



| ICAO PARIS

UNITING AVIATION

Agenda Item 4

# Air Navigation Performance Framework Results from the 2023 data collection exercise

(reflecting State submissions up to 31 October 2024)

EASPG/06

Paris, France

December 2024





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## Executive Summary





- The year 2023 marks the post-COVID phase and the general increase in air traffic and associated demand is also observable within the EUR region. While traffic recovery ranges and trends vary significantly locally, the associated performance indicators for 2023 need to be evaluated in light of the overall recovery of air traffic. In some instances levels equivalent to about 80% of pre-pandemic air traffic were reached. Despite the overall positive traffic development, the EUR region also witnessed additional constraints due to geo-political developments that impacted a share of connections and traffic flows.
- The EUR region is characterised by a wide variety in the size of the airspace as well as of traffic density. The top 5 States included in the report cover 50% of the continental airspace; Two third of the continental airspace is served by a total of 8 States.
- Traffic in 2023 increased continuously in comparison to previous years. About 60% of the total IFR flight hours were serviced by 7 States (while in 2019 8 States served 50% of the traffic). This shows that traffic levels vary from pre-pandemic network connections across the EUR region.
- 7 States are accountable for about two third of all en-route ATCO hours on duty in the EUR Region while the top 8 States accounted for about 60% of all ATCOs in operations at Terminal Facilities, i.e. combined APP and Towers.
- The average flight hours per IFR flight remained constant ranging at about 4.5 min per IFR flight. This shows that flights are served along similar network connections within the different States requiring broadly the same 'service time'.



- More than half of the States have a single continental FIR. A smaller number has 2 (often a division between upper and lower), while 8 reporting States have 4 or more FIRs.  
The number of FIRs is associated with volume of airspace and number of control unit.
- A majority of States have a single ACC. 5 reporting States have established 2 ACCs, while 6 reporting States have 3 or more ACCs.  
The distribution is reflecting the airspace organisation (i.e. the number of FIRs).



- Traffic in 2023 continuously increased in comparison to pandemic levels. However, the traffic levels still range below pre-pandemic levels.  
On average, the average flight hour per IFR flight across the EUR region ranges at 4.5 min per flight.  
On a per country basis, the observed average flight hour per flight ranges in the same order of magnitude than in previous years.  
This suggests that similar flight patterns emerge on a State/center level for a major share of the serviced traffic.
- A concentration of airport IFR movements is observable. 60% of all movements were observed within 6 reporting States.  
The average national number of IFR airport movements ranges around 350.000 while the top 3 States observed airport movement numbers higher than a factor of 4 (ranging about +/- 1.000.000 flights higher).
- Just under two-third of all ATCOs in operations at ACCs are deployed in 7 reporting States within the EUR region. Oceanic service provision is handled by a small number of States within the EUR region (i.e. 3 States reporting).  
The top 8 States accounted for about 60% of all ATCOs in operations at Terminal Facilities, i.e. combined APP and Towers.



- The year 2023 is characterized by a significant level of ATFM delay. The magnitude was comparable to the pre-pandemic year. A variety of drivers contributed to the overall high level of ATFM delay seeing a surge in capacity related delays, but also a higher share of weather and industrial action related ATFM delays across the regions. However, in 2021 a similar pattern is observed with the majority of en-route ATFM delay concentrated in a small number of States, i.e. top 2.
  - 2 States account for about two third of the observed en-route ATFM delay in the EUR region; while
  - the vast majority of States does not generate any significant delay.
- The general traffic recovery can be observed in the traffic trends at the airports of the EUR region. While local differences exist, traffic levels are recovering. The top 20 airports accounted for about 40% of the IFR arrivals in Europe and accrued about 80% of all airport related ATFM delay. The top 10 contributors see average arrival ATFM arrival delay of more than 2 min per arrival, peaking between 3 to 5 min per arrival at the top 5 airports.

- Flight efficiency followed broadly the pattern of the previous years. This suggests that – with the increase in air traffic – further efficiencies due to restructuring of the network, removal of operational/procedural constraints/routing have been limited. The overall total achieved IFR distance observed across the EUR Region in 2023 increased as a function of the number of flights operated (i.e. more km flown).
  - Given the dimensions of the EUR region and the different airspace volumes, about 60% of the total achieved IFR distances is measured for flights within 6 States
- The environmental contribution of air navigation to the footprint of air transport is strongly scale-dependent on the level of inefficiencies in terms of additional flight time (~ engine time ~ emission time). Currently, the top 6 States are accountable for just above 60% of all extra distances observed. Given the emerging capabilities, a better level of numerical quantification of the effect will be feasible in future editions.
- From a cost-effectiveness perspective, 5 States are providing more than 50% of all en-route ATCO hours on duty in the EUR Region. The increasing traffic also resulted in a shift of ATCO hours on duty in APP + TWRs with an expansion of contributing states: 5 States are service just under 45% (vs 2021: 4 States ~ 40%) of all terminal & aerodrome ATCO hours on duty in the EUR Region
- The participation of States and Stakeholders to the ICAO activities (e.g. workshops, meetings, reports) varies greatly and is still impacted by post-pandemic procedures. While there is an increasing number of in-person events, online interactions are a primary interaction tool used also on a day-to-day basis.





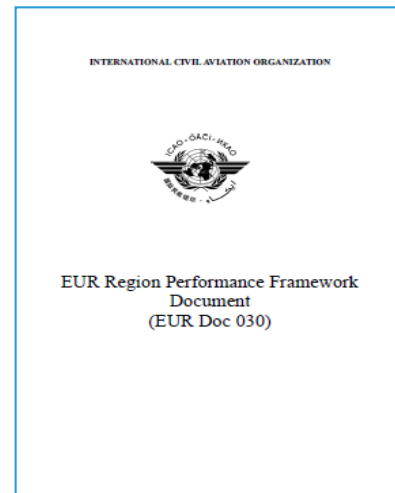
# Introduction



## ICAO Performance Framework Document

ICAO EUR Doc 030 describes the performance Framework  
(available in English/Russian language)

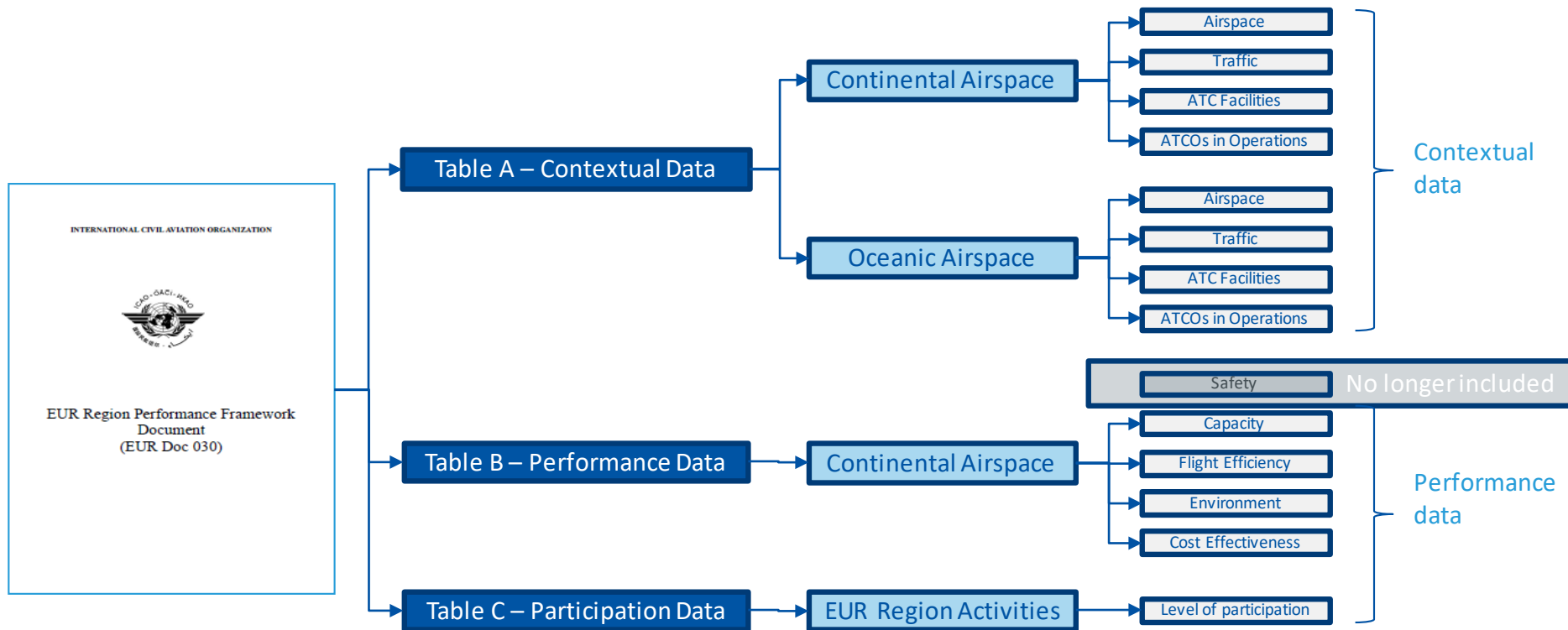
- Introduction
- Background
- Relationship with ICAO Global developments
- Relationship with the EU Performance Scheme
- Geographical scope
- Roles and responsibilities
- KPAs/KPIs/Metrics
- Monitoring and reporting at regional/national level
- Guidance material

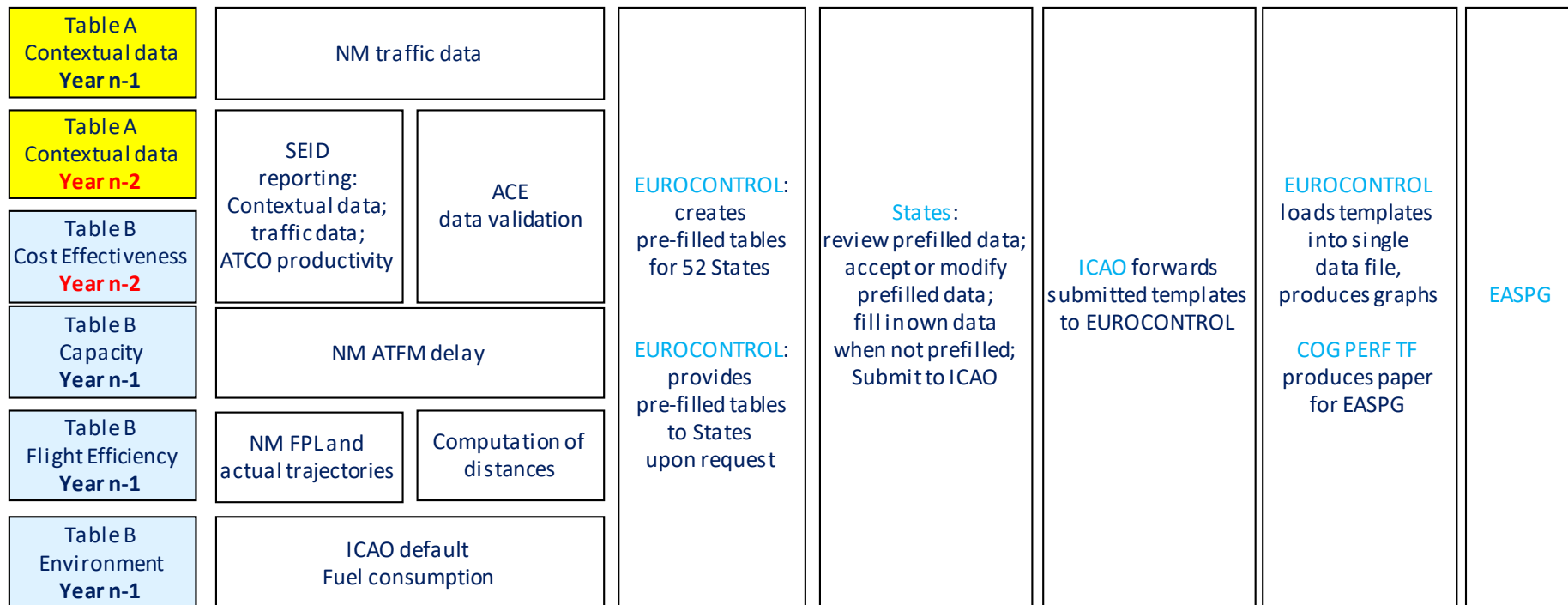


KPA	OBJECTIVES	FOCUS AREAS	INDICATORS
SAFETY	Ensure safety continuous improvement through reduction of ATM related safety occurrences and implementation of uniform safety standards		Effectiveness of Safety Management (Safety Maturity Questionnaire)
			Level of State Safety Culture (Safety Culture Questionnaire)
			Adoption of harmonized occurrences severity classification methodology
CAPACITY	Capacity meets demand for en-route and at airports	En-route ATFM Delay	Average en-route ATFM delay generated by airspace volume
		Airport ATFM Delay	Average ATFM delay per flight in the main airports (to be identified by States)
EFFICIENCY	Ensure users may use most efficient routes	Horizontal Flight Efficiency	Average horizontal en route flight efficiency (length of the en route part of the actual trajectory/last flight planned route vs great circle)
ENVIRONMENT	Contribute to the protection of environment (fuel/CO2 emissions reduction)		CO2 emissions related to inefficiencies in route extension
COST EFFECTIVENESS	Contribute to optimization of costs for ANS	ATCO Productivity	IFR Flights (en-route) per ATCO hour duty
			IFR flight hours per ATCO hour on duty
			IFR movements per ATCO hour on duty
PARTICIPATION BY ATM COMMUNITY	Ensure States' participation to Regional planning and implementation activities		Level of participation to meetings
			Level of responses to planning activities
			Level of provision of performance results

No longer Doc 030  
Regional Safety reporting









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## Level of participation re 2023



32 submissions

Status on 08-11-2024

ICAO EUR/NAT Office accreditation (56 States)

ICAO EUR Region (55 States)

ECAC (44) – Iceland (1) = 43 States

EUROCONTROL (41 States)

SES Performance Scheme RP3 (30 States)

EU (27 States)

MUAC

	Austria		Italy		Norway		Albania		Azerbaijan		Algeria	Iceland
	Belgium		Latvia		Switzerland		Armenia		San Marino		Andorra	
	Bulgaria		Lithuania				Bosnia and Herzegovina				Belarus	
	Croatia		Luxembourg				Georgia				Israel	
	Cyprus		Malta				North Macedonia				Kazakhstan	
	Czech Republic		Netherlands				Republic of Moldova				Kyrgyzstan	
	Denmark		Poland				Monaco				Morocco	
	Estonia		Portugal				Montenegro				Russian Federation	
	Finland		Romania				Serbia				Tajikistan	
	France		Slovakia				Turkey				Tunisia	
	Germany		Slovenia				Ukraine				Turkmenistan	
	Greece		Spain				United Kingdom				Uzbekistan	
	Hungary		Sweden									
	Ireland											

ECAA Member

Pre-filled template available,  
No support requestedSupport requested,  
Pre-filled template provided

ACE data available



Template submitted



- Participation to monitoring exercise for 2023: 32 submissions
- Participation varied over the past years
  - organisational changes during pandemic with ripple effects on staffing levels / priorities in post-pandemic setup
  - SES process for EU Member States; during summer 2024: RP4 Performance Planning
- States actively benefitting from support through prefilling (e.g. reduction of replication, consistency, quicker turnaround) → «thank you»
- Deconflicted timeline with SES process and increased engagement (check-in on submission) was positively received
- Potential to increase participation through targeting non-reporting States

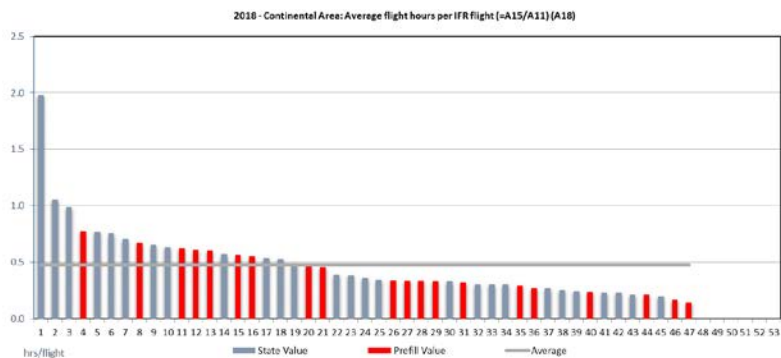
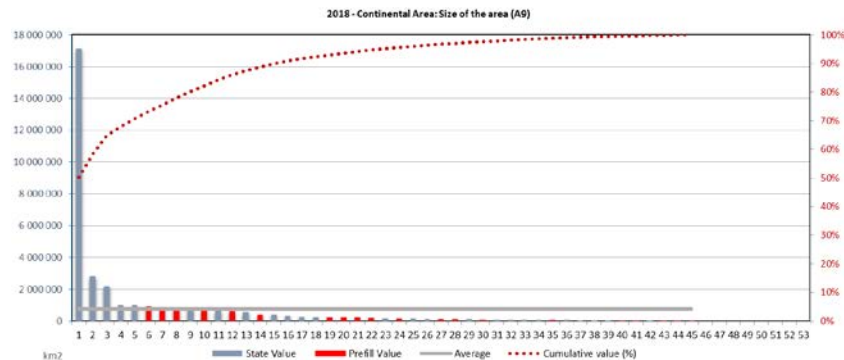
# Processing and presentation of results

- Data is collected in one Excel reporting template per State
- Data of individual States is collated into a single data set
  - Basis for graphical representation of results
    - Combination of prefilled and submitted data
      - Grey bars: data as submitted by the State
      - Red bars: prefilled data where available, for States which did not submit a template
      - In some cases the number of States in the graphs is smaller than the number of pre-filled + submitted templates. Reason: for some States the template is only partially filled.
  - Results are anonymised
    - But each State can see where it stands in comparison to all States in the Region
      - Each State knows its own values and can therefore position itself in the graphs



# Explanation of graphs

- **Title**
  - Identifies the data: year, scope (geographical and/or KPA), name of the data item, identifier code in the template
- **X-axis**
  - The list of anonymised States for the State- and ANSP-based data items (MUAC included as an ANSP), and the list of anonymised airports for the airport-based data items ( $\pm 180$  airports). Note that the labels are ranking numbers, not State/airport identifiers: in principle the mapping between numbers and States/airports is different for each graph.
- **Left y-axis**
  - The value of the data item, with the measurement units in the bottom left corner (blank means it is simply a count).
- **Grey line**
  - The average value (arithmetic mean), based on the number of States/ANSPs for which results are available for this data item (the length of the line indicates for how many States/ANSPs data is available). This value is a proxy for the regional average: it will change as data for more States/ANSPs is available.
- **A series of grey and/or red bars**
  - The profile of individual State/ANSP/airport values in descending order. This provides a good picture of the differences within the region. The bars do not show the difference between a reported value of zero and the value not being reported, but this can be deduced from the brown line (absence of a bar below the grey line means value zero or a value too small to be visible in the graph).
- **A red dotted line**
  - For data items which are aggregatable over States/ANSPs/airports: the cumulative profile of the blue bars in percent (see right-hand axis).



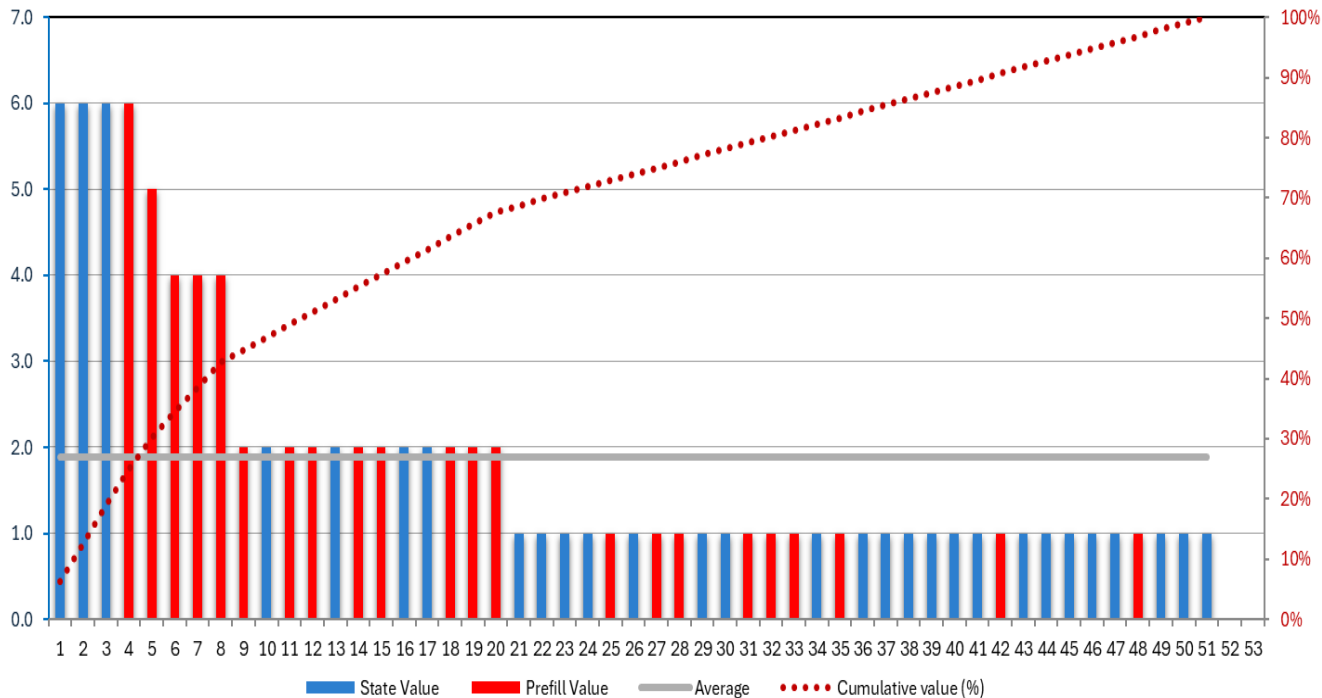
## Contextual data (Table A)



