WORLD AREA FORECAST SYSTEM OPERATIONS GROUP (WAFSOPSG)

SIXTH MEETING

Dakar, Senegal, 21 to 24 March 2011

Agenda Item 5: Operation of the WAFS
5.3: Other issues related to the operation and implementation of the WAFS

COMPARISON OF UPPER AIR DATA ISSUED BY WAFC LONDON AND WAFC WASHINGTON

(Presented by the International Air Transport Association)

SUMMARY

This paper provides a brief summary of an analysis on the application of Upper Air Data provided in flight planning. by WAFC London and WAFC Washington. The results of flight plans calculated with UAD from EGRR and KWBC are compared.
Detailed results are provided in the appendix to this information paper.

1. INTRODUCTION

1.1 World area forecast centre (WAFC) London and WAFC Washington are designated centres for the issuance of global upper air forecasts for aviation purposes. Airlines and flight plan service providers are using this UAD for flight optimization and fuel calculations.

1.2 Each end user has decided which UAD are applied in their systems.

2. DISCUSSION

2.1 This information paper provides the results of a comparison analysis undertaken in December 2010 and February 2011 in order to identify possible significant differences between UAD provided by WAFC London and WAFC Washington in GRIB1 code form.

2.2 Detailed results of the case study are provided in the appendix to this information paper.

2.3 The study showed a tendency for more fuel uplift when using UAD issued by WAFC Washington, but there are variations from city pair to city pair. Summarizing all fuel differences over all calculated flights from the February analysis indicates an average additional fuel of about 90 kg per 1000 nm.

2.4 The analysis performed by Lufthansa Systems on behalf of the International Air Transport Association (IATA) has shown that for 50 international flights considered at random, fuel uplift calculations were between 3 and 5 tonnes (circa 4000 USD) higher using WAFC Washington wind and temperature data over WAFC London data. Some examples show that for flights with tail wind and in higher wind speed conditions the wind speed forecast in KWBC UAD is lower than in EGRR UAD.

2.5 The analysis does not give an indication for a preference of UAD. Both UAD fulfil the actual requirements for accuracy.

3. ACTION BY THE WAFSOPSG

3.1 The WAFSOPSG is invited to note the information presented in this paper.

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APPENDIX A

WAFC Upper Air Data

Case Study on Differences in UAD issued by WAFC London and WAFC Washington

December 2010 / February 2011

Table of Contents

Chapter 1 Introduction

With the reception of Upper Air data (UAD) issued by WAFC Washington a study was invoked in order to identify possible significant differences in Lido/Flight. The purpose of this study was to show the impact of UAD issued by WAFC Washington in comparison to the UAD issued by WAFC London on the results of flight plan calculations.

The study is a snap-shot for a particular observation time and it does not claim any transferability on other weather situations.

Chapter 2 Study conditions

Test cases December 2010:

For the study following 14 city pairs have been selected.

FRA – LAX – FRA
FRA – EZE – FRA
FRA – SHA – FRA
FRA – SIN – FRA
FRA – JNB – FRA
SEA – MIA – SEA
ANC – SJU – ANC
DXB – ORD – DXB
DXB – MEL – DXB
DXB – PEK – DXB
SYD – SCL – SYD
AKL – HNL – AKL
CPT – CCS – CPT
GRU – MEX – GRU

All calculations were based on UAD observation time at **07DEC2010 0600UTC** issued by WAFC London (**EGRR**) and WAFC Washington (**KWBC**)

Minimum Fuel Track (**MFT**) and Minimum Time Track (**MTT**) optimization without restrictions have been selected for the flight plan calculations in order to exclude temporary impacts.

For all calculations UAD forecasts **T+06**, **T+12** and **T+24** are used. In case of some extreme long haul flights (flight time longer than 12 hours) also **T+30** UAD forecast was applied.

A linear time interpolation between the forecasts is applied.

Values for flight levels located between two hPa-levels have been interpolated under the consideration of the max-wind- and tropopause levels.

All flight plans have been calculated with identical flight conditions (aircraft registration, load, speed etc.).

The departure time is always 1200UTC. The arrival time depends on the calculated flight time including the taxi out time.

Aircraft type: B747-400

Payload. 42000 kg

The study is performed in four steps.

Step 1:

Calculate MFT and MTT of all flights of the above listed city pairs applying UAD issued by WAFC London

Table column: **MFT** and **MTT**

Step 2:

Calculate MFT and MTT of all flights of the above listed city pairs applying UAD issued by WAFC Washington

Table column: **MFT** and **MTT**

Step 3:

Use the MFT and MTT results (routing and flight profile) from Step 1 and recalculate the flight plan with UAD issued by WAFC Washington

Table column: **MFT-K** and **MTT-K**

Step 4

Use the MFT and MTT results (routing and flight profile) from Step 2 and recalculate the flight plan with UAD issued by WAFC London

Table column: **MFT-E** and **MTT-E**

The results are presented as graphics and in table form as differences between the output of calculations **KWBC UAD - EGRR UAD**.

Example:

Routing: FRA – LAX

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**1**	**2**	**0**	**0**	**0**	**0**
TKOF-Diff [KG}		**88**	**132**	**88**	**43**	**46**	**93**
Dist-Diff [NM}		**-2**	**-14**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-2**	**0**	**0**	**1**	**1**

Column:

Avg Wind-Dir H → Head wind, T → Tail wind

MFT Differences on Minimum Fuel Track calculation (KWBC - EGRR)
Free optimization with EGRR and KWBC UAD, no restriction

MTT Differences on Minimum Time Track calculation (KWBC - EGRR)
Free optimization with EGRR and KWBC UAD, no restriction

MFT-K Differences on Minimum Fuel Track calculation (KWBC - EGRR)
Optimized MFT routing based on EGRR UAD recalculated with KWBC UAD, flight path and profile not changed

MTT-K Differences on Minimum Time Track calculation (KWBC - EGRR)
Optimized MTT routing based on EGRR UAD recalculated with KWBC UAD, flight path and profile not changed

MFT-E Differences on Minimum Fuel Track calculation (KWBC - EGRR)
Optimized MFT routing based on KWBC UAD recalculated with EGRR UAD, flight path and profile not changed

MTT-E Differences on Minimum Time Track calculation (KWBC - EGRR)
Optimized MTT routing based on KWBC UAD recalculated with EGRR UAD, flight path and profile not changed

Row:

Average wind-comp-Diff [KTS] Differences in average wind component over the entire flight (KWBC - EGRR)
positive values = higher wind component with KWBC UAD
negative values = higher wind component with EGRR UAD

TKOF-Diff [KG} Differences in Take-off Fuel (KWBC - EGRR)
positive values = higher take-off fuel with KWBC UAD
negative values = higher take-off fuel with EGRR UAD

Dist-Diff [NM} Differences in flight distance (KWBC - EGRR)
positive values = shorter flight distance with KWBC UAD
negative values = shorter flight distance with EGRR UAD

Time-Diff [MIN] Differences in flight time (KWBC - EGRR)
positive values = shorter flight time with KWBC UAD
negative values = shorter flight time with EGRR UAD

Test cases February 2011:

In this 36 city pairs have been included.

All calculations were based on UAD forecasts issued by WAFC London (**EGRR**) and WAFC Washington (**KWBC**)

Minimum Fuel Track (**MFT**) optimization without restrictions have been selected for the flight plan calculations in order to exclude temporary impacts.

For all calculations UAD forecasts **T+06**, **T+12** and **T+24** are used. In case of some extreme long haul flights (flight time longer than 12 hours) also **T+30** UAD forecast was applied.

A linear time interpolation between the forecasts is applied.

Values for flight levels located between two hPa-levels have been interpolated under the consideration of the max-wind- and tropopause levels.

All flight plans have been calculated with identical flight conditions (aircraft registration, load, speed etc.).

The departure time is always 1200UTC. The arrival time depends on the calculated flight time including the taxi out time.

Aircraft type: A340-330/A380-800

Payload. Variable depending on possible max payload

The study is performed in four steps.

Step 1:

Calculate **MFT** for all selected city pairs applying UAD issued by WAFC London

Step 2:

Use the **MFT** result (routing and flight profile) from Step 1 and recalculate the flight plan with UAD issued by WAFC Washington

Chapter 3 Study results

All flight plan calculations were based on an actual aeronautical navigational database valid at the time of calculation.

The overall result does not show a significant difference between the two WAFC UAD. However a tendency could be found that UAD from EGRR are forecasting higher wind speeds. This results in a lower trip fuel amount. The summary of all differences in the December test phase shows that flights calculated with KWBC UAD requires about 2300kg more fuel for MFT and about 2500kg for MTT flight plans.

In the February test phase about 4800kg more fuel is calculated over all flights for a total flight distance of about 420000 nm. In other words is the difference about 90 kg per 1000 nm.

Chapter 4 Conclusion

The analysis performed by Lufthansa Systems has shown that for 50 international flights considered at random, fuel uplift calculations were between 3 and 5 tonnes (circa 4000 USD) higher using WAFC Washington wind and temperature data over WAFC London data.

