Cole Jarman

Stansted Airport, 104 High Easter

Noise Monitoring Report

Report 16/0321/R1-4

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Manchester Airport Group

Olympic House
Manchester Airport
Manchester
M90 1QX

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0	Draft	September 2016	Johnny Berrill	Vernon Cole
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Noise Monitoring Report

Executive Summary

An extended noise survey has been undertaken during Summer 2016 at two locations to the east and south east of the Stansted Airport boundary, in the areas of High Easter and Bartholomew Green. This report relates to the monitoring undertaken at High Easter.

Analysis and compilation of the noise survey data has been undertaken by *Cole Jarman*. Where noise levels at the monitoring position were recorded as being above a set trigger level these were compared to Stansted Airport aircraft movements. If the elevated noise level correlated with an aircraft movement above the monitoring position the movement data and associated noise level were logged.

During the period, aircraft operated on south-westerly (Runway 22) movements for the majority of the time. North-easterly (Runway 04) operations took place on a small number of days. This reflects the prevailing weather conditions at Stansted. Analysis of the survey data indicates that Runway 04 operations result in only a small number of movements above this monitoring position, and as a result Runway 22 operations control the impact of aircraft noise upon this location.

The measurements indicate that at High Easter the prevailing daytime noise levels are 52dB $L_{Aeq,16h}$ on average and the analysis indicates this is influenced by aircraft movements. This level sits below the WHO guideline limit of external amenity areas of 55 dB $L_{Aeq,16h}$.

Average daily N60 and N70 events which have been correlated to aircraft movements are seen to sit notably below a level where impact would typically be considered. Additional visual and numerical representations of L_{Amax} levels during correlated aircraft flyovers are provided for reference.

Noise Monitoring Report

1 Introduction

1.1 Noise monitoring has been carried out during Summer 2016 at two locations to the east and south east of the Stansted Airport boundary, in the area of High Easter and Bartholomew Green.

1.2 The monitoring analysis is split into two reports, one for each measurement position, with this report focusing on the methodology employed and results recorded at High Easter, located south east of the Airport.

1.3 The purpose of the monitoring is to determine typical levels and sources of ambient noise prevailing at the present time across an extended period. The aim is then to examine the data having specific regard to noise generated by operations at Stansted Airport at each location.

2 Site Description

2.1 The measurement position at High Easter is in the grounds of property on the northern edge of the village and is shown on attached figure 16/0321/F1.

2.2 The area would be generally described as rural in nature with individual dwelling settlements.

2.3 At High Easter the monitor is set up in the rear garden of the chosen property to the north of High Easter village. The noise climate here was affected by local road traffic at a low level and by air traffic. Noise from birds in nearby trees, particularly during the morning chorus, contributed strongly when present.

2.4 This report concerns itself with noise associated with Stansted Airport which is primarily apparent at this location when operating on Runway 22 (south westerly) for departing aircraft. There are also recorded events for arriving aircraft to both runways and small number of Runway 04 departures.

3 Survey Methodology

3.1 The noise monitoring to which this report relates commenced on Wednesday 29th June 2016 and continued until Wednesday 21st September 2016 covering a total of 85 days.

3.2 Due to the rural location, there were connectivity issues experienced in association with 3G bandwidth for data downloads. As a result, the meter did not collect valid data from 00:00 on 30 July until 11:00 on 1 August, and again from 14:00 on 16th August until 10:00 on 18th August. It was not possible to undertake analysis during these periods resulting in a total analysis period of approximately 82 days.

3.3 Measurements were made at the location shown on attached figure 16/0321/F1 and described below. Monitor positions are given the reference number set by Stansted Operations for ease of reference:

- [P104] In the grounds of a property on the northern edge of the Village

3.4 All measurements were made at approximately 4 metres above ground level, in free field conditions.

3.5 The measurements were predominantly unattended. However, audio recording is enabled to allow a more detailed and subjective analysis of relevant periods if required. A trigger has also been set to allow the correlation of aircraft movements with the measured noise when it exceeds a certain level. The set level in the case of this monitoring is 55 dB(A).

