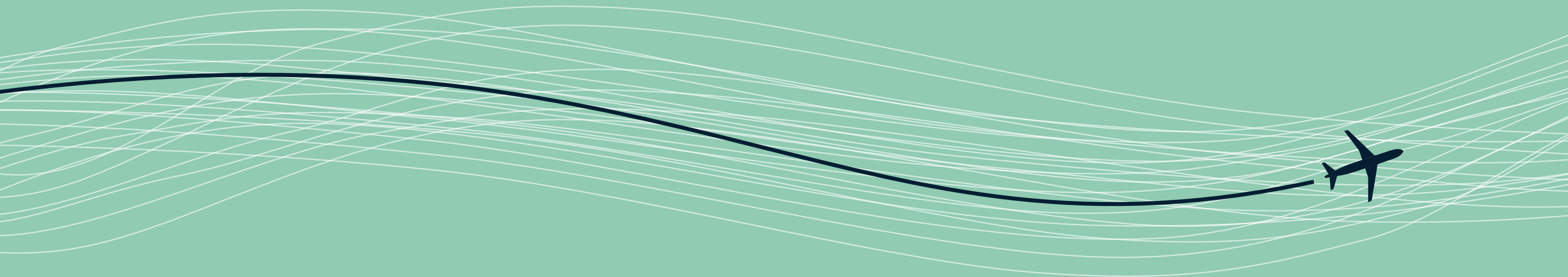




Noise Monitoring Smisby 2023





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Executive Summary

East Midlands Airport has carried out noise monitoring at two locations, in addition to the noise monitoring at its six permanent noise monitors with one location in Smisby being the focus of this report. The monitoring covered the standard summer period of 92 days between 16th June and 15th September 2023.

This report sets out details and results of the Smisby noise monitoring, as well as an analysis of the noise (and weather) data for primary (decision-making) and secondary (explanatory) aviation noise metrics.

The runway split during the monitoring period was 17 % on runway 09 and 83 % on runway 27. This is approximately comparable with the average split over the last five years of 24 % / 76 % (09 / 27).

During the monitoring period, noise levels associated with 252 movements were captured. These were split in to 140 departures, 73 overflights, 7 arrivals and 11 training circuits.

Purely as a result of aircraft, noise level during the day and night have been calculated to be 47 dB $L_{Aeq,16hour}$ (7 am to 11 pm) and 46 dB $L_{Aeq,8hour}$ (11 pm to 7 am) at the monitoring location.

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1.0 Glossary

Acoustic Aviation Terms

Annoyance

The principal health effect relating to daytime (7am to 11pm) aircraft noise, where someone is to some extent bothered, annoyed or disturbed.

Sleep disturbance

The health effect relating to night-time (11pm to 7am) aircraft noise, usually taken to be where someone experiences an awakening.

Summer 92-day period

16th June to 15th September inclusive, representing the busiest period of activity at UK airports.

Shoulder periods

The time period either immediately before (6am to 7am) or after (11pm to 11:30pm) the daytime.

Noise contour

A line around an airport where all points on the line have the same noise level, representing a particular metric.

ANOMS

The Airport Noise and Operations Monitoring System. ANOMS collects data from the airport's noise monitors and radar systems to correlate noise levels and physical locations for individual flights. Weather and flight data are also collected.

NPR

Noise Preferential Routings are established departure routings that aircraft must follow, unless extenuating circumstances apply (such as being instructed otherwise by Air Traffic Control for safety reasons or due to inclement weather).

Touch and Go

An aircraft

Touch and Go

A manoeuvre where an aircraft lands on the runway and then takes back off again in one motion. It is typically undertaken in training but can also be used during an aborted landing.

Noise Metrics and Indices

$L_{Aeq,T}$

The hypothetical steady sound, containing (or equivalent to) the same sound energy as the actual fluctuating sound over the chosen measurement period, T .

$L_{Aeq,16hour}$

The equivalent sound level over a 16-hour day (7am to 11pm) calculated using the average movements over the daytime summer 92-day period. The metric recognised by the UK government for making evidence-based decisions, due to it correlating best with annoyance.

$L_{Aeq,8hour}$

The equivalent sound level over an 8-hour night (11pm to 7am) calculated using the average movements over the night-time summer 92-day period.

L_{day}

The equivalent sound level over a 12-hour day (7am to 7pm) calculated using the annual average daytime movements.

$L_{evening}$

The equivalent sound level over a 4-hour evening (7pm to 11pm) calculated using the annual average evening movements.

L_{night}

The equivalent sound level over an 8-hour night (11pm to 7am) calculated using the annual average night-time movements.

L_{DEN}

The logarithmic time weighted average of L_{day} , $L_{evening}$ and L_{night} , applying a 5 dB penalty to the evening and 10 dB penalty to the night-time.

Number Above (Nx)

The number of aircraft events generating noise levels above x dB $L_{Amax,s}$ (typically 65 or 70 dB during the day and 60 dB at night). A useful communication metric as it correlates well to annoyance.

Sound Exposure Level (SEL)

The equivalent sound level if all the noise energy of an aircraft event is condensed into a one second period. It takes into account both noise level and duration of an event.

$L_{Amax,s}$

Simply the highest measured noise level during an aircraft event, with the sound monitoring equipment taking a measurement every 1 second (known as a slow response). All references to L_{Amax} in this report refer to $L_{Amax,s}$, unless otherwise stated.

Other Referenced Terms

CAA

The UK Civil Aviation Authority.

ERCD

The Environmental Research and Consultancy Department of the CAA.

ERCD Report 0904

Metrics for Aircraft Noise, published by CAA, 2009.

CAP1506

Survey of Noise Attitudes (SoNA), published by CAA, 2021.

ANIS1982

A previous study comparable to that in CAP1506, and is useful for showing how UK noise attitudes have changed over time.

CAP2161

Survey of Noise Attitudes: Aircraft noise and sleep disturbance, published by CAA, 2021.

CAP1767

An investigation into the influence of background ambient noise levels on attitudes to aircraft noise, published by CAA, 2019.

Noise Action Plan

East Midlands Airport Noise Action Plan 2019-2023.

Draft Noise Action Plan

East Midlands Airport Draft Noise Action Plan 2024-2028.

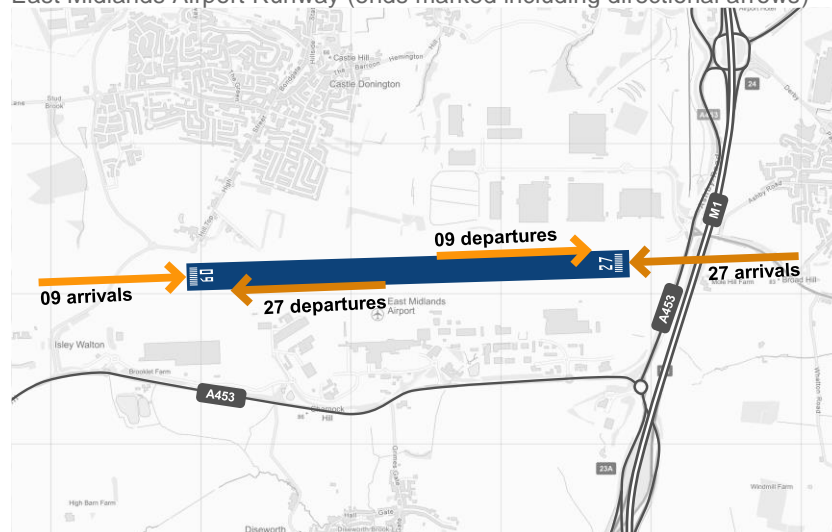
2.0 East Midlands Airport

2.1 East Midlands Airport and the surrounding areas are shown in **Figure 1**. The airport has one runway, facing in an east / west direction.

2.2 There are six main paths that departing aircraft will follow, two to the west and four to the east. These are known as Noise Preferential Routings (NPRs). East Midlands six NPRs and their names can be seen in **Figure 1**.

2.3 The two runway ends are named '09' and '27'. These ends indicate the direction of travel for arriving and departing aircraft, as can be seen in **Figure 2**.

Figure 2
East Midlands Airport Runway (ends marked including directional arrows)



2.4 Aircraft typically take off in a westerly direction and arrive from the east; this is due to the prevailing wind conditions. As set out in the Airport's Draft Noise Action Plan, the historic split over the last five years has been 76% departing to the west and 24% to the east. As this split is purely due to wind direction, it is not expected to have been affected by the pandemic.

2.5 In practice, aircraft arriving at East Midlands Airport can be taken to arrive in the same line as the runway direction.

2.6 East Midlands Airport is used by some airlines based there as a training centre. Aircraft can be flown in 'circuits' around the airport, to allow pilots to train on things like departure and arrival procedures. The circuits shown on Figure 1 are strictly indicative.