Some examples show that for flights with tail wind and in higher wind speed conditions the wind speed forecast in KWBC UAD is lower than in EGRR UAD.

The analysis does not give an indication for a preference of UAD. Both UAD fulfill the actual requirements for accuracy.

A higher accuracy is expected with the introduction of GRIB2 In the flight plan calculations.

It is planned to perform a similar analysis with GRIB2 and also a comparison of flight plans calculated with GRIB1 and GRIB2.

Chapter 5 Result details

Test cases December 2010

City Pair: FRA – LAX – FRA

Routing: FRA – LAX

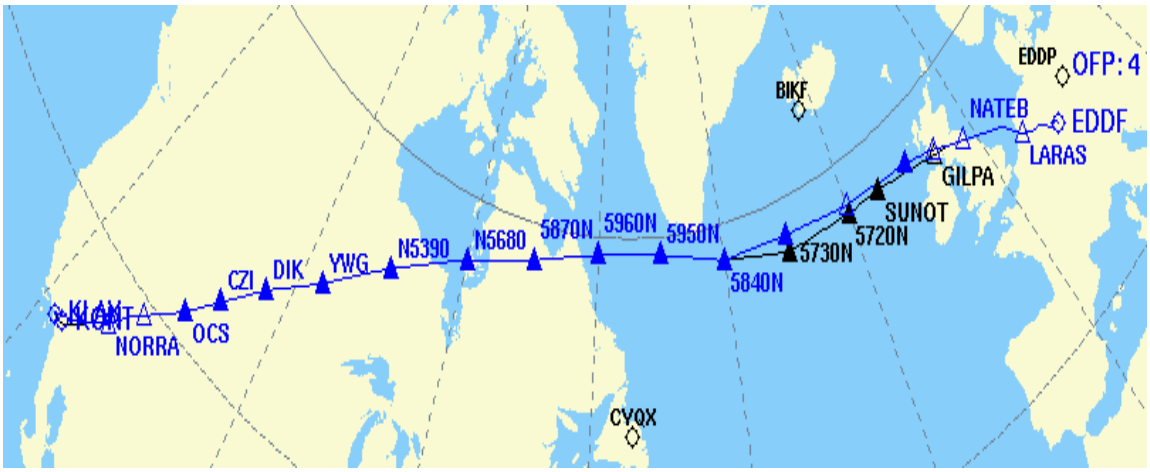
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**1**	**2**	**0**	**0**	**0**	**0**
TKOF-Diff [KG}		**88**	**132**	**88**	**43**	**46**	**93**
Dist-Diff [NM}		**-2**	**-14**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-2**	**0**	**0**	**1**	**1**

MFT routing based on KWBC UAD is 2nm shorter and differs only in some minor parts of the routing from the MFT of EGRR UAD. The required fuel is about 100kg higher.
MTT routing based on KWBC UAD is 14nm shorter and differs only in some minor parts of the routing from the MTT of EGRR UAD. The required fuel is about 100kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is nearly identical (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is nearly identical (MFT-E, MTT-E).
The average wind component is calculated as head wind (M004 and M007) with higher values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: FRA – LAX (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)


EDDP
OFP: 3
BIKF
NATEB
EDDF
LARAS
BRUCE
GOMUP
5720N
5730N
5840N
5950N
5960N
6060N
5970N
5780N
5490N
YWG
DIK
CZI
URNUW
OCS
NORRA
CYQX
KIND
KSDF
KBDL
LPLA

MTT Routing: FRA – LAX (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



Routing: LAX – FRA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-1**	**2**	**-3**	**-1**	**0**	**-2**
TKOF-Diff [KG]		**-301**	**-360**	**106**	**49**	**539**	**355**
Dist-Diff [NM]		**-24**	**2**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**0**	**2**	**0**	**0**	**3**	**2**

MFT routing based on KWBC UAD is 24nm shorter and differs in more than 80% of the routing from the MFT of EGRR UAD. The required fuel is about 300kg lower.
MTT routing based on KWBC UAD is 2nm longer and differs in more than 80% of the routing from the MTT of EGRR UAD. The required fuel is about 350kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 100kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is more up to 550kg higher (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P039 and P042) with a higher value for MTT KWBC UAD. This is also reflected in the lower required fuel.
The lower wind component of MFT KWBC UAD is compensated by the shorter distance of the routing.

MFT Routing: LAX – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: LAX – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: FRA – EZE

City Pair: FRA – EZE – FRA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**2**	**4**	**1**	**1**	**-2**	**-2**
TKOF-Diff [KG}		**-196**	**-429**	**-126**	**-119**	**236**	**198**
Dist-Diff [NM}		**3**	**49**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-2**	**-2**	**-2**	**-2**	**3**	**2**

MFT routing based on KWBC UAD is 3nm longer and differs only in a minor part of the routing from the MFT of EGRR UAD. The required fuel is about 200kg lower.
MTT routing based on KWBC UAD is 49nm longer and differs between the departure airport and the Acores Islands significantly from the MTT of EGRR UAD. The required fuel is about 400kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 100kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is more up to 200kg higher (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P003 and P012) with higher values KWBC UAD. This is also reflected in the lower required fuel.
The higher wind component of MTT KWBC UAD is compensated by the longer distance of the routing.

MFT Routing: FRA – EZE (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: FRA – EZE (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: EZE – FRA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-3**	**0**	**-1**	**0**	**0**	**0**
TKOF-Diff [KG]		**2**	**34**	**326**	**55**	**25**	**-39**
Dist-Diff [NM]		**-24**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**0**	**0**	**1**	**0**	**0**	**0**

MFT routing based on KWBC UAD is 24nm shorter and differs completely from the MFT of EGRR UAD. The required fuel is identical.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD. The required fuel is identical.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 300kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is nearly identical (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P032and P035) with lower values for KWBC UAD. This is also reflected in the higher required fuel.
The lower wind component of MFT KWBC UAD is compensated by the shorter distance of the routing.

MFT Routing: EZE – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: EZE – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

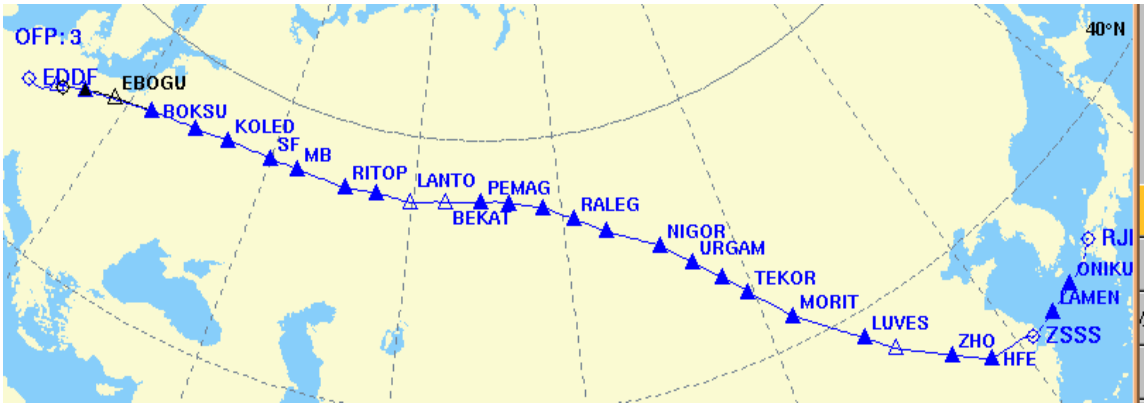
City Pair: FRA – SHA – FRA

Routing: FRA – SHA

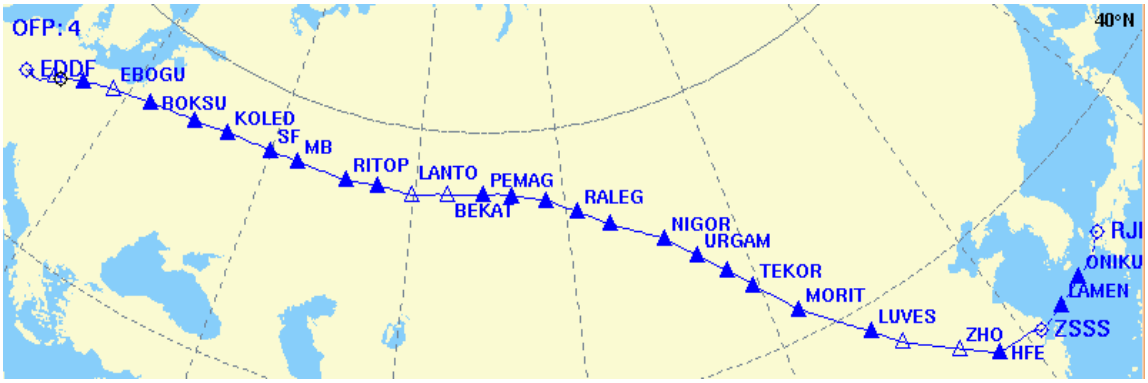
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-2**	**-2**	**-2**	**-2**	**2**	**2**
TKOF-Diff [KG}		**575**	**917**	**641**	**642**	**-596**	**-608**
Dist-Diff [NM}		**0**	**13**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**2**	**4**	**2**	**2**	**-2**	**-2**

