KPI

Annual Report 2024

ACDM GERMANY

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Content

1 Management Summary

Introduction

This report covers a set of general Key Performance Indicators (KPIs) that were deemed by the Editorial Board to be comparable among the A-CDM airports Munich, Frankfurt, Düsseldorf, Berlin, Stuttgart, and Hamburg.

The KPIs contained within this report serve to continuously monitor the A-CDM process and usually portray only individual parts of the overall process.

The KPIs allow a measurement of A-CDM effects and steering of the process. They are the basis for local reporting at the individual airports. The KPIs were defined using input from EUROCONTROL's A-CDM Implementation Manual, experiences of the local German Airport CDM airports, as well as local and future necessities.

The report is intended to provide a general overview of KPI trends at the A-CDM airports, as well as serve as basis for decisions regarding adjustments to or steering of the A-CDM process.

This report describes the experiences, measurements and results of the calendar year 2024. It utilises regular evaluations and measurements on a monthly basis, the conclusions that are drawn address points that were mutually agreed by *ACDM Germany* which are reflected in the KPI Concept.

Summary of Results and Tendencies

After the high growth rates in 2023 due to catch-up effects following the COVID-19 pandemic, the increase in traffic at German airports declined significantly in 2024. Even though there was a slight positive overall trend in traffic development, traffic figures at all German airports still remained well below the pre-pandemic levels of 2019. Compared to the overall development of European air traffic, where pre-COVID levels were almost reached and even exceeded by some airports during 2024, traffic growth in German air traffic and at German A-CDM airports lagged behind.

After the severely limited personnel and handling resources had posed major challenges for airports in 2022 and 2023 following the pandemic—impacting the predictability and stability of ground processes, and thus also the A-CDM process and the associated target time quality for the European air traffic management—a positive development was observed in 2024. The measures to stabilize the turnaround process, which had been initiated and implemented in the previous two years, took effect, with moderately increased traffic volumes supporting this development. At most German A-CDM airports, overall performance and punctuality, as well as TOBT performance, could be significantly improved in 2024 compared to the previous two years. TOBT quality in some cases even exceeded the pre-pandemic level of 2019.

Despite the increased traffic volumes across Europe, the resulting network influences and regulatory constraints, and the ongoing high CTOT volatility, the predictability of the turnaround process and the conditions for timely and more accurate updates of TOBTs were measurably improved at the airports through locally implemented measures. These improvements are evident in several key figures in this report.

The local reporting and performance monitoring of the A-CDM process have helped to recognize that traffic levels and resource availability must be in a balanced relationship, and that sufficiently accurate target time predictions must be ensured as a basis for efficient use of resources. This allowed targeted projects to be launched and carried out, aimed at gradually improving the predictability of the turnaround process (e.g., introduction of Ground Coordination in Munich, introduction of Turnaround Management in Frankfurt, targeted communication, documentation and training for ground handlers, introduction of automatically triggered TOBT updates based on the begin of boarding for Lufthansa flights in Frankfurt and Munich, and the display of camera pictures of the aircraft stands in the CSA Tool at Frankfurt Airport).

2 German Harmonisation Initiative A-CDM Germany

2.1 European A-CDM Concept

Airport Collaborative Decision Making (A-CDM) is the operational approach (idea/concept/process) to achieving an optimal turnaround process at airports. A-CDM covers the period from EOBT -3 h until take-off. It is a continuous process beginning with processing of the ATC flight plan, via landing of the inbound flight, the turnaround process on the ground, to departure.

By exchanging estimated landing and take-off times between the A-CDM airports and Network Management Operations Centre (NMOC), airports can be further integrated into the European ATM Network EATMN.

A-CDM improves operational collaboration between the partners:

- Airport Operator,
- Aircraft Operators,
- Handling Agencies,
- Ground Handling Agencies,
- Air Navigation Service Provider, and
- European Air Traffic Flow Management (NMOC).

A-CDM in Germany is based upon the European A-CDM spirit, the Community Specification of A-CDM, as well as recommendations by the German Harmonisation Initiative *A-CDM Germany*.

A-CDM aims to optimise utilisation of available capacity and operational resources at airports and within European airspace through high-quality target times and efficiency increases in the individual steps of the turnaround process.

2.2 German Harmonisation Initiative for A-CDM

European A-CDM fundamentally relies on Community Specification EN 303212. However, development of A-CDM in Germany has shown a need of harmonisation to a level of detail that is beyond the Specification’s scope.
The A-CDM partners recognised this need and founded the German Harmonisation Initiative *A-CDM Germany*. Collaboration within the Initiative is determined by a Letter of Intent that was signed by all partners.

Partners within *A-CDM Germany* are currently:

- Deutsche Flugsicherung (DFS)
- Munich Airport (FMG)
- Frankfurt Airport (Fraport)
- Berlin Airport (FBB)
- Düsseldorf Airport (FDG)
- Stuttgart Airport (FSG)
- Hamburg Airport (FHG)
- Leipzig/Halle Airport (FLHG)

Leipzig/Halle Airport has commenced an Airport CDM project and is therefore already a member of *A-CDM Germany*, however implementation is currently paused. Therefore, Leipzig/Halle is not shown in the following chapters.

A-CDM Germany's goals are, among others:

- Exchange of information and best practices between the various A-CDM airports,
- Common understanding of A-CDM in Germany and common representation towards international partners (Eurocontrol, EU, ICAO, IATA)
- Harmonisation in the interest of partners and customers ("one face to the customer")
- Best Practices developed within *A-CDM Germany* can be provided to other European A-CDM projects and working groups to advance harmonisation.

Creation and coordination of harmonised procedures and documentations are achieved within *A-CDM Germany's* working groups and regular harmonisation meetings.

3 Purpose of the Report

This document shows A-CDM KPIs that are generally comparable across A-CDM airports in Germany. KPIs fit for inclusion in this report were selected by a working group with participation of all A-CDM airports as well as DFS. The group also defined required data to be gathered and calculation rules.

This report is not intended to replace local KPIs, nor does it pre-empt local KPI reporting routines. It is designed as a baseline to which local KPI concepts and reports can add additional indicators or even measure the same KPIs using different criteria.

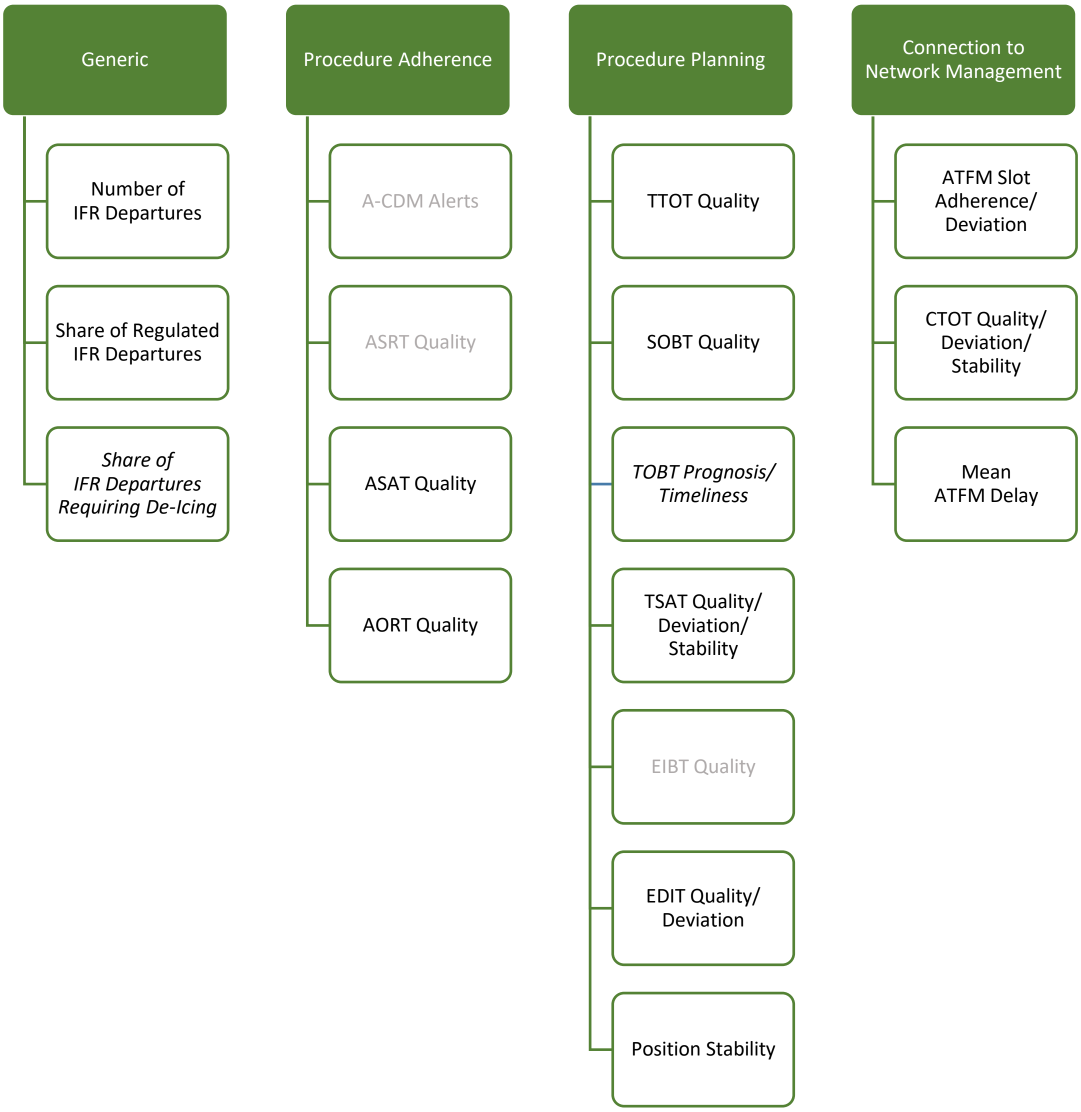
The common reporting that serves as basis for the KPIs contained within this report provide A-CDM airports with the opportunity of highlighting changes and developments, recognising potential for improvements, and developing harmonised A-CDM subprocesses.

Further details regarding the A-CDM process and its specifics at the individual airports are described within the local A-CDM procedure descriptions and publications.

4 Results

In order to achieve the local operational and network benefits associated with A-CDM, the quality of target times and process adherence are essential. For this reason, commonly available indicators from the following categories were selected:

- Generic Traffic Numbers
- Procedure Adherence of A-CDM Partners
- Procedure Planning
- Connection to Network Management



The KPIs coloured in light grey are not yet part of this report as the necessary historic data is not yet available at all German A-CDM airports. As soon as this changes, they will be included in a subsequent Annual KPI Report.