Figure 1

East Midlands Airport, its surrounds and Noise Preferential Routings (NPRs)

■ Trent ■ Daventry ■ Pole Hill ■ Brookmans Park ■ Indicative Training Circuits

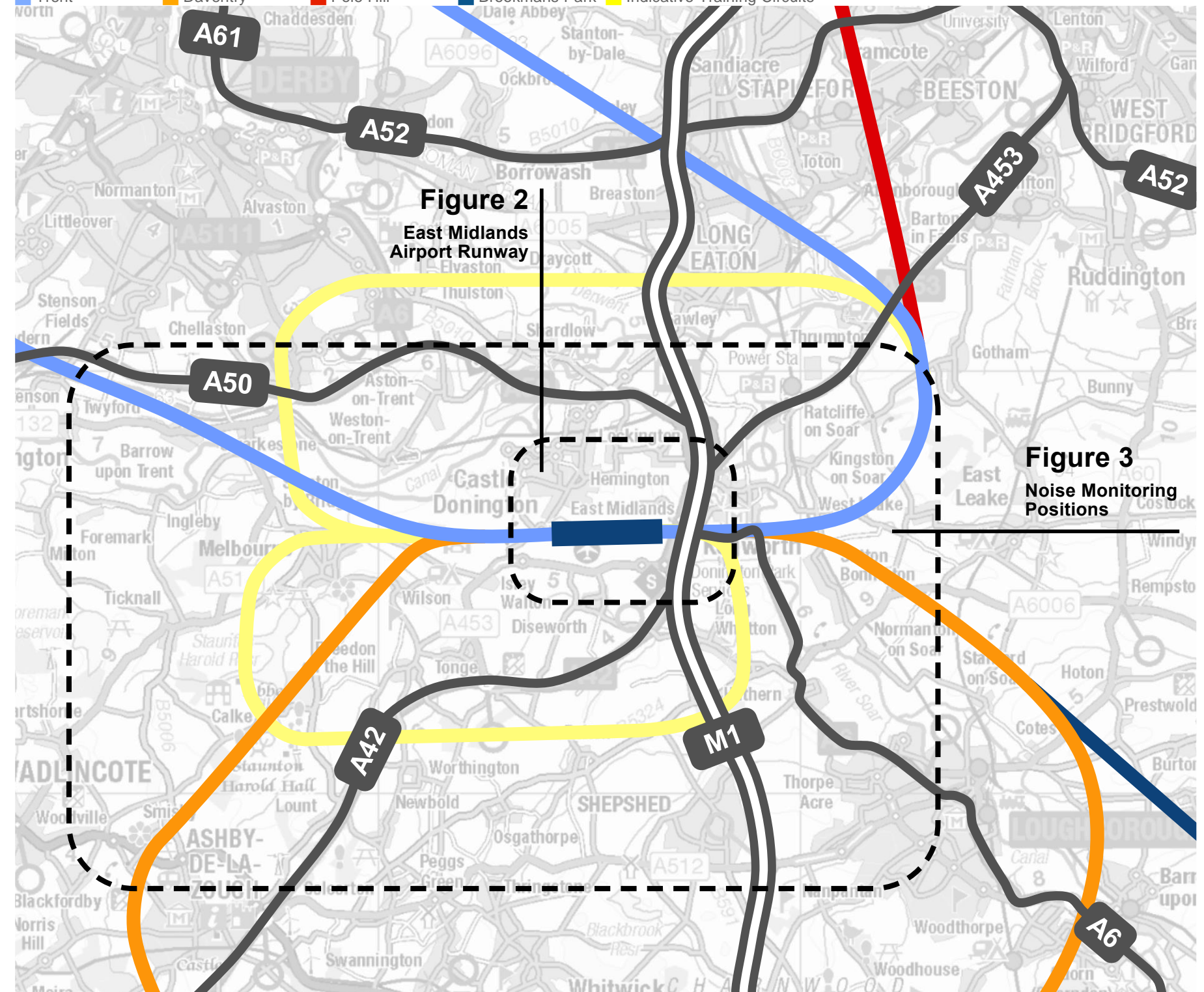


Figure 2
East Midlands
Airport Runway

Figure 3
Noise Monitoring
Positions

2.7 There are six permanent noise monitors installed around East Midlands Airport, with two at each end of the runway and one to the north of the Airport. These monitoring locations can be seen in **Figure 3** to the right.

2.8 These figures also show how the permanent noise monitors are located relative to East Midlands Airport's NPRs. Noise data from these permanent monitors can be seen in near-real-time at <https://webtrak.emsbk.com/ema2>.

2.9 Position M114, the location of which is shown in the bottom left on **Figure 3**, is the temporary position on which this report focuses. The location is approximately 11 km from the airport's southwestern perimeter, within a residential garden off Main Street.

2.10 Monitoring at Location M114 was undertaken between 15th June and 19th September 2023. Data beyond 15th September has been omitted to only analyse the 92-day summer period.

2.11 Location M114 has captured departures on the Daventry NPR using runway 27, which passes above the monitoring location, as well as a small number of arrivals.

2.12 Further information on the noise monitor and associated software are set out in **Appendix A**.

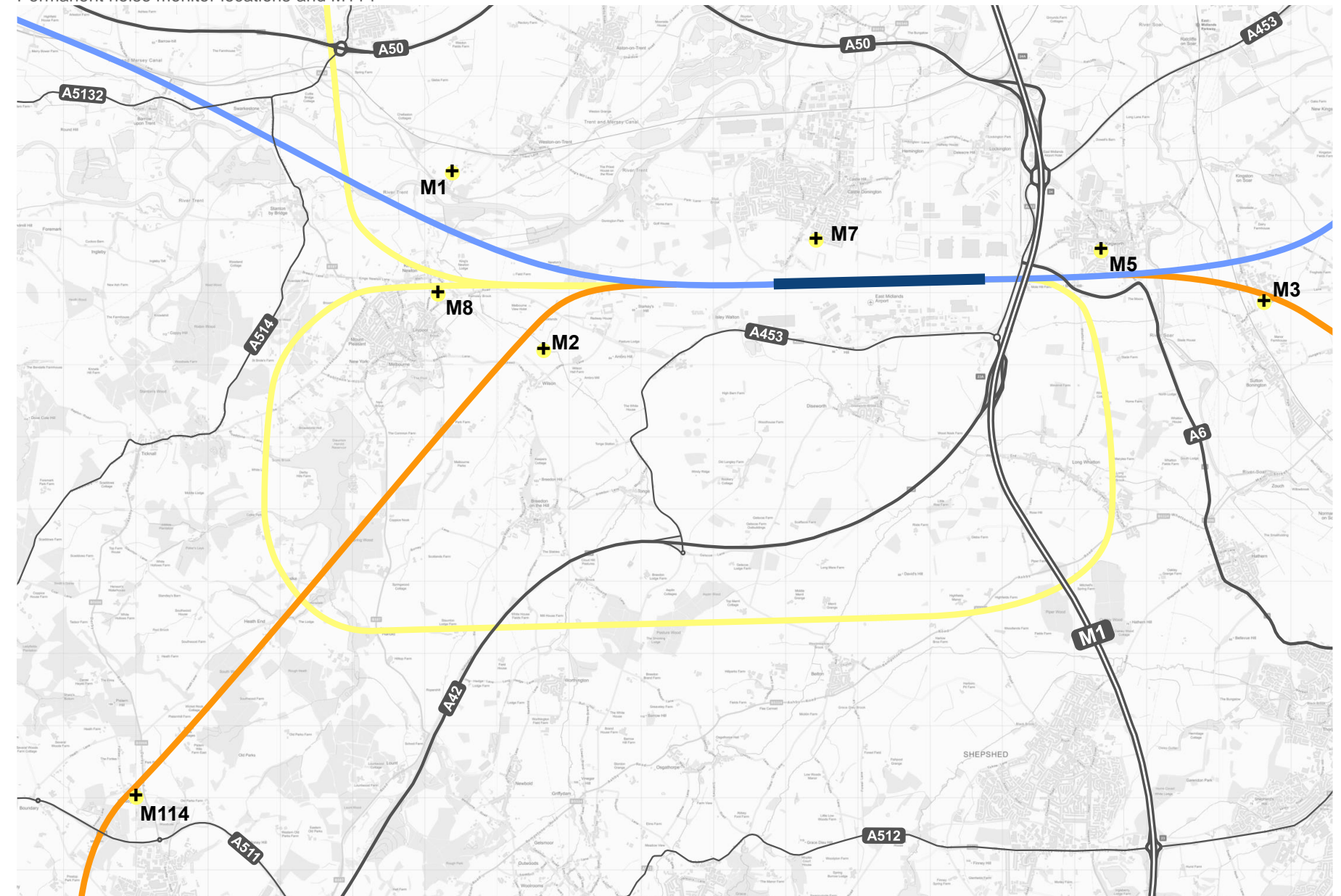
2.13 Noise data for the whole monitoring period are set out in **Appendix B**.

2.14 Weather conditions were acceptable for noise measurements for the vast majority of the monitoring period. The weather data during the monitoring period are also set out in **Appendix B**.

2.15 We note that the NPRs shown in Figures 1 and 3 are all to provide context only. They do not show the full width of each path, within which aircraft should remain within.

2.16 The provided gate data, as is set out in **Appendix A**, shows how correlated events flew relative to the NPRs.

Figure 3
Permanent noise monitor locations and M114



3.0 Movements During Monitoring

3.1 Monitoring at the Smisby location is considered over 92 days, between 16th June and 15th September 2023, inclusive. During that time, a total of 19,775 movements operated from East Midlands Airport. How these movements are split is set out in **Table 1**.

3.2 A 'gate' located above the monitor captured 5,179 movements. How these movements are split is also set out in **Table 1**. More information on the gate, what it is and how it works is set out in **Appendix A**.

3.3 26.2 % of movements operating from East Midlands Airport were captured by the gate. The 74%, or so, not captured flew on routes that the gate did not cover. Some aircraft may have overflown the monitor but not generated noise levels high enough to trigger the monitor.

3.4 As set out East Midlands Draft Noise Action Plan document, 58.4 % of all daytime departures used the 27 Daventry routing (falling to 37.2 % in the night-time). 53.7 % of all departures were captured by the gate so the data captured during this exercise is in line expectations.

3.5 As would also be expected for such a position, the majority of movements captured were departures (5,048), and then arrivals (84). A small number of overflights (43) and "touch and go" or training (4) movements were also captured which are categorised as 'other' within **Table 1**.

3.6 From the total movement data, a runway split has been calculated. This shows during the monitoring period, runway 27 was in use 83 % (departures potentially overflying the monitoring position) of the time and runway 09 was in use 17 % of the time.

3.7 The long-term (5-year average) split at East Midlands Airport is 76 % / 24 %, showing wind conditions during the monitoring period cannot be considered close to typical.