MFT routing based on KWBC UAD is identical with MFT of EGRR UAD. The required fuel is significant higher (575kg).
MTT routing based on KWBC UAD is 13nm longer, but does not differ significantly from the MTT of EGRR UAD. The required fuel is significant higher (917kg).
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is more 600kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 600kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P080 -- P082) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: FRA – SHA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: FRA – EZE (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



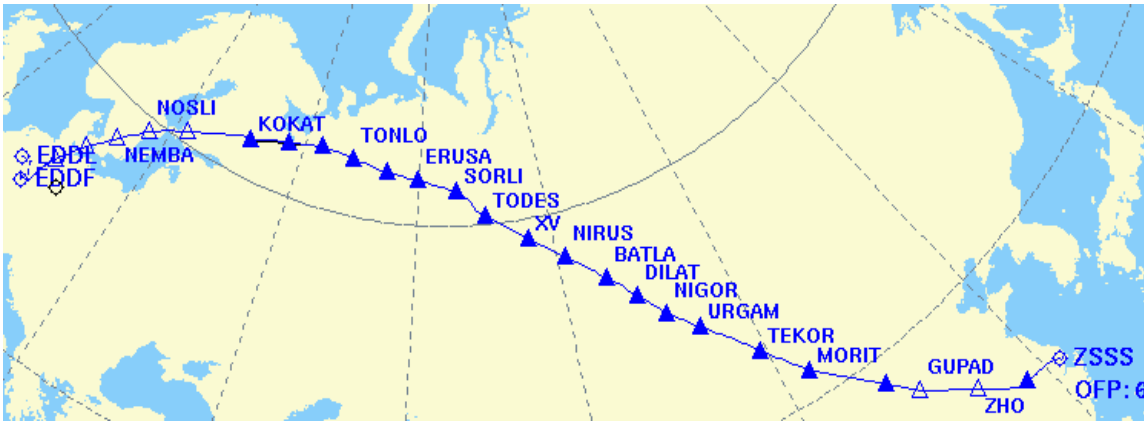
Routing: SHA – FRA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**2**	**0**	**-1**	**-2**	**-1**	**1**
TKOF-Diff [KG]		**293**	**-381**	**343**	**-336**	**-216**	**412**
Dist-Diff [NM]		**6**	**1**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**1**	**-1**	**1**	**-1**	**0**	**2**

MFT and MTT routings differ significantly.
MFT routing based on KWBC UAD is 6nm longer, but does not differ significantly from the MTT of EGRR UAD. The required fuel is about 300kg higher.
MTT routing based on KWBC UAD is 1nm longer, but does not differ significantly from the MTT of EGRR UAD. The required fuel is about 400kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is more 600kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 600kg lower (MFT-E, MTT-E).
The average wind component is calculated as head wind (M005 – M007 for MFT; M0045 – M047 for MTT) with higher values for MFT KWBC UAD. This is also reflected in the higher required fuel for MFT KWBC UAD.

MFT Routing: SHA – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: SHA – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)


NOSLI
KOKAT
TONLO
ERUSA
SORLI
TODES
XV
NIRUS
BATLA
DILAT
NIGOR
URGAM
TEKOR
MORIT
GUPAD
ZHO
ZSSS
EDDL
EDDF
NEMBA

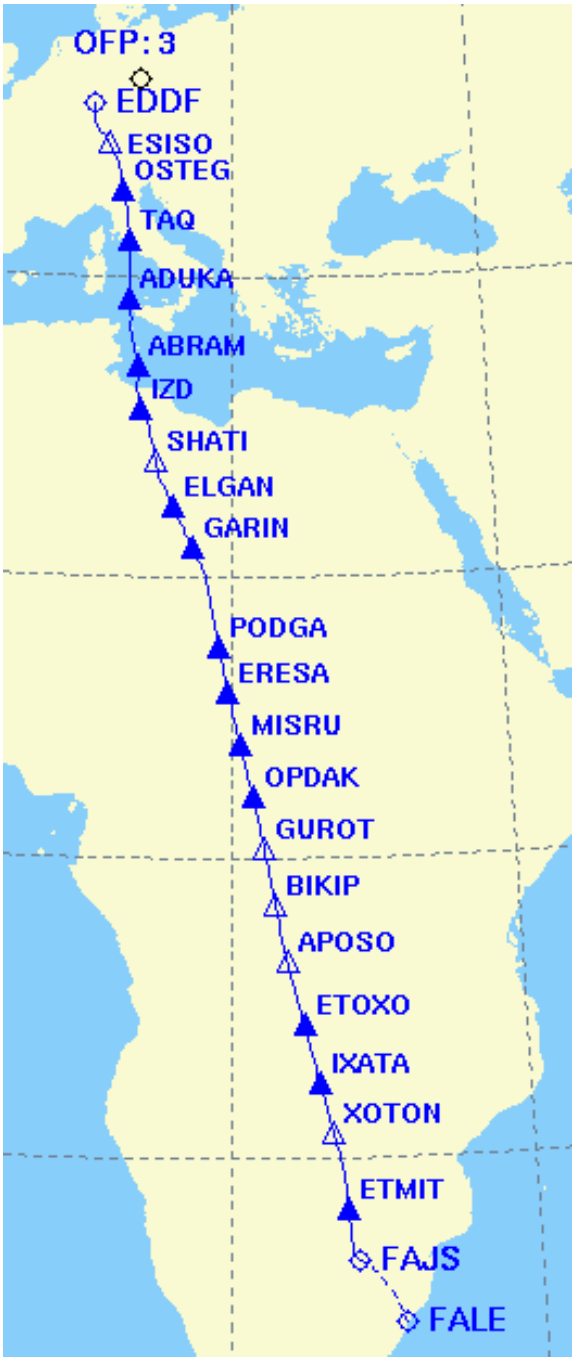
City Pair: FRA – JNB – FRA

Routing: FRA – JNB

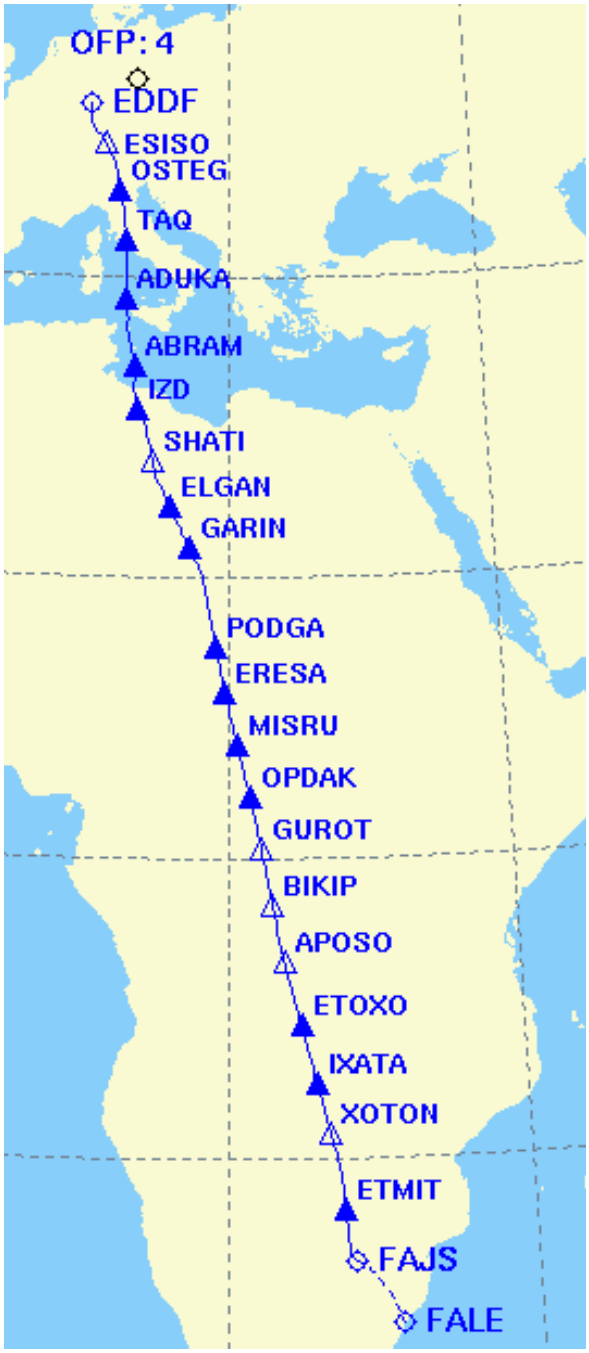
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**1**	**1**	**1**	**1**	**-1**	**-1**
TKOF-Diff [KG}		**-149**	**366**	**-116**	**-143**	**229**	**313**
Dist-Diff [NM}		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-1**	**0**	**0**	**1**	**1**

Due to a lack of routing options MFT and MTT of both WAFC UAD are showing identical routings. In this case only the impact of the UAD forecast on the fuel calculation is shown.
MFT routing based on KWBC UAD is identical with MFT of EGRR UAD. The required fuel is about 150kg lower.
MTT routing based on KWBC UAD is identical with MTT of EGRR UAD. The required fuel is about 350kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is more 100kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about up to 300kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P008 – P010) with higher values for KWBC UAD. This is also reflected in the lower required fuel MFT KWBC UAD, while MTT KWBC UAD requires more fuel.