4.1 Generic

4.1.1 Number of IFR Departures

Description
Number of IFR departures within the calendar year as well as the previous calendar year and 2019 reference values

Goal
Show the amount and trend of traffic

Charts

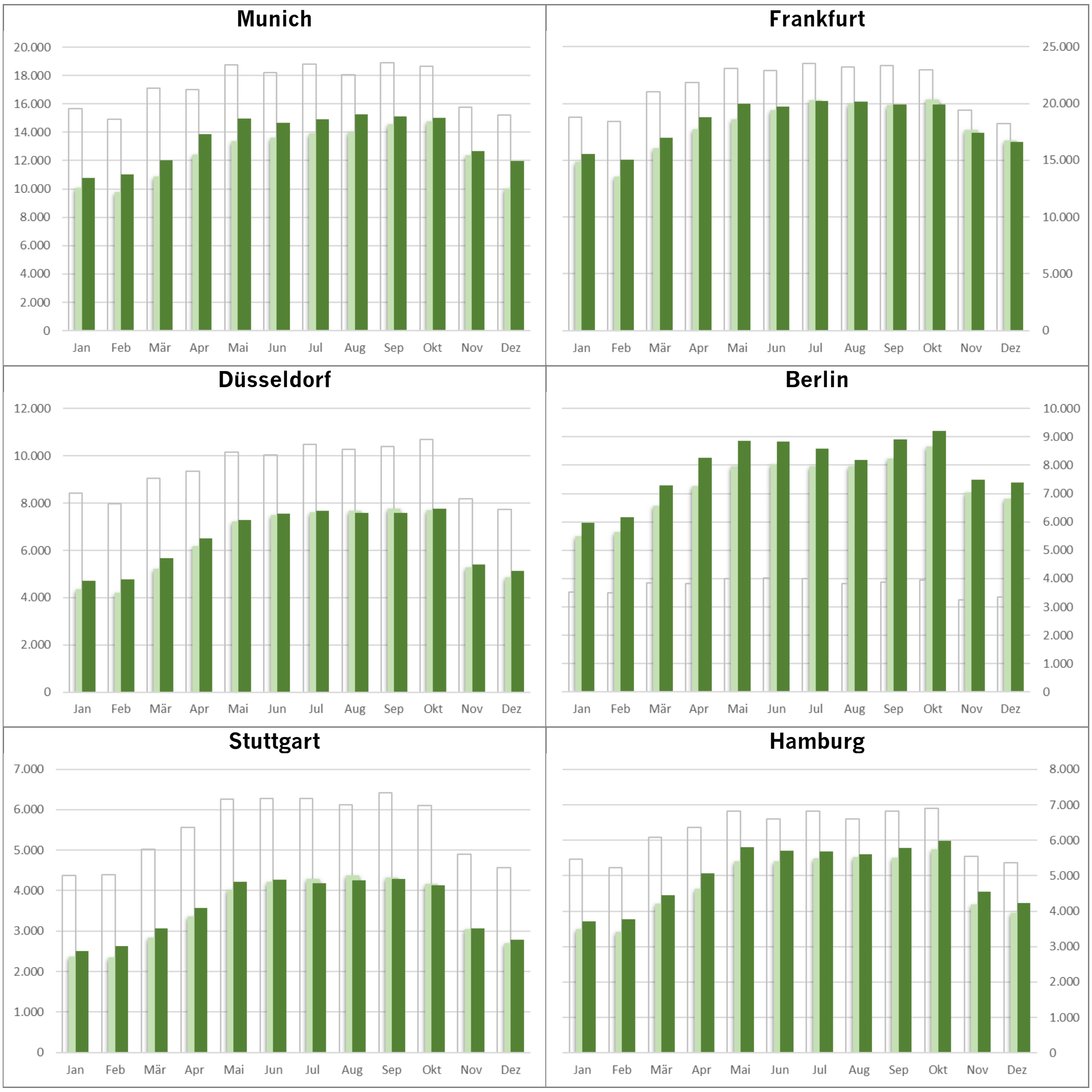


Fig. 1: Number of IFR departures, previous year (light green) and 2019 (white)

Conclusion
The traffic share of the six German A-CDM airports in total departures in Germany was 71.4% in 2024, slightly lower than in the previous year.

In 2024, traffic growth rates at German airports tended to decline, after having increased more strongly in 2023 following the end of the COVID-19 crisis. In comparison, the annual growth rates of aircraft movements at Frankfurt, Düsseldorf, and Stuttgart airports were somewhat lower, at 2–3%, than at Munich, Berlin, and Hamburg airports, where slightly higher growth rates of 5–8% were achieved. Despite the slight positive traffic development, traffic volumes at all German airports still remained significantly below the 2019 pre-pandemic level. Even compared to other European countries, where some airports had already reached or even exceeded 2019 traffic levels in 2024, overall traffic growth at German airports was lower.

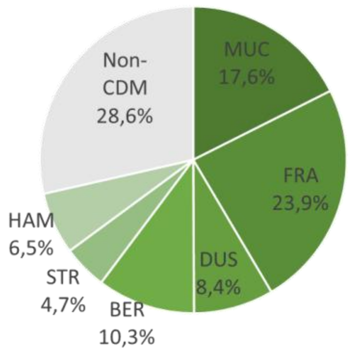


Fig. 1: Share of total departures originating from A-CDM airports in Germany

4.1.2 Share of Regulated IFR Departures

Description
Share of IFR departures with ATFM slot (CTOT), in %

Goal
Illustrate the monthly share of IFR departures that were subject to an air traffic flow measure by NMOC.

Charts

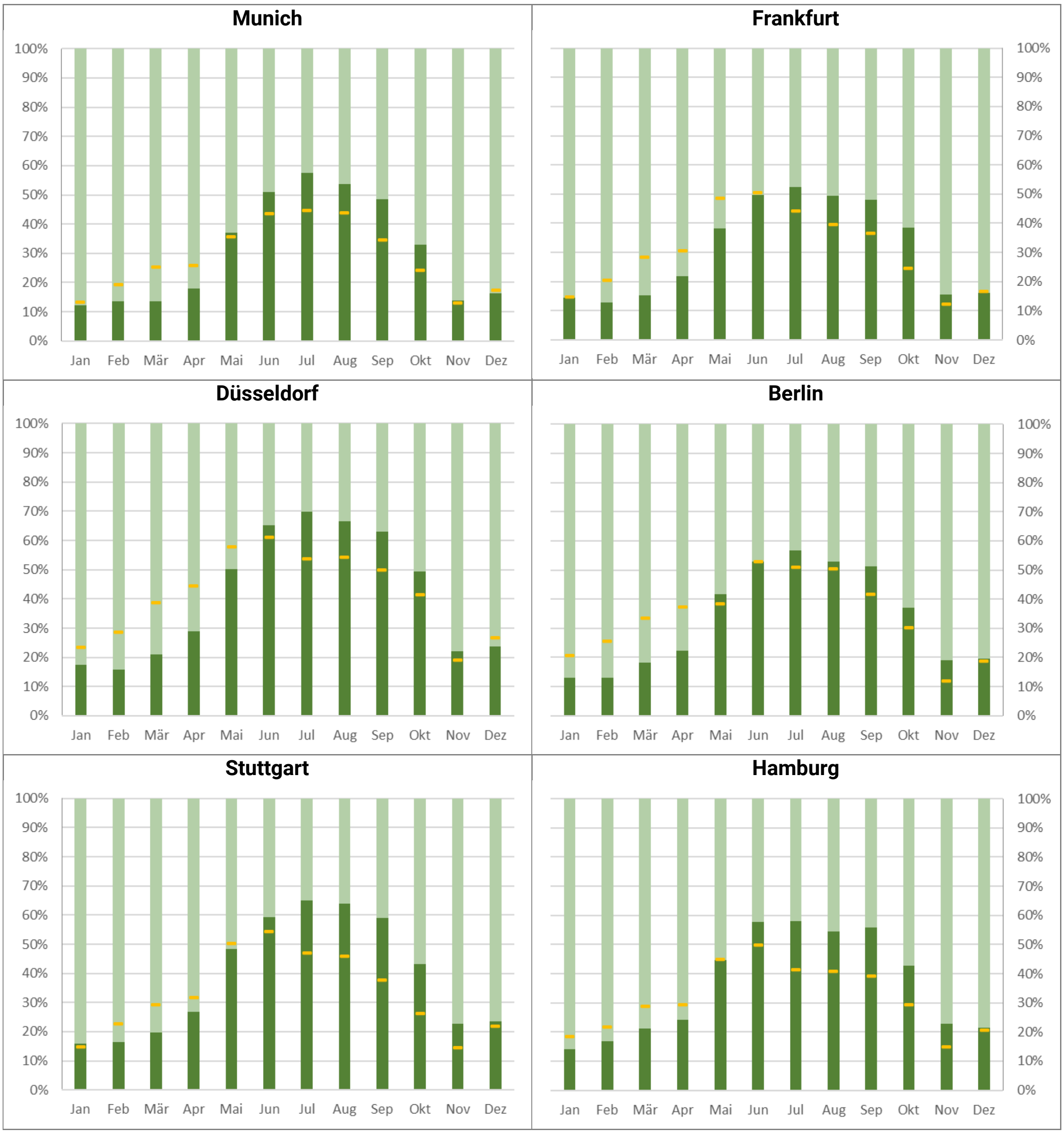


Fig. 1: Share of unregulated (light green) and regulated (dark green) IFR departures, and 2019 share (yellow)

Conclusion
Even though the number of flight movements in Germany before the COVID-19 crisis has not yet been reached in 2024, the overall traffic volumes in Europe have once again exceeded the levels of 2019.

As a result, the proportion of regulated flights was also above the very high levels seen in 2018 and 2019. The main reasons for this high proportion were, especially during the summer months, the ongoing resource shortages at air navigation service providers and airports, as well as the impact of weather. Airspace restrictions due to the ongoing war between Russia and Ukraine, which result in additional traffic flows being routed around the conflict area, have also contributed to the high number of regulations.

The share of regulated flights in the first months of the year was significantly lower than in 2023, despite higher traffic volumes. In contrast, the share of regulated flights was significantly higher during the summer months, with similar traffic growth rates.
This suggests that, up to a certain saturation point, the overall network operates with fewer traffic flow management measures compared to previous years, but once this saturation level is exceeded, there is a disproportionately higher need for such measures. Therefore, it can be inferred that, within the current system, any further growth in traffic will likely lead to a disproportionate increase in regulations.

