

International Civil Aviation Organization

ICAO

INFORMATION PAPER (IP/xx)

ICAO ASIA AND PACIFIC (APAC)
THIRTIETH MEETING OF THE METEOROLOGY
SUB-GROUP (MET SG/30)

Bangkok, Thailand, 20 - 24 July 2026

Agenda Item 8: Research, Development and Other Initiatives**AVIATION IMPACT-BASED FORECAST SERVICE**

(Presented by the Republic of Korea)

SUMMARY

This paper presents an introduction to and details of the runway surface temperature and frost prediction information services provided in the Republic of Korea to support airport stakeholders' decision-making.

1. INTRODUCTION

1.1 ICAO PANS-MET Chapter 8 states that the meteorological authority shall provide operators and flight crew members with meteorological information on factors affecting aircraft operations, including icing. Accordingly, the Aviation Meteorological Office (AMO) of the Korea Meteorological Administration (KMA) provides aviation impact-based forecast services during the summer and winter seasons each year to support decision-making by airport stakeholders and the safe operation of aircraft.

2. DISCUSSIONRunway Surface Temperature Prediction Information Service

2.1 AMO developed a prediction equation for runway surface temperature to support decision-making on runway watering operations, which are conducted in summer to prevent runway pavement damage and increased landing distances due to elevated runway surface temperatures. Based on this equation, AMO provides the runway surface temperature prediction information service to airport stakeholders.

2.2 The prediction equation was derived through multiple regression analysis using observations of runway surface temperature at Incheon International Airport, along with observations of air temperature, cloud amount, wind speed, and relative humidity. Regression-based runway surface temperature prediction information was then produced by applying the equation to MOS values. Following verification and refinement, the developed prediction equation was first applied to Incheon International Airport in 2019 and its application was later expanded to seven civil airports, as well as Gimhae International Airport.

2.3 Prediction information is produced twice daily at 0000 and 1200 UTC and provides predicted values for the 0000-1200 UTC period of the day. Since runway watering operations are conducted at the discretion of the airport operator when the observed runway surface temperature reaches 60°C or higher, predicted values of 48°C or higher are displayed as the Caution level in orange, and those of 50°C or higher are displayed as the Danger level in red.

2.4 Forecasters at each airport refer to this prediction information, compare it with MOS prediction values, and comprehensively assess whether precipitation is expected the following day. They then include phrases related to runway surface temperature in the aerodrome weather information provided twice daily at 0800 and 2100 UTC, thereby providing the information to airport stakeholders. This information is provided annually from June 1 to September 30.

2.5 The regression-based runway surface temperature prediction equation is improved annually using runway surface temperature observations and observation data from the Aerodrome Meteorological Observation System (AMOS). In addition, NWP model-based runway surface temperature prediction information for Incheon International Airport has been under development, verification, and refinement since 2024, with plans to expand the service to the remaining airports. Further details on the runway surface temperature prediction information service, including the display method, verification results, and information delivery method, are provided in Appendix A.

Aircraft Frost Prediction Information Service

2.6 ICAO Doc 9640 (Manual of Aircraft Ground De-icing/Anti-icing Operations) states that de-icing/anti-icing operations are required when ice, snow, slush, or frost is present on critical aircraft surfaces. Based on this guidance, AMO developed an aircraft frost forecast method in response to growing user demand for forecast information on frost to support decision-making on de-icing/anti-icing operations. AMO provides the aircraft frost prediction information service using this method.

2.7 Weights were calculated for each factor using frost observations at Incheon International Airport, along with observations of air temperature, wind speed, cloud amount, relative humidity, and diurnal temperature range. Aircraft frost prediction information was then generated by applying MOS values. After undergoing trial operation at Incheon International Airport starting in 2021, followed by verification and refinement, the service is currently provided at Incheon, Gimpo, Muan, and Ulsan airports.

2.8 Prediction information is produced twice daily based on MOS data issued at 0000 and 1200 UTC, and it takes approximately four hours for the final data to be displayed. The information shows the hourly probability of aircraft frost occurrence from 1500 to 2200 UTC on the following day, as well as the average probability of aircraft frost occurrence during the 1500-2200 UTC period. It is provided in two levels—Caution (orange) and Danger (red)—with the threshold values for each level varying by airport.

2.9 Forecasters at each airport refer to this prediction information and include phrases related to the occurrence of aircraft frost in the aerodrome weather information provided twice daily at 0800 and 2100 UTC to inform airport stakeholders. This information is provided annually from November 1 to March 31 of the following year.

2.10 Aircraft frost prediction information is improved annually, with plans to expand the service to the remaining airports. Further details on the aircraft frost prediction information service, including the display method, verification results, and information delivery method, are provided in Appendix B.