3.6 Measurements have been made of the L_{Aeq}, and L_{A90} indices (see attached Glossary of Acoustic Terms for explanation of noise units used).

3.7 Noise measurements were made using the following equipment:

Item	**Manufacturer**	**Type**
Sound Level Analyser	Bruel and Kjaer	3639 – A (portable)
Acoustic Calibrator	Bruel and Kjaer	Auto calibration

T1 Equipment used during noise surveys

3.8 The sound level analysers and their containers are designed specifically for this type of long term external noise monitoring. Each analyser is located in a locked, waterproof case and each microphone is fitted with a weather proof windshield.

3.9 The equipment auto-calibrates on a continual regular basis while in-situ and is manually calibrated annually.

4 Weather and Operating Conditions

4.1 Weather conditions at the commencement of the survey on Wednesday 29th June were understood to be warm and dry, with no precipitation. No significant wind was experienced, but a mild breeze from a south-westerly direction was apparent.

4.2 The weather conditions during the entirety of the survey are displayed on attached figures 16/0321/W03, W10, W99. The runway which was in use for any operations triggering the pre-set level at the noise monitoring locations is also shown on these figures. The locations of the monitoring equipment are shown on the attached site plan 16/0321/F1.

4.3 Due to data collection issues, the weather data at monitor 03 is not available after 18th August. However, sufficient data from monitors 10 and 99 is available to represent the weather conditions across the monitoring period.

4.4 The data collected by the Noise Monitoring Terminal is imported directly into the airport's noise and track keeping system, ANOMS[1]. This system also receives a radar feed directly from Air Traffic Control (for Stansted Operations only). All the data is processed including radar, noise, METAR and flight data. Operations that trigger a noise event are then correlated to that aircraft movement, enabling the system to be interrogated for directly correlated aircraft noise events and background noise events. In addition to the correlated data, the ANOMS system was setup to also capture the height and lateral tracks of aircraft by means of a 'Gate'.

4.5 Aircraft movements were established by use of this virtual gate above the monitoring position. Aircraft movements which passed through this gate from ground level up to 10,000ft above the monitoring position with a horizontal deviation of 3000m to both sides of the position were recorded and correlated with any noise events which exceeded a trigger level of 55 dB(A). Further information is provided on the gate in Appendix A.

4.6 It can be seen from figures 16/0321/W03, W10, W99 that average conditions varied over the course of the measurement period, with changes in wind direction leading to changes in the operational mode for aircraft departures and arrivals. Over the course of the measurements, data from the gate analysis indicates that the vast majority of noted movements (97%) above the monitoring position were due to movements (both departures and arrivals) on Runway 22 (south-westerly runway). Only 3% of noted movements above the monitoring position were due to operations associated with Runway 04, these being primarily arrivals.

4.7 Aircraft movements were also established for all airport operations during the monitoring period. For comparison with the above noted movements, the following table sets out details of the runway use for the airport over the monitoring period obtained directly from NATS[2]. It can be seen that the percentage of movements above the monitor indicated by the gate analysis does not correlate well with the total runway use during the monitoring period indicated by the NATS data. Operations on Runway 22 are seen to result in the majority of flyovers above this monitoring position to a greater extent than the runway usage split during the monitoring period.

	NATS Log Movements		**Percentage Movements**	
	Runway 04	**Runway 22**	**Runway 04**	**Runway 22**
June (*2 days*)	0	1,091	0%	100%
July (*whole month*)	221	16,292	1%	99%
August *(whole month)*	4,755	11,980	28%	72%
September (*21 days*)	3,625	7,515	33%	67%
Total (85 days)	***8,601***	***36,878***	***19%***	***81%***

T2 Runway Use Summary

[1] Airport Noise and Operations Monitoring System
[2] National Air Traffic Services

4.8 In general, weather conditions were conducive to accurate measurement of typical noise conditions, with data recorded for both operating directions.

5 Measurement Results

5.1 Results of the L_{Aeq}, noise measurements at position P104 are presented in the attached figures:

5.2 16/0321/L1 sets out a comparison of the measured hourly $L_{Aeq,1h}$ levels with $L_{Aeq,1h}$ levels attributable solely to aircraft movements exceeding the pre-set trigger level as well as 'community' levels which are derived from a logarithmic subtraction of the aircraft level from the total measured level.