As in previous years, the high volume of regulations was again accompanied by high volatility in CTOT updates (see section 4.4.2). As a result, the planning of ground handling resources, gates, and positions at the most affected airports (e.g., Frankfurt) was again severely impacted. However, thanks to the further expansion of ground staff and handling resources, the negative impacts of the increased volume of regulations and updates could be better compensated at most airports compared to the previous year (2023).

4.1.3 Share of IFR Departures Requiring De-Icing

Description
Share of IFR departures that required aircraft de-icing, in %

Goal
This KPI serves only as context information for other KPIs, e.g. TSAT Quality.

Charts

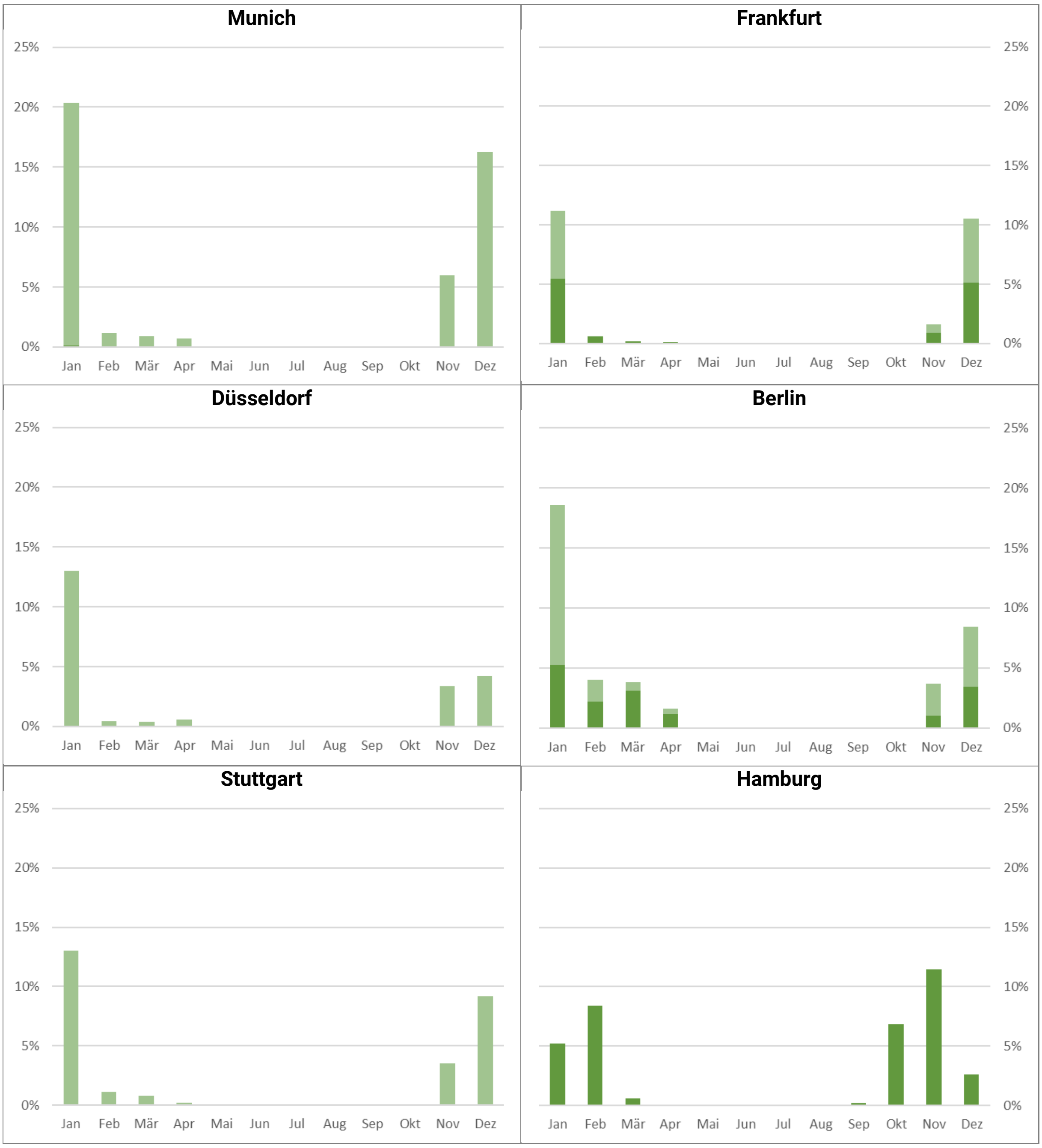


Fig. 2: Share of IFR departures requiring aircraft de-icing on stand (dark green) and remotely (light green)

Most airports only do remote de-icing, i.e. on designated de-icing areas. In this case, de-icing takes place after TSAT.
In the case of on-stand de-icing the flights are de-iced on their parking stands, i.e. after TOBT but before TSAT. Planned de-icing begin and duration are included in the TSAT calculation.

4.2 Procedure Adherence

4.2.1 ASAT Quality

Description
Share of IFR departures that received start-up approval (ASAT) within TSAT ± 5 min via radio, in %

Goal
Measure procedure adherence of Air Traffic Control (Tower)

Charts

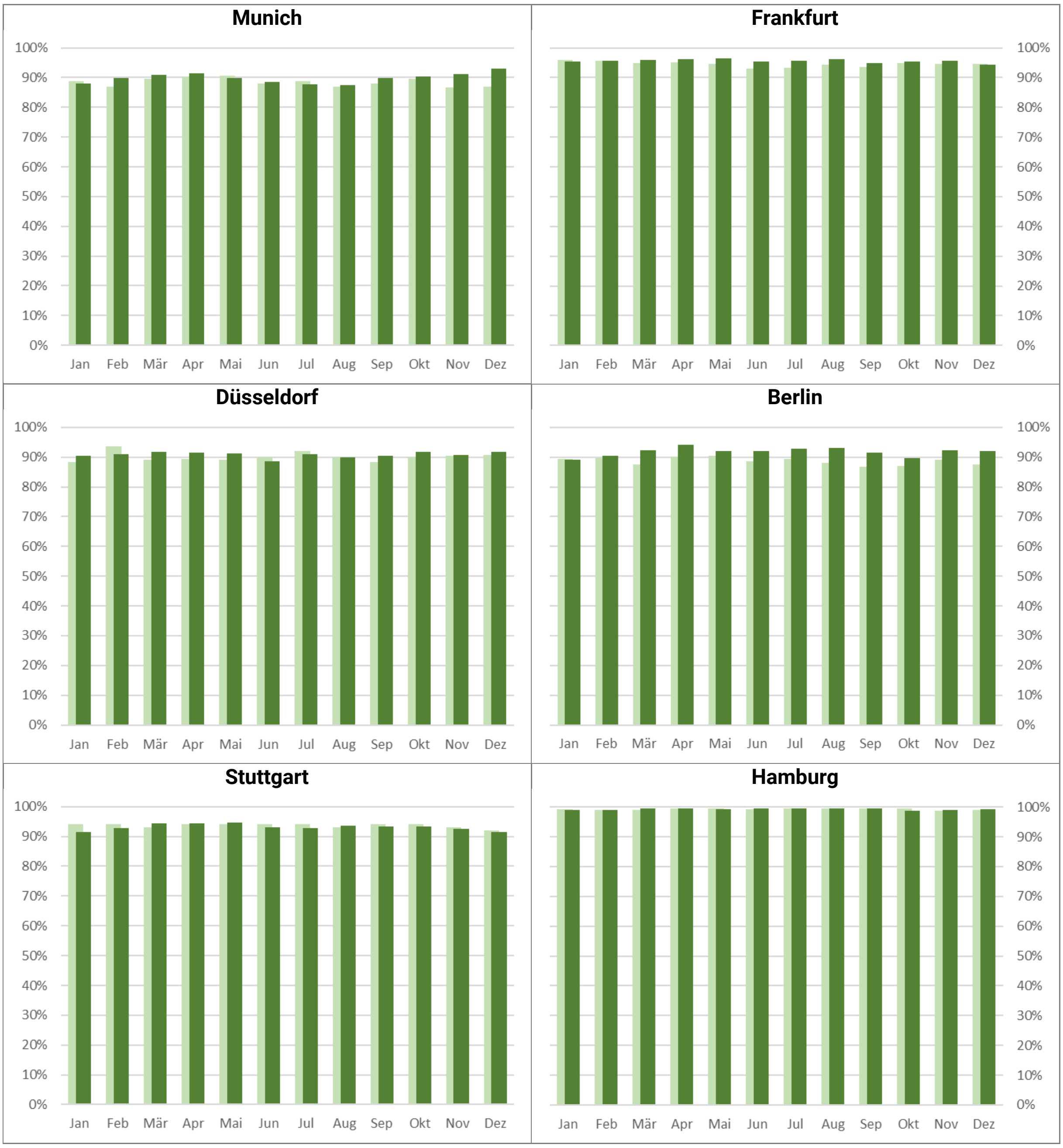


Fig. 3: Share of IFR departures that received start-up approval within TSAT ± 5 min via radio, compared to the previous year (light green)

Conclusion
At the major airports Frankfurt, Munich, and Berlin, there has generally been an improvement in ASAT quality, which can be attributed to greater process stability associated with improvements in the availability of ground handling staff and resources.

4.2.2 AORT Quality

Description
Share of IFR departures that asked for their off-block clearance (AORT) within the window of ASAT + 5 min (start-up via radio) or TSAT ± 5 min (start-up via datalink), in %

Goal
Measure procedure adherence of the Flight Crew

Charts

Fig. 2: Share of IFR departures with conformant AORT (green) compared to the previous year (grey), radio in darker shade, datalink in lighter shade

Conclusion
AORT quality is shown only for flights' final off-block requests that resulted in off-block clearance. Denied off-block requests, for instance after exceeding ASAT time tolerance, are not considered.

At the airports Frankfurt, Düsseldorf and partly also Stuttgart, AORT quality appears to be higher when using radio than when using datalink. Requests via datalink are often submitted before the turnaround has actually completed which may negatively affect TSAT window compliance as no direct enforcement by TWR can take place. Requests via radio, however, are usually submitted at the end of turnaround activities which tends to be correlated with off-block requests sooner afterwards. Also, TWR normally rejects start-up requests that are submitted too early which makes off-block requests outside of the TSAT window less likely.

4.3 Procedure Planning

4.3.1 TTOT Quality

Description

Progression of the difference between current E/TOBT + current EXOT to ATOT (in minutes), in 5-minute intervals from 120 minutes prior ATOT.

Goal

Determination of TTOT prediction quality as reported to the Network Manager for unregulated flights.