MFT Routing: FRA – JNB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: FRA – JNB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

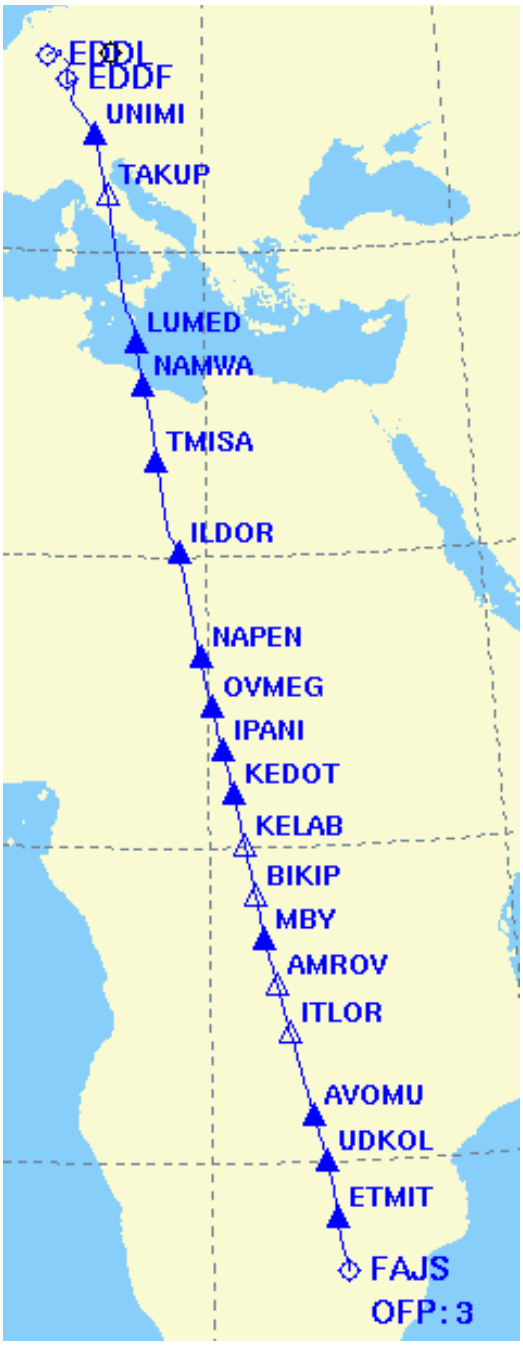


Routing: JNB – FRA

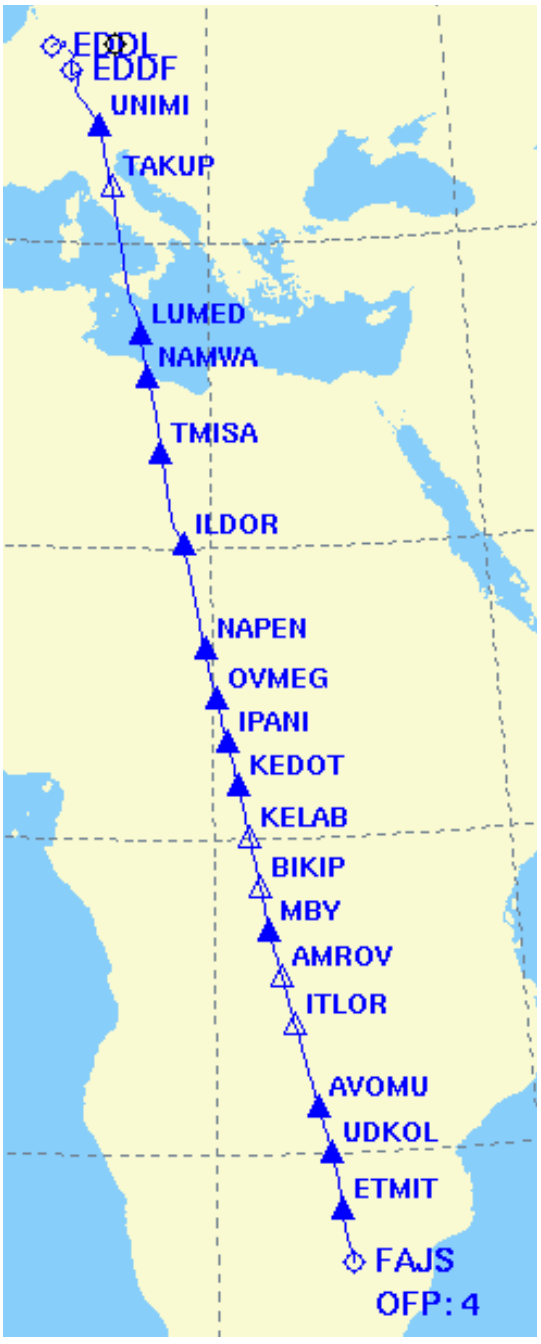
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**-1**	**-1**	**-1**	**-1**	**0**	**0**
TKOF-Diff [KG]		**-347**	**-348**	**-311**	**-317**	**329**	**318**
Dist-Diff [NM]		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-1**	**-2**	**-2**	**1**	**1**

Due to a lack of routing options MFT and MTT of both WAFC UAD are showing identical routings. In this case only the impact of the UAD forecast on the fuel calculation is shown.
MFT and MTT require about 350kg less fuel for a flight based on KWBC UAD.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is about 300kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 300kg higher (MFT-E, MTT-E).
The average wind component is calculated as head wind (M011 – M012) with lower values for KWBC UAD. This is also reflected in the lower required fuel.

MFT Routing: JNB – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: JNB – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



City Pair: FRA – SIN – FRA

Routing: FRA – SIN

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-1**	**-1**	**0**	**-1**	**1**	**1**
TKOF-Diff [KG}		**71**	**61**	**99**	**90**	**-11**	**-13**
Dist-Diff [NM}		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**1**	**1**	**1**	**1**	**0**	**0**

Due to a lack of routing options MFT and MTT of both WAFC UAD are showing identical routings. In this case only the impact of the UAD forecast on the fuel calculation is shown.
The average wind component is calculated as tail wind (P022 – P023) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: FRA – SIN (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: FRA – SIN (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: SIN – FRA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**1**	**1**	**1**	**0**	**-1**	**0**
TKOF-Diff [KG]		**252**	**273**	**267**	**303**	**-246**	**-260**
Dist-Diff [NM]		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**1**	**2**	**1**	**2**	**-1**	**-2**

Due to a lack of routing options MFT and MTT of both WAFC UAD are showing identical routings. In this case only the impact of the UAD forecast on the fuel calculation is shown.
KWBC UAD causes a higher amount of fuel.
The average wind component is calculated as head wind (M014 – M015) with higher values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: SIN – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: SIN – FRA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

City Pair: SEA – MIA – SEA

Routing: SEA – MIA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-4**	**-3**	**-3**	**-3**	**2**	**2**
TKOF-Diff [KG}		**182**	**198**	**211**	**215**	**-156**	**-148**
Dist-Diff [NM}		**-7**	**-5**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**2**	**2**	**2**	**2**	**-1**	**-1**

MFT routing based on KWBC UAD is 7nm shorter and differs in the central part of the routing from the MFT of EGRR UAD.. The required fuel is about 200kg lower.
MTT routing based on KWBC UAD is 5nm shorter and differs in the central part of the routing from the MFT of EGRR UAD.. The required fuel is about 200kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is about 200kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 150kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P069 – P073) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: SEA – MIA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: SEA – MIA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: MIA – SEA

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**1**	**0**	**1**	**0**	**No result**	**No result**
TKOF-Diff [KG]		**-12**	**0**	**2**	**20**	**No result**	**No result**
Dist-Diff [NM]		**0**	**2**	**0**	**0**	**No result**	**No result**
Time-Diff [MIN]		**0**	**0**	**0**	**0**	**No result**	**No result**

No differences found for this flight.
The average wind component is calculated as head wind (M044 – M046) with higher values for KWBC UAD.