Continental Area		
	Airspace	
A8	Number of FIRs	Number
A9	Size of the area	km <sup>2</sup>
A10	Radar Surveillance Coverage at FL 290	km <sup>2</sup>
	Traffic	
A11	Total number of IFR flights controlled (=A12+A13+A14)	Flights/year
A12	Number of domestic IFR flights controlled	Flights/year
A13	Number of international IFR flights controlled	Flights/year
A14	Number of IFR overflights controlled	Flights/year
A11b	Total number of IFR flights controlled (use only if A12+A13+A14 not available)	Flights/year
A15	Number of IFR flight-hours controlled	hrs/year
A16	Number of IFR airport movements controlled (departures+arrivals)	Mov/year
A17	Number of VFR airport movements controlled (departures+arrivals)	Mov/year
A18	Average flight hours per IFR flight (=A15/A11)	hrs/flight
A19	Average IFR traffic density (=A15/A9)	hrs/km <sup>2</sup> /year
	ATC facilities	
A20	Number of ACCs	Number
A21	Number of co-located ACC/Approach Facilities	Number
A22	Number of Approach Control Facilities	Number
A23	Number of co-located Tower/Approach Facilities	Number
A24	Number of stand-alone Towers	Number
A25	Number of co-located ACC/Tower/Approach Facilities	Number
	ATCOs in operations	
A26	Number of ATCOs in operations at ACCs	FTE
A27	Number of ATCOs in operations at Terminal Facilities (APP+TWRs)	FTE

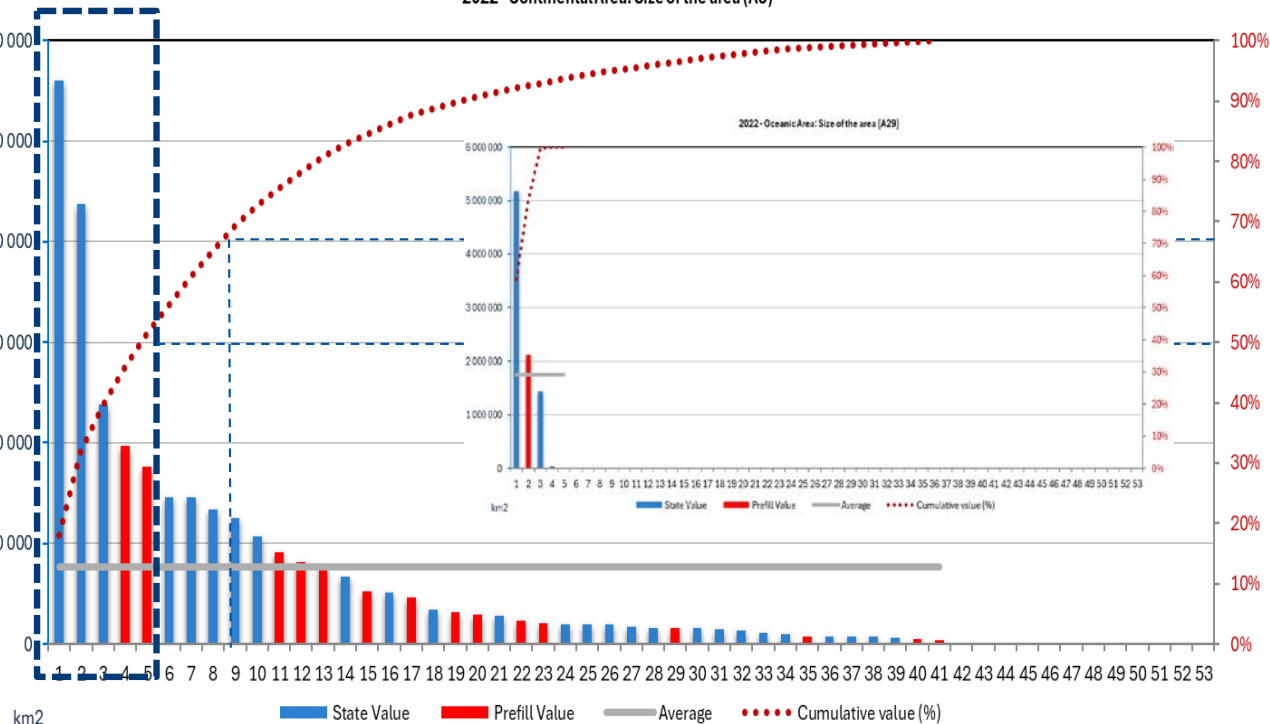
Oceanic Area (for States having an Oceanic Area)		
	Airspace	
A28	Number of FIRs	Number
A29	Size of the area	km <sup>2</sup>
A30	Radar Surveillance Coverage at FL 290	km <sup>2</sup>
	Traffic	
A31	Number of IFR flights controlled (=A32+A33+A34)	Flights/year
A32	Number of domestic IFR flights controlled	Flights/year
A33	Number of international IFR flights controlled	Flights/year
A34	Number of IFR overflights controlled	Flights/year
A31b	Number of IFR flights controlled (use only if A32+A33+A34 not available)	Flights/year
A35	Number of IFR flight-hours controlled	hrs/year
A36	Average flight hours per IFR flight (=A35/A31)	hrs/flight
A37	Average IFR traffic density (=A35/A29)	hrs/km <sup>2</sup> /year
	ATC facilities	
A38	Number of OACs	Number
	ATCOs in operations	
A39	Number of ATCOs in operations at OACs	FTE

2022 - Continental Area: Number of FIRs (A8)



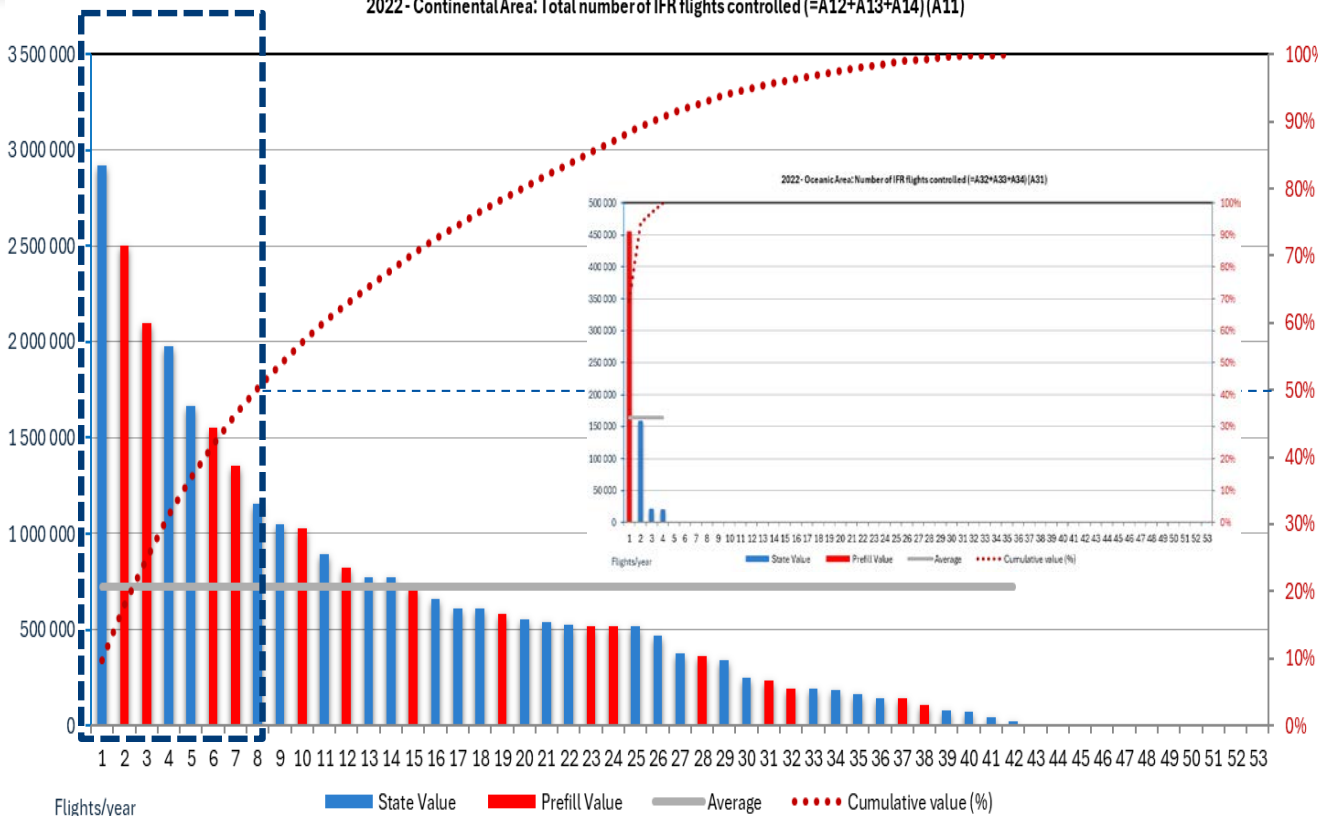
- Continental airspace in the EUR region varies widely, including the organisation of service provision in terms of FIRs.
- Smaller States / airspaces organise their air navigation service regions as a single FIR while larger nations (and associated airspace) is structured in a multitude of FIRs.
- 8 reporting states have 4 or more FIRs accounting for just above 40% of all FIRs.
- A high share of states operates 2 FIRs, while the majority of states (size-dependent) services within 1 FIR

2022 - Continental Area: Size of the area (A9)



- The top 5 States included in the report cover over 50% of the continental airspace. Two third of the continental airspace is served including another 3 States (= total 8 States).
- Airspace sizes vary widely across the EUR region performance framework participants.
- With 50% of the States, 95% of the continental airspace is covered.
- The EUR region is characterised by a wide variety in the size of the continental airspace. Oceanic airspace and service provision is largely concentrated and provided by a small number of States, i.e., 3.

2022 - Continental Area: Total number of IFR flights controlled ( $=A12+A13+A14$ )(A11)



- Traffic in 2022 increased in comparison to previous years and the continued recovery of air transport from COVID19. However, across the year, traffic levels still were impacted by local and global post-pandemic impacts and geo-political developments.
- The average controlled IFR traffic across the region accounts to about 750.000 flights.
- About 50% of the total IFR flight hours are accrued by 7 States showing a continual return to the pre-pandemic concentration in a smaller number of States).
- In line with the overall IFR traffic in the European region, service provision varies across the States.
- Oceanic traffic (primarily long-range) international traffic increased with the global recovery of air traffic / connectivity.

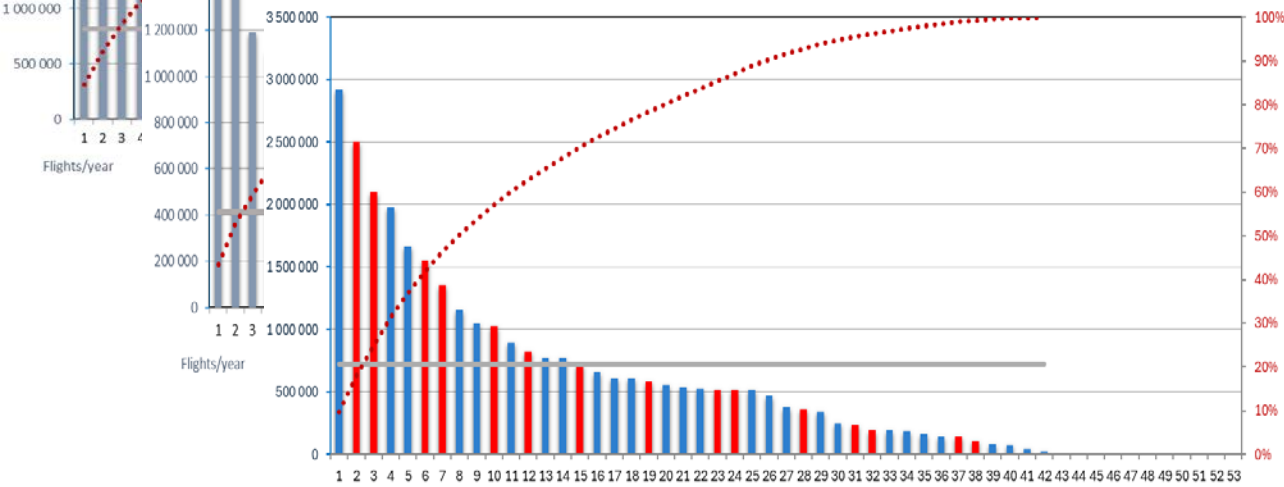
2019 - Continental Area: Total number of IFR flights controlled (=A12+A13+A14) (A11)



2021 - Continental Area: Total number of IFR flights controlled (=A12+A13+A14) (A11)



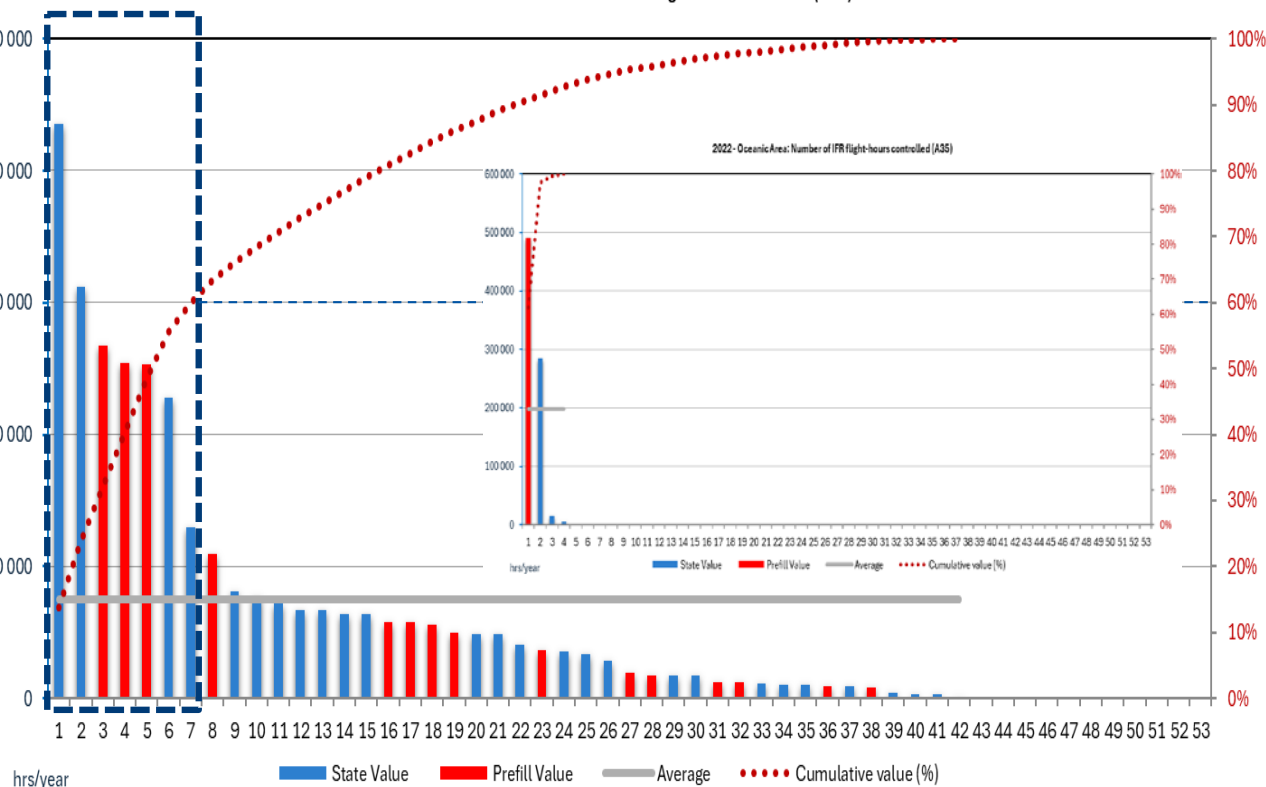
2022 - Continental Area: Total number of IFR flights controlled (=A12+A13+A14) (A11)



- Comparing traffic levels in 2019 vs 2021 and 2022, the overall recovery of air traffic becomes apparent.
- While in 2019 traffic ranged from just under 3.4 million flights to under 100,000 flights; the level per state increased following the decline in 2020 in 2021. In 2022, a further rebound can be seen.
- Total annual traffic ranged on average 55-85% of pre-pandemic levels across the region.
- This suggests a continual recovery of air transport demand across the EUR region.



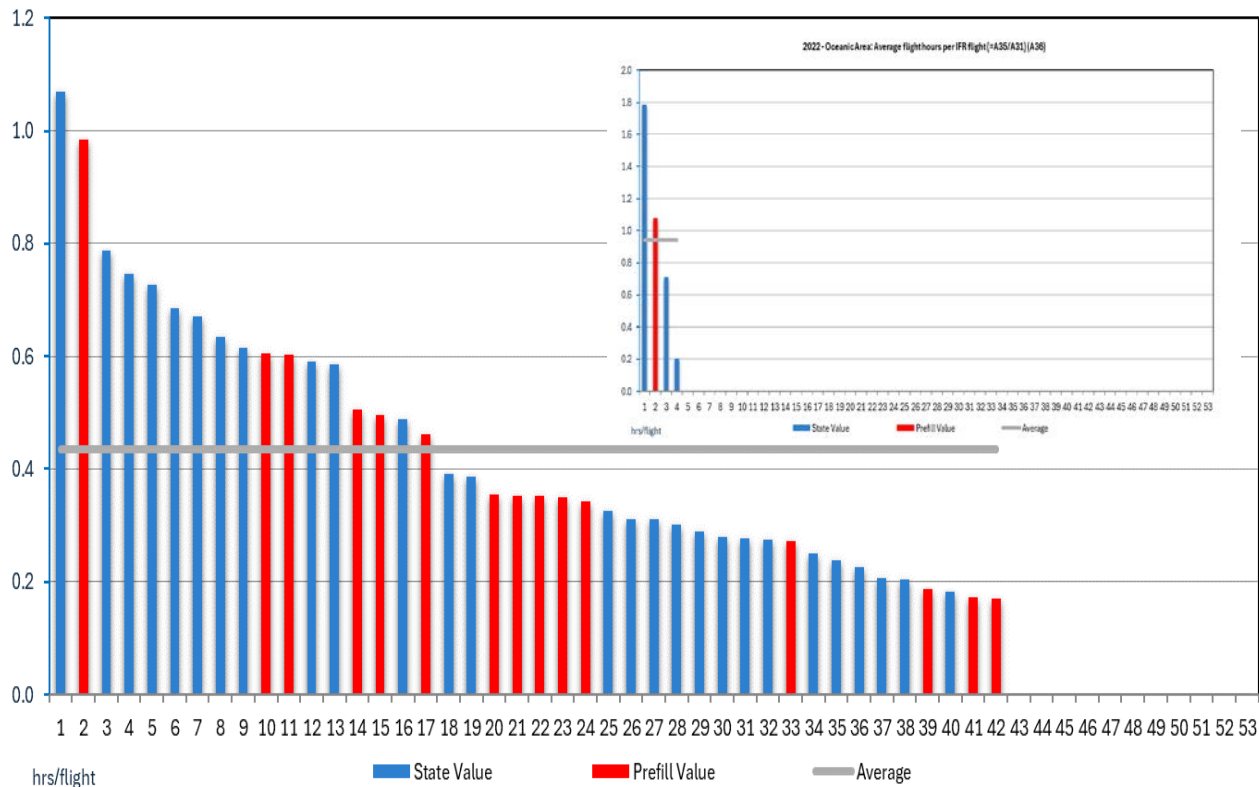
2022 - Continental Area: Number of IFR flight-hours controlled (A15)



- About 60% of the IFR flight hours within the continental airspace in 2022 is serviced by 7 participating States. Six of these States serviced more than 1 mio flight hours.
- The majority of States serviced at or below 400k flight hours in 2022.
- IFR hours are associated with the overall IFR traffic accounted by the States and the associated airspace (FIR) size
- The oceanic traffic is served by 3 States with 2 participating States handling the majority of the oceanic flights



2022 - Continental Area: Average flight hours per IFR flight (=A15/A11) (A18)



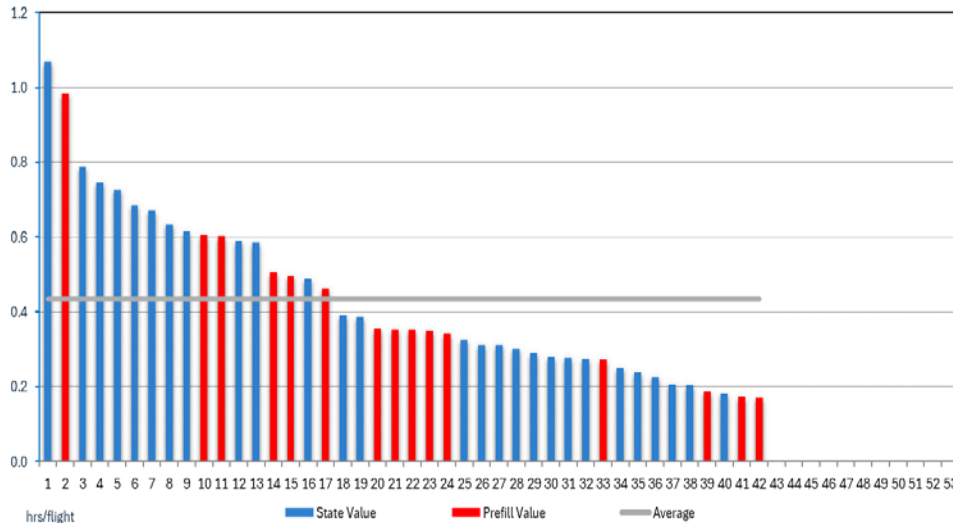
- Despite the higher number of participants and associated variety of the number of served traffic and respective airspace sizes, the average flight hour remained constant in comparison to the previous year and ranges now around 0.45 min/flight.
- About half of the participating States observed an average flight hours per flight of under half an hour. This is strongly correlated with the size of the national airspace volume.