Charts

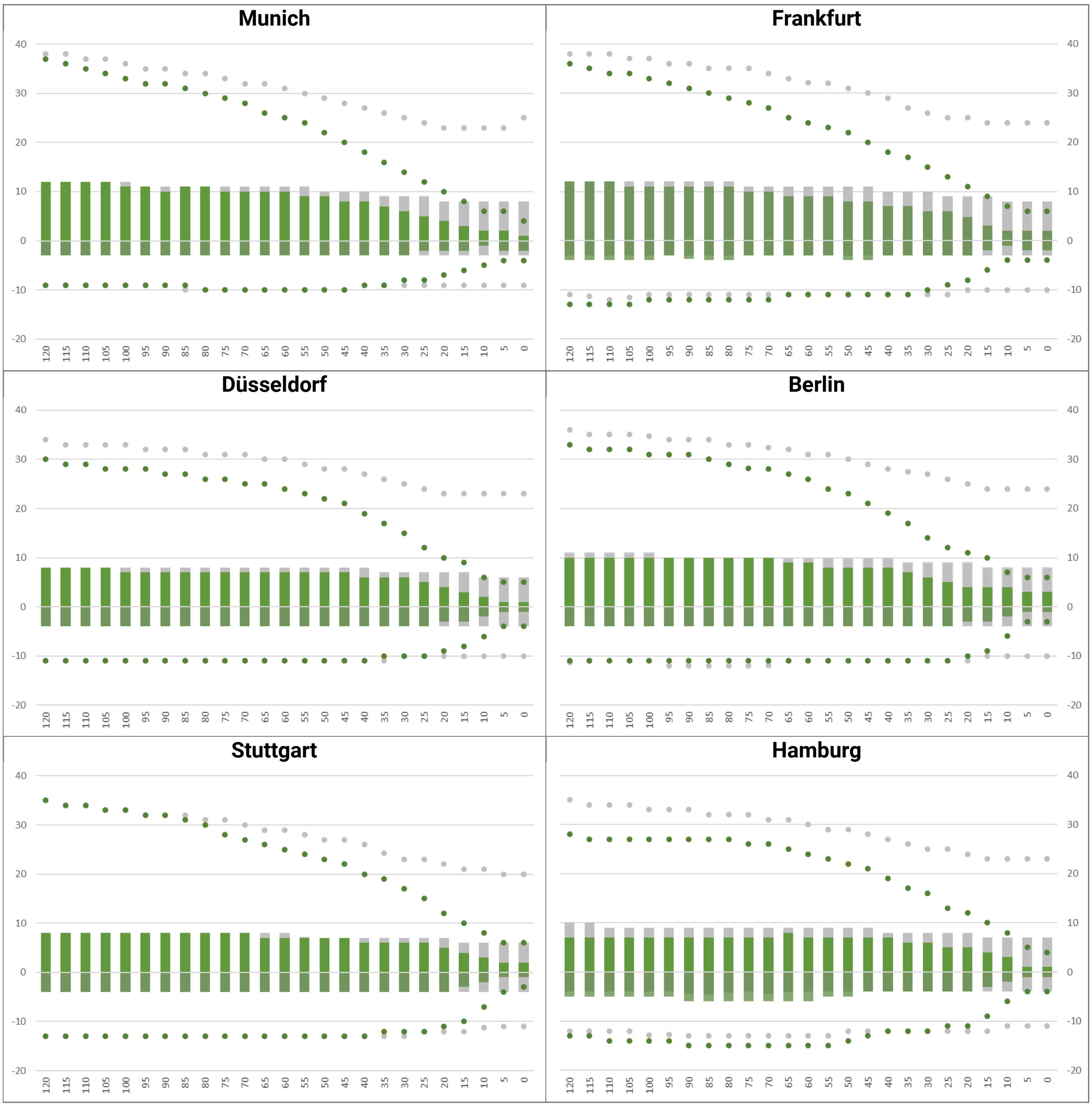


Fig. 4: Median (columns) and 90th percentile (dots) differences between E/TTOT and ATOT in minutes with a given lead time in minutes prior ATOT, split by flights with E/TTOT < ATOT (positive Y values) and E/TTOT > ATOT (negative Y values). ETOT in grey, TTOT in green.

Conclusion

Generally, every flight has a predicted take-off time based upon the ATC FPL's EOBT (ETOT). A-CDM airports additionally provide a prediction based upon the locally updated TOBT and the current departure capacity (TTOT). Both values are available to the Network Manager.

The above charts show that predictions based on local A-CDM data have a lower deviation from actual take-off times than those based on ATC FPLs only. From 90 to 50 minutes before departure, this improved quality is most pronounced because both TOBT and TSAT process are factored in at this stage.

Improved take-off predictions allow a more accurate traffic prognosis for the purpose of Air Traffic Flow Management and a more efficient use of airspace capacity.

4.3.2 SOBT Quality

Description
Monthly share of flights whose first EOBT provided in an ATC flight plan is equal to the SOBT agreed with the Airport Coordinator, in %

Goal
Difference between seasonal planning vs. first planning on the day of operations

Charts

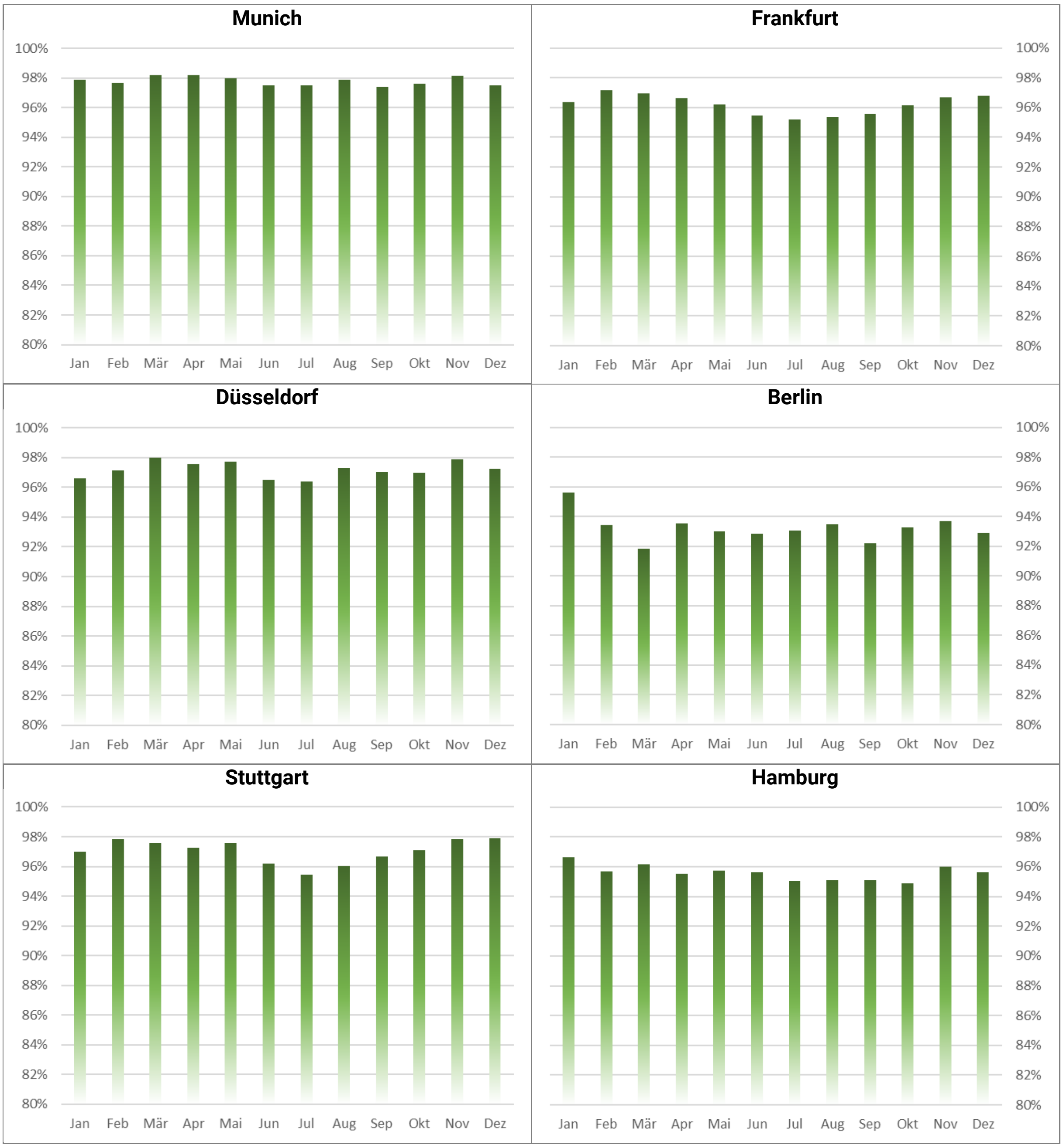


Fig. 5: Monthly share of IFR departures where first EOBT = SOBT

Conclusion
A high SOBT quality shows reliability of the strategic planning processes (seasonal planning) compared to the actual flight intention as expressed by the ATC flight plan. Significant differences between flight planning and slot coordination are being monitored and investigated by the German Airport Coordinator’s Slot Performance Monitoring.

4.3.3 TOBT Prognosis and Timeliness

TOBT Prognosis

Description
Difference of TOBT and its input time. A score of 100% is granted if the difference is at least 10 minutes. Lower differences result in a linear score reduction which reaches 0% if the difference is 5 minutes or less.

Goal
Scoring the amount of foresight that goes into TOBT updates

Charts

Fig. 6: Average Prognosis score of all TOBT updates per month compared to the same month in the previous year (light green) and 2019 (white).

TOBT Timeliness

Description
Difference of current TOBT and input time of a new TOBT. A score of 100% is granted if the difference is at least 10 minutes. Lower differences result in a linear score reduction which reaches 0% if the difference is 5 minutes or less.

Goal
Scoring how close to the existing TOBT an update is provided

Charts

Fig. 10: Average Timeliness score of all TOBT updates per month compared to the same month in the previous year (light green) and 2019 (white).

Conclusion

The timeliness of TOBT updates has a positive impact on the planning and deployment of resources at the airport and within the network. It is therefore encouraging that, in 2024, most airports saw a positive development in the timeliness of TOBT updates compared to the previous year.