MFT Routing: MIA – SEA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: MIA – SEA (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

City Pair: ANC – SJU – ANC

Routing: ANC – SJU

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-2**	**-2**	**0**	**0**	**1**	**1**
TKOF-Diff [KG}		**204**	**257**	**322**	**373**	**-264**	**-234**
Dist-Diff [NM}		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**2**	**2**	**1**	**1**	**0**	**0**

MFT and MTT of both WAFC UAD are showing identical routings. In this case only the impact of the UAD forecast on the fuel calculation is shown.
MFT routing based on KWBC UAD is identical with the MFT of EGRR UAD and about 200kg more fuel is required for a flight based on KWBC UAD.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD and about 250kg more fuel is required for a flight based on KWBC UAD.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is about 400kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 300kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P041 – P043) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: ANC – SJU (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: ANC – SJU (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: SJU – ANC

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**-1**	**-2**	**-1**	**-2**	**2**	**2**
TKOF-Diff [KG]		**-552**	**-583**	**-424**	**-470**	**567**	**601**
Dist-Diff [NM]		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-1**	**-2**	**-2**	**2**	**2**

MFT routing based on KWBC UAD is identical with the MFT of EGRR UAD and about 600kg less fuel is required for a flight based on KWBC UAD.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD and about 600kg less fuel is required for a flight based on KWBC UAD.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is about 450kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 600kg higher (MFT-E, MTT-E).
The average wind component is calculated as head wind (M018 – M021) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: SJU – ANC (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: SJU – ANC (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

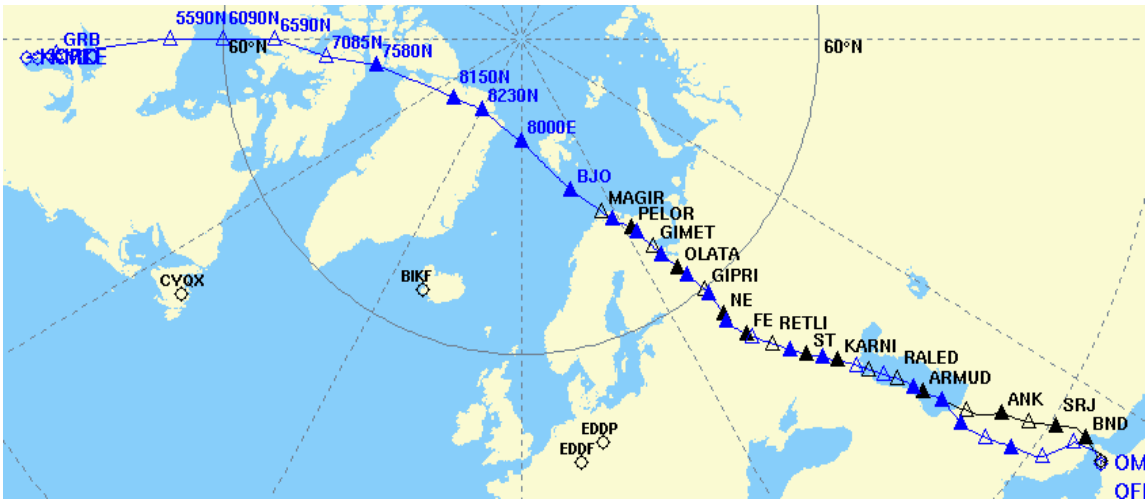
City Pair: DXB – ORD – DXB

Routing: DXB – ORD

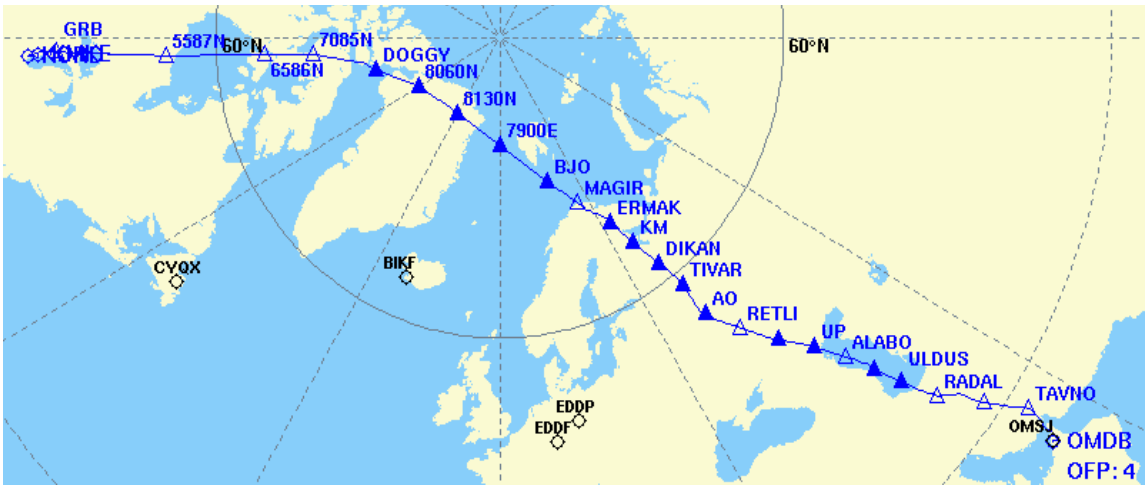
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-1**	**-1**	**-1**	**-1**	**1**	**1**
TKOF-Diff [KG}		**-236**	**196**	**347**	**209**	**-283**	**-195**
Dist-Diff [NM}		**-18**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**1**	**2**	**2**	**-2**	**-1**

MFT routing based on KWBC UAD is 18nm shorter and requires about 250kg less fuel..
MTT routing is identical with the MTT of EGRR UAD, but about 200kg more fuel is required for a flight based on KWBC UAD.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 350kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 300kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P000 – P006) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: DXB – ORD (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: DXB – ORD (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



Routing: ORD – DXB

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-1**	**0**	**-1**	**-1**	**1**	**1**
TKOF-Diff [KG]		**260**	**83**	**284**	**379**	**-265**	**640**
Dist-Diff [NM]		**0**	**17**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**2**	**1**	**2**	**2**	**-2**	**-1**

MFT routing is identical with the MFT of EGRR UAD, but about 250kg more fuel is required for a flights based on KWBC UAD.
MTT routing based on KWBC UAD is 17nm longer and differs over the North Atlantic from the MTT of EGRR UAD. The required fuel is marginally higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 400kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 250kg lower for MFT and more than 600kg higher for MTT (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P028 – P030) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: ORD – DXB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: ORD – DXB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

City Pair: DXB – MEL – DXB

Routing: DXB – MEL

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-3**	**-3**	**-1**	**-1**	**1**	**1**
TKOF-Diff [KG}		**208**	**202**	**292**	**275**	**-101**	**-104**
Dist-Diff [NM}		**-21**	**-24**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**1**	**2**	**2**	**2**	**-1**	**-1**

MFT routing based on KWBC UAD is shorter and differs in the middle part from the MFT of EGRR UAD. The required fuel is about 200kg higher.
MTT routing based on KWBC UAD is longer and differs in the middle part from the MTT of EGRR UAD. The required fuel is about 200kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 300kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is about 100kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P051 – P054) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: DXB – MEL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: DXB – MEL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: MEL – DXB

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**3**	**2**	**3**	**3**	**-2**	**-1**
TKOF-Diff [KG]		**935**	**818**	**973**	**837**	**-712**	**-650**
Dist-Diff [NM]		**-8**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**3**	**3**	**4**	**4**	**-3**	**-3**

MFT routing based on KWBC UAD is 8nm shorter and differs in the first part from the MFT of EGRR UAD. The required fuel is more than 900kg higher.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD, but the required fuel is more than 800kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 1000kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 700kg lower (MFT-E, MTT-E).
The average wind component is calculated as head wind (M004 – M007) with higher values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: MEL – DXB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: MEL – DXB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