2019 - Continental Area: Average flight hours per IFR flight (=A15/A11) (A18)

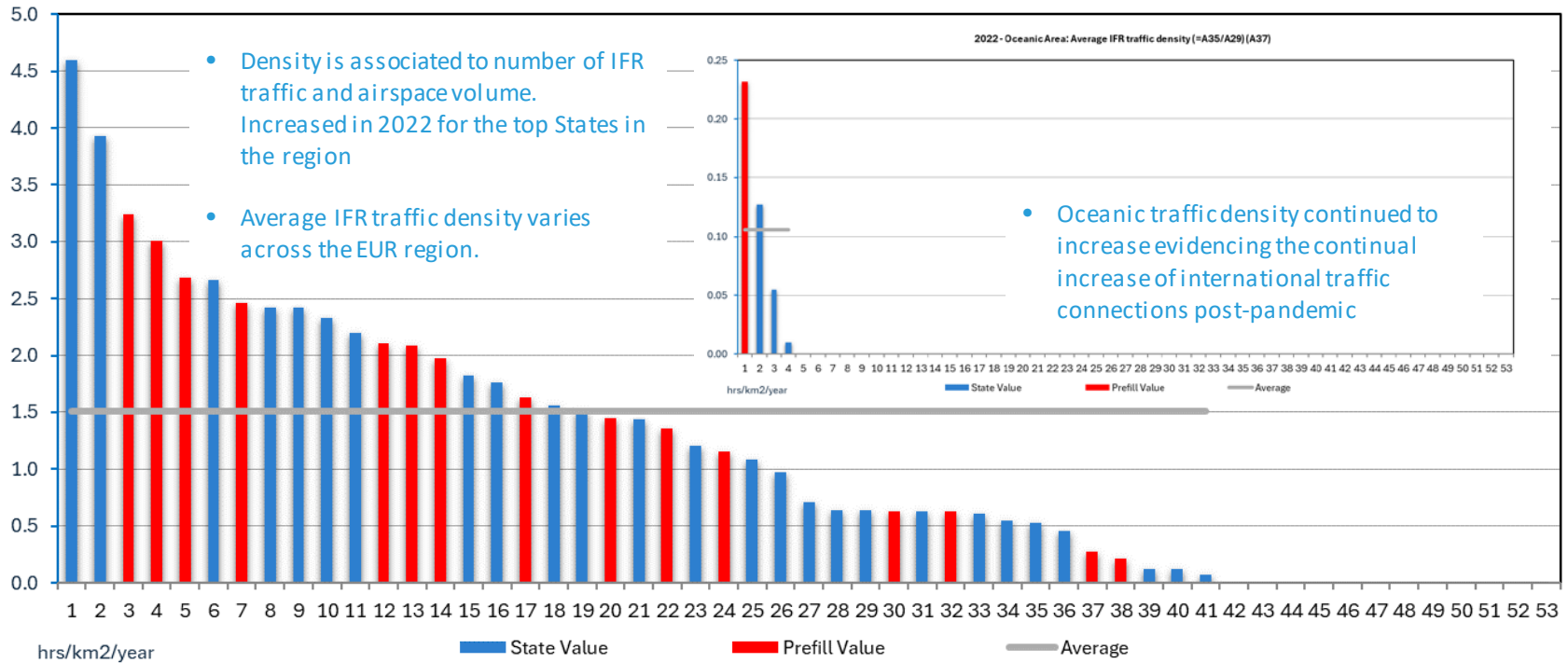


2022 - Continental Area: Average flight hours per IFR flight (=A15/A11) (A18)

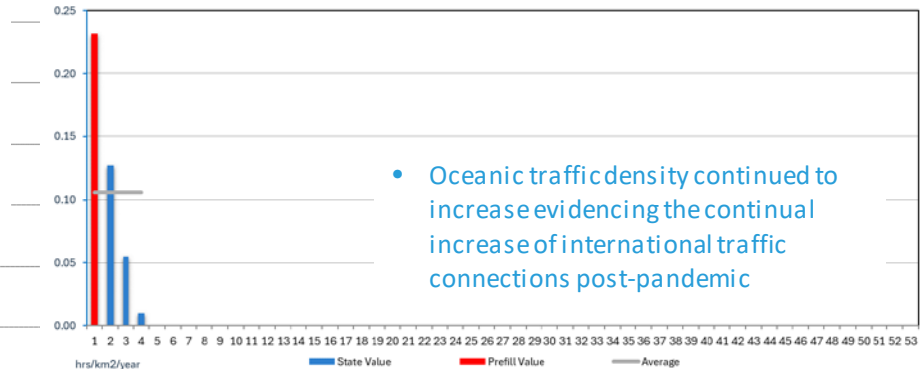


- Comparing average flight hours per IFR flight in 2019 vs 2022 – average flight hours are consistent with the pre-pandemic years.
- On average the average flight hour per IFR flight ranges around 4.5 min/flight – similar to 2019.
- On a per country basis, the observed average flight hour per flight, however, ranges in the same order of magnitude.

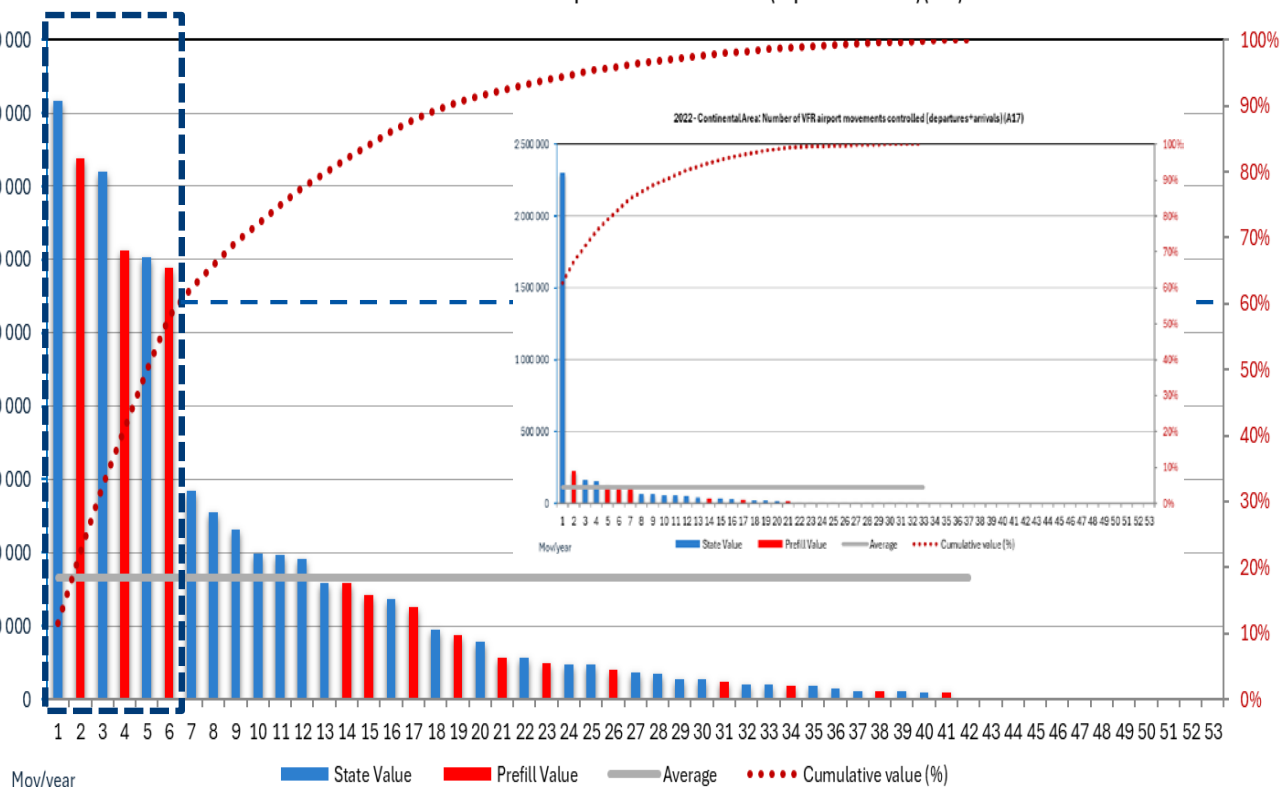
2022 - Continental Area: Average IFR traffic density (=A15/A9) (A19)



2022 - Oceanic Area: Average IFR traffic density (=A35/A29) (A37)

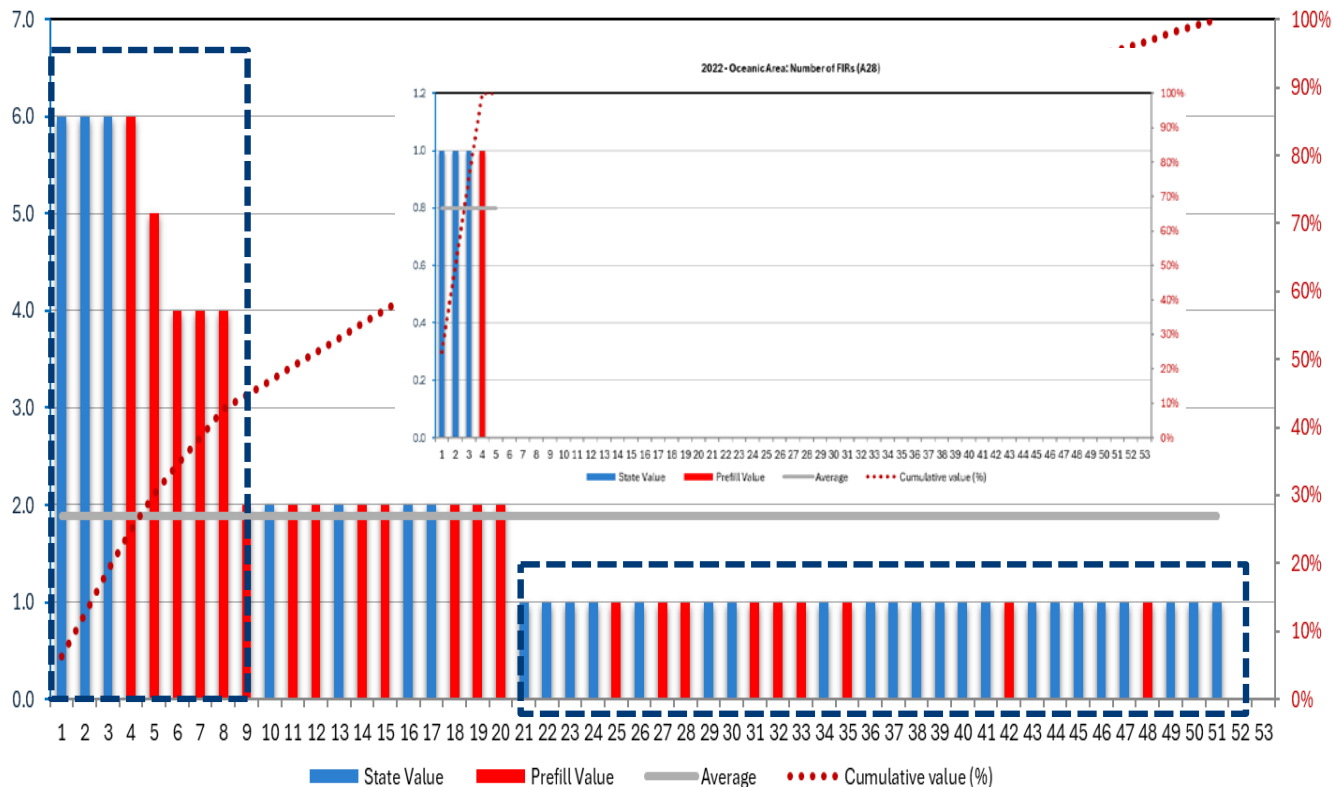


2022 - Continental Area: Number of IFR airport movements controlled (departures+arrivals) (A16)



- Traffic changes observed at the national airport level follow the overall traffic developments in 2022 vs 2020.
- These traffic levels may vary widely locally as traffic recovery at several airports, depends on various factors.
- A concentration of airport IFR movements is observable. 60% of all movements were observed within 6 reporting States. The average national number of IFR airport movements ranges around 350.000 while the top 3 States observed airport movement numbers higher than a factor of 4 ( ranging about +/- 1.000.000 flights higher).
- VFR movements were concentrated within a smaller number of States within the European region.

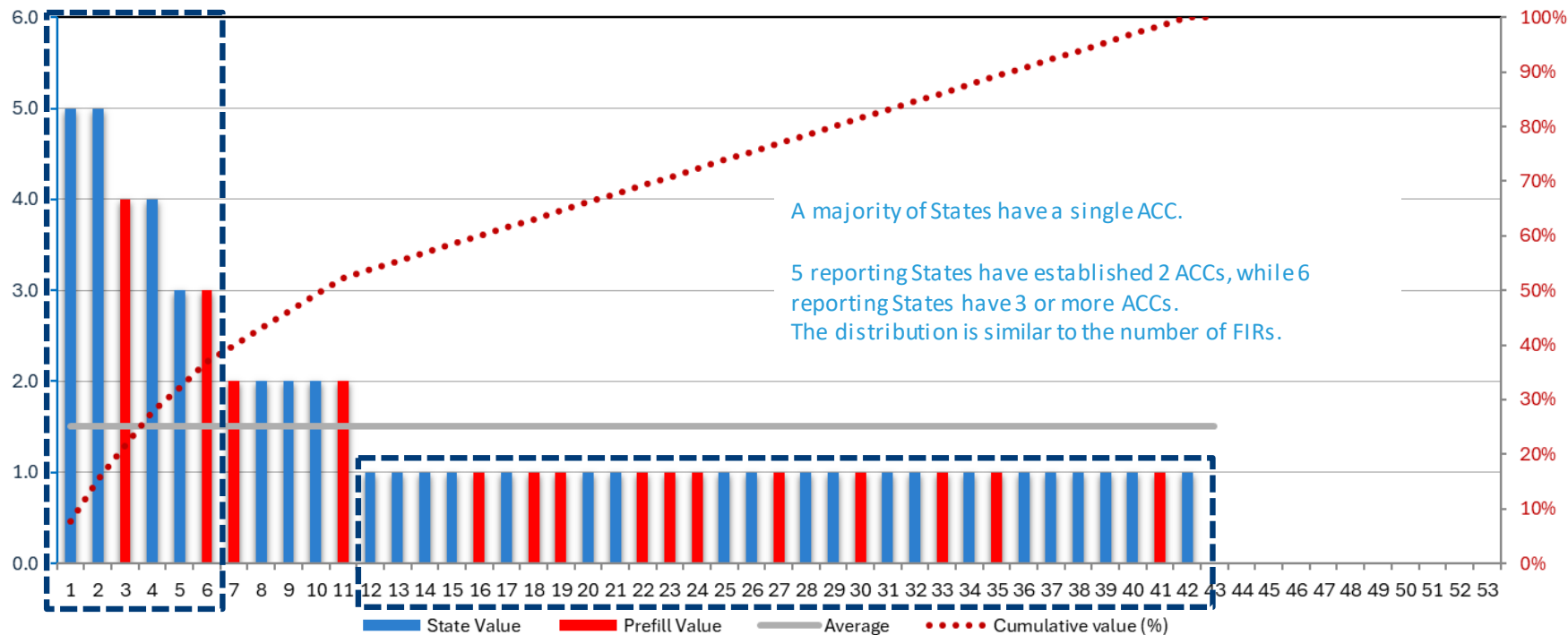
2022- Continental Area: Number of FIRs (A8)



- More than half of the States have a single continental FIR. A smaller number has 2 (often a division between upper and lower), while 8 reporting States have 4 or more FIRs.
- The number of FIRs is associated with volume of airspace and number of control units.
- Oceanic service provision is typically organised in 1 FIR.

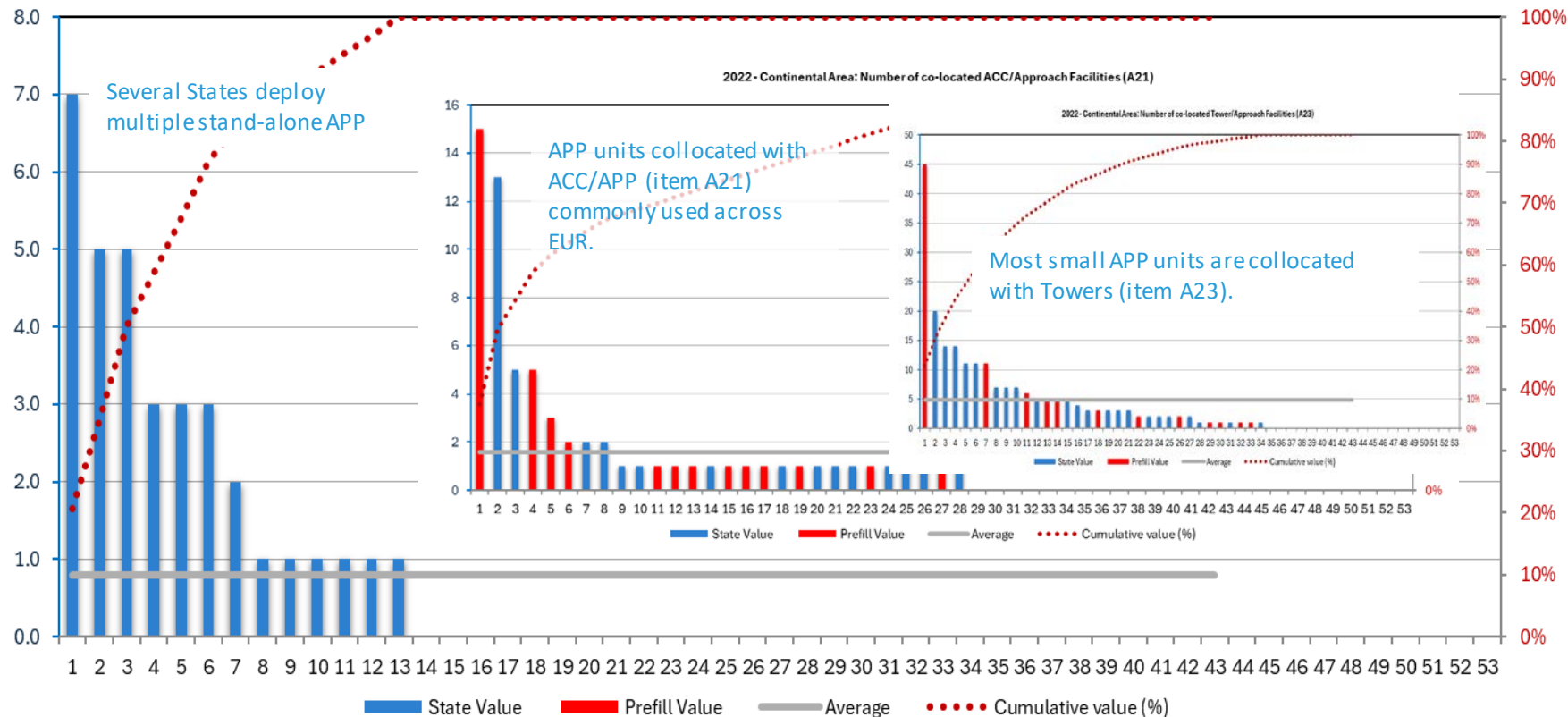


2022 - Continental Area: Number of ACCs (A20)

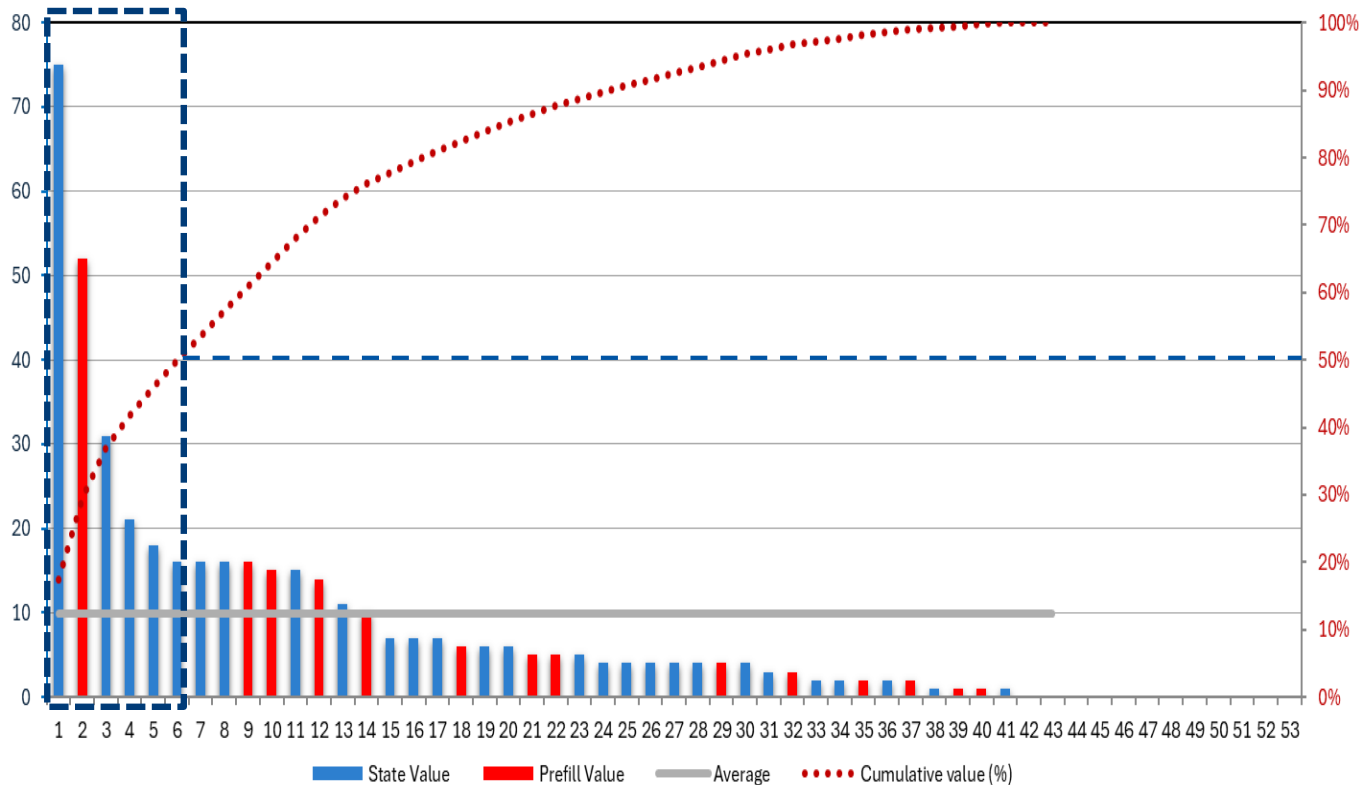




2022 - Continental Area: Number of Approach Control Facilities (A22)



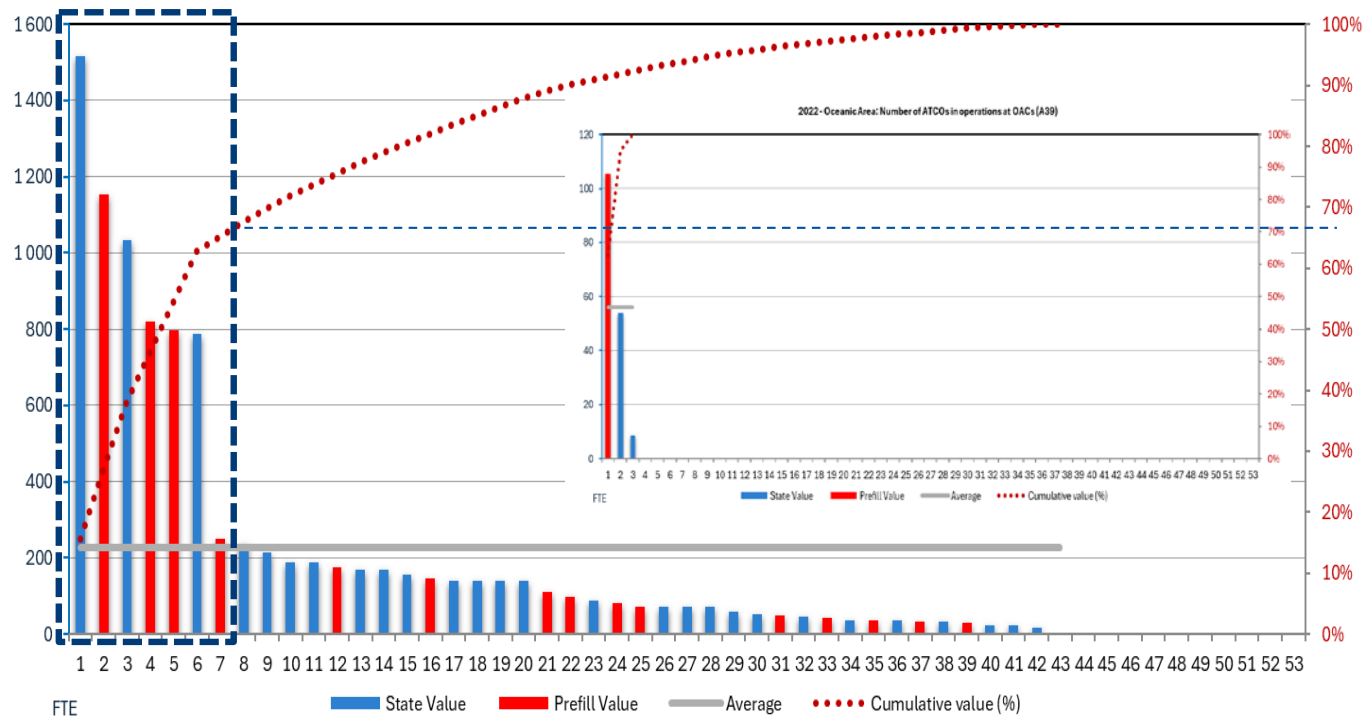
2022 - Continental Area: Number of stand-alone Towers (A24)



- The top-6 States account for 50% of all Towers in the EUR Region.
- The remaining States operate under 20 towers.
- The average number of stand-alone towers per State is 10.

