information of various airlines' go around caused by rainfall during the period of 2021-2024, and obtained a validation value of>1.2 mm/3 minutes for the quantitative judgment standard of heavy rainfall. This standard is derived from a comprehensive analysis of a large amount of actual operational data from various airlines, fully reflecting the impact of heavy rainfall on flight in the actual scenario of civil aviation operations. In order to develop a more suitable judgment standard for civil aviation operations, the research team

adjusted the quantitative judgment standard for automatic observation rain gauges verified by meteorological service agencies in Table 2.1 from>1.3mm/3min to>1.2 mm/3min.

2.5 Based on the verification results of meteorological service agencies and aviation users, the quantitative judgment criteria for rainfall intensity in East China are obtained, as shown in Table 2.4

Parameter indicators	Light rain	moderate rain	Heavy rain
3min Accumulated rainfall (mm/3min)	≤0.3	(0.3,1.2]	＞1.2
1min Instantaneous rainfall (mm/min)	≤0.1	(0.1,0.3]	＞0.3

Table 2.4 Quantitative Determination Criteria for Rainfall Intensity in East China

2.6 In order to better apply research results to practical work, the East China Air Traffic Control Bureau has compiled the "Guidelines for Quantitative Observation of Civil Aviation Meteorological Rainfall Intensity", which has passed expert review. This manual provides specific details on the relevant provisions of rainfall intensity observation in the Civil Aviation Meteorological Ground Observation Specification, and guides the daily observation and service work of rainfall intensity.

2.7 The trial work of the quantitative judgment standard for "minute level" rainfall intensity has been comprehensively carried out in the East China region. In the future, we will continue to use actual operational data during thunderstorm seasons to expand the sample size and conduct in-depth trials and verifications of this judgment standard. By continuously optimizing and improving, we can effectively ensure its reliability and practicality under complex weather conditions.

3. ACTION BY THE MEETING

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

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