5.3 In addition to the above, noise indices relevant to various environmental and aircraft noise assessments have been calculated. The indices are set out in the attached 16/0321/SCH1 and are described below.

- $L_{Aeq,16h}$ is the standard A-weighted continuous sound pressure level used to represent day time noise levels covering the period 0700h-2300h, as referenced in *World Health Organisation* guidance[3] and BS8233:2014[4]
- L_{day} is the descriptor used under the European Environmental Noise Directive 2002 for the standard A-weighted continuous sound pressure level average across day time noise levels covering the period 0700h-1900h
- $L_{evening}$ is the descriptor used under the European Environmental Noise Directive 2002 for the standard A-weighted continuous sound pressure level average across evening time noise levels covering the period 1900h-2300h
- L_{night} is the descriptor used under the European Environmental Noise Directive 2002 for the standard A-weighted continuous sound pressure level average across night time noise levels covering the period 2300h-0700h. It is equivalent to the $L_{Aeq,8h}$ night time noise level referred to in *WHO* guidance and BS8233:2014.
- L_{den} is a logarithmic composite of the L_{day} $L_{evening}$, and L_{night} levels, being corrected for time and with the $L_{evening}$ and L_{night} levels subject to a 5 dB and 10 dB penalty respectively.

5.4 The following table presents a summary of the derived noise indices at the High Easter measurement position, averaged over the duration of the survey.

[3] *WHO Guidelines for Community Noise*, WHO headquarters 1999
[4] BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*

Level	Average Levels as Measured (dB)	Average Levels with Aircraft Removed (dB)	Average Levels due to Aircraft Alone (dB)
$L_{Aeq,16h}$	52	49	48
L_{day}	52	49	49
$L_{evening}$	50	46	47
L_{night}	45	42	41
L_{den}	54	51	50

T3 Noise Indices Summary

5.5 Figures in the above table are given as an average across all days, including those where there were no correlated aircraft movements. It can be seen that aircraft levels result in an approximate 3 dB increase on levels with aircraft events removed.

5.6 In addition to the above indices the N70 (number of noise events due to aircraft exceeding 70 dB) and N60 levels were established. The N70 was calculated by summing the number of aircraft incidences which caused the L_{Amax} level between 0700h and 2300h to exceed 70dB. A similar exercise was carried out for a 60 dB limit between 2300h and 0700h to establish the N60. The following table summarises these results.

	N70 (0700h-2300h)		N60 (2300h-0700h)	
	Total	**Daily Average**	**Total**	**Daily Average**
Total	130	1.5	687	8.1
	Daily Average	**Daily Max**	**Daily Average**	**Daily Max**
June (*2 days*)	5	8	7	13
July (*whole month*)	2	7	10	13
August *(whole month)*	1	4	8	16
September (*21 days*)	1	4	6	14

T4 N70 and N60 Summary

5.7 It is expected that these numbers are pessimistic due to the inclusion of noise levels which may not be due to aircraft movements, particularly with regards to the N60. This is due to a prevalence of elevated noise levels at certain times, and particularly during the morning hours, which could be associated with birdsong or other local noise sources. Due to the lack of audio recordings from the limited connectivity it was not possible to identify and remove such events therefore the levels as measured remain in the analysis.

5.8 An example can be seen on 21st July at 15:42 where an L_{Amax} level of 79.3 dB was recorded during an Airbus A320-100/200 flyover. Across the monitoring period, during a flyover of this aircraft type, the average L_{Amax} level measured of this aircraft type was 63.5 dB while the highest L_{Amax} level measured in the absence of the anomalous level was 67.8 dB.

5.9 Based on the time profile of this noise event, and in comparing the measured level to other levels from the same aircraft type, it is not expected that the measured level is associated with the aircraft flyover. However, there was no accompanying audio recording therefore it is not possible to state that this was not due to the aircraft flyover. As a result, the analysis provides a pessimistic representation of the noise levels due to aircraft at this location.