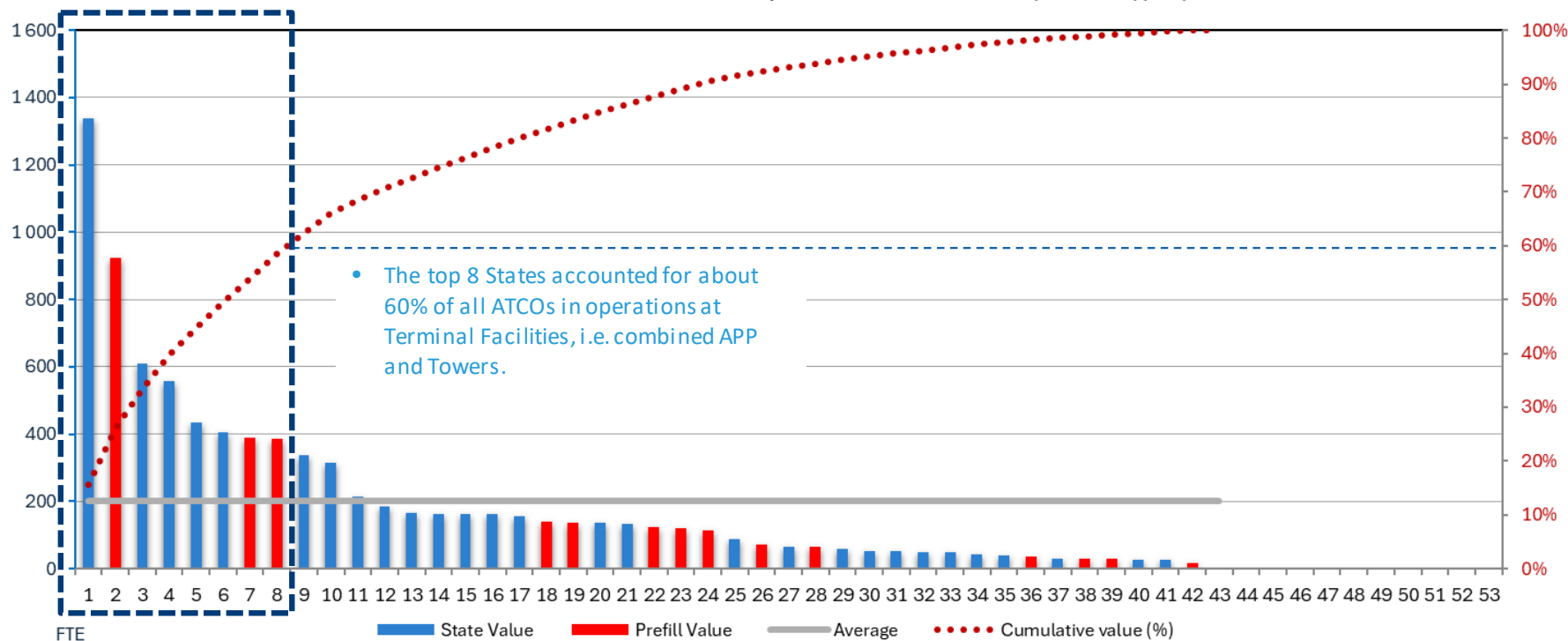


2022 - Continental Area: Number of ATCOs in operations at ACCs (A26)



- Just under two-third of all ATCOs in operations at ACCs are deployed in 7 reporting States.
- There is only a small subset of States operating oceanic traffic with associated staffing levels.

2022 - Continental Area: Number of ATCOs in operations at Terminal Facilities (APP+TWRs) (A27)





## Performance data (Table B)



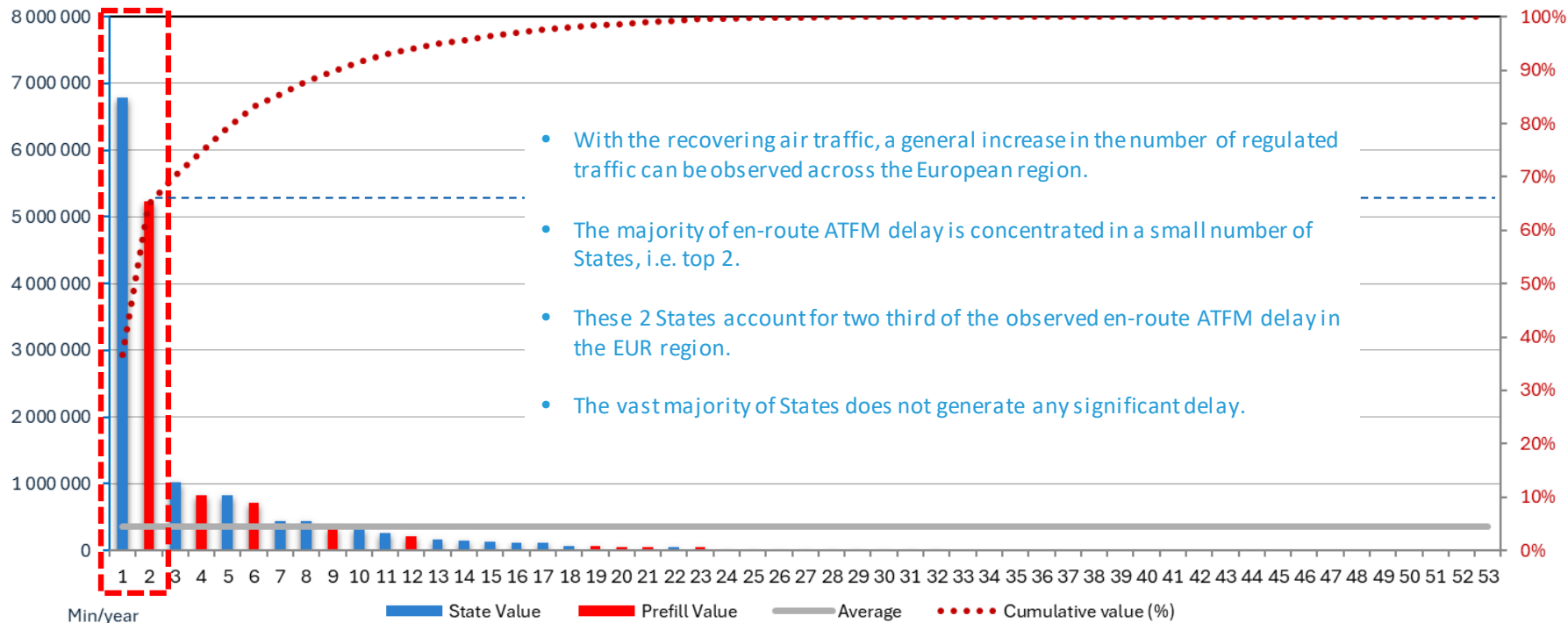
KPA	Capacity
Objective	Ensure that Air Navigation Service capacity meets demand in en-route airspace and at airports
Indicators	<ul style="list-style-type: none"><li>- Average ATFM delay per flight generated by the airspace volume (en-route)</li><li>- Average ATFM delay per flight in the main airports (to be identified by States in advance and based on the regional relevance)</li></ul>

# Please note

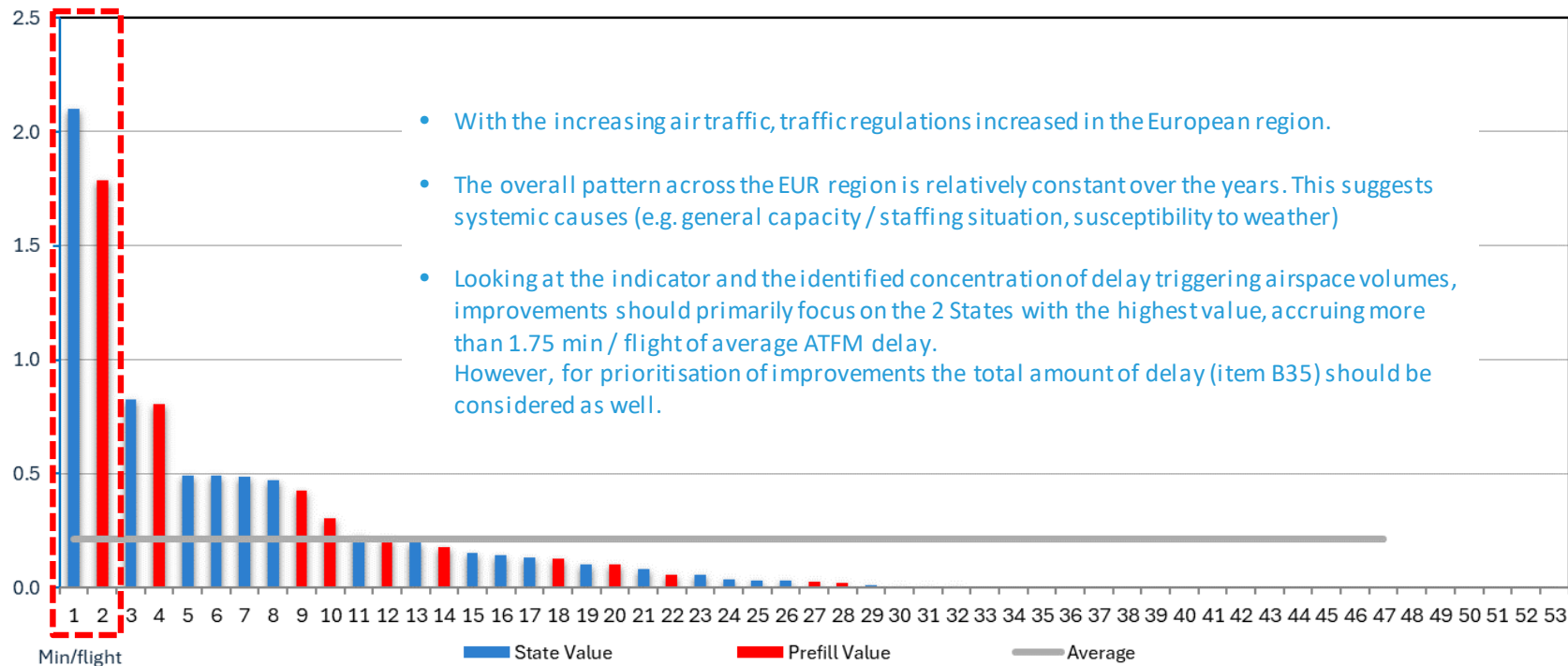
- Indicators measure
  - The location where the problem (capacity bottleneck) is, not where the delay is taken (departure airport)
  - Performance of airspace volumes and airports, not flights
    - Despite the expression as a value “per flight”
  - Within the Capacity KPA
    - Demand/capacity imbalance
    - Not capacity itself
- Limitations
  - Not designed to measure excess capacity
  - No data if airspace or airport does not participate in a centralised ATFM process

Capacity		
En-route ATFM delays (continental airspace)		
B35	Total en-route ATFM delay generated in the State (all causes) (=B37+B38+B39+B40)	Min/year
B36	Average ATFM delay per flight (=B35/A11)	Min/flight
B37	En-route ATFM delay generated in the State (ATC capacity causes)	Min/year
B38	En-route ATFM delay generated in the State (ATC other causes)	Min/year
B39	En-route ATFM delay generated in the State (Weather causes)	Min/year
B40	En-route ATFM delay generated in the State (All other causes)	Min/year
B35b	En-route ATFM delay generated in the State (Cause unknown, use only if B37, B38, B39 & B40 not available)	Min/year
Airport ATFM delays		
	Airport identifier	ICAO code
B41	Total number of IFR arrivals at the airport	Arrivals/year
B42	Total airport ATFM delay generated by the airport (all causes) (=B44+B45+B46+B47)	Min/year
B43	Average ATFM delay per arrival (=B42/B41)	Min/arrival
B44	Airport ATFM delay generated by the airport (ATC & aerodrome capacity causes)	Min/year
B45	Airport ATFM delay generated by the airport (ATC other causes)	Min/year
B46	Airport ATFM delay generated by the airport (Weather causes)	Min/year
B47	Airport ATFM delay generated by the airport (All other causes)	Min/year
B42b	Airport ATFM delay generated by the airport (Cause unknown, use only if B44, B45, B46 & B47 not available)	Min/year

2023 - Continental Area: Total en-route ATFM delay generated in the State (all causes) (=B37+B38+B39+B40) (B35)



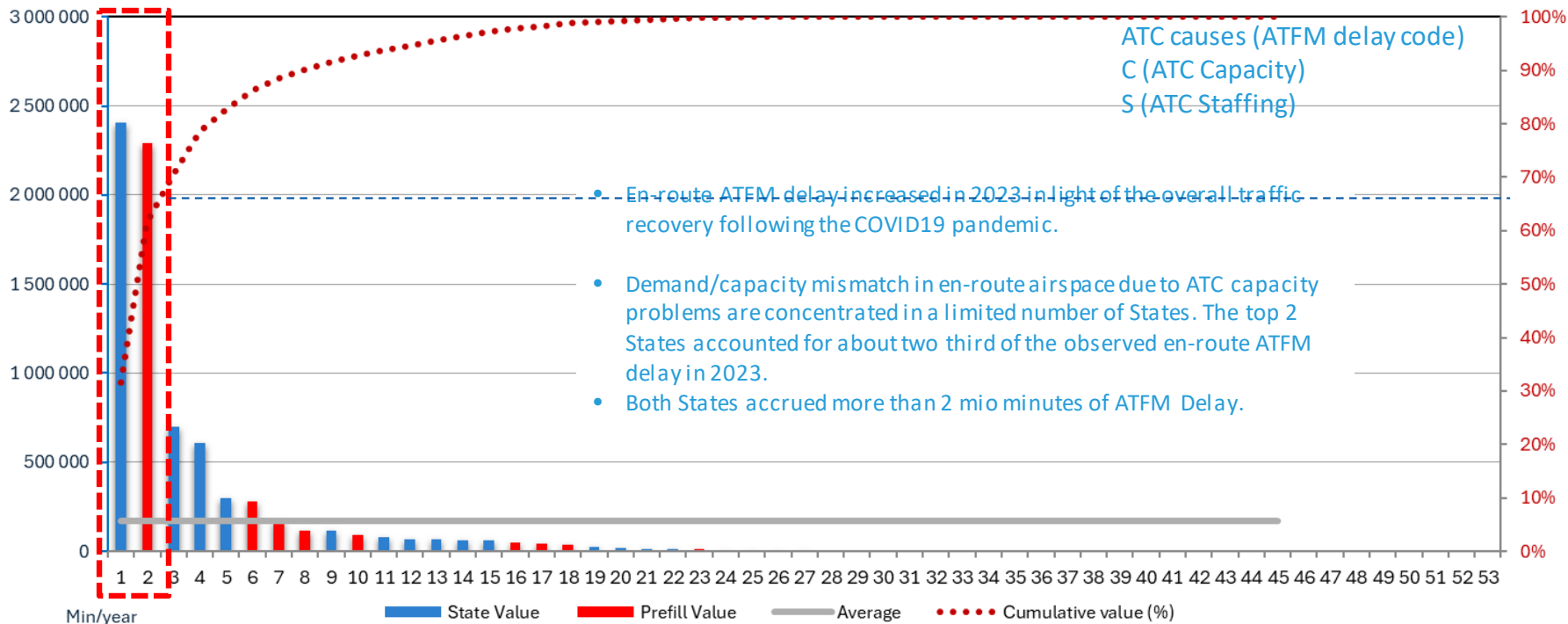
2023 - Continental Area: Average ATFM delay per flight (=B35/A11)(B36)

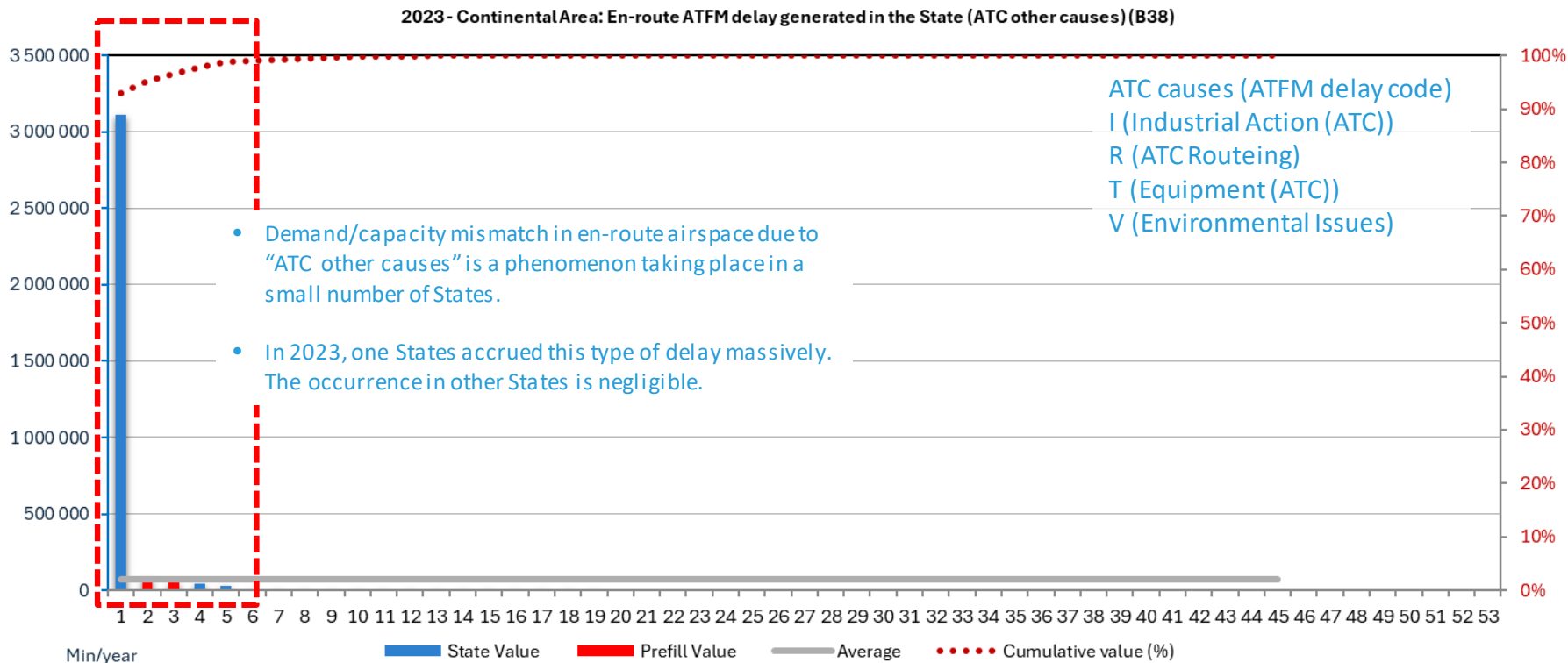


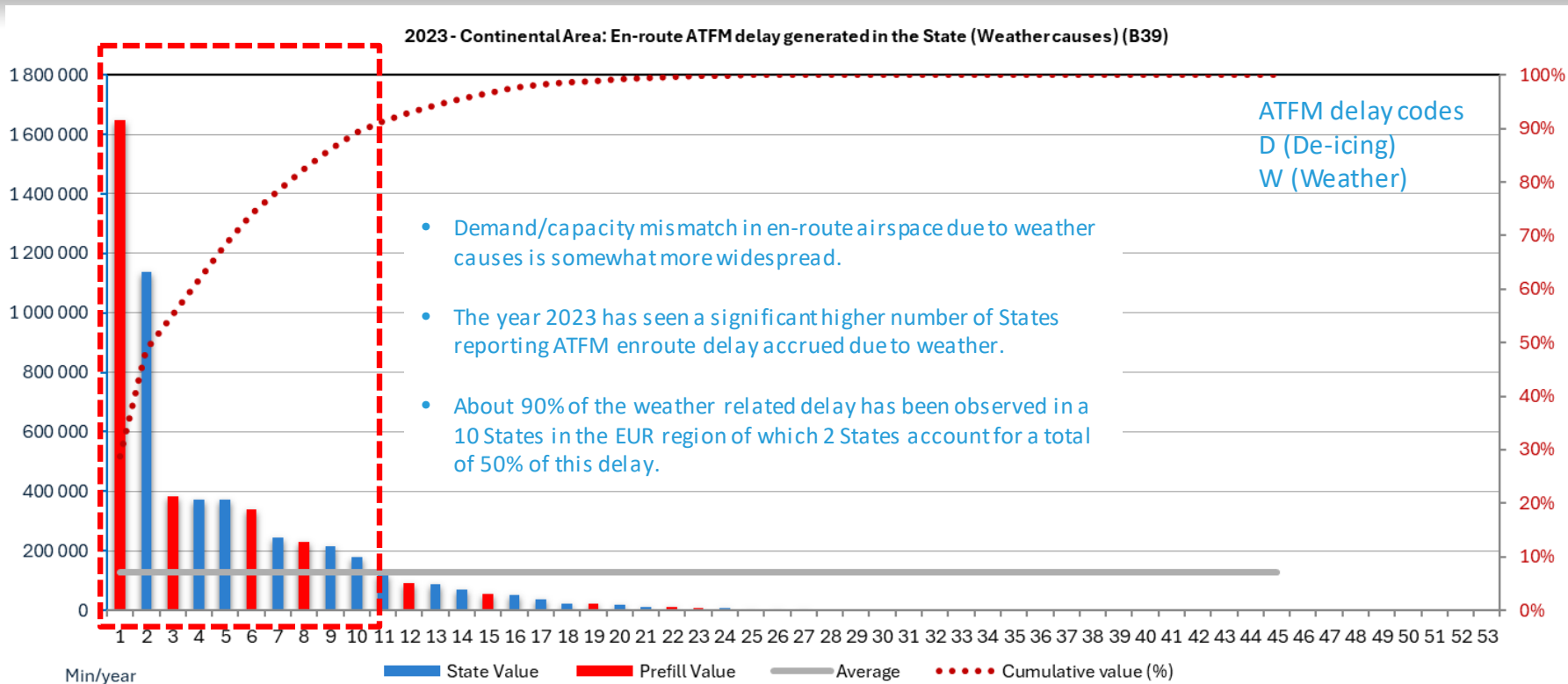
- With the increasing air traffic, traffic regulations increased in the European region.
- The overall pattern across the EUR region is relatively constant over the years. This suggests systemic causes (e.g. general capacity / staffing situation, susceptibility to weather)
- Looking at the indicator and the identified concentration of delay triggering airspace volumes, improvements should primarily focus on the 2 States with the highest value, accruing more than 1.75 min / flight of average ATFM delay. However, for prioritisation of improvements the total amount of delay (item B35) should be considered as well.