This trend can be attributed to the implementation of various measures aimed at stabilizing the turnaround process, which have begun to take effect (e.g., increased staffing, introduction of Ground Coordination in Munich, introduction of Turnaround Management in Frankfurt). Additional measures directly targeting the quality of TOBT handling, such as improved communication, documentation, and training for ground handlers, the introduction of automatically triggered TOBT updates based on the start of boarding at Lufthansa in Frankfurt and Munich, as well as the display of camera images of handling positions in the CSA Tool at Frankfurt Airport, have contributed to improvements in TOBT updates. At some airports, TOBT performance in 2024 even exceeded pre-crisis levels seen in 2019.

At Hamburg Airport, the improvement in TOBT timeliness achieved in 2023 was also maintained in 2024. This is due to early updates of the automatic TOBT up to Actual In-Block Time (AIBT) of the inbound flight, if no TOBT has been provided by the TOBT handler. These early TOBT updates continued to have a positive effect on the TOBT Timeliness score.

4.3.4 TSAT Quality, Deviation and Stability

TSAT Quality

Description
Monthly share of last TSATs that were equal to TOBT, in %

Goal
Operational adherence to planning on the day of operations.

Charts

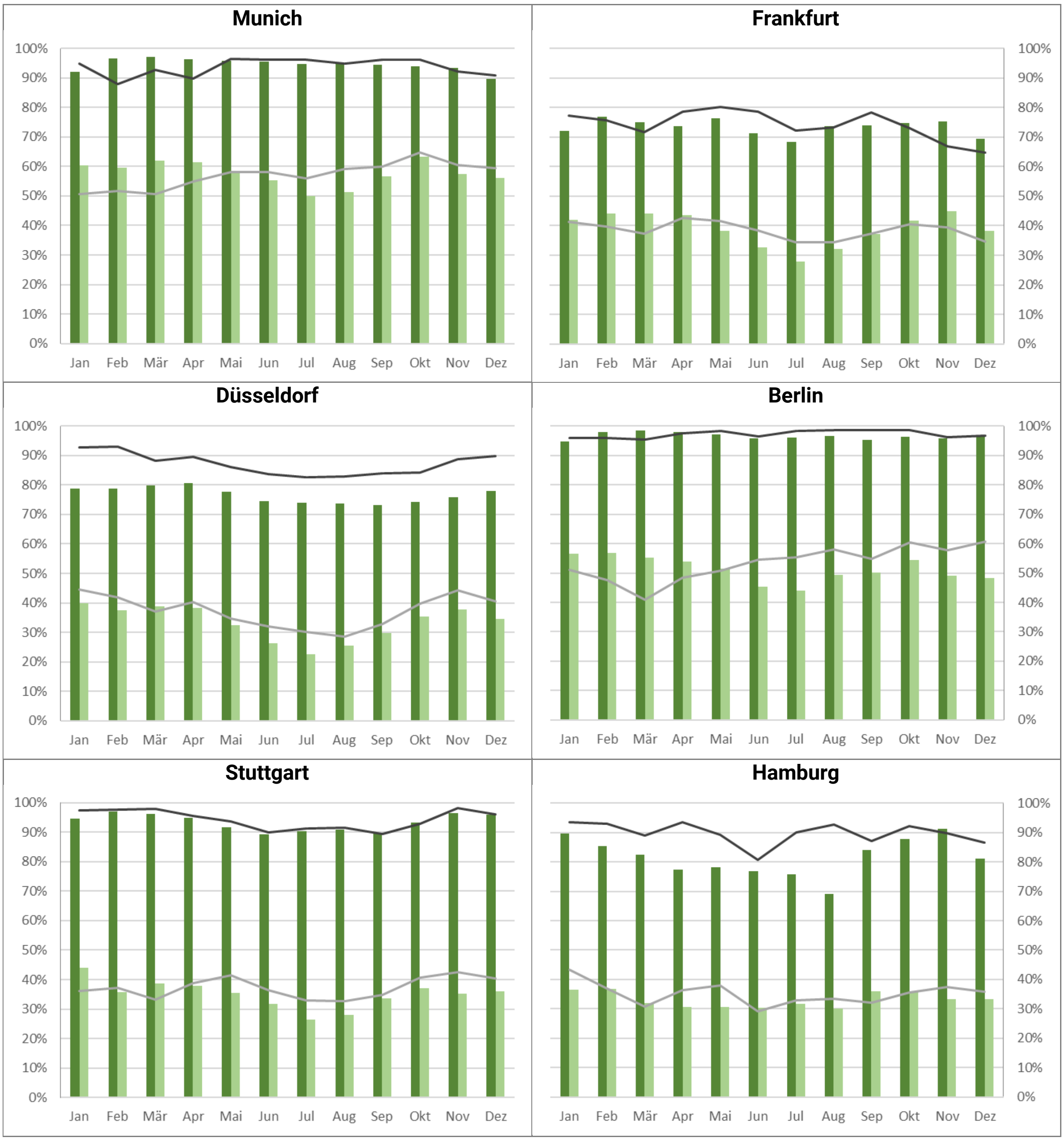


Fig. 7: Share of regulated and unregulated IFR departures (green) vs. previous year (grey) where last TSAT = TOBT. Non-regulated flights in darker shade, regulated lighter.

TSAT Deviation

Description
Monthly mean deviation of TOBT and last TSAT, in minutes

Goal
Show mean deviation of planning on day of operations versus actual operations

Charts

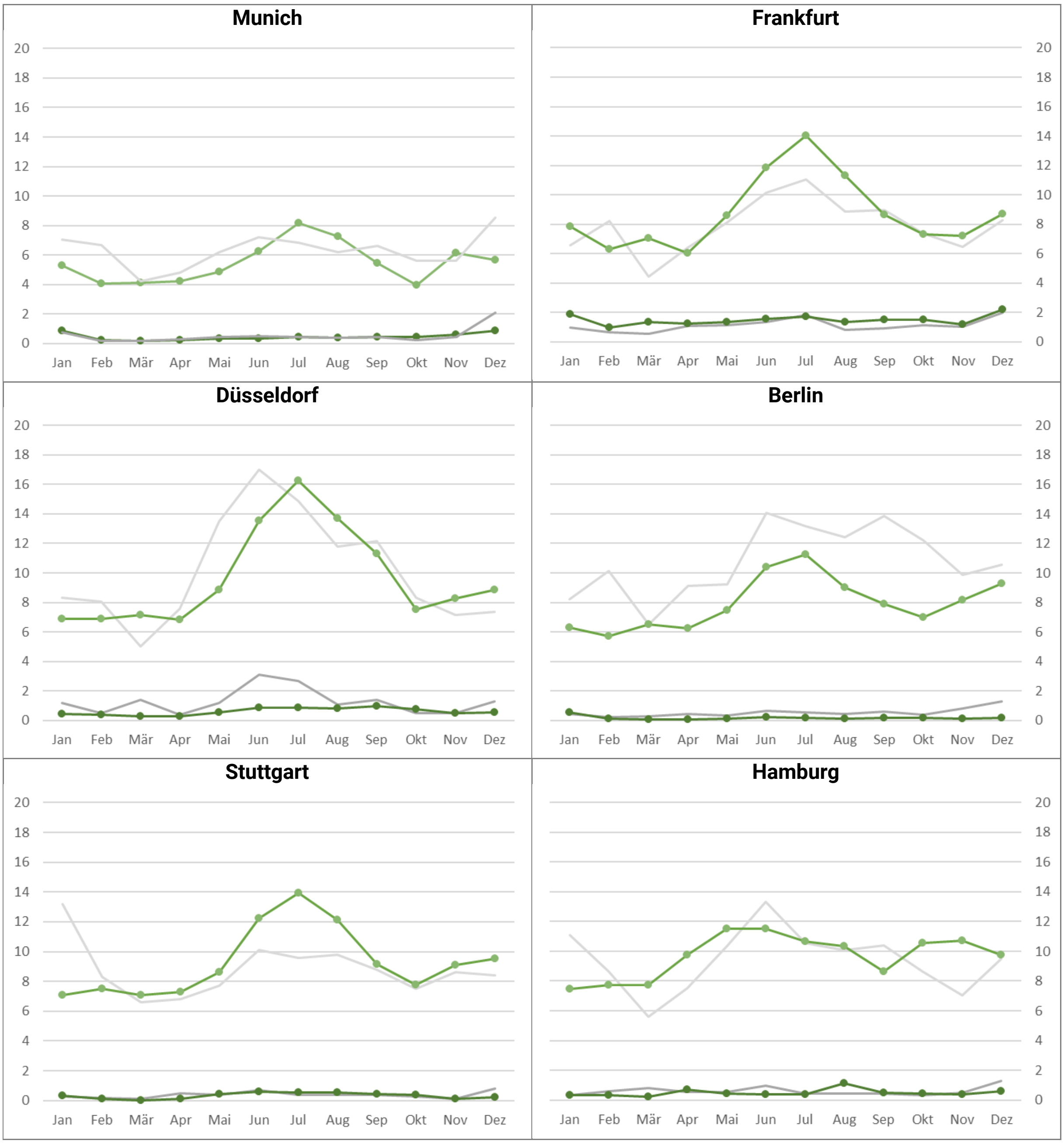


Fig. 12: Mean deviation of last TSAT and TOBT in minutes (green) vs. previous year (grey). Non-regulated flights in darker shade, regulated lighter.

TSAT Stability

Description

Number of TSAT changes from first publication (TOBT – 40 min) for non-regulated and regulated flights

Goal

Measuring TSAT stability

Charts

Fig. 8: Mean number of TSAT changes per regulated (light green) and non-regulated (dark green) flight and month without first TSAT, including deletions

Conclusion
For unregulated flights, a low TSAT quality shows that local capacity constraints have caused delays. For regulated flights, TSAT generally follows CTOT and therefore correlates more with ATFM delay.

Noticeable TSAT delays occurred throughout the year at Frankfurt Airport and, to a lesser extent, at Düsseldorf and Hamburg airports, even for non-regulated flights, with a stronger manifestation during the summer months. In Frankfurt, runway capacity is relatively lower during runway direction 25 than 07, and in Düsseldorf, the periods when dual runway operations are permitted do not always coincide with the busiest traffic phases of the day. In Hamburg, TSAT delays mainly arise during local traffic peaks, varying in magnitude depending on wind direction and the associated runway configuration.

In general, regulated flights exhibited lower TSAT stability than non-regulated flights due to the numerous CTOT updates. However, at Frankfurt Airport—which has the highest traffic load and is most affected by regulations—and, to some extent, at Hamburg Airport—which, despite an overall lower traffic level, is still heavily regulated—it is noteworthy that the TSAT stability for non-regulated flights was occasionally lower than for regulated flights. This is because CTOT updates tend to destabilize the overall pre-departure sequence during periods of high demand. Since regulated flights are generally given higher priority in the sequence than non-regulated flights, the non-regulated flights are resequenced more frequently as a result of the numerous CTOT updates for regulated flights.