3. ACTION BY THE MEETING

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

APPENDIX [A]

1. Latest Verification Results for the Improved Regression-Based Runway Surface Temperature Prediction Information

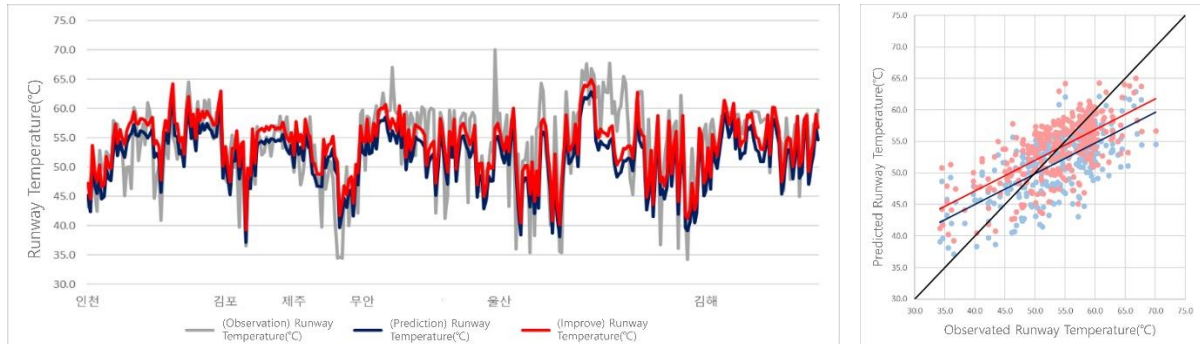


Figure 1. Verification results for the improved regression-based runway surface temperature prediction in 2024 (Before improvement: blue; After improvement: red)

Verification Result	Before	After
Mean Bias	-2.14	0.00
RMSE	5.38	4.94
POD	0.83	0.91
CSI	0.77	0.80
ACC	0.81	0.83

Table 1. MOS verification result after improvement in 2024

2. Latest Verification Results for the Improved NWP Model-Based Runway Surface Temperature Prediction Information

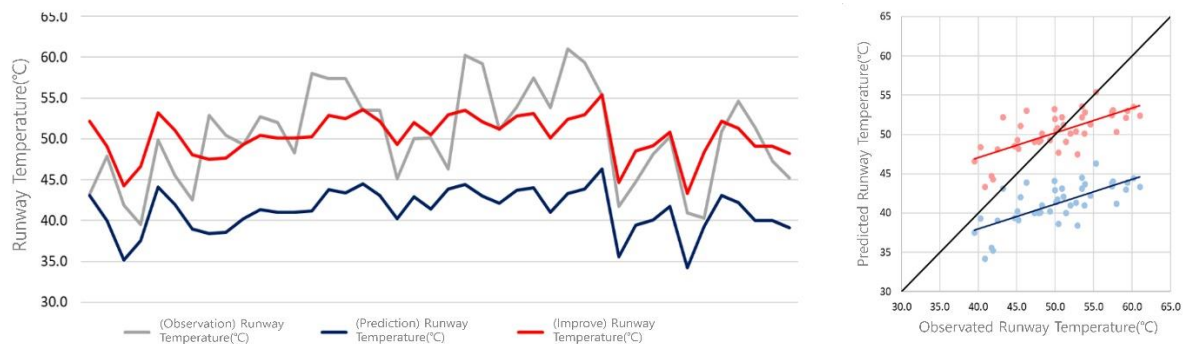


Figure 2. Verification results for the improved runway surface temperature prediction based on the NWP model (KIM-Applied) in 2024 (Before improvement: blue; After improvement: red)

Verification Result	Before	After
Mean Bias	-9.09	0.00
RMSE	10.1	4.37
POD	0.00	0.88
CSI	0.00	0.72
ACC	0.43	0.81

Table 2. Post-improvement verification results for runway surface temperature prediction based on the NWP model (KIM-Applied) in 2024

3. Display Method

airport	23일 09시	23일 10시	23일 11시	23일 12시	23일 13시	23일 14시	23일 15시	23일 16시	23일 17시	23일 18시	23일 19시	23일 20시	23일 21시
Incheon (Regression)	29.5	30.7	32.2	32.9	32.8	33.1	32.6	32.3	30.4	28.8	27.0	25.5	24.7
Incheon (Regression)	19.6	26.4	28.9	30.1	30.5	30.0	28.9	27.5	25.1	22.1	18.9	17.3	16.3
Gimpo	33.0	36.2	38.5	40.6	41.4	41.4	40.3	39.2	38.1	35.2	32.4	29.0	27.5
Jeju	35.1	35.5	33.0	33.2	32.2	32.5	36.1	36.1	35.9	32.9	31.9	33.5	32.7
Muan	35.6	38.2	39.7	41.2	41.6	41.7	41.5	40.4	38.5	37.0	34.7	32.2	30.7
Ulsan	41.5	44.8	47.9	48.5	48.9	49.6	49.2	48.4	47.5	46.0	42.8	38.6	34.4
Yeosu	39.3	43.4	46.4	49.1	51.0	51.8	52.5	51.9	51.0	48.8	45.8	42.9	40.8
Yangyang	40.5	42.3	44.0	46.0	46.8	47.9	47.3	46.9	46.8	44.9	41.7	39.7	38.0
Gimhae	37.8	42.1	44.9	46.3	46.5	45.3	44.3	43.1	42.8	41.0	39.0	36.3	35.4

48°C Below	48°C above 50 °C below	50°C Above
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Figure 3. Example display of runway surface temperature prediction information for airports nationwide

4. Information Delivery Method



항공기상청

책임운영기관

2026년 06월 03일 06시 발표

예보관 : 김예보

○○공항 기상정보(제00-00호)

- 오늘 가뭄 구름많음, 내일 낮 한때 소나기 -

▶ 알기개함

○ (오늘) 현재(06시) ○○공항은 맑은 가운데 북서풍이 3㎞로 불고 있으며, 시정은 10km 이상입니다. 오늘(3일)은 서해상에서 동쪽으로 이동하는 고기압의 가장자리에 들겠고, 가뭄 구름 많겠습니다.

