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Agenda Item 9: Environmental-Related Initiatives and Impacts

CIVIL AVIATION METEOROLOGICAL SERVICES FOR ENVIRONMENTAL PROTECTION IN CHINA

(Presented by China)

SUMMARY

China's civil aviation has actively responded to global initiatives on aviation carbon emissions reduction and environmental protection. China’s civil aviation meteorological departments have improved the accuracy and practicality of their products, while aviation operators have strengthened coordination in flight operations. When addressing adverse weather such as thunderstorms, typhoons, icing, snow and fog, operators have adopted flight rerouting, schedule adjustments and holding to avoid unnecessary circling and diversions. This provides effective support for carbon emission reduction during the pre-tactical and tactical phases of flight flow management, while also improving operational efficiency.

1. INTRODUCTION

1.1 Carbon emission reduction within air transport constitutes a core theme of the aviation sector’s green transition. Beyond aircraft technological innovations and the widespread adoption of sustainable aviation fuel (SAF), enhanced operational efficiency represents another critical pathway for emission abatement. Serving as a fundamental underpinning of flight operations, aviation meteorological services deliver precise, timely forecasts and thereby have a direct bearing on aircraft fuel burn and associated carbon emissions.

1.2 A unified operational monitoring system has been established to strengthen coordination across all civil aviation entities and comprehensively improve the operational applicability of meteorological forecast products. These measures substantially mitigate disruptions to flight operations triggered by severe weather, reduce aviation carbon emissions and advance environmental protection.

2. DISCUSSION

2.1 Enhance Accuracy and Operational Applicability

2.1.1 In recent years, new meteorological observation instruments including phased-array weather radars, lidars and wind profiler radars have been progressively deployed, markedly improving the monitoring precision of low-level wind fields and convective systems at airports. On the research front, customized optimizations of numerical weather prediction (NWP) models, the integrated application of machine learning algorithms in nowcasting, and continuous refinement of en route

turbulence diagnosis models have collectively extended the bounds of weather predictability and boosted forecast accuracy.

2.1.2 Aviation meteorological authorities have continuously advanced the operational transformation of forecast products by refining both spatial and temporal granularity for significant weather forecasts. Meanwhile, meteorological services are driving the shift toward impact-based forecasting, translating meteorological descriptive information into actionable decision-making information readily accessible to air traffic control (ATC).

Such refined granularity provides air traffic controllers and airlines with an accurate operational basis, enabling more targeted adjustments to flight schedules and flight operation arrangements. This measure cuts airborne holding, flight diversions and flight returns arising from ambiguous meteorological data, and curbs high-carbon operational scenarios at the source.

2.1.3 We have actively deployed visual display functions for meteorological forecast products to further enhance their operational applicability and strengthen air traffic controllers' advisory support and decision-making capabilities when handling severe weather.

For example, air traffic management authorities across China have widely deployed the ATOM System (Air Traffic Operation Management System) and the NTFM System (National Civil Aviation Traffic Flow Management System) in recent years. Weather data is natively visualized on both systems, greatly improving controllers' ability to evaluate severe weather and make operational decisions.

2.1.4 Pre-Tactical Support: Civil aviation meteorological services shall provide users with 54-hour significant weather probability forecast products indicating the occurrence likelihood of critical weather phenomena at aerodromes, terminal areas and air routes.With reference to such products, airlines may finalize pre-adjustments to operational plans one day before flight departure. Forward-looking decision-making can effectively reduce inefficient operational occurrences caused by sudden weather changes, including ad hoc flight cancellations, extensive delays and additional refuelling requirements. This cuts excess fuel burn generated by surface and airborne holding, and delivers carbon emission control at the pre-tactical stage.

2.1.5 Tactical Support: Meteorological authorities shall activate continuous monitoring and rolling update mechanisms for significant weather events six hours in advance. Thunderstorm alerts and flow management measures shall be issued no less than three hours prior to thunderstorm onset to optimize tactical time slot allocation and diversion contingency arrangements.Based on regularly updated forecast guidance, air traffic control units may proactively implement measures such as runway alternation, flight pre-sequencing and optimized approach separation, to reduce go-arounds, airborne holding and diversions triggered by abrupt weather deterioration.

2.2 Full Enhancement of System Synergy

2.2.1 China has put in place a nationwide flight operation monitoring mechanism. The National Flight Operation Monitoring Center holds unified national flight operation coordination meetings no less than twice daily. The Meteorological Center under the Air Traffic Management Bureau of the Civil Aviation Administration of China (CAAC) presents updates on observed significant weather conditions nationwide and their evolutionary trends, providing meteorological data support for flight rerouting and operational adjustments.

2.2.2 Since 2018, airport operation coordination committees, composed of airport operators, air traffic control authorities, relevant airlines and other stakeholders, have been gradually established

at Chinese airports with an annual passenger throughput exceeding 10 million. When encountering adverse weather, all relevant organizations implement the CAAC's "Five Early" requirements: early warning, early joint consultation, early decision-making, early response and early notification. The air traffic control sector also advocates the concept of "integrating meteorology with air traffic control and air traffic flow management (ATFM)". All parties act collaboratively and promptly adopt measures including schedule adjustments, rerouting and flight reductions to proactively address the risk of widespread flight delays arising from complex weather, thus significantly reducing the impacts of adverse weather on flight operations.

2.2.3 Collaborative rerouting constitutes a pre-tactical and tactical ATFM measure. When extensive adverse weather including thunderstorms, freezing precipitation and typhoons poses a risk of flight delays, airlines file rerouting requests, and air traffic control services jointly develop rerouting schemes taking into account available operational capacity and airspace constraints, followed by the issuance of associated NOTAMs.

2.2.4 Throughout the 2025 thunderstorm season, daily flight movements surpassed 20,000 for the first time; the flight punctuality rate stood at 84.99%, an increase of 7.2% year-on-year, with the average flight delay reduced by 6.79 minutes, achieving greater operational efficiency, enhanced service quality and lower-carbon, environmentally friendlier flight operations.

2.3 Notable Achievements in Environmental Protection

In recent years, by proactively addressing various adverse weather conditions, China's civil aviation sector has ensured the safe operation of commercial air transport, achieved marked improvements in flight punctuality and sustained its high level, substantially reduced aviation carbon emissions, effectively supported aviation operators in cost reduction and efficiency gains, and delivered the green and low-carbon development strategy.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper.

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