4.3.5 EDIT Quality and Deviation

EDIT Quality

Description
Monthly share of IFR departures with on-stand de-icing or remote de-icing whose EDIT was within ADIT ±3 min, in %

Goal
Verify the reliability of estimated de-icing duration as input parameter for A-CDM

Charts

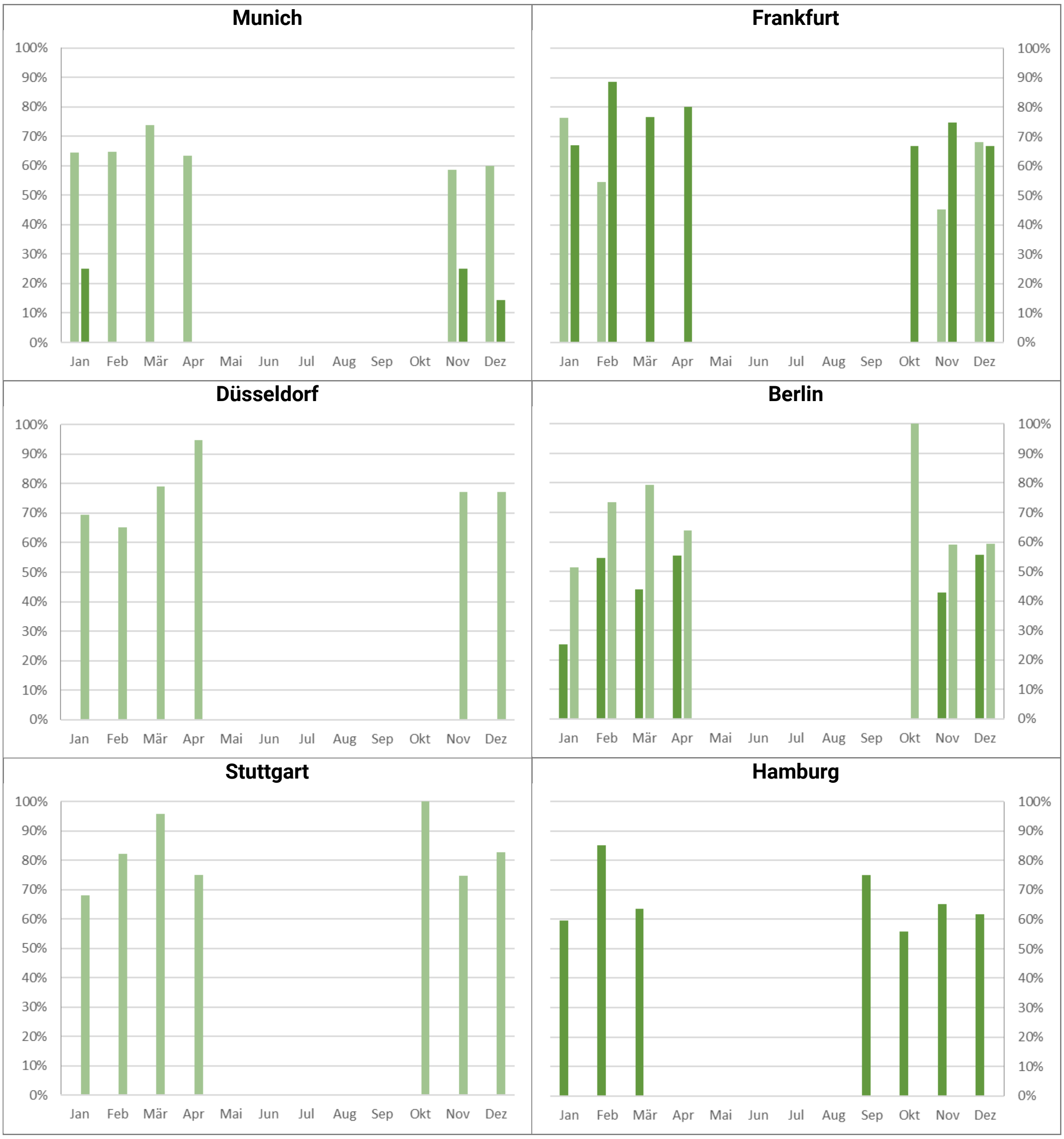


Fig. 9: Percentage of flights with on-stand (dark green) and remote de-icing (light green) where EDIT = ADIT±3 min

EDIT Deviation

Description
Monthly mean deviation of ADIT and EDIT for IFR departures with on-stand de-icing or remote de-icing in minutes per de-iced flight and airport, in minutes

Goal
Verify the accuracy of estimated de-icing duration as input parameter for A-CDM

Charts

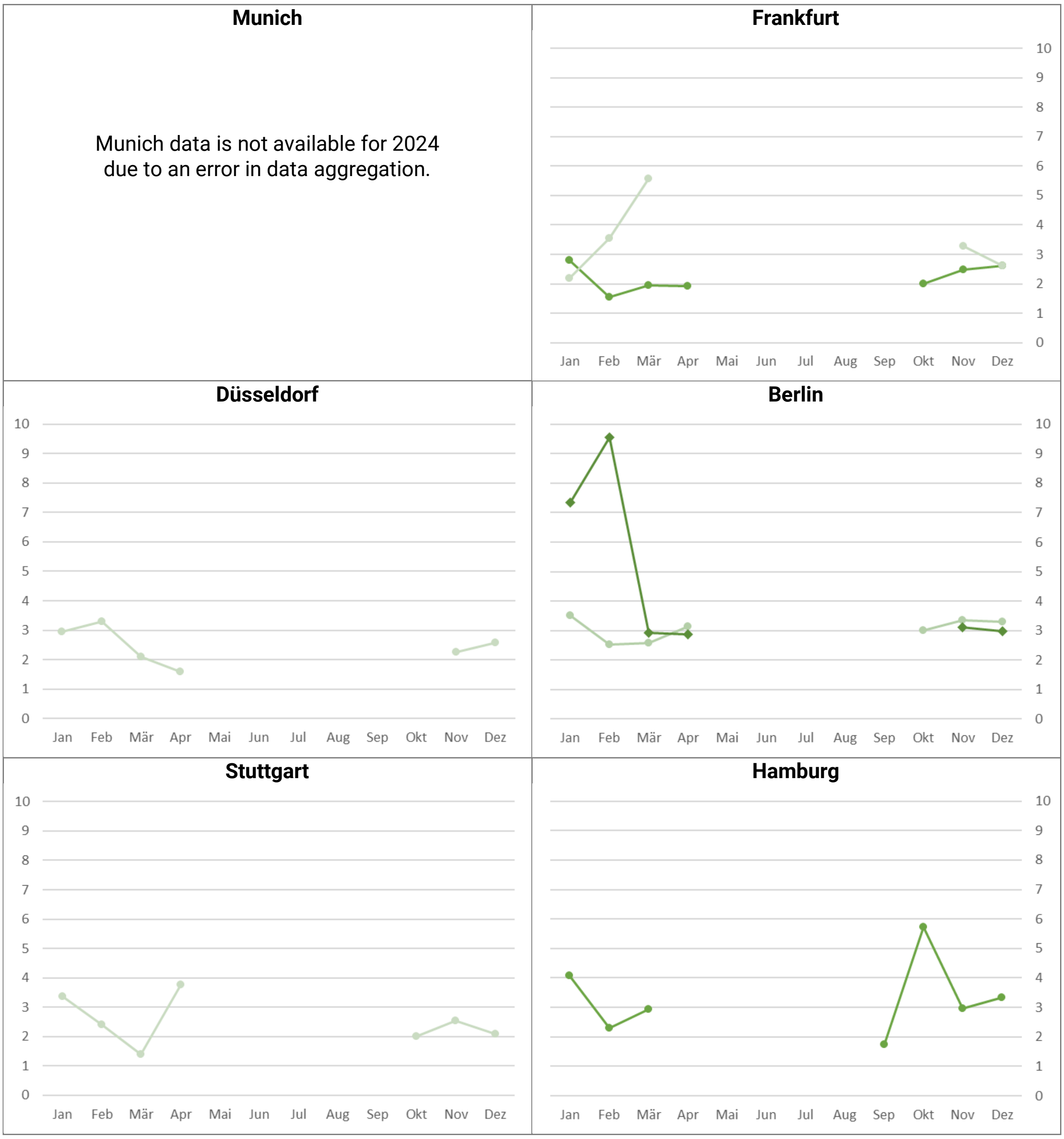


Fig. 10: Mean deviation in minutes of EDIT and ADIT for on-stand (dark green) and remote de-icing (light green)

Conclusion
EDIT quality for remote de-icing is generally higher as the process itself is less prone to disturbances and, therefore, easier to plan. On-stand de-icing performance depends on the location of the parking stand and activities on neighbouring areas which makes accurate EDIT predictions more difficult.

4.3.6 Position Stability

Description
Share of IFR arrivals for whom no position change had to be effected from ALDT-10 min until AIBT, in %

Goal
Determine the number of short-term position changes at the airport in relation to ELDT and ALDT. Indicates the reliability of positioning information for process planning.

Charts

Fig. 11: Share of flights where no short-term position change was necessary, compared to previous year (grey)

Conclusion
At highly utilized Frankfurt Airport, the summer months showed the same effect of unstable ground processes leading to lower position stability as in the previous year. The difficulties of high CTOT volatility combined with limited stand and gate resources resulted in unclear perspectives on when parking stands were indeed going to be vacated, so more landings had to be repositioned on short notice. This effect was also visible in early 2024 due to waiting times for de-icing.

At most airports, the slightly higher position stability during the summer months compared to the previous year is an indicator that critical subprocesses within the turnaround process were able to be carried out more reliably and as planned.

4.4 Network Management

4.4.1 ATFM Slot Adherence and Deviation

ATFM Slot Adherence

Description
Share of flights adhering or not adhering to Slot Tolerance Window prescribed by NM, in %

Goal
Measure procedure adherence of regulated flights. Nominally, ATOT should be within the Slot Tolerance Window (STW, usually CTOT -5/+10 min but may be extended in special conditions). Adjustment of the CTOT to the local TTOT within the A-CDM process improves ATFM slot adherence, pre-departure sequence and procedure adherence.
“Early” flights have an ATOT before STW begin, “late” flights have their ATOT after STW end.