○ (내일) 서해상에서 동쪽으로 이동하는 고기압의 가장자리에 들겠고, 낮 한때 소나기가 내리겠습니다.

※ "□" "△" "한자" 키를 누르면 "○"을 삽입할 수 있습니다.

예상 최저/최고기온 (°C)

예상 낮최고체감온도(°C)

예상 강수량(mm)

(오늘) - / 31, (내일) 20 / 28

(오늘) 30, (내일) 29

(내일) 5-40

▶ 위험기상예보

○ (특영) 오늘은 '관심' 수준의 폭염이 예상됩니다. 시원하고 깨끗한 물을 충분히 마실 수 있게 하고, 될 수 있는 그늘을 준비하며 온열질환에 취약한 근로자 및 작업강도가 높은 힘든 작업은 사전에 확인하시기 바랍니다.

※ 일반/산업 폭염 위험수준: (오늘) 주의 ■■■□□ (위험>경고>주의>관심)

○ (활주로표면온도) 오늘 낮(12-15시) 동안 활주로 표면온도가 50°C 이상 높을 것으로 예상되니, 공항시설 운영 및 야외작업 등에 유의하시기 바랍니다.

Figure 4. Example of phrases included in aerodrome weather information

APPENDIX [B]

1. Verification Results for the Improved Aircraft Frost Prediction Equation (at or above the Caution level)

Classification	Incheon airport		Gimpo airport		Muan airport		Ulsan airport	
	Before	After	Before	After	Before	After	Before	After
POD	0.08	0.55	0.25	0.51	0.50	0.53	0.48	0.55
CSI	0.07	0.44	0.24	0.48	0.50	0.50	0.33	0.45
FAR	0.67	0.31	0.10	0.11	0.00	0.11	0.48	0.30
ACC	0.91	0.82	0.62	0.77	0.91	0.86	0.85	0.88

Table 3. Post-improvement verification results in 2024

2. Threshold Values for the Aircraft Frost Prediction Equation

Classification	Incheon airport		Gimpo airport		Muan airport		Ulsan airport	
	Before	After	Before	After	Before	After	Before	After
Caution Level	63	44	74	84	56	53	30	27
Danger Level	68	48	82	88	58	58	33	30

Table 4. Threshold values for the aircraft frost prediction equation by airport

3. Display Method

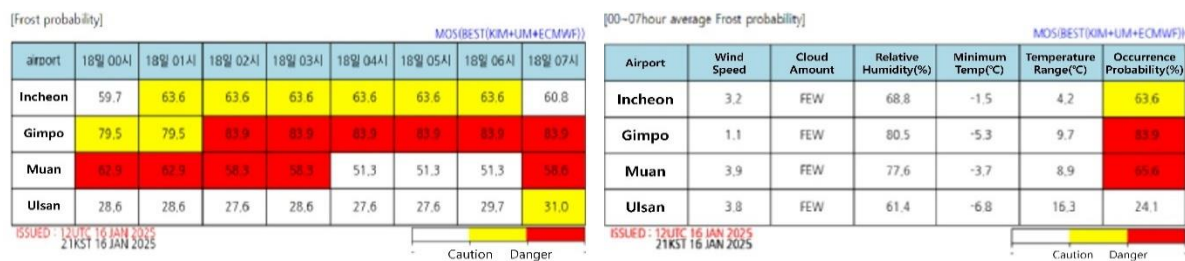


Figure 5. Example display of aircraft frost prediction information by airport (left: hourly occurrence probability; right: average occurrence probability during the 0000 to 0700 KST period)

4. Information Delivery Method

Figure 6 shows an example of phrases included in aerodrome weather information. The interface displays a header with the airport name and a section for "알기개념" (Concepts to Know). Below this, there is a section for "위험기상예보" (Weather Hazard Forecast) with a red box highlighting a specific warning message.

Header: ○○공항 기상정보(제00-00호)

알기개념:

- (오늘) 현재(17시) ○○공항은 맑은 가운데 북서풍이 6㎞로 불고 있으며, 시정은 10km입니다. 오늘(17일)은 중국 중부지방에 위치한 고기압의 영향을 받아 대체로 맑겠습니다.
- (내일) 서해상에서 동쪽으로 이동하는 고기압의 영향을 받아 대체로 맑겠습니다.

위험기상예보:

○(서리적설) 내일 새벽(01시~07시)에 항공기 서리적설이 발생할 확률이 높으니, 업무에 참고하시기 바랍니다.

Figure 6. Example of phrases included in aerodrome weather information