5.10 It is worth noting that, even with inclusion of these levels, the maximum recorded N70 and N60 incidences are still considered to be low; maps presenting such incidences in the vicinity of airports rarely indicate contours representing N values below 10, and where the analysis has been used for UK airports, '25 events per day' is typically the minimum contour.

6 Measurement Discussion

6.1 General Comments

6.1.1 The attached time history graph 16/0321/L1 sets out the hourly noise levels, with data processed in a manner that permits analysis of the influence on the prevailing ambient noise levels of aircraft operations.

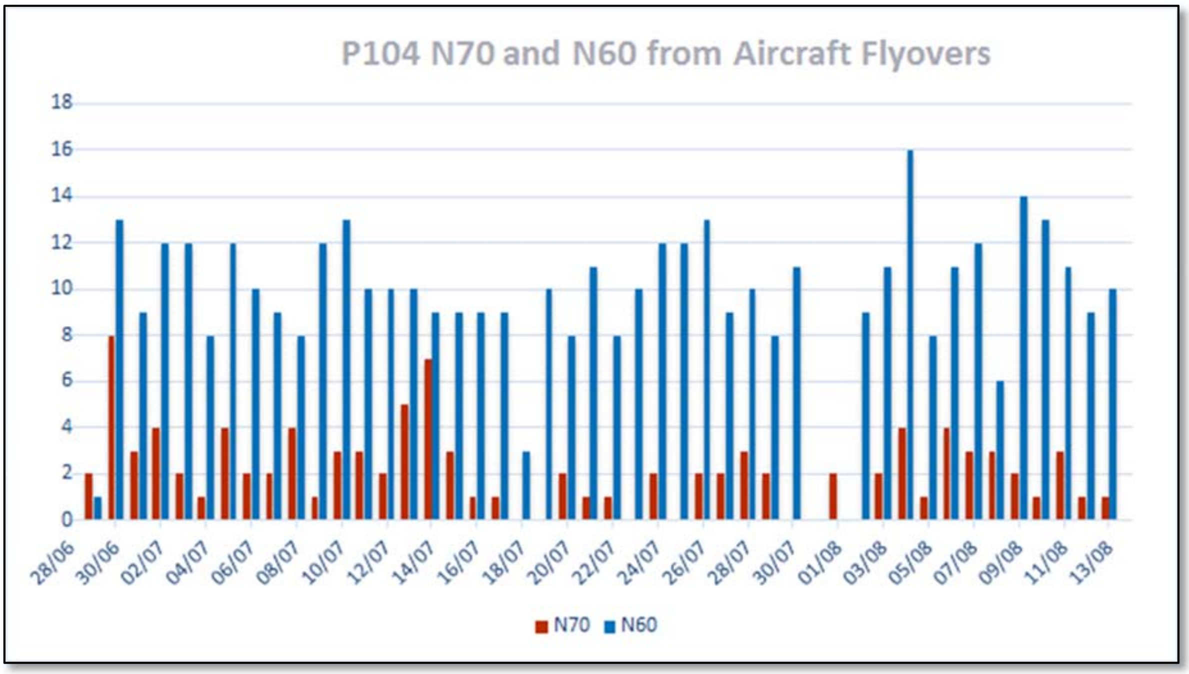
6.1.2 It is worth noting that there are periods of elevated noise levels which do not appear to correlate with aircraft movements. Examples are seen on 5th July, 1st, 10th August and 2nd, 18th, 20th September.