Charts

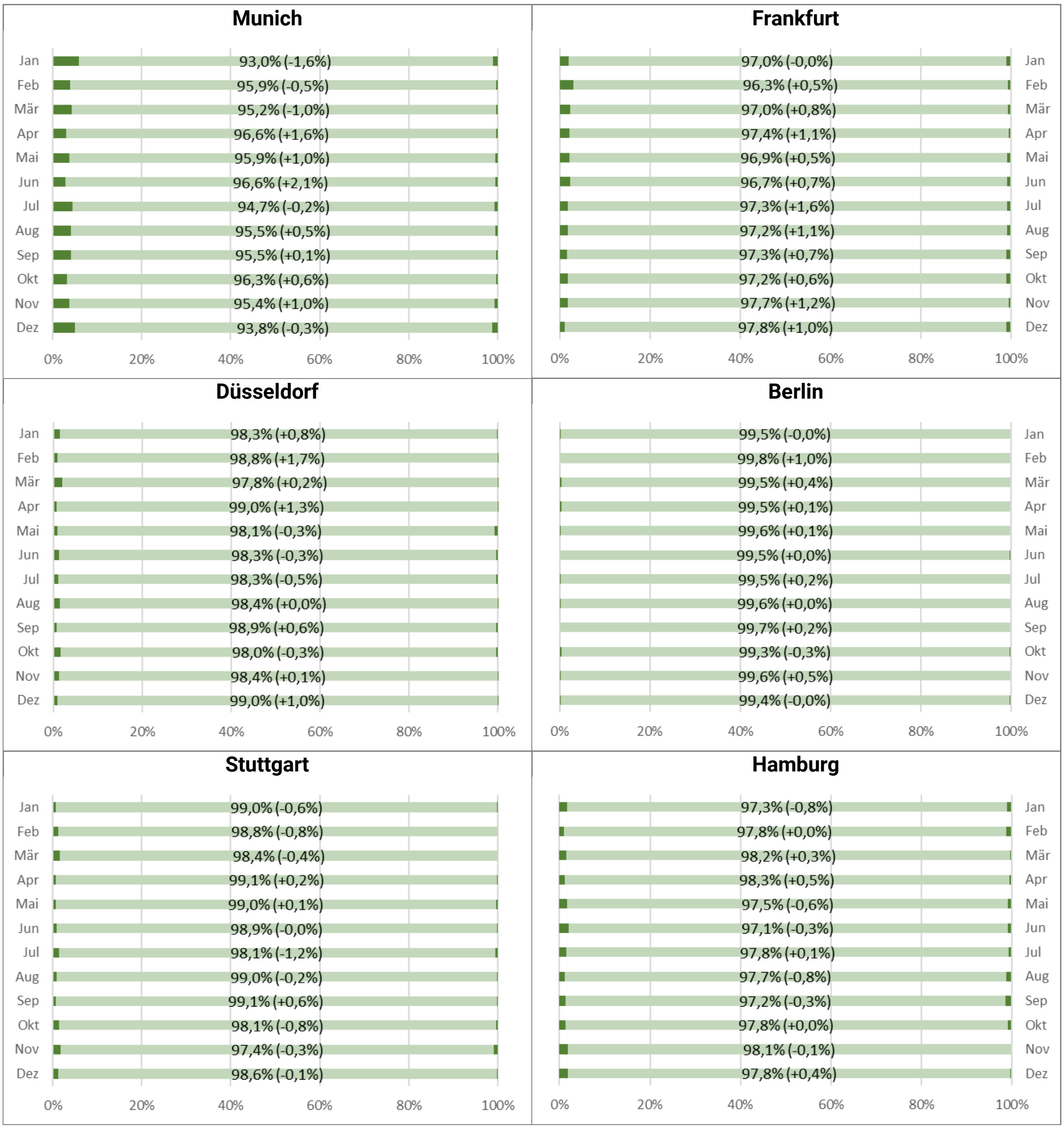


Fig. 3: Share of flights with ATOT before (dark green left), within (light green) and after (dark green right) STW, in brackets the difference to previous year's value

ATFM Slot Deviation

Description
Mean Deviation from the STW prescribed by NM, in minutes

Goal
Measure the level of slot deviations for regulated flights. This measurement counts only flights whose ATOT was outside of the Slot Tolerance Window and measures the time in minutes between ATOT and the nearest STW limit. "Early" flights have an ATOT before STW begin, "late" flights have their ATOT after STW end.

Charts

Fig. 18: Mean deviation in minutes of ATOT and STW for early (light green) and late (dark green) departures

Conclusion

Despite a significant increase in the proportion of regulated flights during the summer months compared to the previous year, all airports in 2024 achieved at least the same or even better slot adherence than in 2023. On the one hand, the trend towards more stable turnaround processes and the associated better TOBT compliance, as well as the only slightly increased low taxi traffic volumes, contributed to this result. On the other hand, it also shows that, due to the local A-CDM process at the airports, CTOTs can be planned more effectively according to local conditions and can therefore be better adhered to.

At Munich Airport, a significant share of flights depart earlier than their Slot Tolerance Window, though not by a large margin as evidenced by the low Slot Deviation indicator. This is due to regulated flights being sequenced at the runway at CTOT – 5 minutes rather than at CTOT as on the other airports. This increases the likelihood of flights departing slightly earlier than their Slot Tolerance Window.

It is also notable that the average ATFM slot deviation for departures that took off too early compared to the CTOT at the airports Frankfurt, Berlin, Düsseldorf, Stuttgart, and Hamburg is significantly higher in some months. This phenomenon is explained by the overall high CTOT adherence, meaning that a small number of individual flights with large deviations have a major impact on this KPI. Short-term failures in data transmission to the Network Manager and, in some cases, unusually late adjustments of routing in the ATC flight plan led to CTOT updates after off-block, which could no longer be taken into account operationally.

4.4.2 CTOT Quality, Deviation and Stability

CTOT Quality

Description
Monthly percentage of IFR departures with CTOT = TTOT+≤5 min/+≤15 min/+>15 min at First CTOT, First TSAT Issue and AOBT

Goal
Measure suitability of network CTOT to the local A-CDM process over the progress of a turnaround

Charts

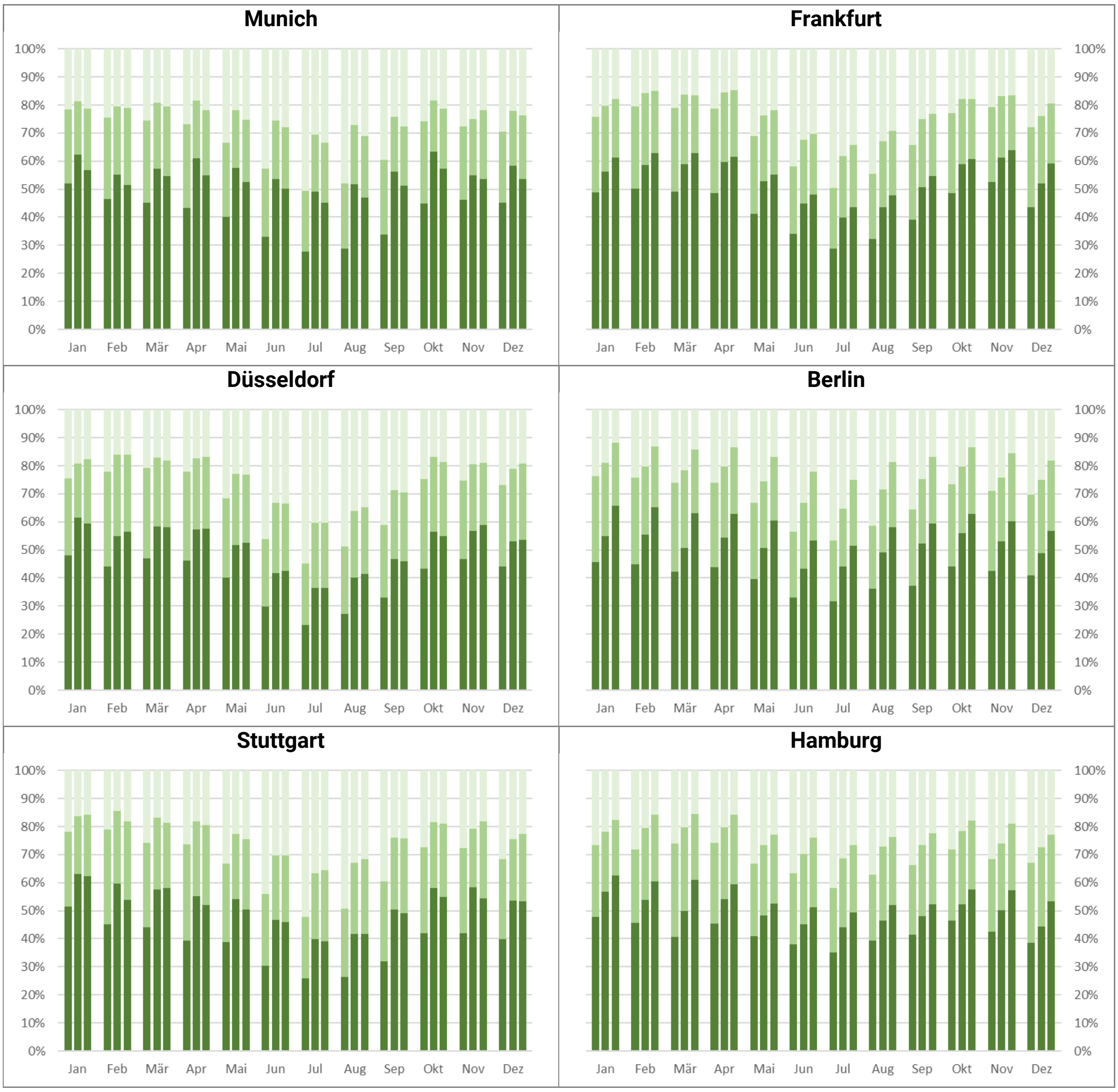


Fig. 19: Share of regulated IFR departures per month where CTOT is a maximum of 5 (dark green), 15 (green) or more than 15 minutes (light green) later than TTOT. First CTOT left, First TSAT Issue centre, AOBT right.