Figure 4

Average movements per hour

■ Total, ■ Departures, ■ Arrivals

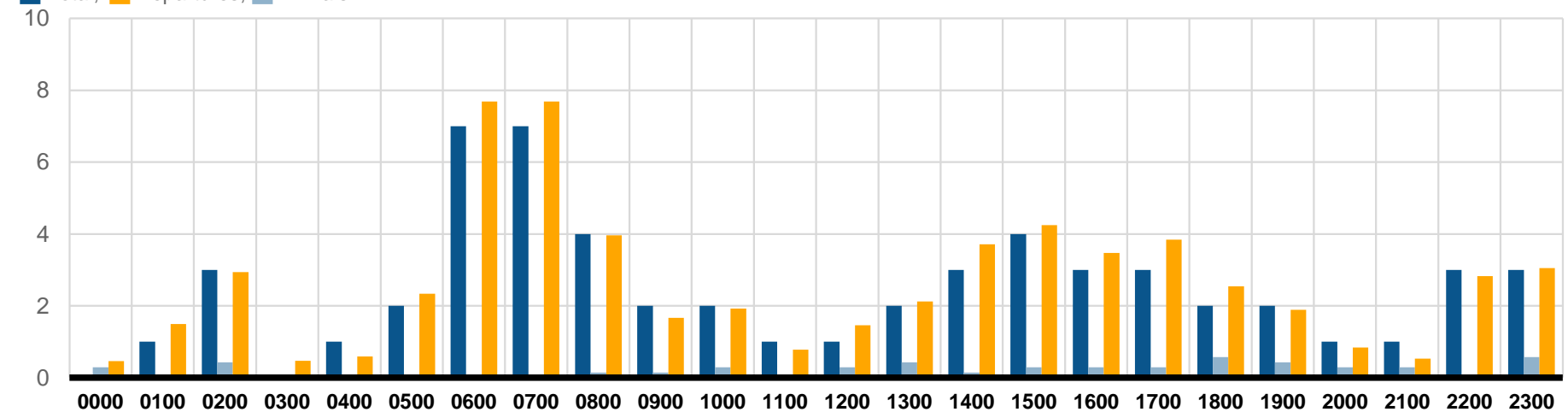


Table 1 Movements breakdown

Operation	Departures	Arrivals	Other	Total
<i>Total movements</i>				
East (09)	1,578	1,748	104	3,430
West (27)	7,934	7,774	510	16,218
Gate-captured movements	5,048	84	47	5,179

Table 2 Most common aircraft type movements captured

Aircraft Type	No. Movements Captured	% of movements
Boeing 737-800	3,007	58.1 %
Boeing 737 MAX 8	453	8.8 %
Boeing 767-300	289	5.6 %
Boeing 757-200	274	5.3 %
Boeing 737-400	201	3.9 %
Alenia ATR 72-212A (600)	126	2.4 %
Alenia ATR 72-211/-212	114	2.2 %
Boeing 767-200 / 200ER	99	1.9 %
Alenia ATR 72-212A (500)	76	1.5 %
Boeing 777-200 Freighter	62	1.2 %

3.8 **Figure 4** is a graph showing how the number of captured movements are split over each hour of the day.

3.9 It can be seen in **Figure 4** that when the Airport is operating on runway 27, departing aircraft can overfly this location during both the daytime and the night-time.

3.10 The 10 most common aircraft types captured are set out in **Table 2**.

3.11 The main known aircraft operators during the monitoring period were:

- Ryanair (27 % of all captured movements)
- Jet2 (22 % of all captured movements)
- TUI Airways (15 % of all captured movements)
- Freight operators, including DHL (6 %) and European Air Transport (7 %).

3.12 For the approximate quarter of movements not flown by the above operators, movements were split between 51 different operators. None of these operators held more than a 5 % of the fleet and the majority held less than 1 %.

4.0 Ambient Noise Analysis

Rationale

4.1 The CAA state that $L_{Aeq,16hour}$ is the metric to be used for evidence-based decisions, as it correlates best with annoyance in UK-based surveys on daytime noise attitudes. It is important to note that the $L_{Aeq,16hour}$ value to be used is the average resulting from all movements during a 92 day summer period between mid-June and mid-September. The latest survey was undertaken in 2014 and is set out in *CAP1506*.

4.2 As explained in *CAP1506*, even though some people have criticisms of $L_{Aeq,16hour}$ (such as 'an equivalent continuous level is not consistent with people's perception of aircraft noise as a number of discrete, noticeable events'), it is important for metrics to correlate with the impact being described, which is what $L_{Aeq,16hour}$ does, and it does it better than any other metric.

4.3 This correlation is known as a dose-response function.

4.4 The expected impact of a noise level can be correlated between a noise level and % likelihood of a typical person being highly annoyed using Table 25 of *CAP1506*, reproduced in **Table 3**.

4.5 During the night-time, impact is correlated between noise level and sleep disturbance. The CAA states that $L_{Aeq,8hour}$ is the metric to use and is supported by their indicative findings in *CAP2161*.

4.6 As set out in *CAP2161*, $L_{Aeq,8hour}$ correlates best with mean disturbance during the night-time.

4.7 **Table 3** shows that the likelihood of annoyance and disturbance increase with noise level.

4.8 It is important to note that aircraft noise levels can be audible even when below the ambient noise climate, due to the potential for different frequency spectra.

4.9 The CAA undertook an investigation into any correlation between annoyance to aircraft noise and background ambient noise levels; this investigation is set out in document *CAP1767*.

4.10 The CAA found that there is only a weak link between such a relationship, and crucially any response is tied in with noise sensitivity and socio-economic status as well. It was not possible for the CAA to recommend a link between an individual's aircraft noise-annoyance response related to background ambient noise.

4.11 East Midlands Airport is also required to produce L_{day} , $L_{evening}$, L_{night} and L_{den} metrics every five years as part of the Environmental Guidelines (England) Regulations 2006. There is

therefore benefit in calculating these metrics from the noise monitoring, but it is important to note that these metrics do not correlate as well with annoyance as $L_{Aeq,16hour}$.

4.12 The above studies were not able to differentiate the response of people living near airports depending on whether or not they have had enhanced glazing installed, either through an airport-supported scheme or otherwise.

Table 3 % highly annoyed as a function average summer day noise exposure, $L_{Aeq,16hour}$

Average summer day noise exposure, $L_{Aeq,16hour}$ (dB)	% highly annoyed	
	ANIS 1982	SoNA 2014
51	3	7
54	5	9
57	9	13
60	14	17
63	23	23
66	34	31
69	48	39

Table 4 Aviation noise metric results, dB

Metric	Measured Results	Without aircraft	Aircraft only
Whole Period			
$L_{Aeq,16hour}$	52	50	47
$L_{Aeq,8hour}$	48	44	46
L_{day}	53	51	48
$L_{evening}$	47	45	44
L_{night}	48	44	46
L_{DEN}	55	52	53

Results

4.13 The monitoring period covered the full 92-day summer period, The results set out in this section can therefore be compared directly to the figures detailed in **Table 3**.

4.14 Noise levels associated with the movements set out in **Section 3** above have been analysed to produce values in various aviation metrics.

4.15 ANOMS can correlate noise events with aircraft movements and can therefore calculate contributions from overall noise levels with those specifically from aircraft. These contributions are set out in **Table 4**, calculated over the whole monitoring period (omitting several brief time periods, as detailed in **Appendix B**).

4.16 From **Table 4**, it can be concluded that aircraft is a main contributing factor to the ambient noise climate in both the day and night periods.

4.17 However, comparing the results to those in **Table 3** well below 7% of the community in the vicinity of the monitoring position would be expected to be highly annoyed by aircraft noise.

4.18 This is found using the lowest result of *CAP1506* and comparing $L_{Aeq,16hour}$ noise levels from aircraft only, calculated for all movements, noting that the noise level is lower than the range of *CAP1506*.

4.19 This does not mean that aircraft are not audible, nor that the local community will not be subject to any annoyance or disturbance from aircraft noise.

5.0 Number Above Analysis

Rationale

- 5.1 Number Above contours are specifically stated in UK aviation policy as being helpful in explaining noise impacts around an airport.
- 5.2 The N70, N65 and N60 metrics relate to different noise impacts, and all three are set out within this section.
- 5.3 N70 was first used in Australia to relate to the number of times that speech interference would be expected throughout the day. For the equivalent effect to be relevant in the UK, a threshold greater than 70 dB L_{Amax} would be more appropriate.
- 5.4 However, the research set out in CAP1506 clearly states that N65 (a lower L_{Amax} threshold than N70) correlates better with annoyance than N70. This trend suggests that any threshold greater than 70 dB L_{Amax} would not be beneficial.
- 5.5 As with the analysis in the section above, the trend was found to correlate most closely during the 92-day summer period.
- 5.6 CAP1506 states that $L_{Aeq,16hour}$ correlates best with annoyance, then N65 over the same summer period (excluding those surveyed who experienced less than 1 event). N70 correlates least well of all the metrics considered.
- 5.7 N60 relates to a similar effect to N65 and N70, except during the night-time period.
- 5.8 CAP2161 states that $L_{Aeq,8hour}$ correlates best with night-time disturbance, then L_{night} , then N60.