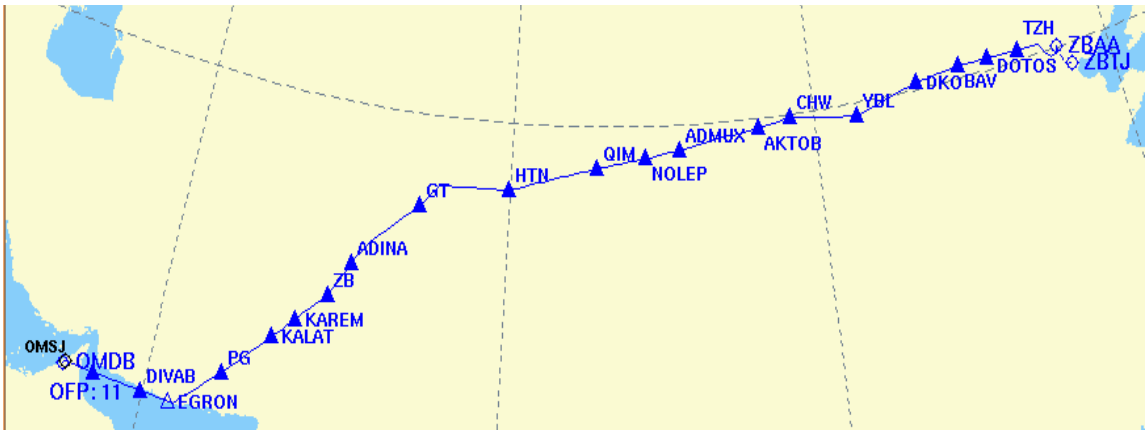
City Pair: DXB – PEK – DXB

Routing: DXB – PEK

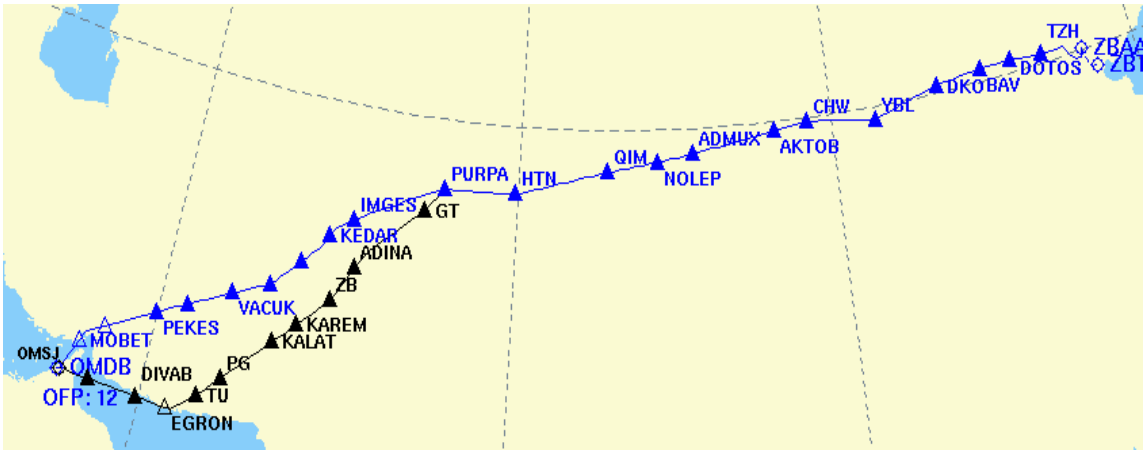
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-5**	**-12**	**-4**	**-4**	**3**	**2**
TKOF-Diff [KG}		**292**	**333**	**428**	**433**	**-384**	**-279**
Dist-Diff [NM}		**0**	**-80**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**3**	**3**	**2**	**2**	**-2**	**-2**

MFT routing based on KWBC UAD is identical with the MFT of EGRR UAD, but the required fuel is about 300kg higher.
MTT routing based on KWBC UAD is 80nm shorter and differs in the first part significantly from the MTT of EGRR UAD. The required fuel is more than 300kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is more than 400kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 400kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P054 – P066) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: DXB – PEK (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: DXB – PEK (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

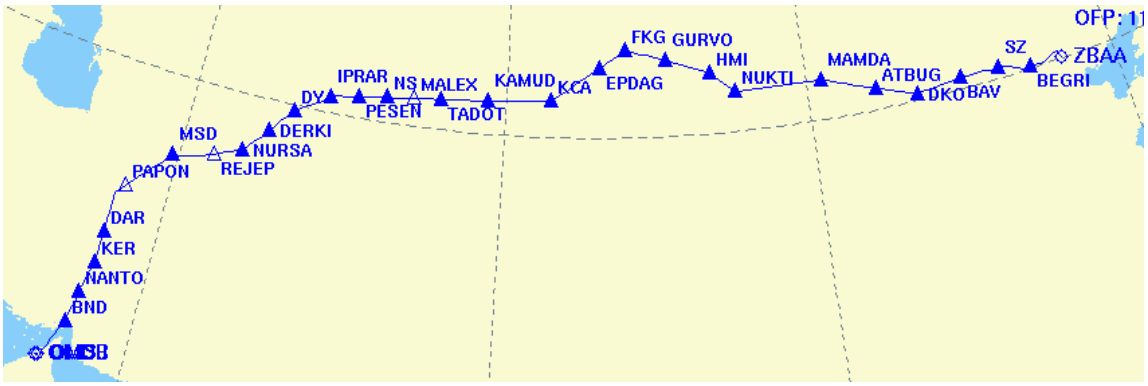


Routing: PEK – DXB

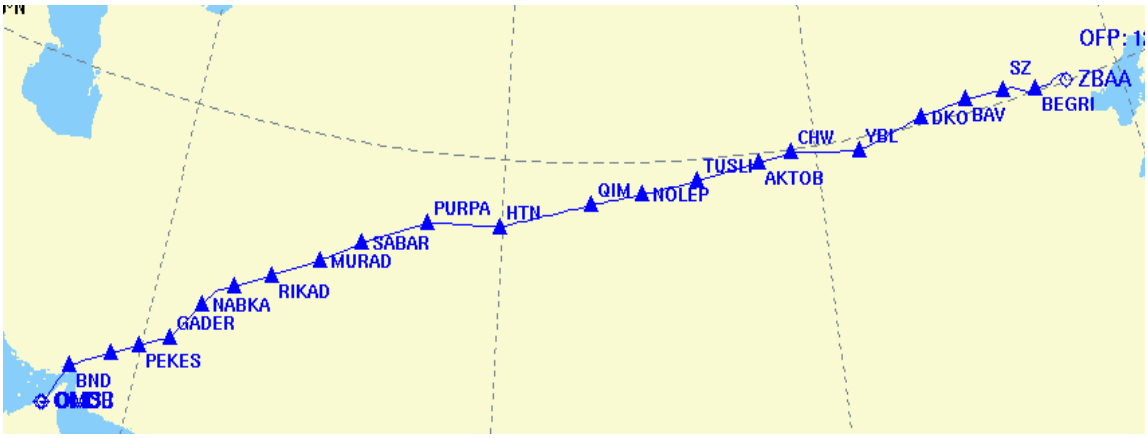
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**-3**	**-2**	**-3**	**-2**	**3**	**3**
TKOF-Diff [KG]		**-657**	**-444**	**-649**	**-428**	**639**	**485**
Dist-Diff [NM]		**0**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-3**	**-2**	**-3**	**-2**	**3**	**2**

MFT routing based on KWBC UAD is identical with the MFT of EGRR UAD, but the required fuel is about 650kg higher.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD. The required fuel is more than 400kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 650kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 650kg higher (MFT-E, MTT-E).
The average wind component is calculated as head wind (M016 – M045) with lower values for KWBC UAD. This is also reflected in the lower required fuel.

MFT Routing: PEK – DXB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: PEK – DXB (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



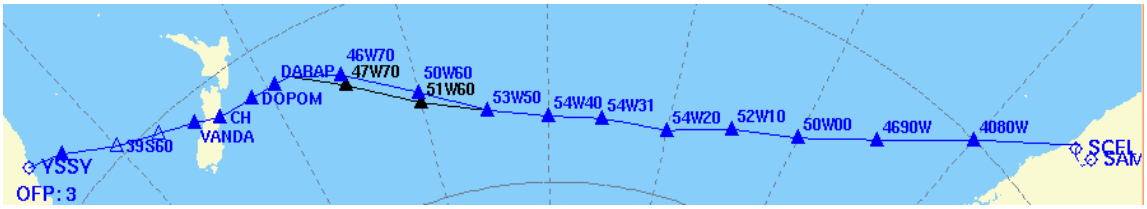
City Pair: SYD – SCL – SYD

Routing: SYD – SCL

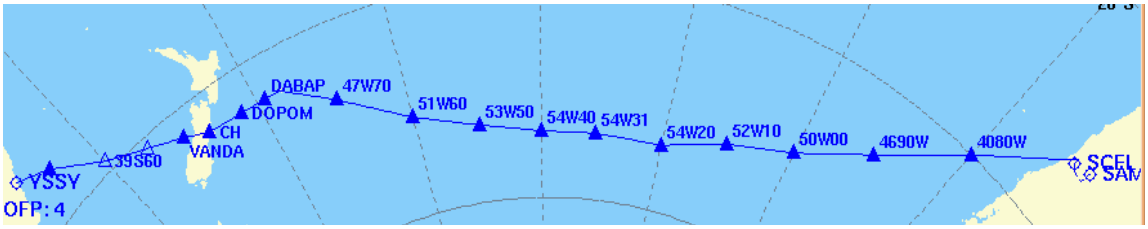
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-2**	**-2**	**-3**	**-3**	**2**	**2**
TKOF-Diff [KG}		**753**	**753**	**934**	**959**	**-635**	**-694**
Dist-Diff [NM}		**6**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**1**	**1**	**3**	**3**	**-2**	**-2**

MFT routing based on KWBC UAD is 6nm longer and differs in the second quarter from the MFT of EGRR UAD. The required fuel is more than 750kg higher.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD, but the required fuel is more than 750kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 1000kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 700kg lower (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P051 – P054) with lower values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: SYD – SCL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: SYD – SCL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