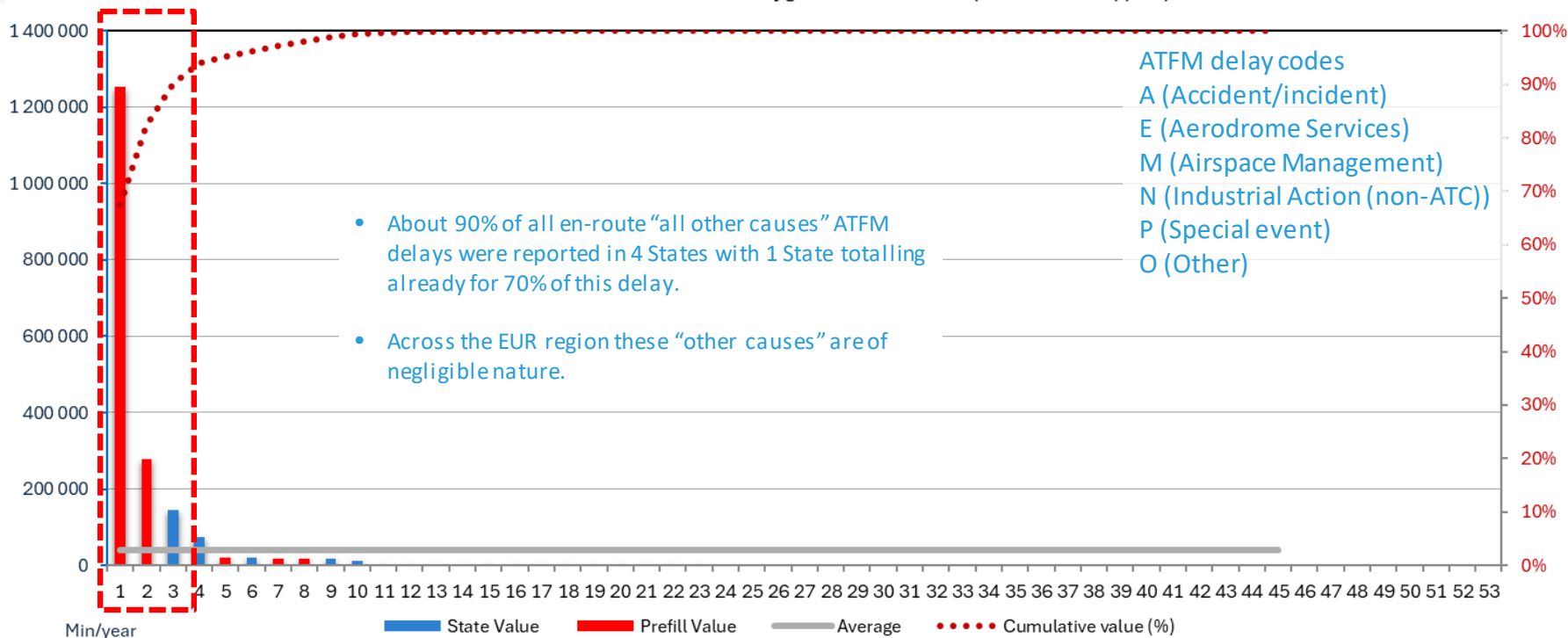
2023- Continental Area: En-route ATFM delay generated in the State (ATC capacity causes) (B37)







2023 - Continental Area: En-route ATFM delay generated in the State (All other causes) (B40)

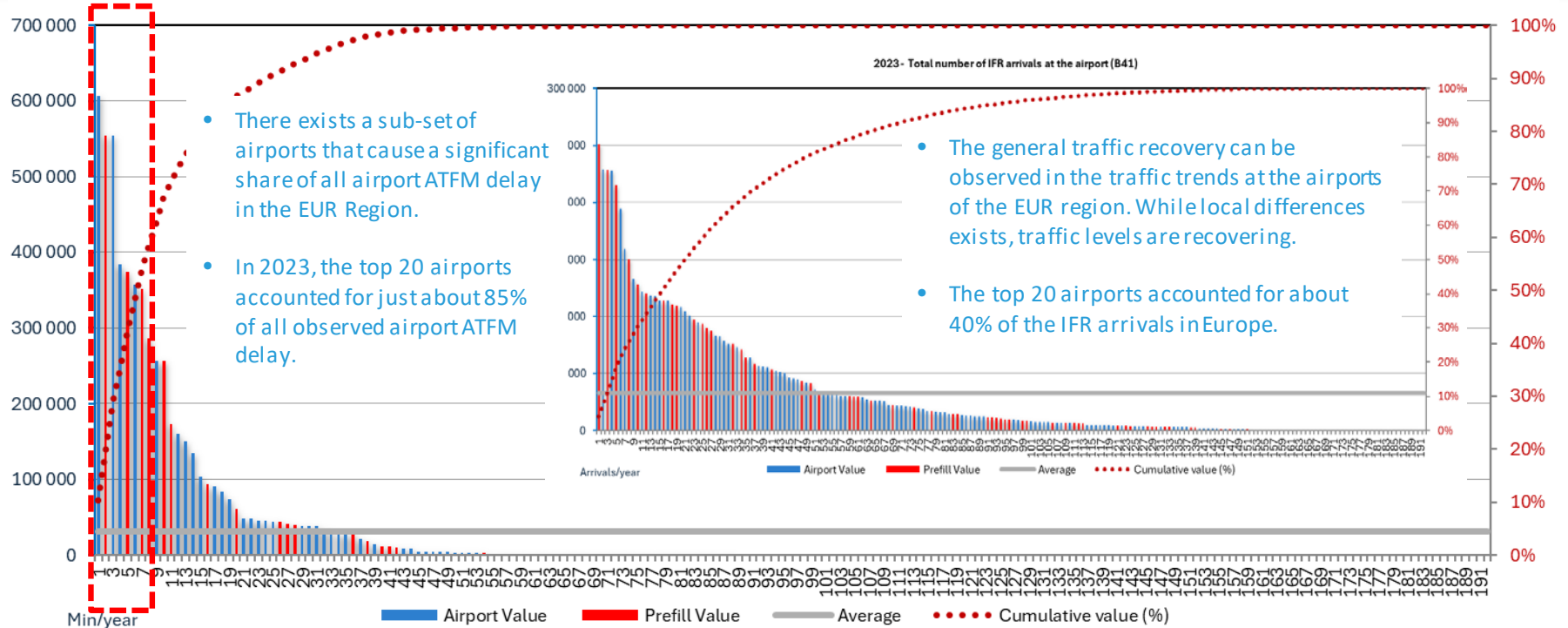


2023 - Total airport ATFM delay generated by the airport (all causes) (=B44+B45+B46+B47) (B42)

- There exists a sub-set of airports that cause a significant share of all airport ATFM delay in the EUR Region.
- In 2023, the top 20 airports accounted for just about 85% of all observed airport ATFM delay.

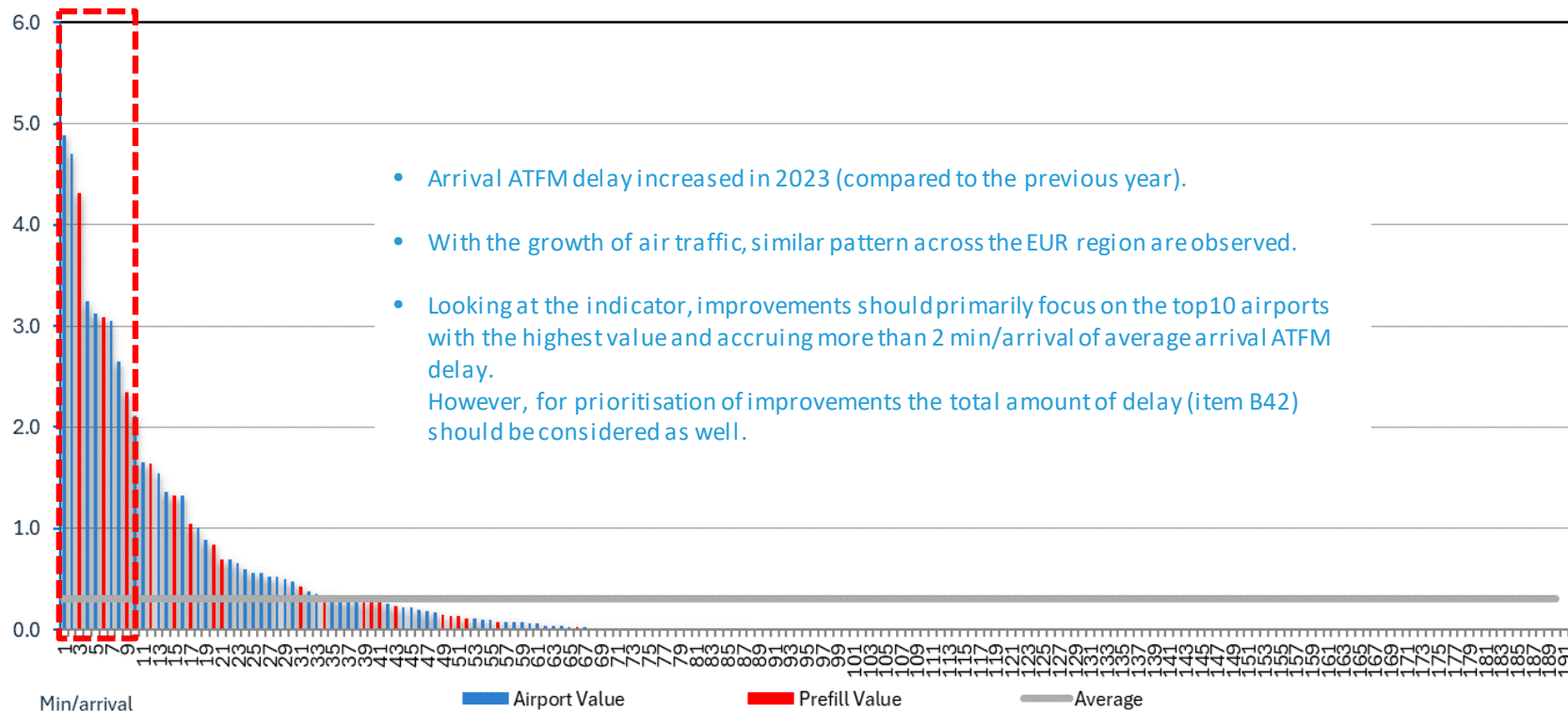
2023 - Total number of IFR arrivals at the airport (B41)

- The general traffic recovery can be observed in the traffic trends at the airports of the EUR region. While local differences exists, traffic levels are recovering.
- The top 20 airports accounted for about 40% of the IFR arrivals in Europe.

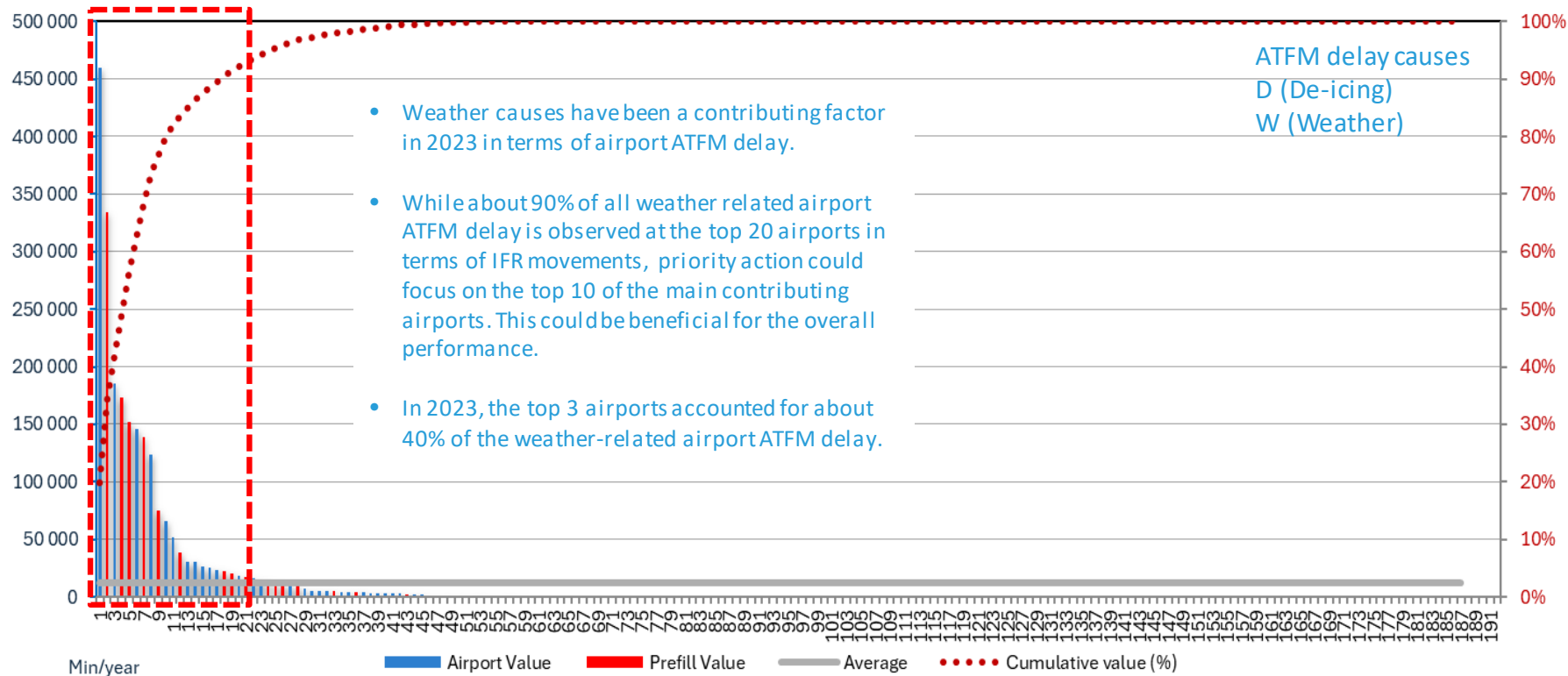


8 airports are causing 50% of all airport ATFM delay in the EUR Region.

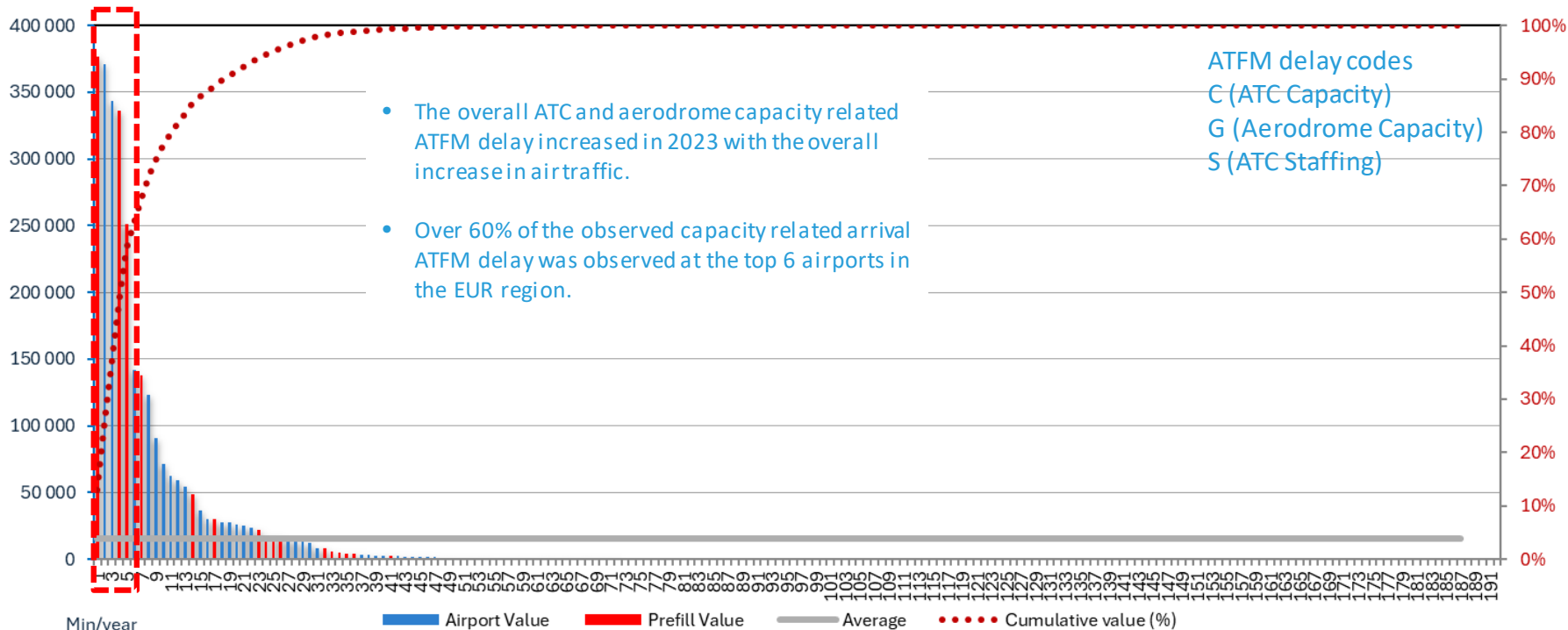
2023 - Average ATFM delay per arrival (=B42/B41)(B43)



2023 - Airport ATFM delay generated by the airport (Weather causes)(B46)

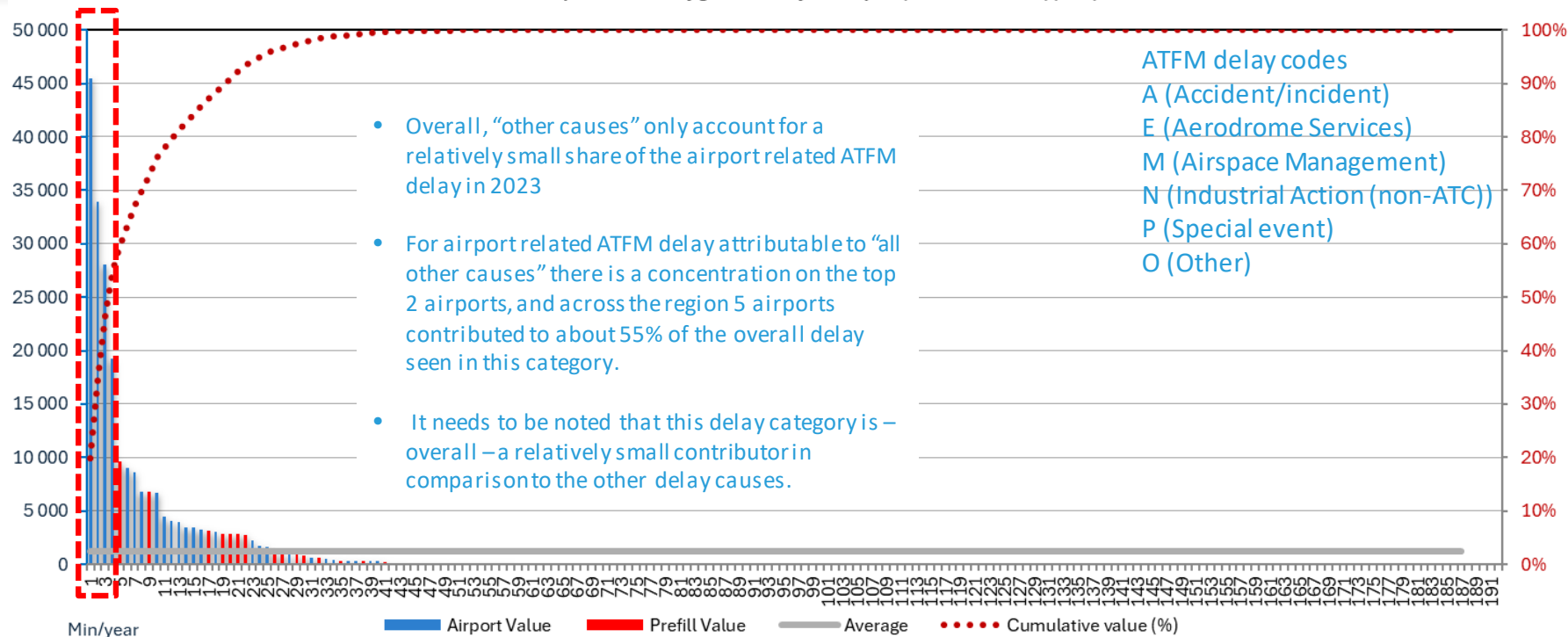


2023 - Airport ATFM delay generated by the airport (ATC & aerodrome capacity causes) (B44)