Figure 5
N70 by day, arrivals, departures

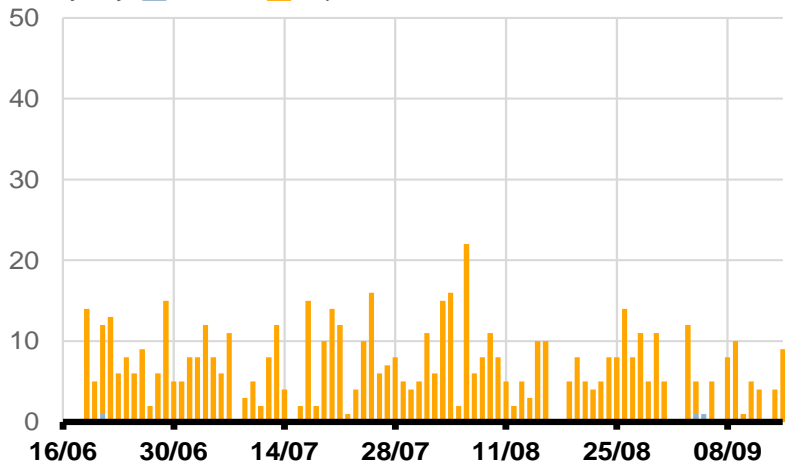


Figure 6
N65 by day, arrivals, departures

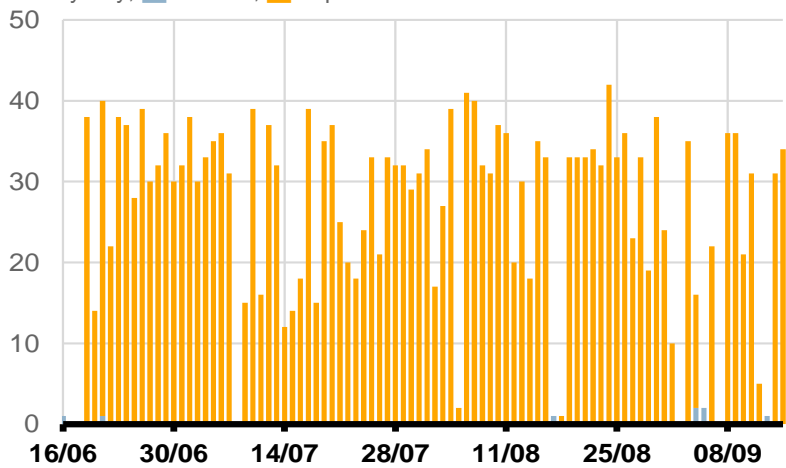
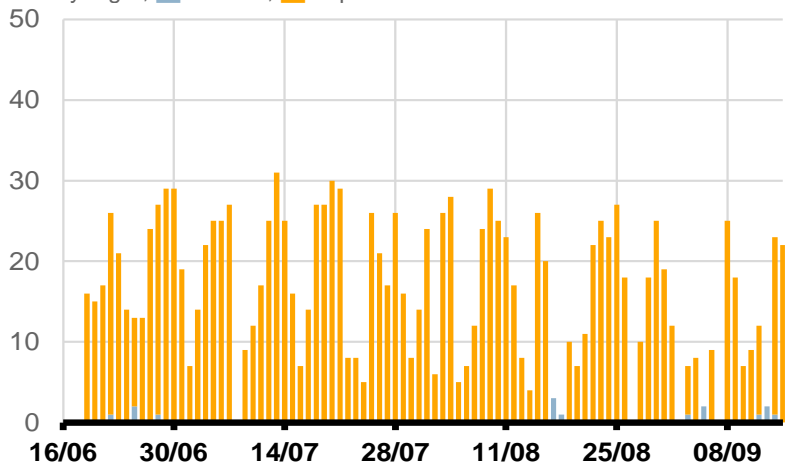


Figure 7
N60 by night, arrivals, departures



Results

- 5.9 Averaged over the 92-day period, the following number of events meeting the relevant threshold were captured:
- N70 (day): 622 events;
 - N65 (day): 2,415 events;
 - N60 (night): 1,461 events.
- 5.10 **Table 5** below sets out the percentage of movements that triggered the relevant threshold to be counted in the Number Above metrics.
- Table 5** Percentage movements within Number Above thresholds
- | Metric | Arrivals | Departures | Total |
|--------|----------|------------|-------|
| N70 | 6% | 19% | 19% |
| N65 | 16% | 76% | 74% |
| N60 | 71% | 99% | 99% |
- 5.11 As set out in **Table 5**, nearly all night-time movements (99 %) generated a noise level of at least 60 dB L_{Amax} above the monitoring position.
- 5.12 Three quarters of all daytime movements (74 %) generated at least 65 dB L_{Amax} and few (19 %) of all daytime movements generated at least 70 dB L_{Amax} .
- 5.13 The trend for total movements matches that of departures as only a small number of arrivals were recorded.

6.0 Individual Event Analysis

Rationale

6.1 All of the metrics considered reflect the noise generated by multiple aircraft movements. There is also benefit in analysing noise levels corresponding to individual events.

6.2 Noise levels corresponding to an individual aircraft movement differ due to a wide range of factors, including aircraft type, weight, engine and weather. It is also important to account for the duration of the noise, for example an aircraft passing overhead quickly may be less disturbing than one passing more slowly.

6.3 The SEL (Sound Exposure Level) metric takes into account the overall noise of an aircraft movement. This includes the maximum noise generated during the movement; due to the logarithmic nature of noise levels, it is typical that the SEL is driven by the L_{Amax} of an aircraft event.

6.4 Not only does SEL account for both noise level and duration, but by summing multiple SELs, it is possible to calculate the L_{Aeq} over the time period in which they all occur. It is therefore a powerful metric for explaining aviation noise.

6.5 The L_{Amax} metric also has a part to play. It is the simplest measure of a noise event, providing only the highest noise level generated by an aircraft flyover. The L_{Amax} noise level cannot be correlated to annoyance, as no known dose-response function exists for aviation noise. It is, however, easy to understand and so is included within this section.

Figure 8
Average to maximum range in **Arrivals SEL**

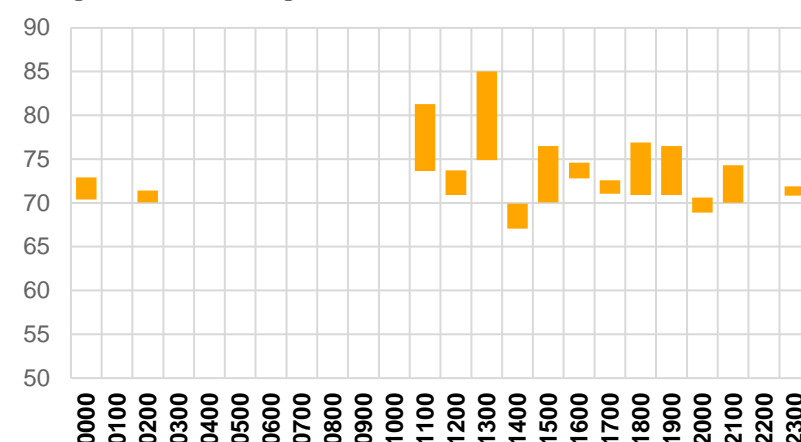


Figure 9
Average to maximum range in **Departures SEL**

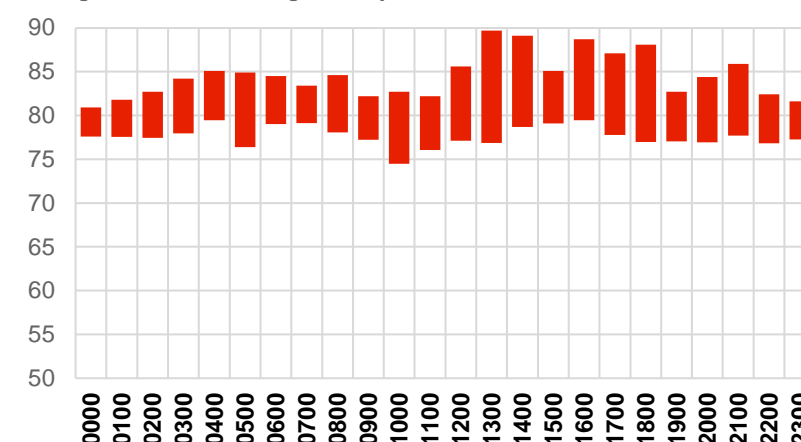


Figure 10
Average to maximum range in **Arrivals L_{Amax}**

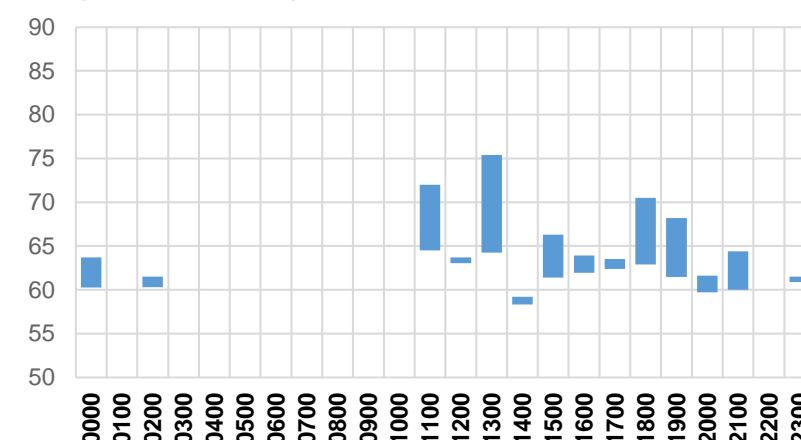
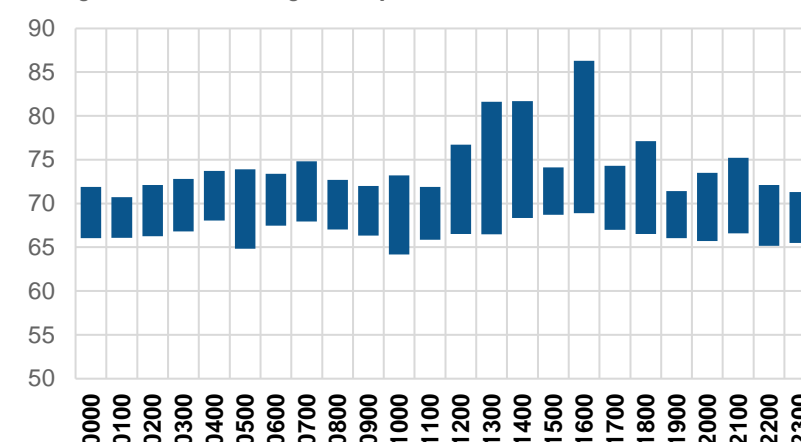


Figure 11
Average to maximum range in **Departures L_{Amax}**



Results

6.6 **Figures 8 and 9** show how the average and maximum SEL varies over the course of the day for arrivals and departures. **Figures 10 and 11** show how the average and maximum L_{Amax} varies over the course of the day.