CTOT Deviation

Description
Mean monthly deviation CTOT-TTOT at First CTOT, First TSAT Issue and AOBT, in minutes

Goal
Measure suitability of network CTOT to the local A-CDM process over the progress of a turnaround

Charts

Fig. 20: Mean deviation CTOT-TTOT of regulated IFR departures at First CTOT (light green), First TSAT Issue (green) and AOBT (dark green)

CTOT Stability

Description
Number of CTOT updates per IFR departure with CTOT

Goal
Measure CTOT stability

Charts

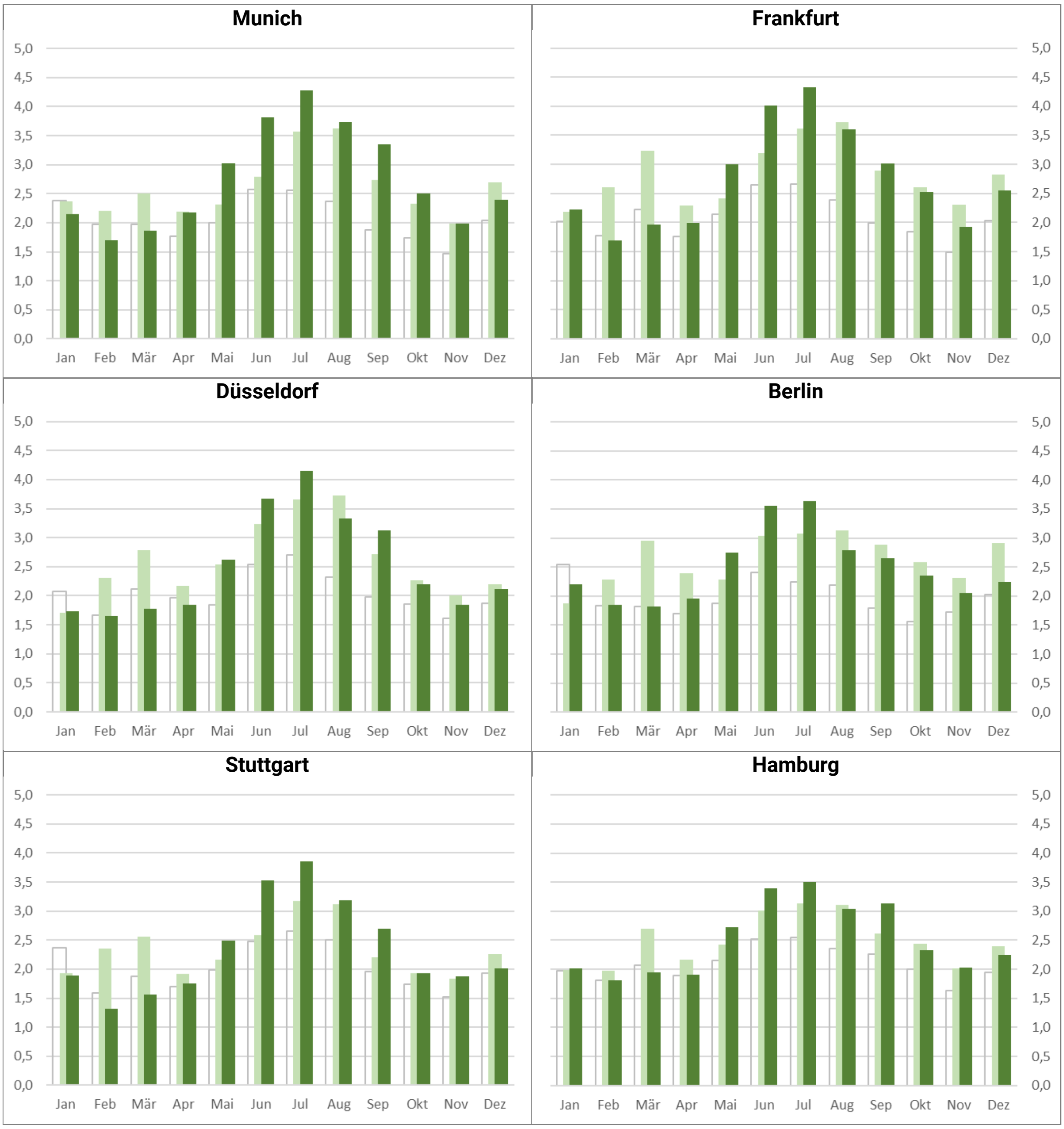


Fig. 21: Mean number of CTOT updates (without first CTOT) per flight and month, compared to previous year (light green) and 2019 (white)

Conclusion

The indicators CTOT Quality and Deviation clearly show how well the network CTOTs match the earliest possible local departure times reported by A-CDM airports. At most airports, it can be observed that there is generally an improvement in the assigned CTOTs during the A-CDM process. The initially assigned CTOTs often have a higher delay than the subsequent CTOT updates, as the Network Manager’s optimization algorithm tries over time to find a CTOT that fits as closely as possible to the departure time calculated based on the TOBT. Early TOBT updates therefore increase the likelihood of keeping CTOT delays as low as possible.

At Munich Airport throughout the year, as well as at Düsseldorf and Stuttgart airports in certain months, it can be seen that CTOT quality and deviation at the time of AOBT were somewhat worse compared to the time of the first TSAT issue. At these airports, late TOBT updates also occur more frequently in comparison, so a feedback effect is observed here. The later TOBT updates are made before the actual end of handling, the less opportunity the systems of the Network Manager have to provide a CTOT that matches the new situation.

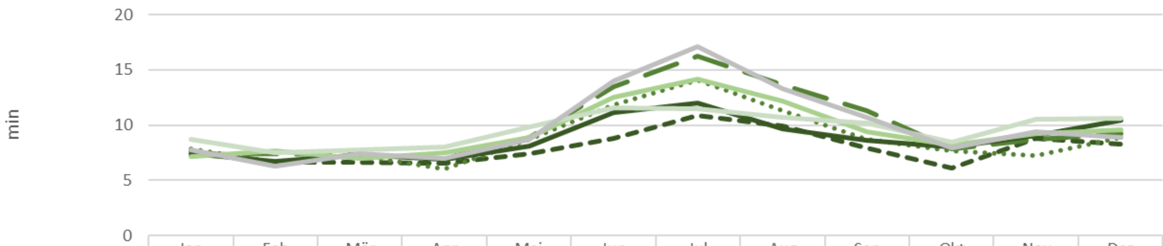
CTOT stability generally improved in the winter months compared to the previous year, but was again significantly worse in the summer months compared both to the previous year and to 2019. Similarly, the continued high number of departures affected by 20 or more CTOT updates again significantly complicated planning processes at airports in 2024. This also had an impact on non-regulated departures, as the high CTOT volatility made it impossible to predict or plan when the handling resources tied to a flight until AOBT would again be available for other handling operations.

4.4.3 Average ATFM Delay

Description
Average ATFM delay per regulated departure, in minutes

Goal
Measure the average ATFM delay for regulated departures

Chart



	Jan	Feb	Mär	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
MUC	7,7	6,7	6,6	6,6	7,4	8,8	10,9	10,0	7,9	6,1	8,8	8,3
FRA	7,8	6,6	7,2	6,1	8,7	11,8	14,0	11,3	8,7	7,7	7,2	8,9
DUS	7,4	7,4	7,3	6,9	8,9	13,5	16,2	13,7	11,3	7,9	8,7	9,2
BER	7,4	6,7	7,3	6,9	8,1	11,1	12,0	9,7	8,6	8,0	9,1	10,5
STR	7,1	7,6	7,0	7,5	8,8	12,5	14,2	12,2	9,4	8,1	9,2	9,6
HAM	8,7	7,5	7,7	8,0	9,8	11,6	11,4	10,7	10,2	8,4	10,5	10,6
Non-CDM	7,8	6,3	7,4	7,0	8,7	14,0	17,1	13,3	10,7	7,9	9,4	8,9

Fig. 22: Average ATFM delay per airport in minutes

Conclusion
During the winter season, there were significantly fewer regulations overall, making the summer season more statistically relevant. During this period, all German Airport-CDM airports showed a lower ATFM delay per flight compared to non-CDM airports.

5 Outlook

After the severely limited personnel and handling resources had posed major challenges for airports in 2022 and 2023 following the pandemic—impacting the predictability and stability of ground processes, and thus also the A-CDM process and the associated target time quality for the European air traffic control network—a positive development was observed in 2024. The measures to stabilize the turnaround process, which had been initiated and implemented in the previous two years, took effect, with the moderately increased traffic volumes supporting this development. At most German A-CDM airports, overall performance and punctuality, as well as TOBT performance, could be significantly improved in 2024 compared to the previous two years. TOBT quality in some cases even exceeded the pre-crisis level of 2019.

It also became clear that the continued increase in traffic volumes across Europe and the associated rise in network influences—such as high levels of regulation and ongoing high CTOT volatility—no longer severely impact the planning of the turnaround process or the timely and accurate updating of TOBTs. This also clearly demonstrates that the measures initiated and implemented at the airports in previous years have taken effect.

Nevertheless, due to the continued increase in traffic volume, European airspace is expected to be more strongly regulated in the summer of 2025, with the rate of increase expected to be significantly higher than that of the traffic demand itself.

The local reporting and performance monitoring of the A-CDM process will continue to be expanded by ACDM Germany in order to be able to demonstrate in the future how the forecasted development of traffic, in connection with the measures planned for the future—some of which have already begun at certain airports (e.g., automatic time-stamp recording based on "computer vision" or the development of AI-based turnaround forecasts to predict the end of handling)—will impact quality.

List of Abbreviations

	DESCRIPTION
ADIT	Actual De-Icing Time
AORT	Actual Off-Block Request Time
ASAT	Actual Start-Up Approval Time
ASRT	Actual Start-Up Request Time
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATOT	Actual Take-Off Time
CTOT	Calculated Take-Off Time
DCL	Datalink Clearance
EDIT	Estimated De-Icing Time
FPL	ATC Flight Plan
IFR	Instrument Flight Rules
NM	Network Manager
NMOC	Network Manager Operations Centre
SOBT	Scheduled Off-Block Time
STW	Slot Tolerance Window
TOBT	Target Off-Block Time
TSAT	Target Start-Up Approval Time

List of Sources

CHAPTER	KPI	SOURCE
4.1.1	Number of IFR Departures	NM ATFCM Monthly Summary per Airport
	Share A-CDM	DFS
4.1.2	Share of Regulated IFR Departures	NM ATFCM Monthly Summary per Airport
4.1.3	Share of IFR Departures Requiring De-Icing	Airports
4.2.1	ASAT Quality	Airports
4.2.2	AORT Quality	Airports
4.3.1	TTOT Quality	DFS
4.3.2	SOBT Quality	DFS
4.3.3	TOBT Prognosis and Timeliness	DFS
4.3.4	TSAT Quality, Deviation and Stability	DFS
4.3.5	EDIT Quality and Deviation	Airports
4.3.6	Position Stability	Airports
4.4.1	ATFM Slot Adherence and Deviation	NM ATFCM Monthly Slot Adherence, NM
4.4.2	CTOT Quality, Deviation and Stability	DFS
4.4.3	Mean ATFM Delay	NM ATFCM Monthly Summary per Airport