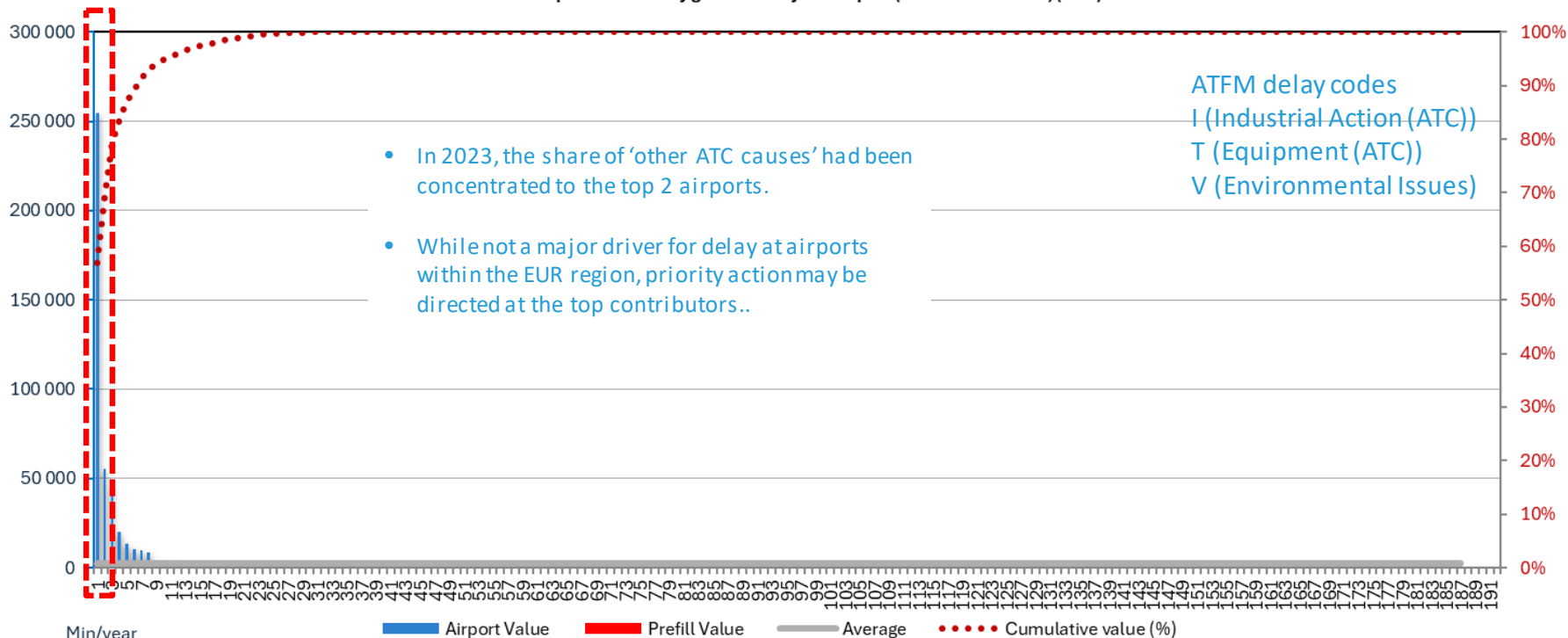




2023 - Airport ATFM delay generated by the airport (All other causes) (B47)



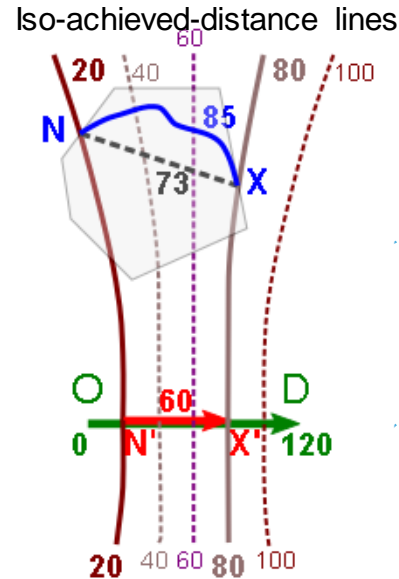
2023 - Airport ATFM delay generated by the airport (ATC other causes) (B45)



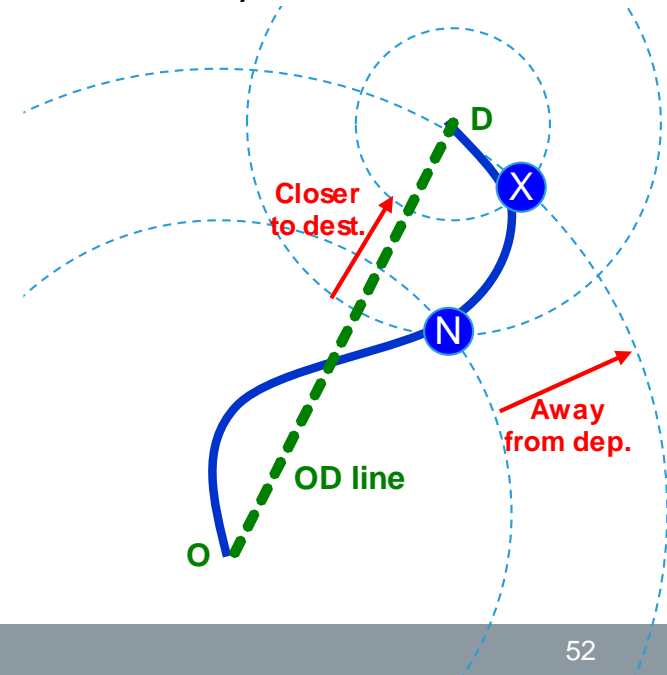
On average, ATC other causes is the smallest contributor to airport ATFM delay

KPA	Efficiency
Objective	Ensure that users [can?] use the most efficient routes – focussing on the horizontal flight-efficiency
Indicator	Average horizontal en route flight efficiency, defined as the difference between the length of the en route part of the actual trajectory (where available) or last flight planned route and the great circle.

- O, D, N, X: **O**rigin, **D**estination, **eN**try, **eX**it
- “Corresponding portion of the great circle distance OD” = **achieved distance N’X’** (needed to calculate the indicator at State level)
- Calculation of **achieved distance N’X’** for flight segment NX:  
(distance-closer-to-destination + distance-away-from-departure)/2
- Important properties
  - Sum of achieved distances of flight segments is always equal to total direct (great circle) distance from O to D
  - Actual, achieved and excess distances for flight segments are aggregatable (bottom-up from State level to regional level)



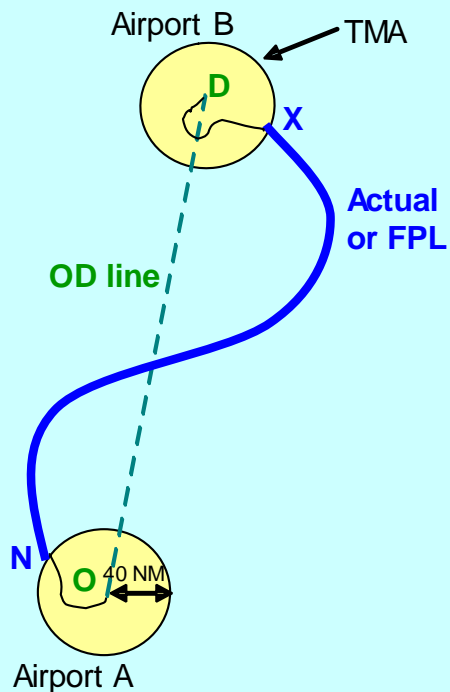
In the example to the left:  
 Extra distance:  $85 - 60 = 25$   
 Inefficiency =  $25 / 60 = 0.42 = 42\%$



# Processing of domestic flights and overflights

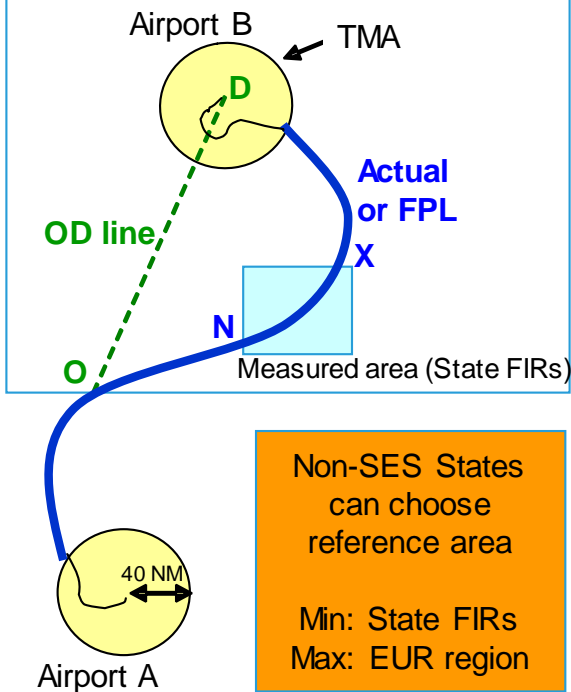
## Domestic flight

Measured area (State FIRs)



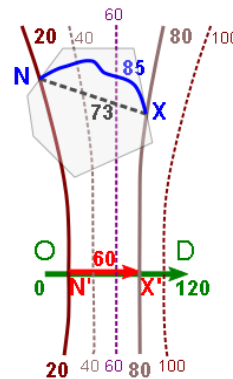
## Overflight

Reference area (eg EUR region)



Non-SES States  
can choose  
reference area

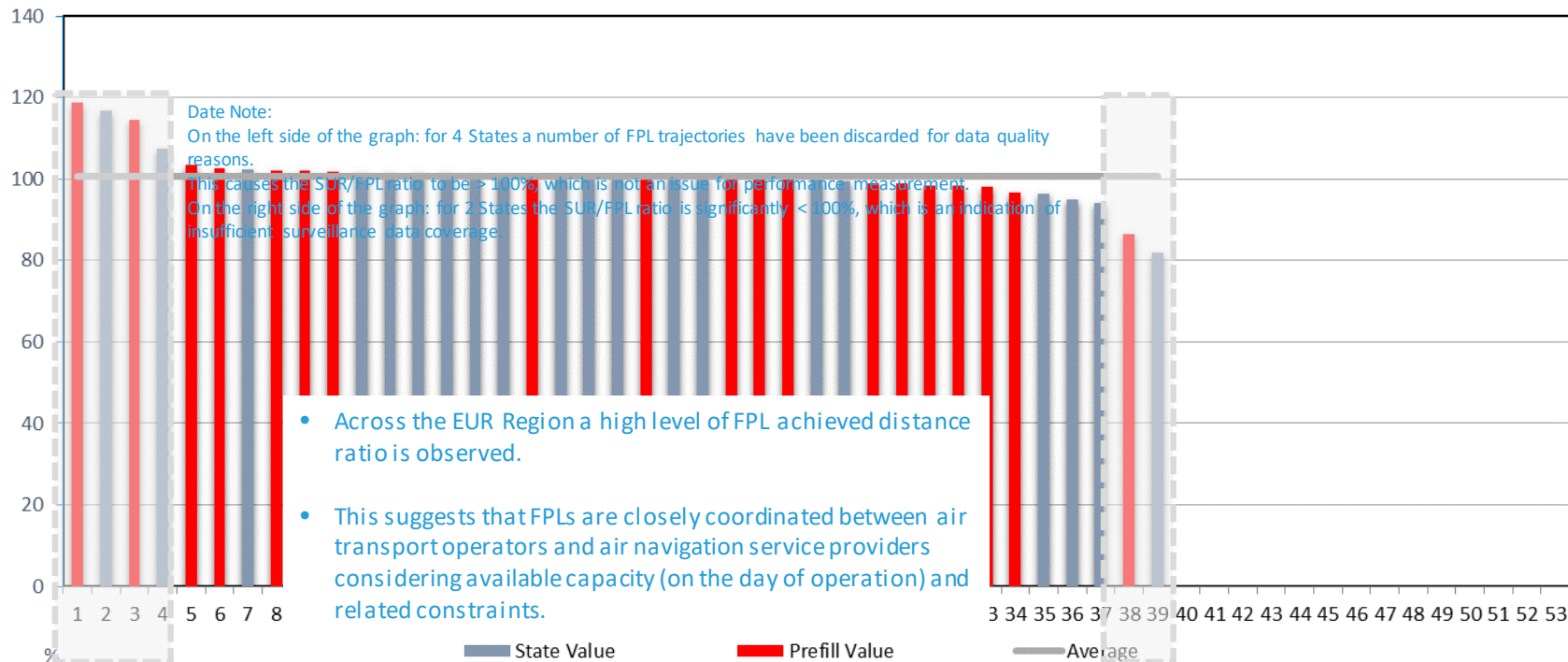
Min: State FIRs  
Max: EUR region



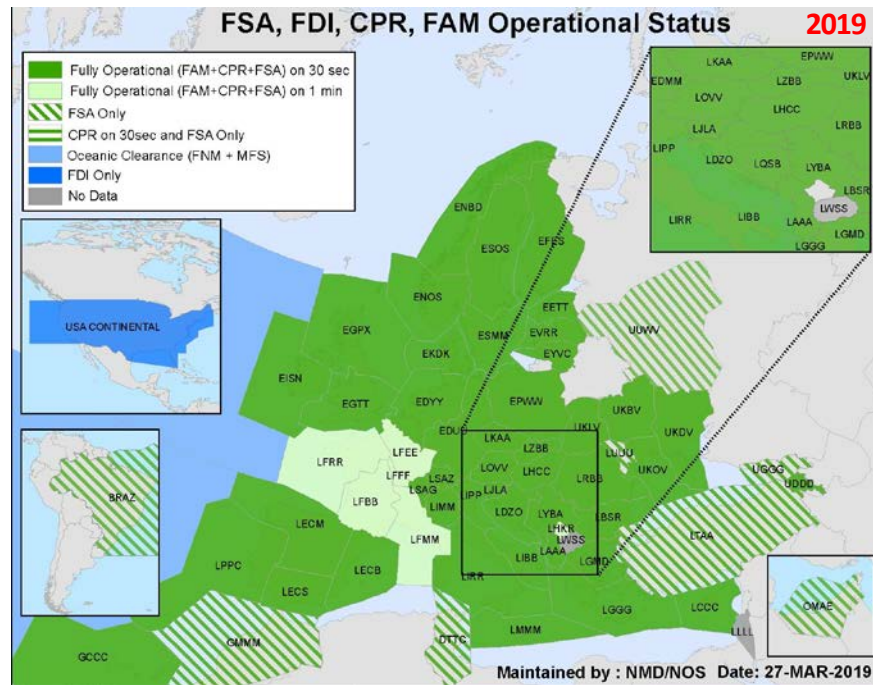
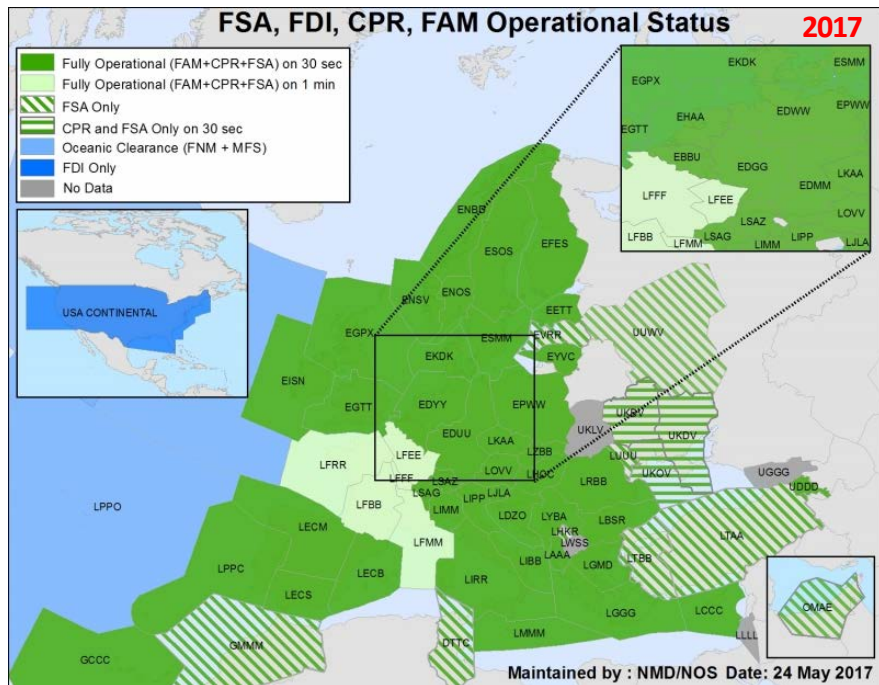
- Required inputs: Trajectory and the coordinates of points O, D, N, X (Origin, Destination, eNtry, eXit)
- Computed: Trajectory distance (NX), achieved distance (N'X')
- For the NX parts of all trajectories of IFR flights domestic, departing, arriving, or overflying IFR flights

Flight Efficiency		
	Horizontal en-route flight efficiency	
B48	Name of selected reference area (provide list of FIRs in annex)	Text
B50fpl	Total planned IFR distance (flight plan)	km/year
B51fpl	Total achieved IFR distance (flight plan)	km/year
B50sur	Total actual IFR distance (surveillance data)	km/year
B51sur	Total achieved IFR distance (surveillance data)	km/year
B49	Data source for B50 - B53 (surveillance data or flight plan)	SUR or FPL
B49b	SUR/FPL achieved distance ratio (<95% = incomplete coverage)	%
B50	Total flown IFR distance	km/year
B51	Total achieved IFR distance	km/year
B52	Total extra IFR distance (=B50 - B51)	km/year
B53	Horizontal en-route flight efficiency (=B52/B51)	%

**SUR/FPL achieved distance ratio (<95% = incomplete coverage) (B49b)**

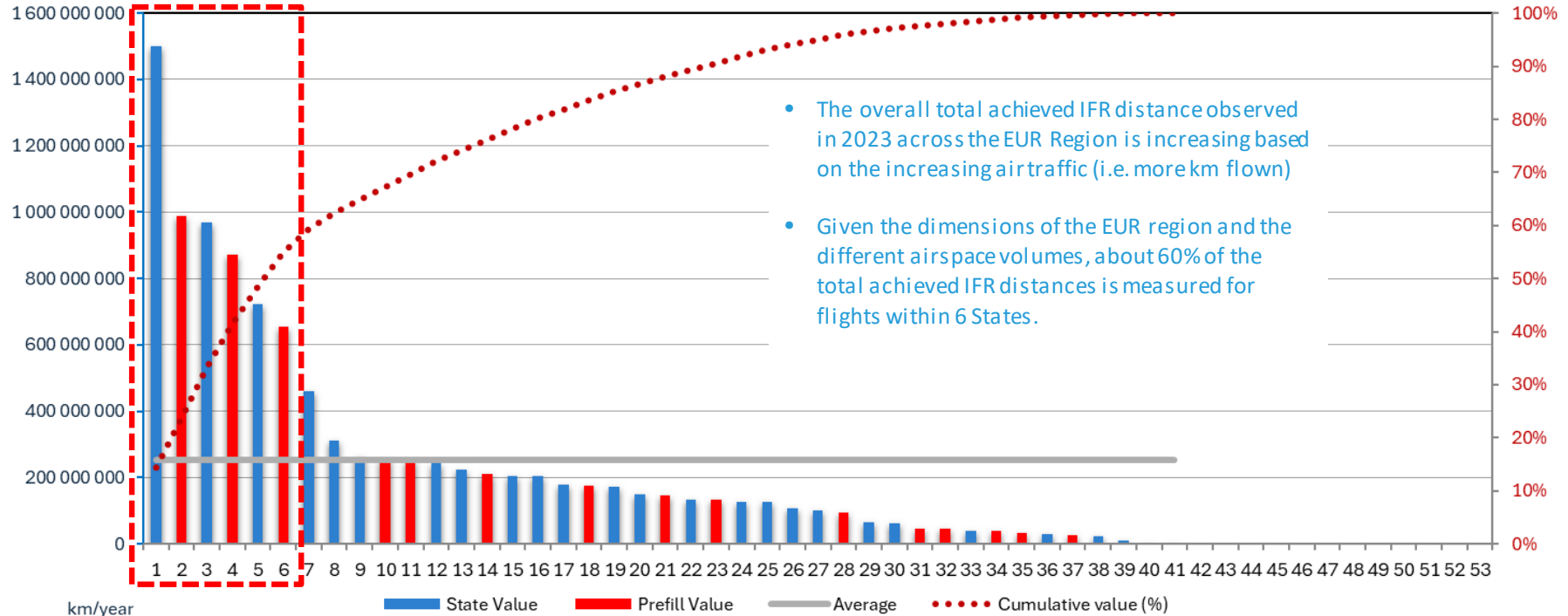


# Surveillance data (CPR) coverage



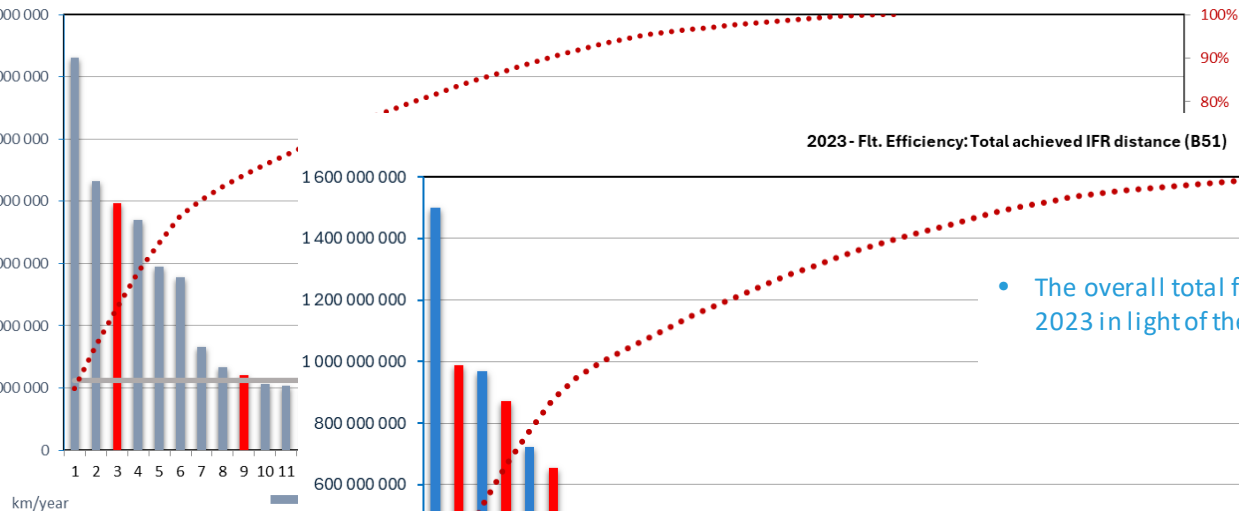


2023 - Flt. Efficiency: Total achieved IFR distance (B51)