6.7 For arrivals, it can be seen in **Figures 8 and 10** that there is some small variation in average SEL and L_{Amax} values throughout the day. Given that the number of movements captured overall is small, some variation could reasonably occur without being notable.

6.8 For departures, it can be seen in **Figures 9 and 11** that there is greater variation in average SEL and L_{Amax} values throughout the day and night.

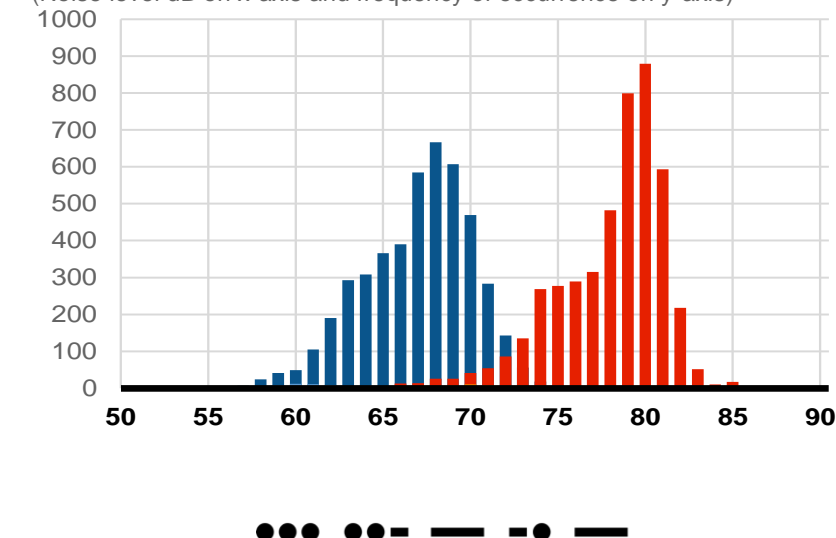
6.9 Departures were captured during every hour of the day. There are multiple hours in the morning where no arrivals were captured.

6.10 The single highest SEL and L_{Amax} noise events captured during the monitoring period are:

- SEL (arrival): 85 dB; Augusta Westland AW119 helicopter.
- SEL (departure): 88 dB; Boeing 747-400.
- L_{Amax} (arrival): 75 dB; Augusta Westland AW119 helicopter.
- L_{Amax} (departure): 77 dB; Boeing 747-400.

6.11 The highest SEL and L_{Amax} for arrivals and departures both correlate to the same events. Both the above events occurred during the day. Set out in **Figure 12** is the frequency distribution of aircraft noise events at the monitoring location for departures.

Figure 12
■ L_{Amax} (departures), ■ SEL (departures)
(Noise level dB on x-axis and frequency of occurrence on y-axis)



Appendix A

Noise Monitor and Gate Details

Monitoring Location M114

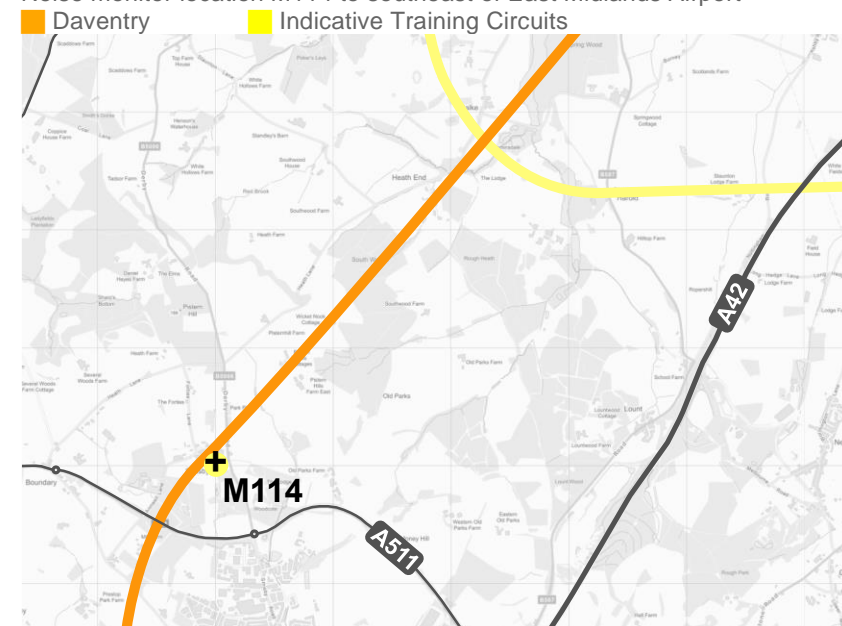
Noise monitoring has been undertaken at Location M114, which is located within a residential garden off Main Street, to the southwest of East Midlands Airport.

The monitoring location can be seen on **Figure A.1**.

The ambient noise climate is controlled by road traffic on the A511.

Figure A.1

Noise monitor location M114 to southeast of East Midlands Airport



Monitoring was undertaken continuously between 15th June and 19th September 2023.

The equipment installed is a *Brüel and Kjær* Sound Level Analyser (Type 3639 – A), which self-calibrates to ensure a suitable level of accuracy is maintained.

The microphone was positioned at 4.0 m above the local ground level, to minimise the measuring of noise reflecting off the ground. The microphone is located within a weatherproof windshield to protect it. The monitor setup can be seen in **Figure A.2**.

Figure A.2

Noise monitor in position



The Gate

The noise monitor is connected to East Midlands' ANOMS. When noise levels reached a trigger point, ANOMS correlates the noise event to an aircraft movement, assuming an aircraft movement is occurring above the position. The trigger level was set at 55 dB.

There could be some interference in the data, should noises close to the microphone be caused by something louder than an aircraft. To lower this risk, audio recording is made. To avoid an overly onerous, time-consuming process, only audio recordings of distinct outliers are further analysed (as noted in **Appendix B**).

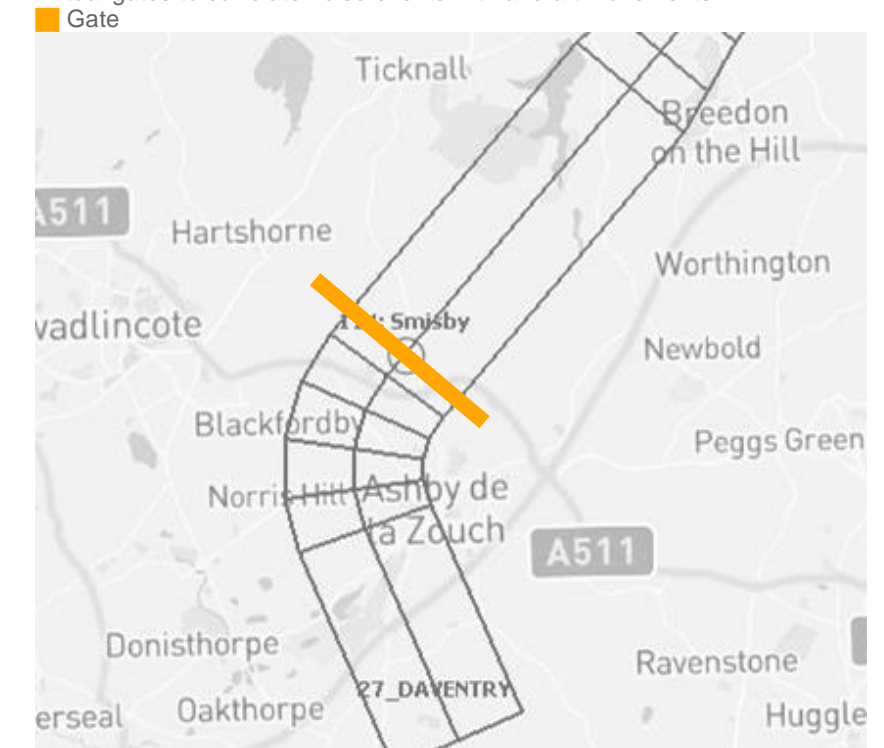
Aircraft events are correlated against movements which passes through the 'gate'.

For Location M114, the 'gate' is located to capture movements departing on the Daventry NPR from runway 27.

The gate is a virtual, rectangular shape stretching from ground level up to 6,000 feet above ground level and 2.5 nautical miles wide. The gate can be seen on **Figure A.3**.

Figure A.3

Virtual gates to correlate noise events with aircraft movements



The flightpaths of aircraft correlated to noise events can be seen in the below three figures, as well as the NPR routing in three dimensions.