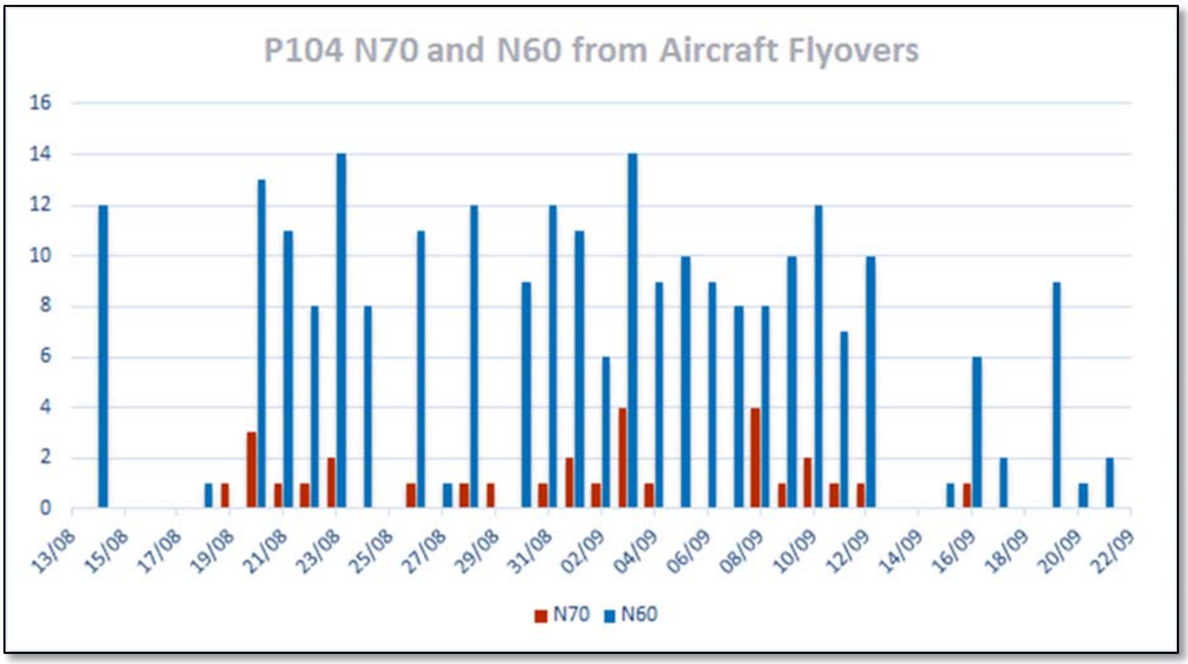
6.1.3 Noise events were not removed from the analysis as it was not possible to confirm that the noise level measured was not due to the aircraft. For example, where a flyover correlated with a local noise event which controlled the measured level, this event level, which may have been due to the local noise event, is attributed to the flyover. The analysis is therefore considered pessimistic, but the approach is more robust than an analysis in which noise levels associated with such events were removed from the flyover data.

6.1.4 It can be seen from Table T3 above that on average there is an approximate 3dB difference between community noise indices with and without aircraft noise.