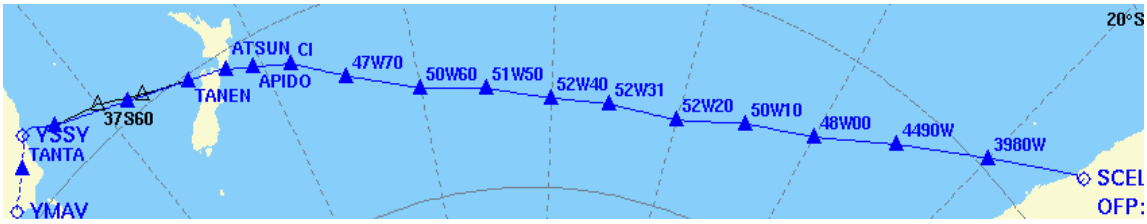


Routing: SCL – SYD

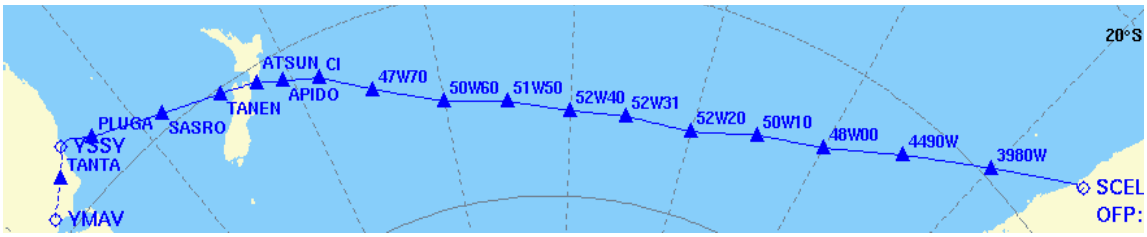
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**-3**	**-3**	**-2**	**-2**	**3**	**3**
Tripfuel-Diff [KG]		**-122**	**-148**	**-109**	**-152**	**147**	**152**
Dist-Diff [NM]		**-3**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-5**	**-6**	**-4**	**-4**	**5**	**5**

Due to tank capacity all flights are carrying the same amount of fuel. Therefore the payload difference is used to identify the differences on the impact of WAFC UAD.
MFT routing based on KWBC UAD is 3nm shorter and differs close to the destination from the MFT of EGRR UAD. The required fuel is about 125kg lower.
MTT routing based on KWBC UAD is identical with the MTT of EGRR UAD, but the required fuel is about 150kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 150kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 150kg higher (MFT-E, MTT-E).
The average wind component is calculated as head wind (M043 – M046) with lower values for KWBC UAD. This is also reflected in the lower required fuel.

MFT Routing: SCL – SYD (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: SCL – SYD (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



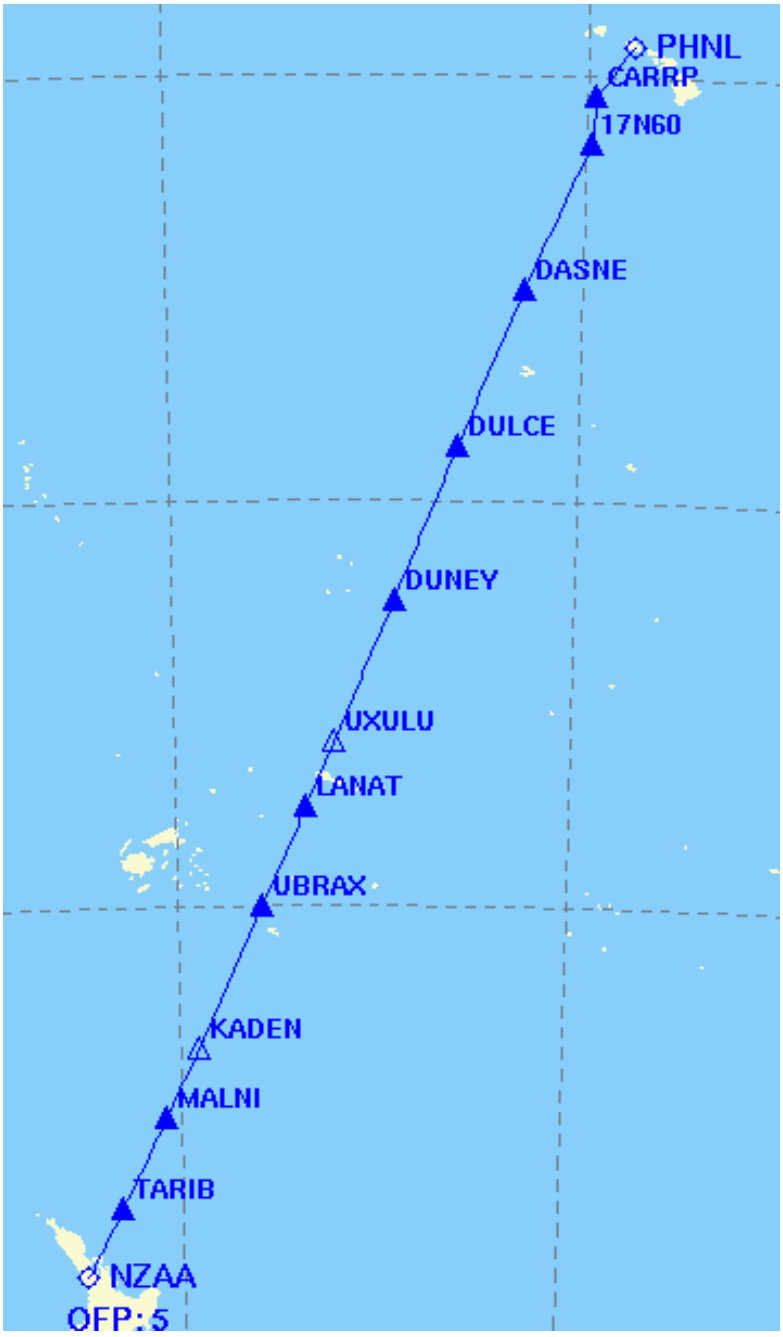
City Pair: AKL – HNL – AKL

Routing: AKL – HNL

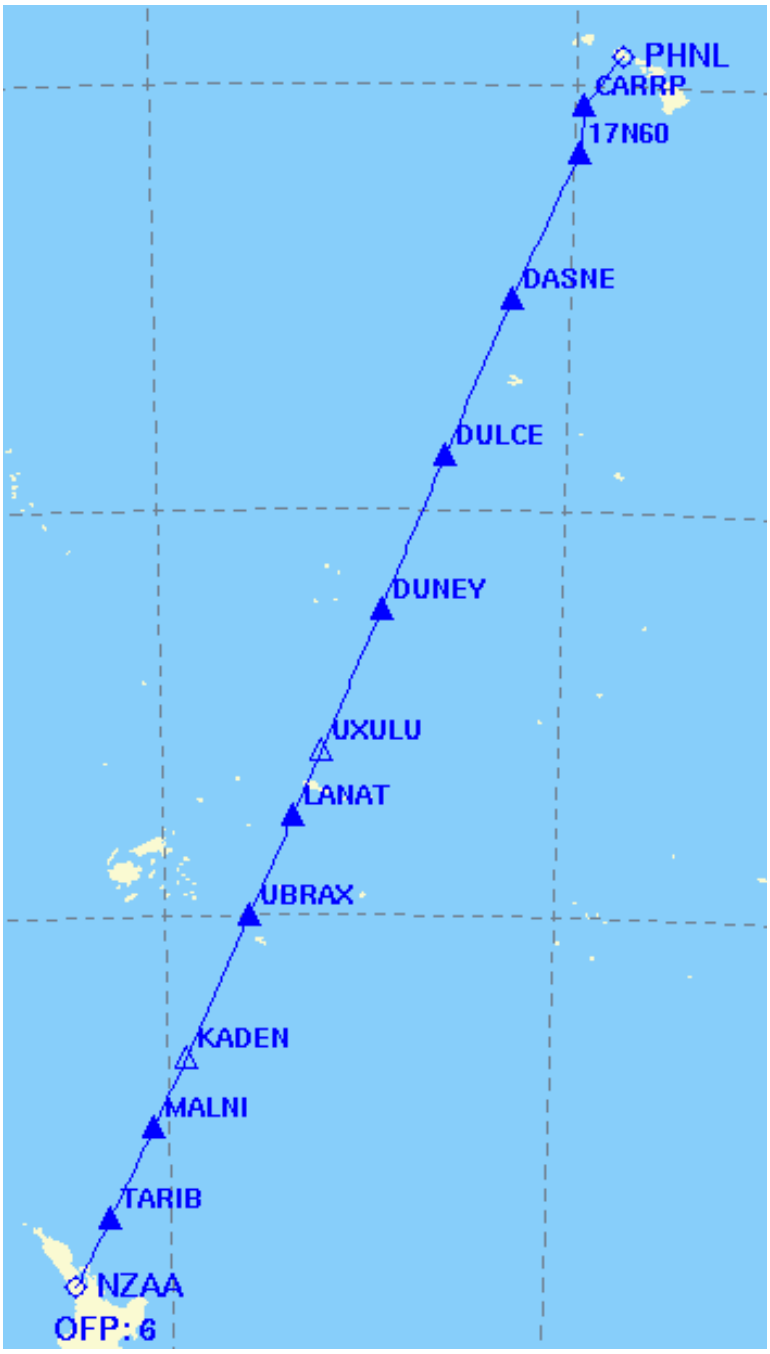
	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**1**	**1**	**1**	**1**	**0**	**-1**
TKOF-Diff [KG}		**-165**	**-165**	**-128**	**-128**	**161**	**46**
Dist-Diff [NM}		**14**	**-5**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-1**	**-2**	**-2**	**1**	**0**

MFT routing based on KWBC UAD is 14nm longer and differs close to the destination from the MFT of EGRR UAD. The required fuel is about 165kg lower.
MTT routing based on KWBC UAD is 5nm and differs close to the destination from the MFT of EGRR UAD. The required fuel is about 165kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 130kg lower (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 160kg higher (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P009 – P010) with higher values for KWBC UAD. This is also reflected in the lower required fuel.