Figure A.5

Departures on 27 Daventry

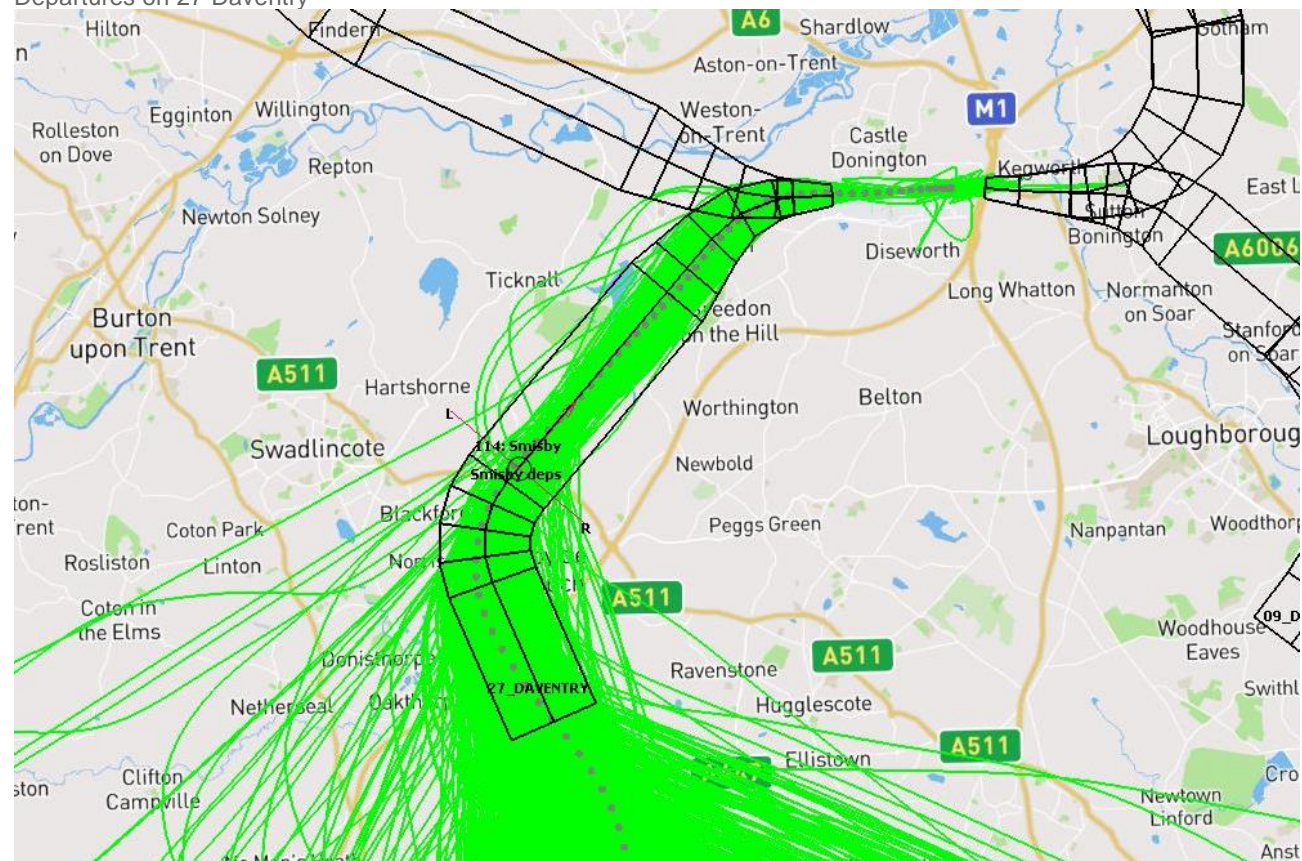
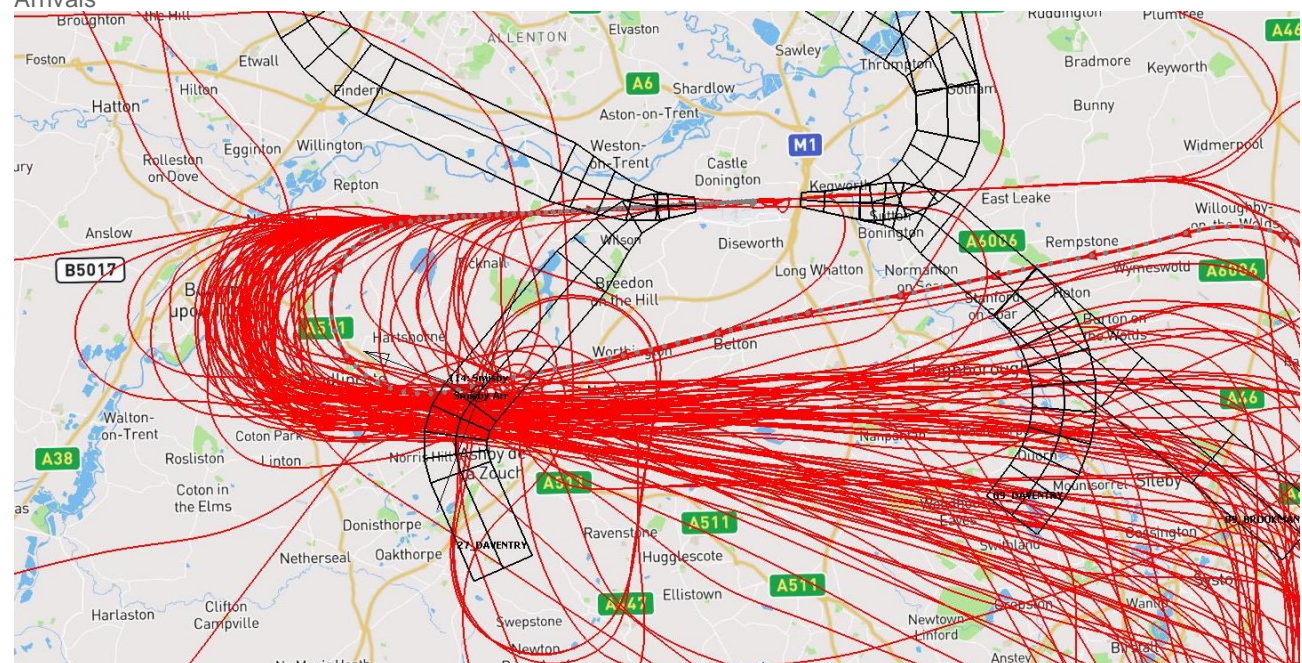


Figure A.6

Arrivals



Appendix B

Monitoring Results

Noise Data

Noise data collected by the monitoring position is presented in this appendix using the $L_{Aeq,1hour}$ metric. A 1-hour period shows how noise levels change hour by hour, allowing for greater inspection than longer period metrics.

Three values are presented, all of which are calculated by the monitoring equipment software. All are measured in dB $L_{Aeq,1hour}$ and are:

- Total noise level – all noise measured by the monitoring position uncorrected. Presented as continuous black line.
- Without aircraft noise level – total noise level minus any influence from correlated aircraft events. Representative of community noise levels if aircraft noise was not present. Presented as dashed grey line.
- Aircraft only noise level – the difference between total and community noise levels. Representative of noise purely from correlated aircraft events. Presented as continuous orange line.

The total and without aircraft noise levels match each other closely and are typically on top of each other on the graphs below due to the low levels of aircraft noise at the monitoring position.

Weather Data

Weather data has been provided alongside the noise data. East Midlands Airport has two weather monitors, with data provided being that from Weather Monitor 2, as this station measures rainfall.

Wind speed (knots), wind direction (degrees) and rainfall (inches) have been provided for the survey duration for every 15-minute period.

We have condensed this data down into 3-hourly periods, by averaging the wind speed and direction and summing the rain.

Multiple periods of data have been omitted from noise analysis due to weather. These periods are set out in **Table 1.1**, alongside the reason why.

Table 1.1 Omitted data

Periods omitted	Reason
18/06/2023 3am until 6am	Rain
18/06/2023 3pm until 19/06/2023 3am	Rain
20/06/2023 6am until 12pm	Rain
20/06/2023 9pm until 21/06/2023 3am	Rain
03/07/2023 12pm until 3pm	Rain
08/07/2023 9am until 09/07/2023 12am	Rain
09/07/2023 3pm until 9pm	Rain
11/07/2023 12am until 3am	Rain
11/07/2023 12pm until 6pm	Rain
13/07/2023 9am until 12pm	Rain
14/07/2023 9am until 6pm	Rain
15/07/2023 12pm until 6pm	Wind and Rain
16/07/2023 12pm until 6pm	Rain
18/07/2023 12pm until 9pm	Rain
21/07/2023 9am until 3pm	Rain
22/07/2023 6am until 12pm	Rain
22/07/2023 9pm until 23/07/2023 12am	Rain
23/07/2023 3pm until 6pm	Rain
24/07/2023 6am until 9am	Rain
26/07/2023 3pm until 27/07/2023 6am	Rain
30/07/2023 9pm until 31/07/2023 12am	Rain
31/07/2023 12pm until 3pm	Rain
02/08/2023 12am until 6am	Rain
02/08/2023 3pm until 6pm	Rain
03/08/2023 3pm until 6pm	Rain
05/08/2023 3am until 9pm	Rain
12/08/2023 12pm until 3pm	Rain
14/08/2023 3am until 12pm	Rain
18/08/2023 9am until 12pm	Rain
18/08/2023 9pm until 19/08/2023 3am	Rain
25/08/2023 6pm until 9pm	Rain
27/08/2023 6am until 12pm	Rain
29/08/2023 3pm until 6pm	Rain
30/08/2023 9am until 12pm	Rain
31/08/2023 3pm until 6pm	Rain
11/09/2023 6pm until 9pm	Rain
12/09/2023 3am until 12pm	Rain

Data Omitted from Analysis

Data omitted due to weather is omitted from noise analyses. It is not necessary to omit the weather-related periods from movement analyses, as the number of aircraft movements was not affected.

Correlated Event Data

Correlated aircraft events are those where an increase in noise level corresponds to a movement passing through the gate.

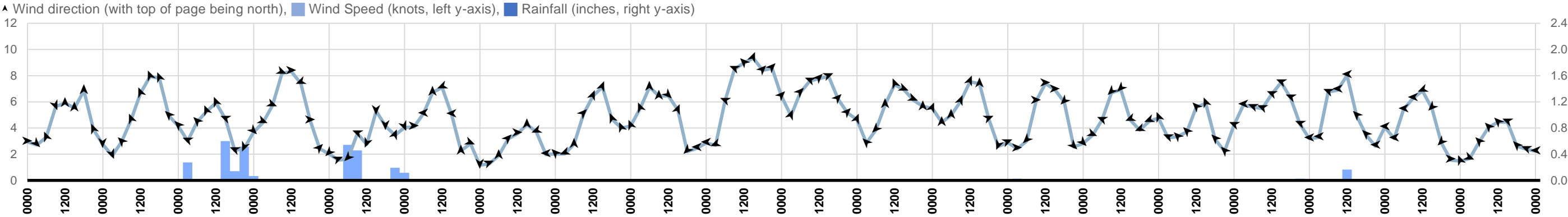
The data presented below shows the number of correlated events that have occurred in each hour of monitoring, split by arrivals and departures as well as the total.