6.2 N70 and N60

6.2.1 The following graphs set out the daily daytime N70 and night time N60 results from the analysis:

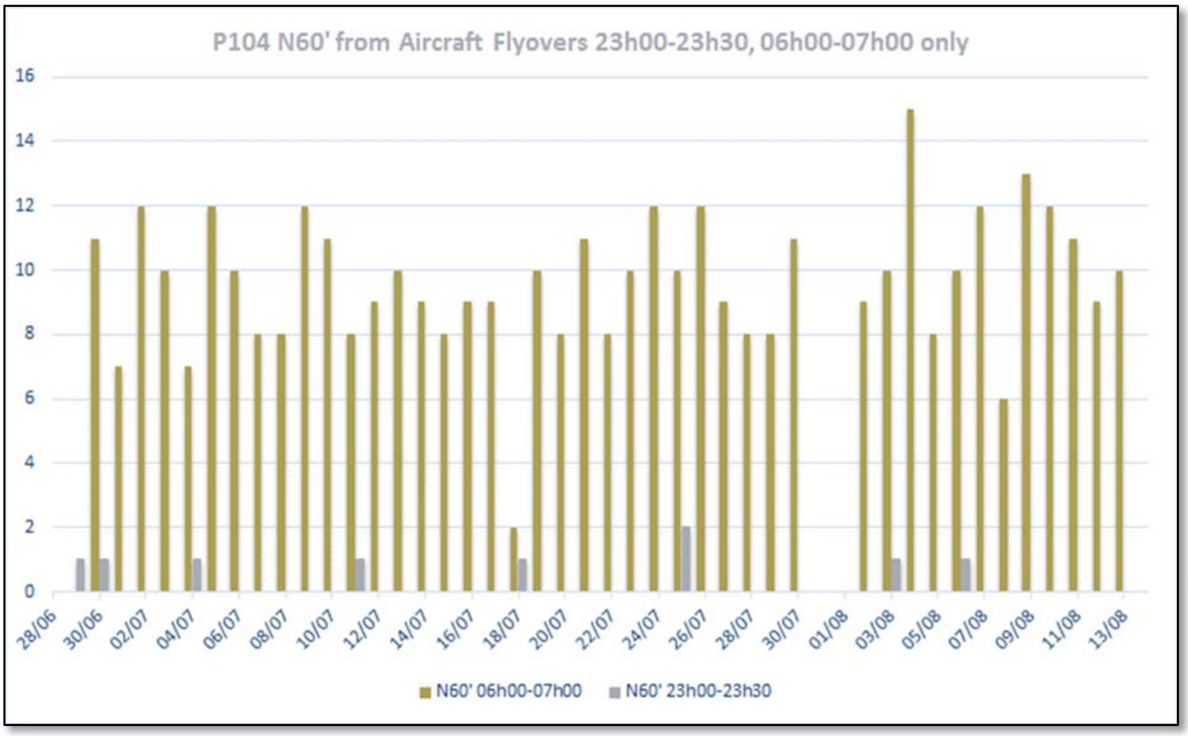


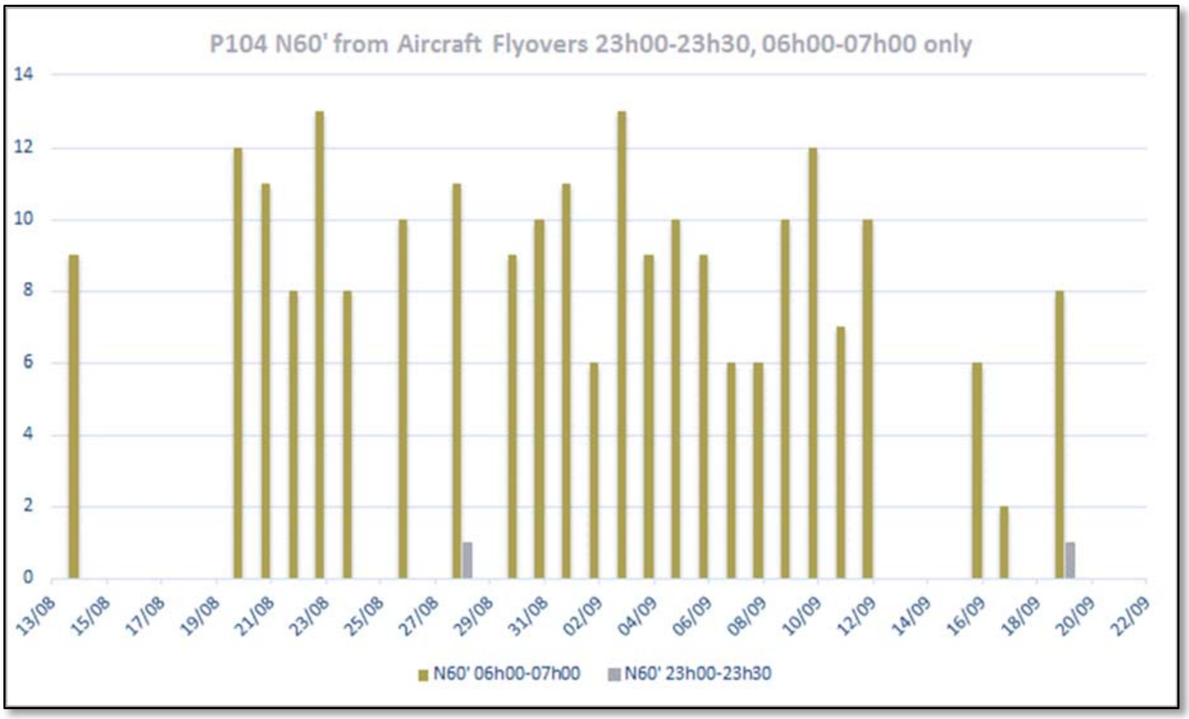


6.2.2 It is worth noting that while the elevated levels have been correlated with aircraft movements timing wise this does not absolutely confirm that the noise levels have been caused by aircraft movements. The majority of N60 occurrences are during daybreak hours and therefore could be influenced by birdsong during the morning chorus. However, for robustness, these levels remain included in the data.