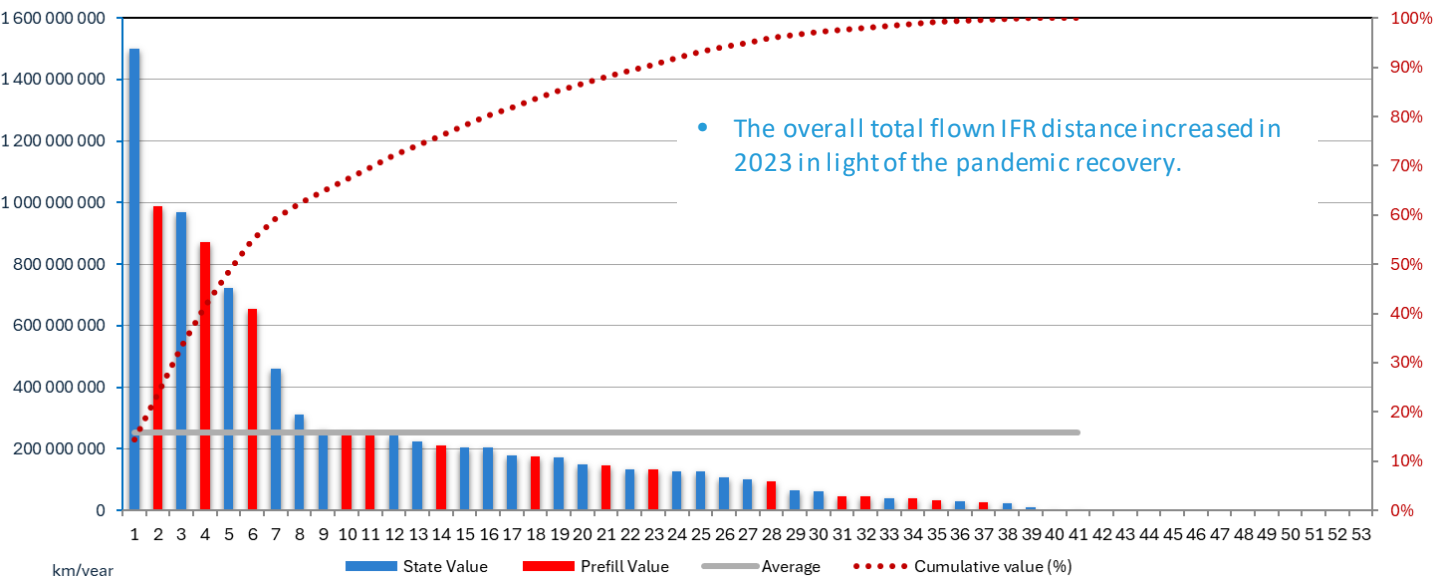


Note: Total achieved IFR distance := contribution to the great circle distance of the flights

2020 - Flt. Efficiency: Total flown IFR distance (B50)



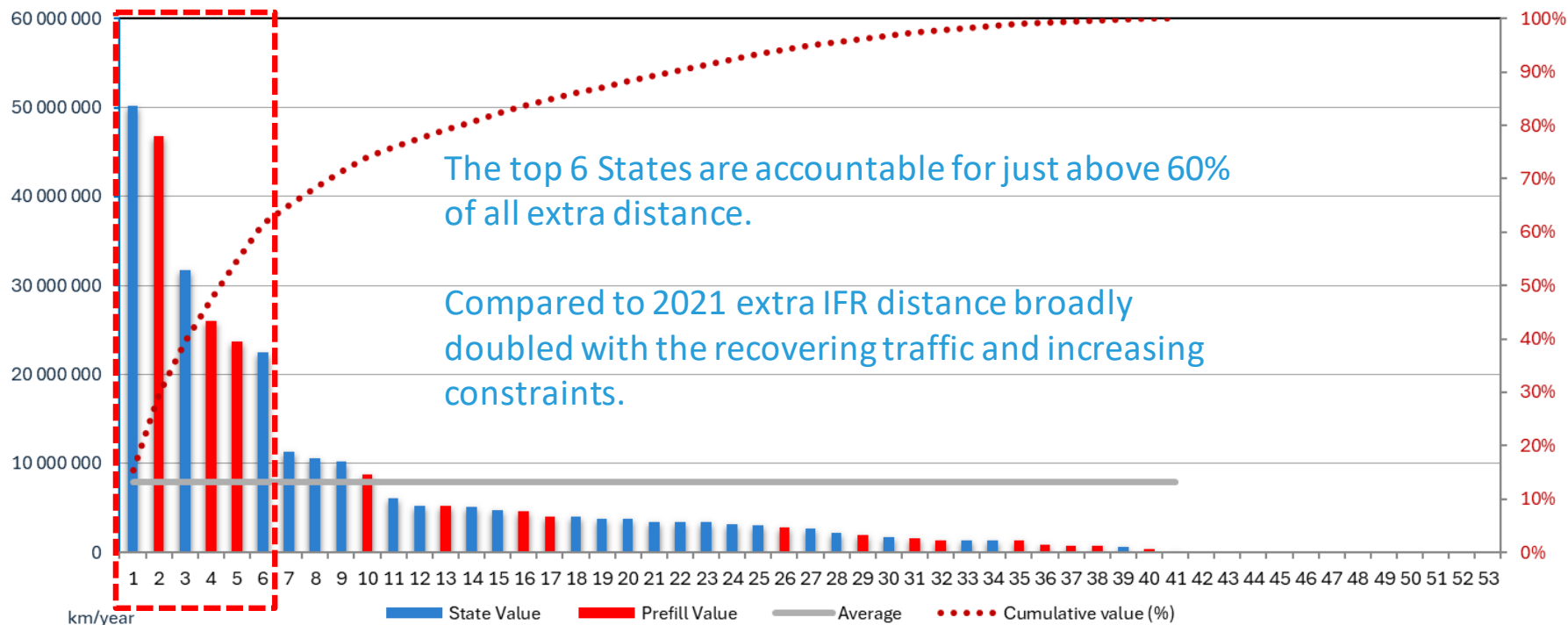
2023 - Flt. Efficiency: Total achieved IFR distance (B51)



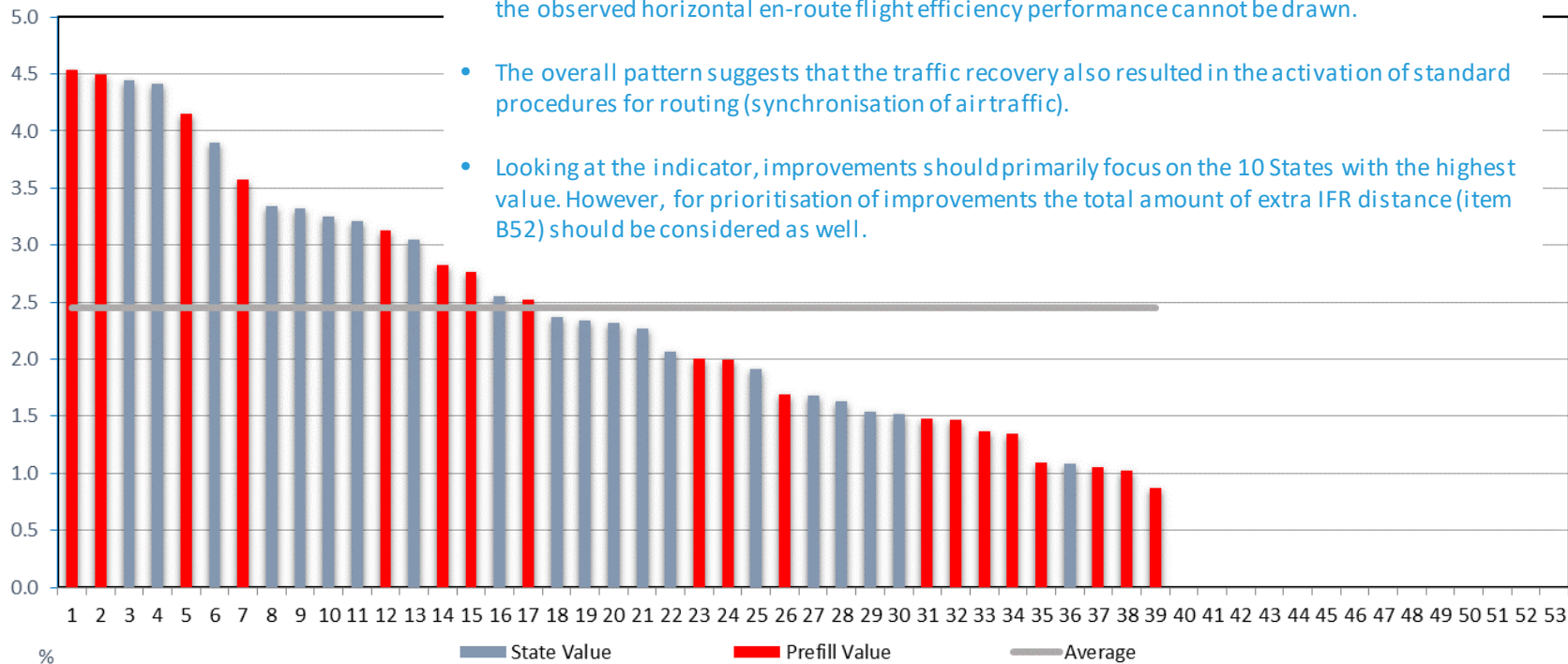
- The overall total flown IFR distance increased in 2023 in light of the pandemic recovery.

Note: Total flown IFR distance (=actual distance) fused from SUR and FPL data sources and adjusted to compensate for insufficient surveillance data coverage.

2023 - Flt. Efficiency: Total extra IFR distance (=B50-B51) (B52)



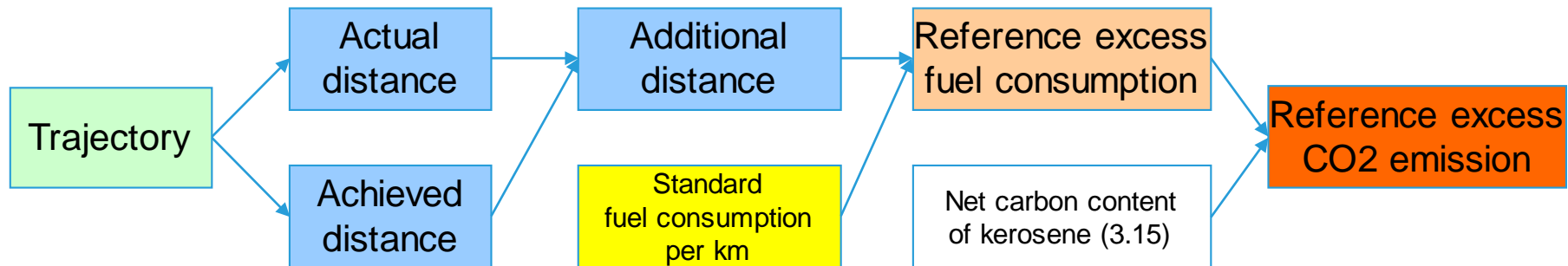
Note: Total extra IFR distance (=excess distance flown) based on fused SUR and FPL data sources and adjusted to compensate for insufficient surveillance data coverage.



KPA	Environment
Objective	Contribute to the protection of the environment – focussing on fuel savings and CO2 emission reductions
Indicator	CO2 emissions deriving from inefficiencies in flight efficiency (conversion of additional distance into CO2 emissions based on standard values formula)

# Definition of indicator

- Reference excess fuel consumption:  
Total additional distance flown in the airspace volume (i.e. State) multiplied by a standard fuel consumption factor (value chosen by each State)
- Reference excess CO<sub>2</sub> emission:  
Reference excess fuel consumption multiplied by 3.15 (net carbon content of kerosene)



# Remarks

- Indicator
  - Has low data requirements and is therefore easy to implement
    - Because mostly based on “additional distance” already computed
  - Publishes an approximation of excess CO<sub>2</sub> emission, resulting from horizontal flight inefficiency
    - The optimum indicator value is not equal to zero
    - Value is influenced by many different factors (including traffic volume, fleet characteristics etc.)
    - Indicator does not cover everything (missing: vertical flight efficiency, TMA inefficiencies, surface movement inefficiencies)
    - Hence the absolute value of the indicator should not be interpreted as representing the CO<sub>2</sub> emissions caused by ANS.
    - Indicator to be used for “general purpose” and trend analysis only

Environment		
	CO2 emissions deriving from inefficiencies in flight efficiency	
B54	Average en-route fuel consumption factor for the State (provide source and computation method in annex)	kg/km
B55	Average en-route CO <sub>2</sub> emission factor for the State (=B54 * 3.15)	kg/km
B56	Theoretical CO <sub>2</sub> emissions deriving from inefficiencies in horizontal en-route flight efficiency (=B52 * B55 / 1000)	Tonnes/year



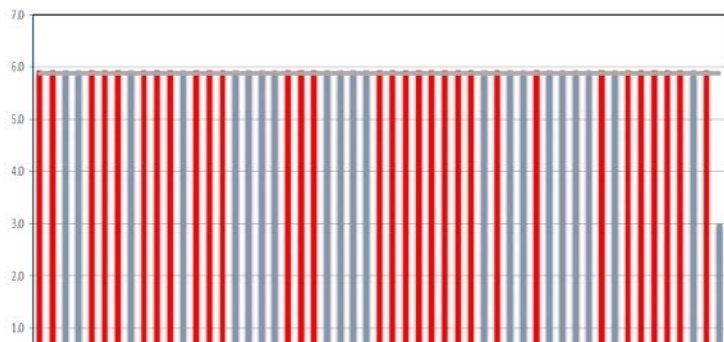


## B54 – Average en-route fuel consumption factor

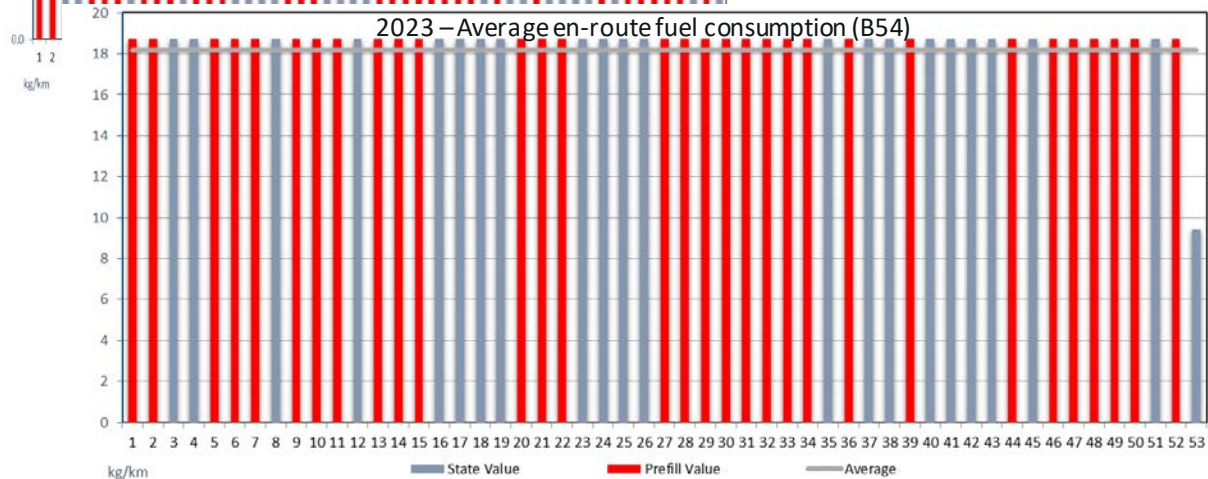
- State can choose method/value
  - Global standard value from ICAO
    - Average fuel burn per nautical mile (NM) of flight = 11 kg/NM = 5.9 kg/km
      - Source: Doc 9750 3rd ed. page App H-8
    - Used for the prefilling of the template
  - State-specific standard value: the standard kerosene consumption per kilometer of a typical jet aircraft type
    - States can select their own “typical aircraft type”, reflecting the composition of traffic in their airspace
  - State-specific measured value: a calibrated average fuel consumption per kilometre flown,
    - computed from the State’s average annual traffic composition in terms of aircraft types, vertical traffic distribution and distance flown
      - using the ICAO Fuel Savings Estimation Tool (IFSET)
      - or any other modeling tool, if available
    - recalibration needed every couple of years to take into account changes in traffic composition



2021 - Average en-route fuel consumption factor for the State (provide source and computation method in annex) (B54)

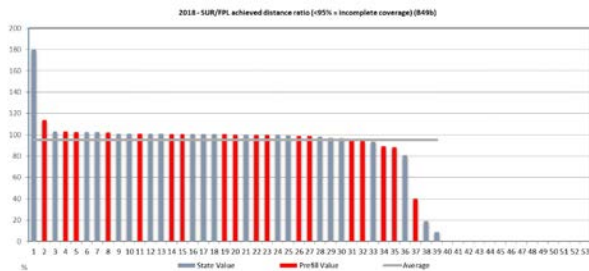
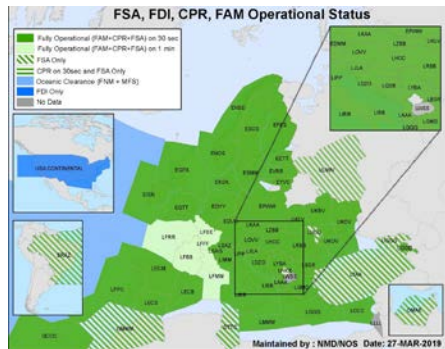


2023 - Average en-route fuel consumption (B54)



- The average en-route fuel consumption factor for the participating States remained constant over the past years. This reflects the reported stability of the observed en-route flight efficiency benefit pool reported above.
- The associated average en-route CO<sub>2</sub> emission factor represents then the estimated emission per km flown, i.e. B54-factor \* 3,15.
- The EUR region network is characterised by a certain stability of the network traffic (in-)efficiency. Accordingly, the benefit pool for CO<sub>2</sub> emissions – expressed per km flown – remained constant.

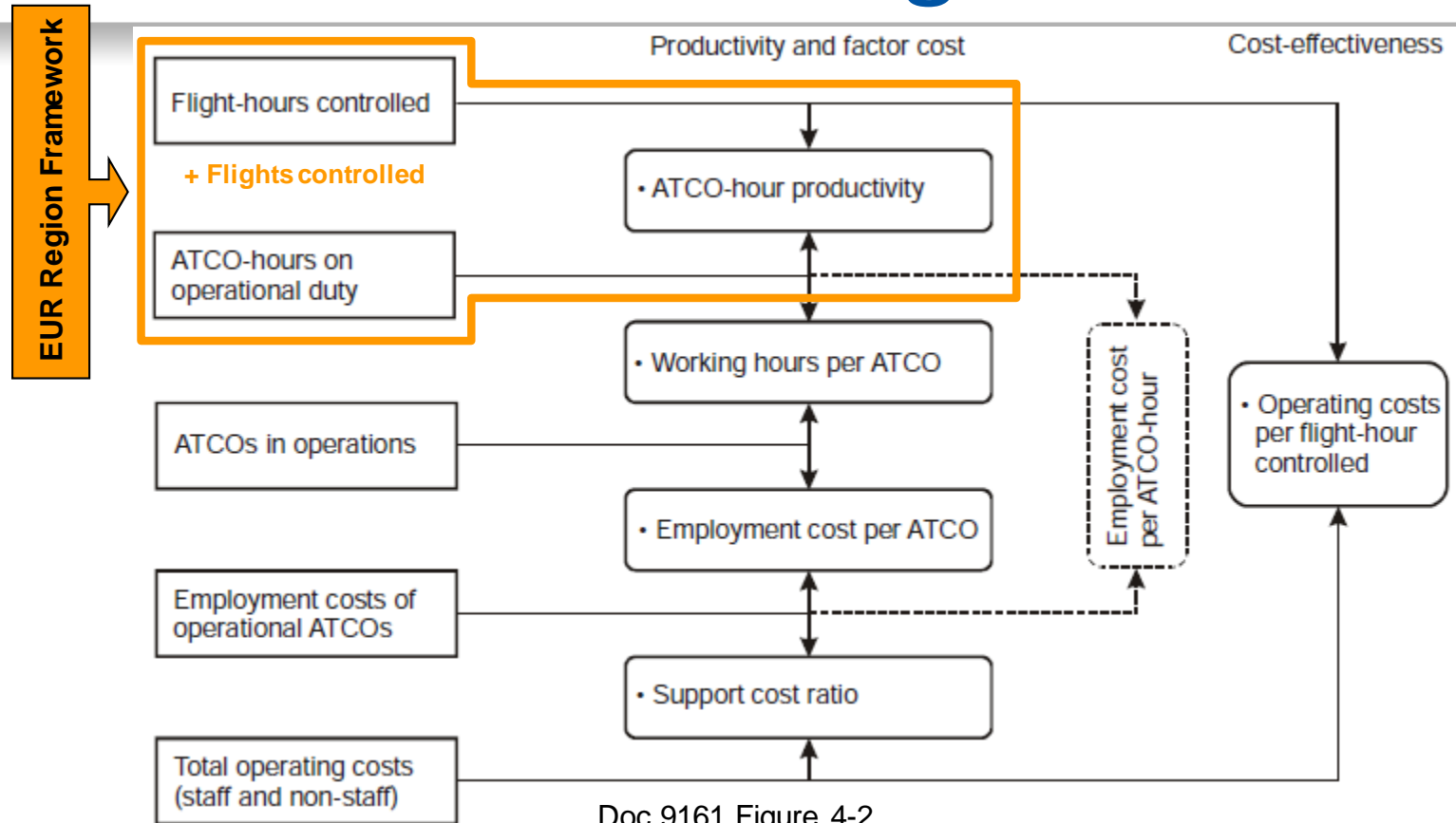
# Thoughts regarding this indicator and its associated coverage issues



- Indicator is an absolute value
  - Susceptible to coverage issues
    - Geographical, time, flight category filtering
- Coverage checks & corrections
  - SUR data available
    - Sufficient match with FPL data (achieved distance comparison >95%)
      - Use additional distance from SUR data as is
    - Insufficient match with FPL data
      - Upscale additional distance from SUR data to 95% of additional distance from FPL data
  - SUR data not available
    - Use additional distance from FPL data
- Future work could include gate-to-gate emission estimation to improve the level of reporting for states where the surveillance data is available.