Inclusion of these correlated events allows for the weather and noise data to be compared, when looking at which direction the runway is operating in, as well as how movements are split by hour and day.

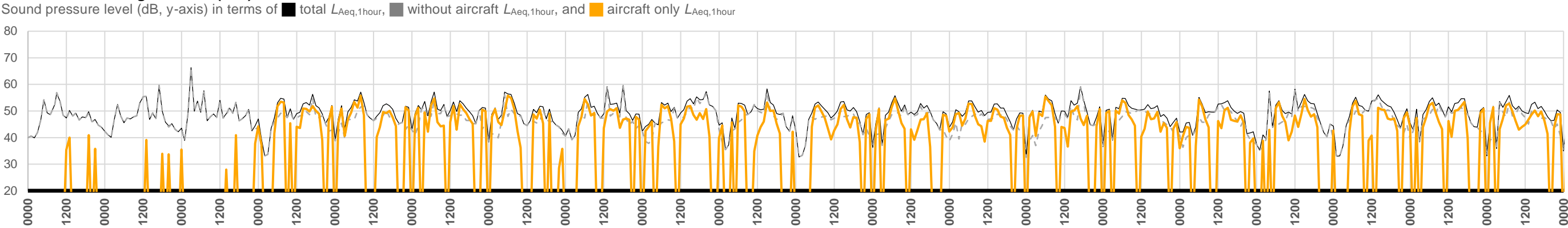
Survey Data: 16 June to 5 July 2023

Data presented at intervals available against date and time (hhmm, x-axis)

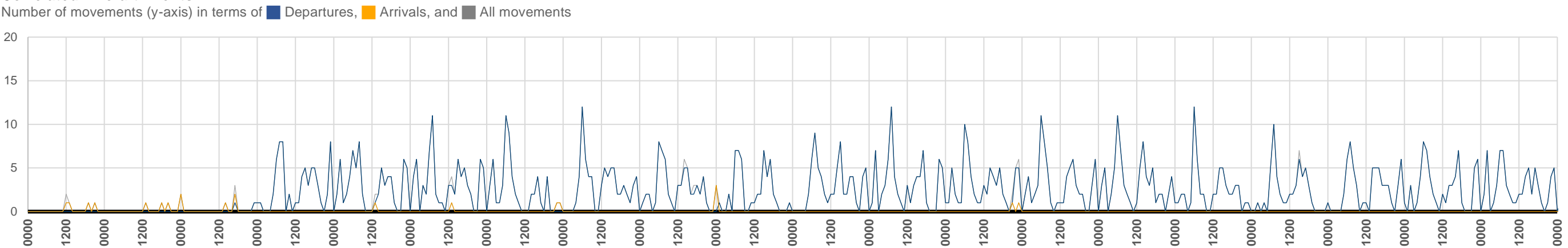
Weather Data at Location 2



Noise at Monitoring Position (114)



Correlated Aircraft Events

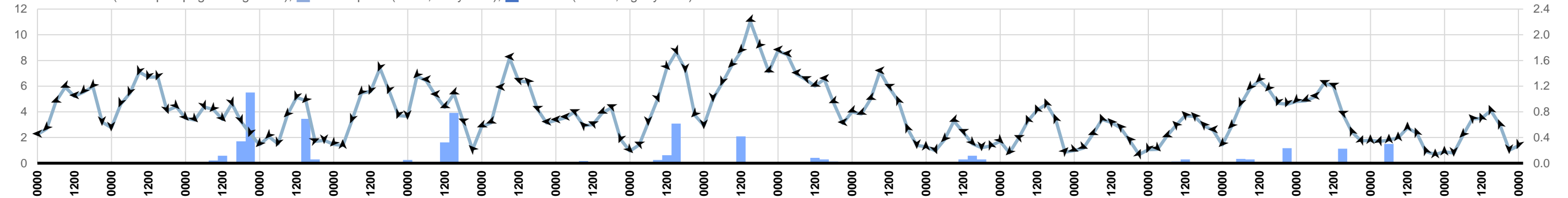


Survey Data: 6 to 25 July 2023

Data presented at intervals available against date and time (hhmm, x-axis)

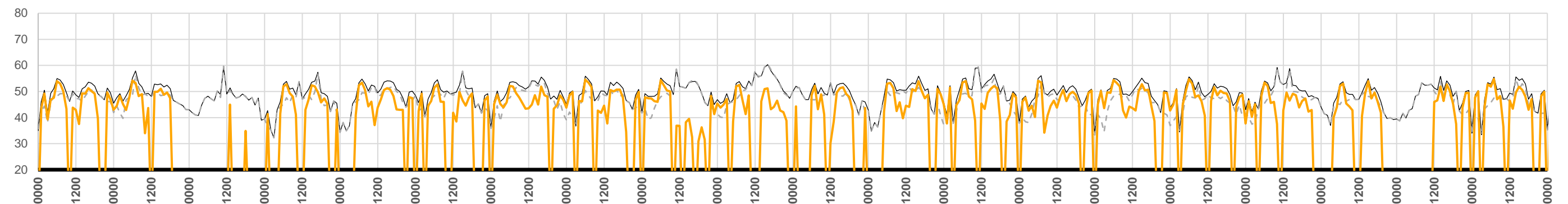
Weather at Location 2

▲ Wind direction (with top of page being north), ■ Wind Speed (knots, left y-axis), ■ Rainfall (inches, right y-axis)



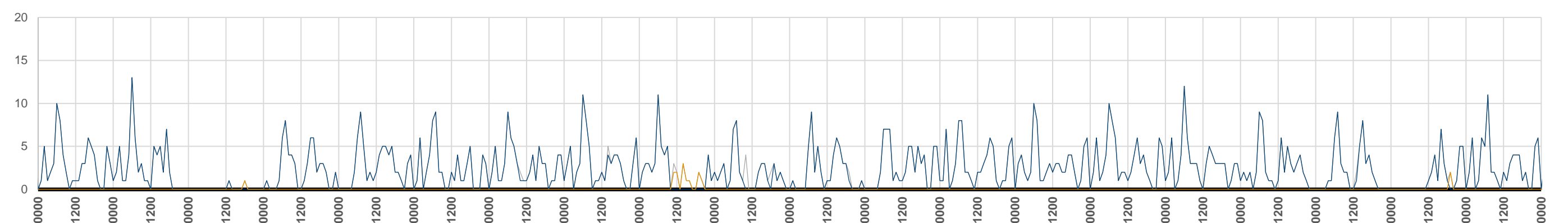
Noise at Monitoring Position (114)

Sound pressure level (dB, y-axis) in terms of total $L_{Aeq,1hour}$, without aircraft $L_{Aeq,1hour}$, and aircraft only $L_{Aeq,1hour}$



Correlated Aircraft Events

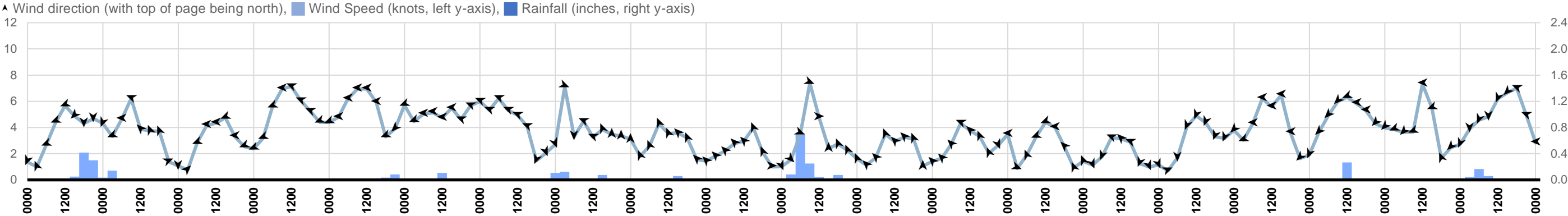
Number of movements (y-axis) in terms of Departures, Arrivals, and All movements



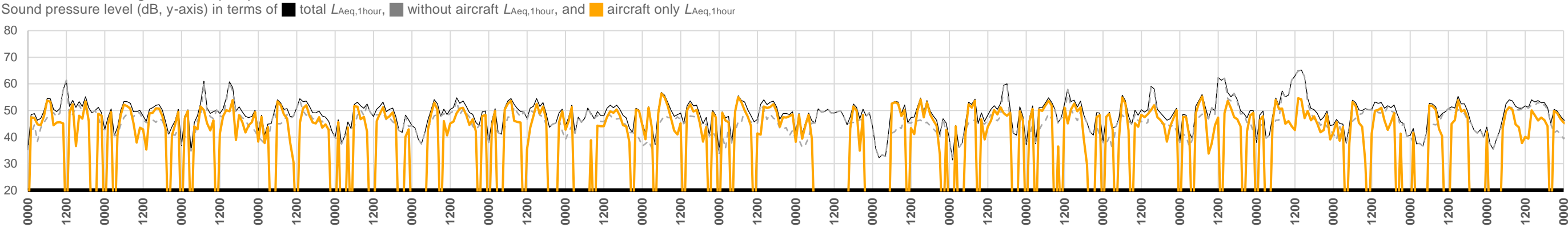
Survey Data: 26 July to 14 August 2023

Data presented at intervals available against date and time (hhmm, x-axis)