MFT Routing: AKL – HNL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



MTT Routing: AKL – HNL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)



Routing: HNL – AKL

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**H**	**1**	**1**	**1**	**1**	**0**	**-1**
TKOF-Diff [KG]		**266**	**235**	**287**	**305**	**-276**	**-270**
Dist-Diff [NM]		**1**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**1**	**1**	**0**	**0**	**0**	**0**

MFT based on KWBC UAD is 1nm longer and differs close to the departure airport from the MFT of EGRR UAD. The required fuel is about 260kg higher.
MTT based on KWBC UAD is identical with the MTT of EGRR UAD. The required fuel is about 240kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 300kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is up to 280kg lower (MFT-E, MTT-E).
The average wind component is calculated as head wind (M006 – M006) with higher values for KWBC UAD. This is also reflected in the higher required fuel.

MFT Routing: HNL – AKL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: HNL – AKL (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

City Pair: CPT – CCS – CPT

Routing: CPT – CCS

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**0**	**0**	**0**	**0**	**0**	**0**
TKOF-Diff [KG}		**107**	**93**	**98**	**179**	**-107**	**-110**
Dist-Diff [NM}		**0**	**7**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**-1**	**-1**	**-1**	**0**	**1**	**1**

No significant difference found for all routings. MTT based on KWBC UAD is slightly longer and requires a little bit more fuel.
The average wind component is calculated as tail wind (P002).

MFT Routing: CPT – CCS (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: CPT – CCS (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: CCS – CPT

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**1**	**1**	**-1**	**-1**	**-2**	**-2**
TKOF-Diff [KG]		**-396**	**-390**	**385**	**396**	**534**	**522**
Dist-Diff [NM]		**3**	**3**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**2**	**2**	**1**	**1**	**3**	**3**

MFT routing based on KWBC UAD is 3nm longer and differs in the second half of the routing from the MFT of EGRR UAD. The required fuel is about 400kg lower.
MTT routing based on KWBC UAD is 3nm longer and differs in the second half of the routing from the MTT of EGRR UAD, but the required fuel is about 400kg lower.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 400kg higher (MFT-K, MTT-K).

A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is more than 500kg higher (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P021 – P023) with higher values for KWBC UAD. This is also reflected in the lower required fuel.

MFT Routing: CCS – CPT (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: CCS– CPT (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

City Pair: GRU – MEX – GRU

Routing: GRU – MEX

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**-1**	**-1**	**-1**	**-1**	**1**	**1**
TKOF-Diff [KG}		**217**	**231**	**220**	**242**	**-190**	**-221**
Dist-Diff [NM}		**2**	**0**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**0**	**0**	**1**	**1**	**-1**	**-1**

MFT based on KWBC UAD is 2nm longer and differs in the first half of the routing from the MFT of EGRR UAD. The required fuel is about 220kg higher.
MTT based on KWBC UAD is identical with the MTT of EGRR UAD, but the required fuel is about 230kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 250kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is more than 230kg higher (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P000 – P001) with higher values for KWBC UAD. This is also reflected in the lower required fuel.

MFT Routing: GRU – MEX (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: GRU – MEX (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Routing: MEX – GRU

	Avg Wind-Dir	MFT	MTT	MFT-K	MTT-K	MFT-E	MTT-E
Average wind-comp-Diff [KTS]	**T**	**6**	**6**	**-2**	**-2**	**2**	**2**
TKOF-Diff [KG]		**162**	**168**	**331**	**331**	**361**	**355**
Dist-Diff [NM]		**-44**	**-44**	**0**	**0**	**0**	**0**
Time-Diff [MIN]		**0**	**0**	**2**	**2**	**2**	**2**

MFT based on KWBC UAD is 44nm shorter and differs in more than 70% of the routing from the MFT of EGRR UAD. The required fuel is about 160kg higher.
MTT based on KWBC UAD is 44nm shorter and differs in more than 70% of the routing from the MTT of EGRR UAD. The required fuel is about 170kg higher.
A recalculation of MFT and MTT based on EGRR UAD with KWBC UAD shows that the calculated fuel is up to 350kg higher (MFT-K, MTT-K).
A recalculation of MFT and MTT based on KWBC UAD with EGRR UAD shows that the calculated fuel is more than 370kg higher (MFT-E, MTT-E).
The average wind component is calculated as tail wind (P000 – P001) for EGRR UAD and as head wind (M003- M005) for KWBC UAD. The head wind component causes the higher required fuel.

MFT Routing: MEX – GRU (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

MTT Routing: MEX– GRU (Black – GRIB1 EGRR; Blue – GRIB1 KWBC)

Test cases February 2011

	Citypair	Tripfuel (KG)	Trip difference	Distance (NM)	Wind		ACC
1	FRA - ATL	65826		4487	M005		EGRR
		65633	-193	4487	M004		KWBC
2	ATL - FRA	48370		4191	P098		EGRR
		48656	285	4191	P095		KWBC
3	LEJ - MEX	82312		5724	P015		EGRR
		82321	9	5724	P015		KWBC
4	MEX - LEJ	65891		5474	P089		EGRR
		66285	394	5474	P086		KWBC
5	YYZ - NRT	87738		5908	P003		EGRR
		87729	-9	5908	P003		KWBC
6	NRT - YYZ	73761		5693	P057		EGRR
		73608	-153	5693	P057		KWBC
7	YVR - SIN	101817		7300	M010		EGRR
		101946	129	7300	M010		KWBC
8	SIN - YVR	98159		7041	P039		EGRR
		98363	204	7041	P038		KWBC
9	DXB - ORD	86446		6912	P020		EGRR
		86691	245	6912	P018		KWBC
10	ORD - DXB	75994		6465	P064		EGRR
		76211	217	6463	P062		KWBC

11	DXB - LAX	185955		7405	P024		EGRR
		186640	685	7403	P022		KWBC
12	LAX - DXB	187646		7732	P043		EGRR
		188818	1172	7730	P040		KWBC
13	ORD - EZE	122582		4960	P008		EGRR
		122385	-197	4960	P009		KWBC
14	EZE - ORD	127246		4989	M003		EGRR
		127054	-192	4989	M002		KWBC
15	JNB - MEL	130707		5745	P053		EGRR
		130898	191	5745	P052		KWBC
16	MEL - JNB	163661		5828	M033		EGRR
		163970	309	5828	M034		KWBC
17	SYD - SCL	143184		6352	P066		EGRR
		143183	-1	6352	P064		KWBC
18	SCL - SYD	185017		6732	M014		EGRR
		185036	19	6732	M014		KWBC
19	LAX - SYD	100279		6635	M002		EGRR
		100065	-214	6635	M001		KWBC
20	SYD - LAX	95365		6626	P027		EGRR
		95211	-154	6626	P028		KWBC
21	DXB - PEK	40256		3323	P070		EGRR
		40449	193	3323	P067		KWBC
22	PEK - DXB	54054		3245	M066		EGRR
		53737	-317	3245	M064		KWBC

23	DXB - GRU	89201		6832	P000		EGRR
		89571	370	6832	M002		KWBC
24	GRU - DXB	82546		7078	P063		EGRR
		83213	667	7101	P059		KWBC
25	MUC - HKG	64045		5058	P061		EGRR
		64297	252	5058	P059		KWBC
26	HKG - MUC	80043		5177	M016		EGRR
		79931	-112	5177	M015		KWBC
27	LHR - CPT	78785		5331	P003		EGRR
		78998	213	5331	P002		KWBC
28	CPT - LHR	79825		5334	P000		EGRR
		79712	-113	5334	P001		KWBC
29	KWI - MEL	85956		7036	P037		EGRR
		86242	286	7036	P035		KWBC
30	MEL - KWI	89946		6826	M004		EGRR
		90003	57	6827	M004		KWBC
31	ICN - SYD	65136		4621	P015		EGRR
		65247	111	4621	P014		KWBC
32	SYD - ICN	71799		4942	P010		EGRR
		71797	-2	4942	P010		KWBC
33	CPT - SCL	121274		4519	M029		EGRR
		120270	-1004	4519	M026		KWBC

34	SCL - CPT	98883		4420	P048		EGRR
		99588	705	4420	P044		KWB C
35	SYD - EZE	159450		6927	P064		EGRR
		160386	936	6927	P061		KWB C
36	EZE - SYD	189549		6932	M008		EGRR
		189356	-193	6932	M008		KWB C

	Fuel Diff	Distance
Summary	**4795**	**419618**

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