KPA	Cost effectiveness
Objective	Contribute to optimize the cost for air navigation services
Indicators	<ul style="list-style-type: none"><li>- IFR flights (en-route) per ATCO hour on duty</li><li>- IFR flight hours (en-route) per ATCO hour on duty</li><li>- IFR movements (airport) per ATCO hour on duty</li></ul>

# Origin of indicators



Doc 9161 Figure 4-2

# Remarks

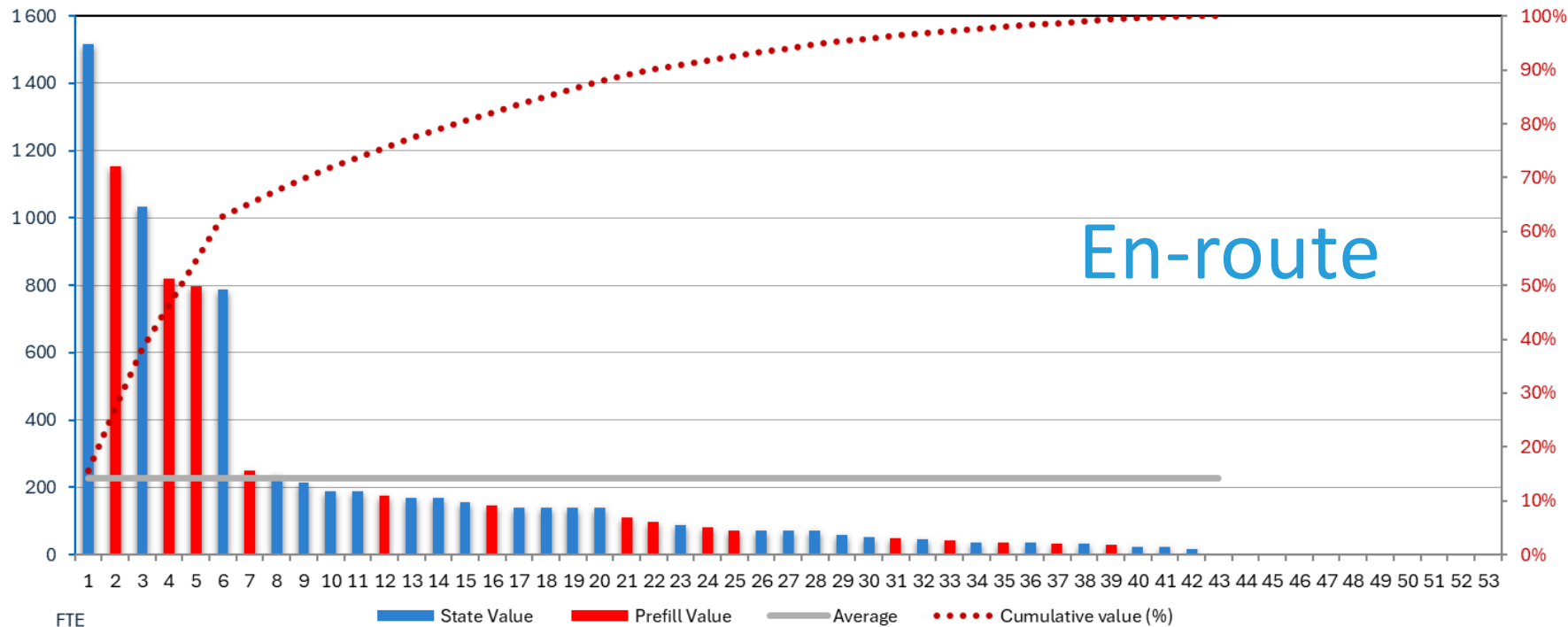
- Indicators
  - Focus on an important component of ANSP costs
    - However with the limitation that working hours per ATCO, employment cost per ATCO, and support cost are not covered
  - Reuse data reporting already in place for many States
    - Also reuse existing data definitions and terminology
      - EUROCONTROL Specification for Economic Information Disclosure (SEID)
  - Have relatively simple reporting requirements
    - Only traffic volume and ATCO hours on duty
  - Avoid entering into financial information disclosure issues for the initial implementation of the framework



Cost effectiveness		
	ATCO productivity (Continental Area)	
B57	Number of ATCO hours on duty (ACCs)	hrs/year
B58	Number of ATCO hours on duty (APP+TWRs)	hrs/year
B59	IFR flights (en-route) per ATCO hour on duty (ACCs) (=A11/B57)	Flights/hr
B60	IFR flight hours per ATCO hour on duty (ACCs) (=A15/B57)	hrs/hr
B61	IFR movements (airport) per ATCO hour on duty (APP+TWRs) (=A16/B58)	Mov/hr



2022 - Continental Area: Number of ATCOs in operations at ACCs (A26)

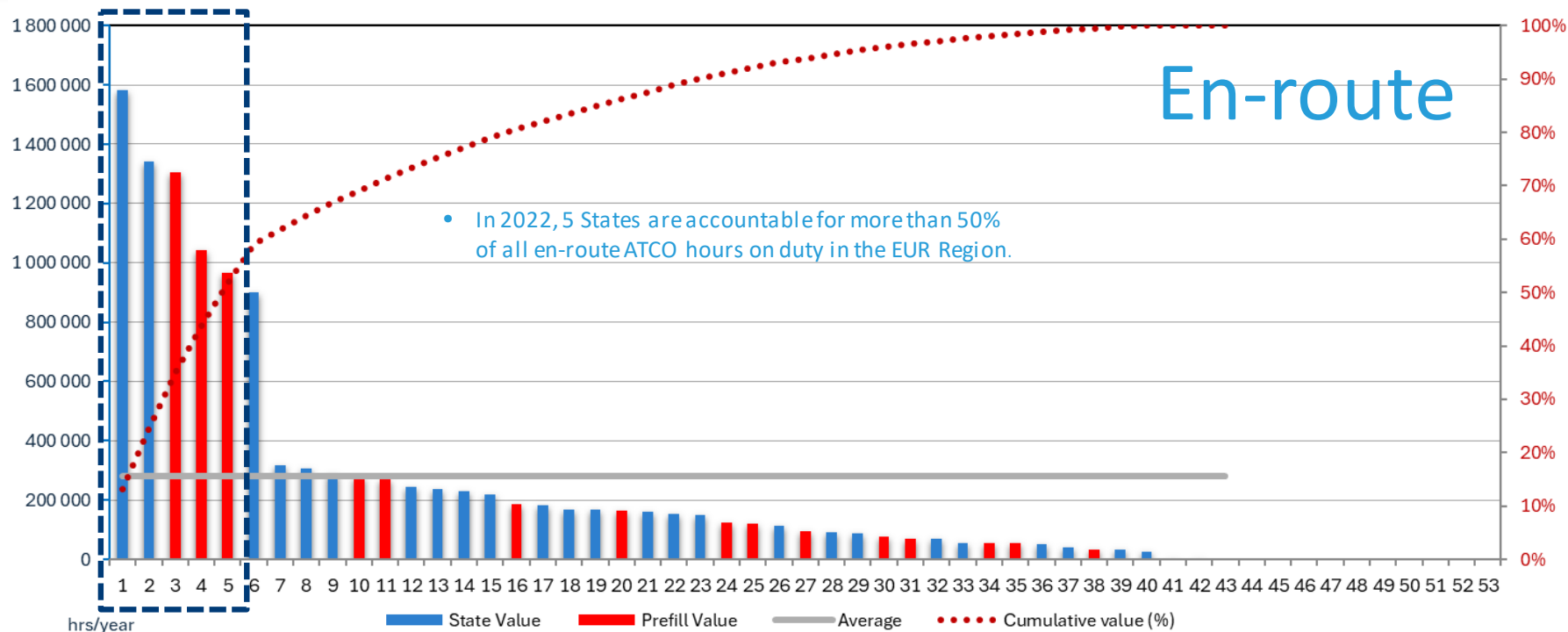


En-route

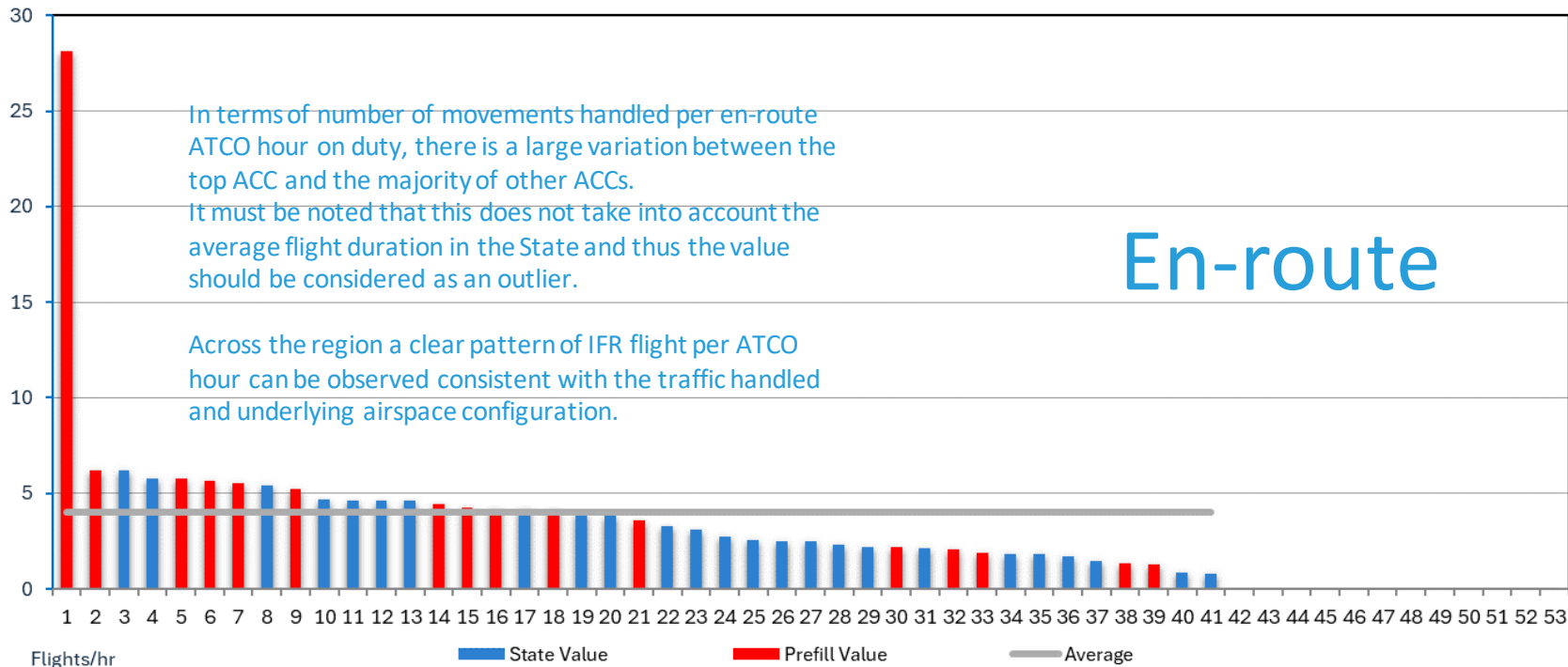
Note: This graph is repeated here for ease of reference and comparison with the next graph (ATCO hours on duty).

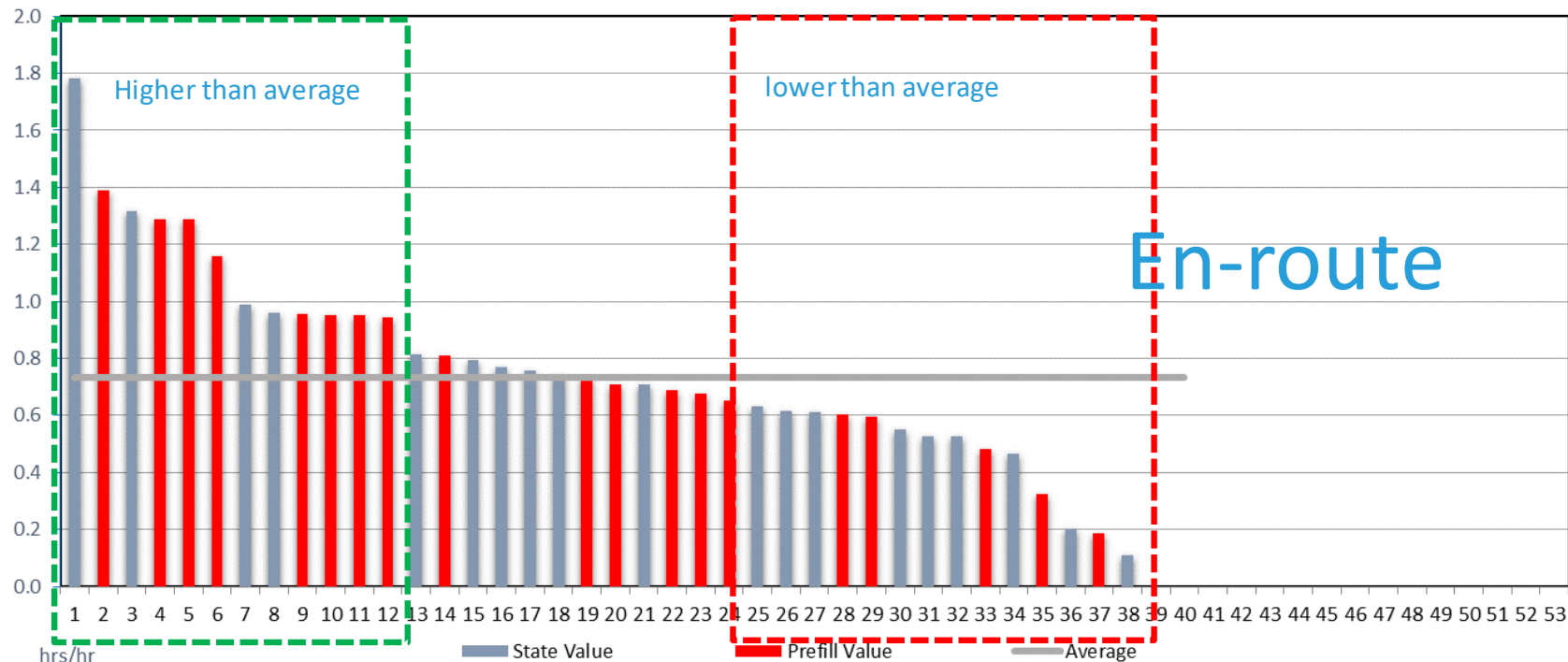


2022 - Continental Area: Number of ATCO hours on duty (ACCs) (B57)



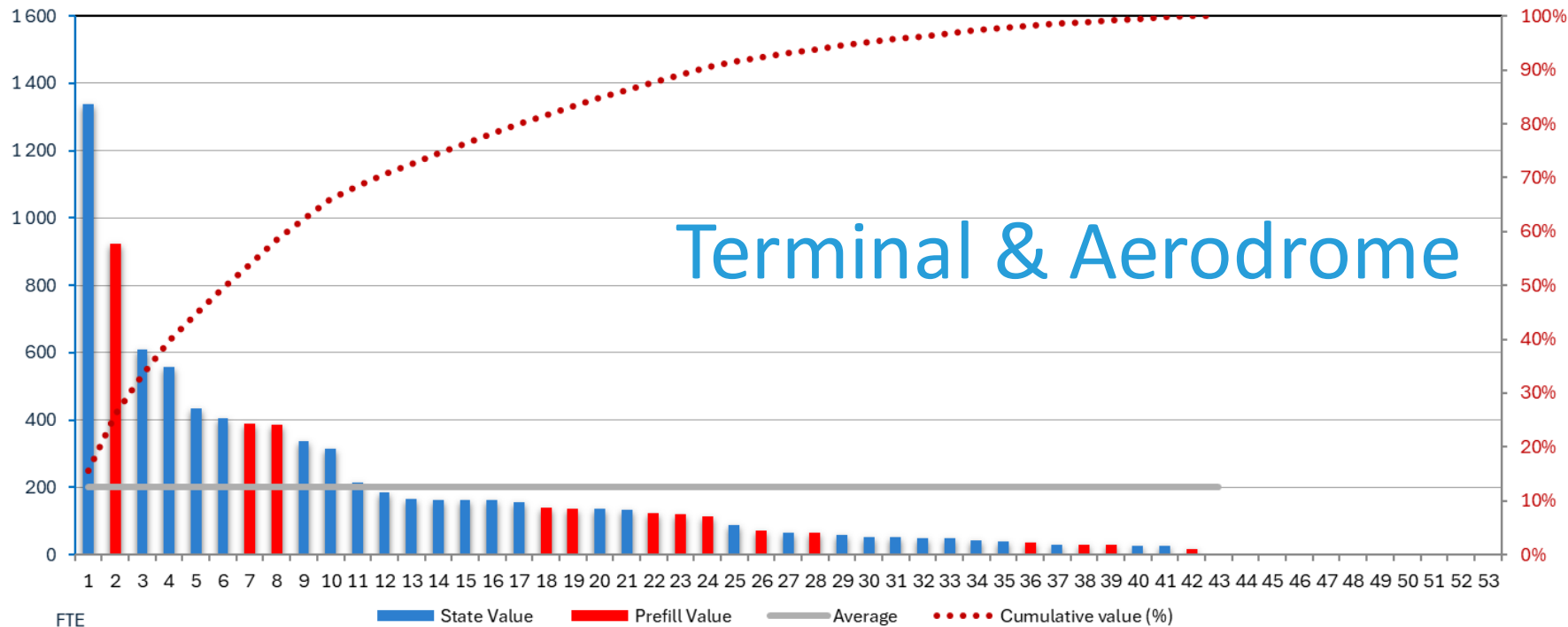
2022 - Continental Area: IFR flights (en-route) per ATCO hour on duty (ACCs) (=A11/B57)(B59)





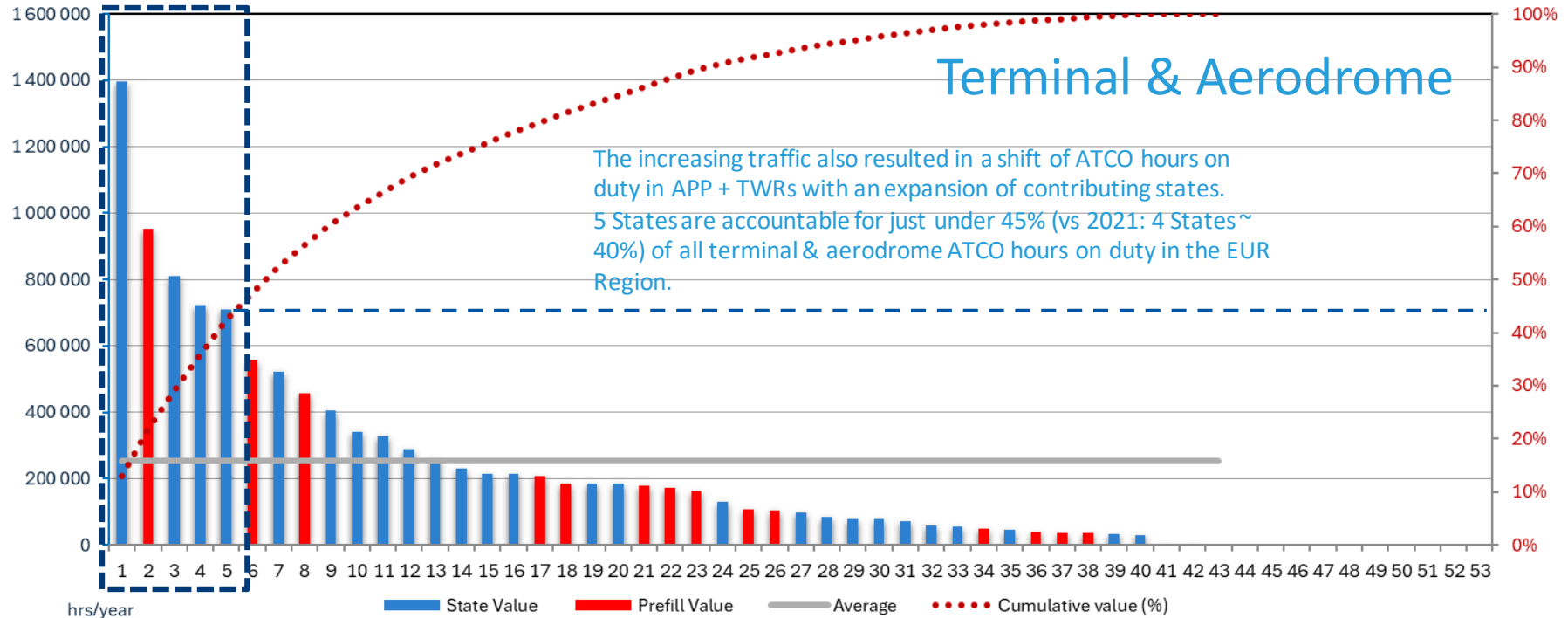
Item B60 is a better indicator for en-route ATCO productivity than item B59. The data suggest that about a dozen States at the tail end of the distribution need to work on improving their ATCO productivity. Lessons can be learned from the dozen States on the left side of the graph which perform better than average.

2022 - Continental Area: Number of ATCOs in operations at Terminal Facilities (APP+TWRs) (A27)



Note: This graph is repeated here for ease of reference and comparison with the next graph (ATCO hours on duty).

2022 - Continental Area: Number of ATCO hours on duty (APP+TWRs) (B58)





## Participation KPA





ICAO PARIS

UNITING AVIATION



ICAO

North American  
Central American  
and Caribbean  
(NACC) Office  
Mexico City

South American  
(SAM) Office  
Lima

ICAO  
Headquarters  
Montréal

Western and  
Central African  
(WACAF) Office  
Dakar

European and  
North Atlantic  
(EUR/NAT) Office  
Paris

Middle East  
(MID) Office  
Cairo

Eastern and  
Southern African  
(ESAF) Office  
Nairobi

Asia and Pacific  
(APAC) Sub-office  
Beijing

Asia and Pacific  
(APAC) Office  
Bangkok



THANK YOU