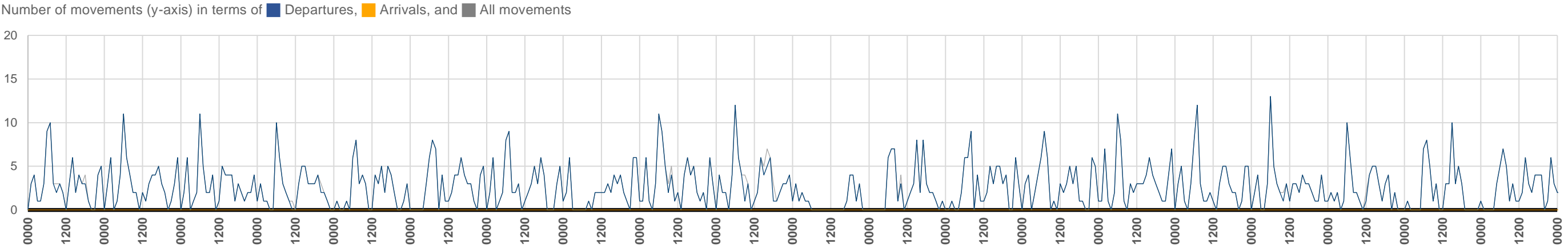
Weather at Location 2



Noise at Monitoring Position (114)



Correlated Aircraft Events

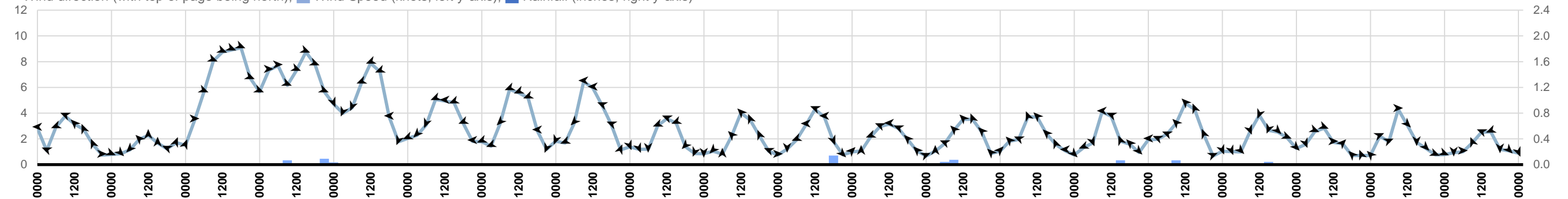


Survey Data: 15 August to 3 September 2023

Data presented at intervals available against date and time (hhmm, x-axis)

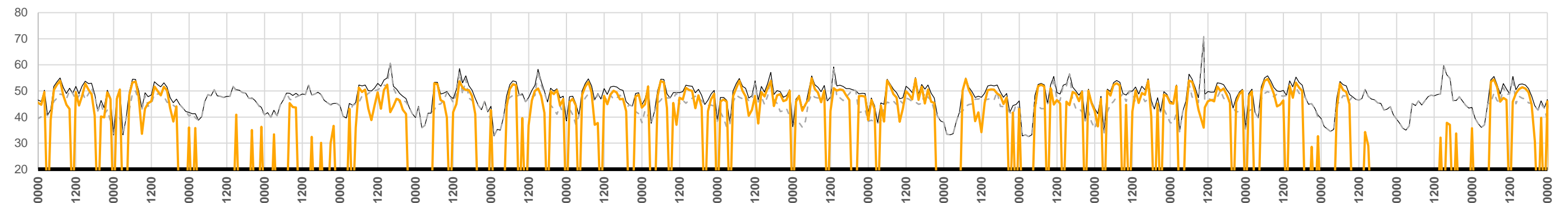
Weather at Location 2

▲ Wind direction (with top of page being north), ■ Wind Speed (knots, left y-axis), ■ Rainfall (inches, right y-axis)



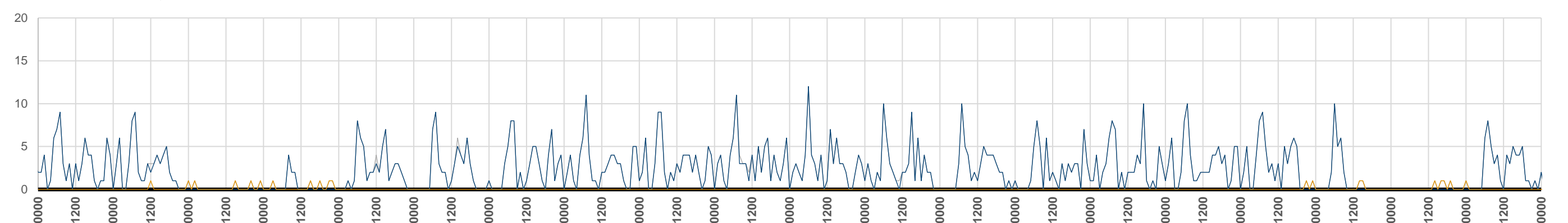
Noise at Monitoring Position (114)

Sound pressure level (dB, y-axis) in terms of ■ total $L_{Aeq,1hour}$, ■ without aircraft $L_{Aeq,1hour}$, and ■ aircraft only $L_{Aeq,1hour}$



Correlated Aircraft Events

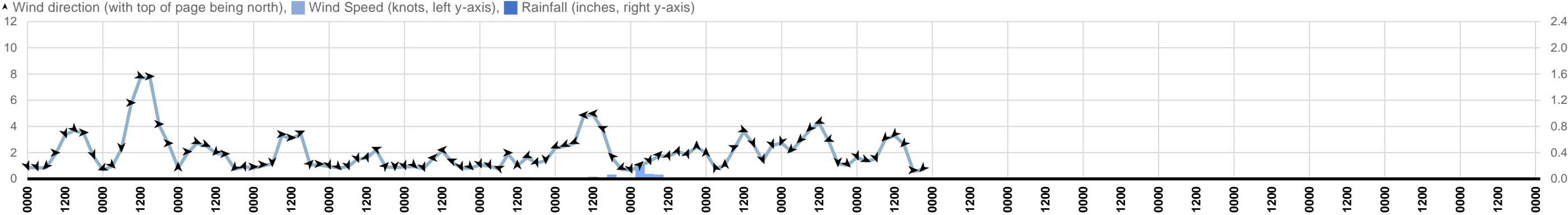
Number of movements (y-axis) in terms of ■ Departures, ■ Arrivals, and ■ All movements



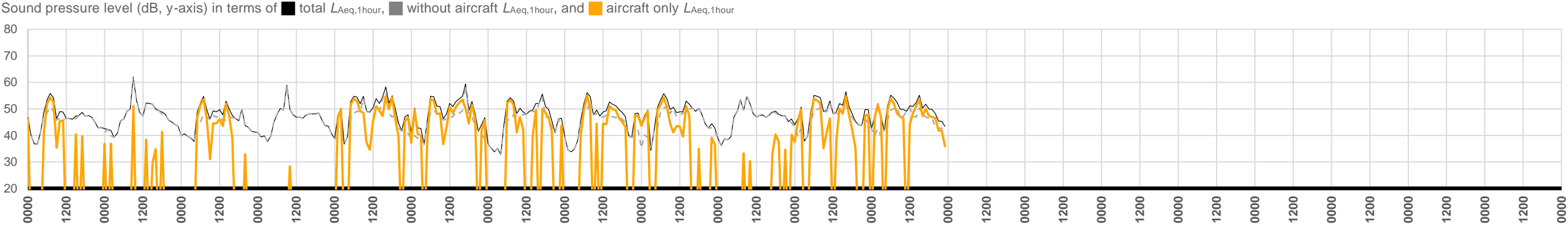
Survey Data: 4 September to 24 September 2023

Data presented at intervals available against date and time (hhmm, x-axis)

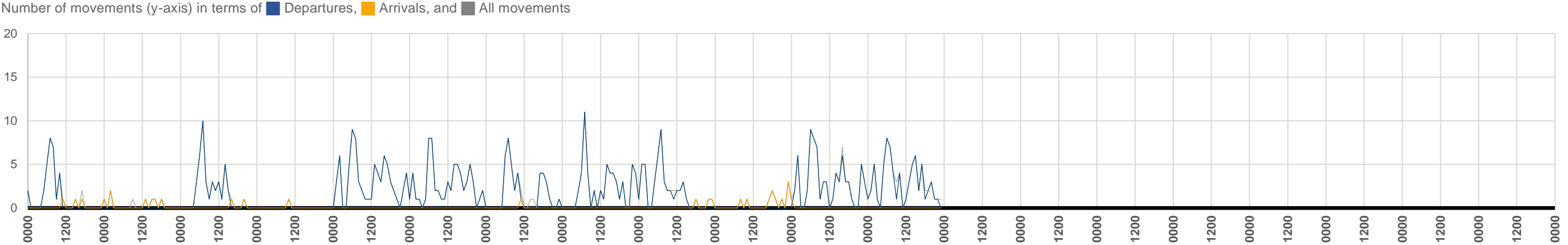
Weather at Location 2

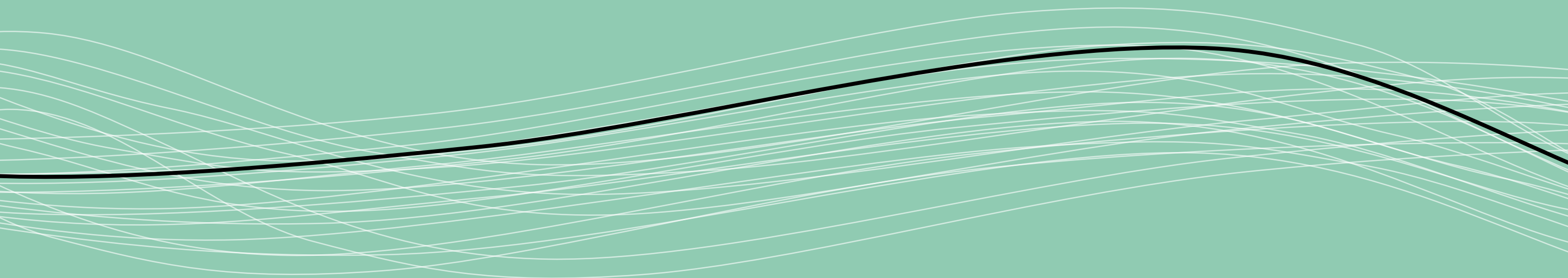


Noise at Monitoring Position (114)



Correlated Aircraft Events





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decoding the science of sound