6.3 N60 and N70 Variations

6.3.1 In order to examine the aircraft flyovers in more detail, the night time 60 dB L_{Amax} and day time 70 dB L_{Amax} levels were analysed in a manner that deviates from the standard N60 and N70 analysis. Firstly, the exceedances of 60 dB L_{Amax} was analysed during the night time 'shoulder periods' of 23h00 to 23h030 and 06h00 to 07h00. This index is referred to as N60' in the following figures.





6.3.2 It can be seen within the above figures, and from comparison of the N60′ figures with the N60 figures in Section 6.2, that the majority of night time exceedances of 60 dB L_{Amax} occur between 06h00 and 07h00.

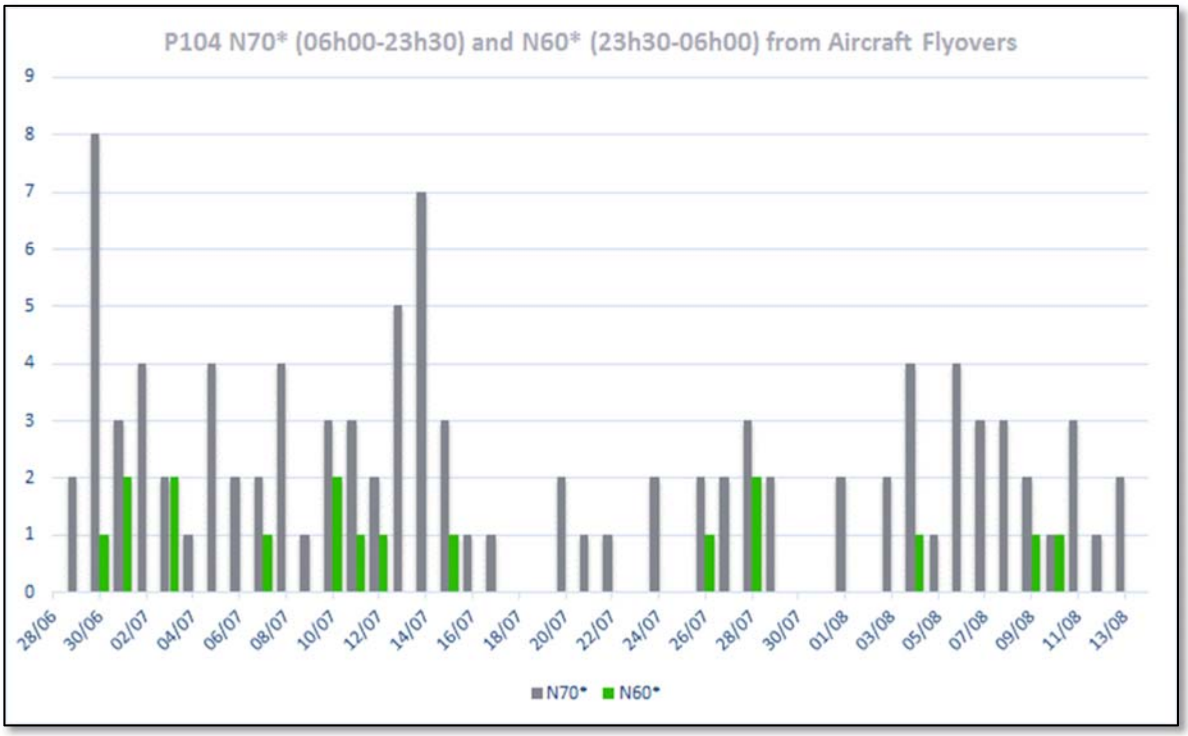
6.3.3 A second analysis has been undertaken with reference to the existing permitted flying hours at Stansted airport, with operations being allowed as standard between 06h00 and 23h30 and operations outside of these hours being subject to a night time quota.

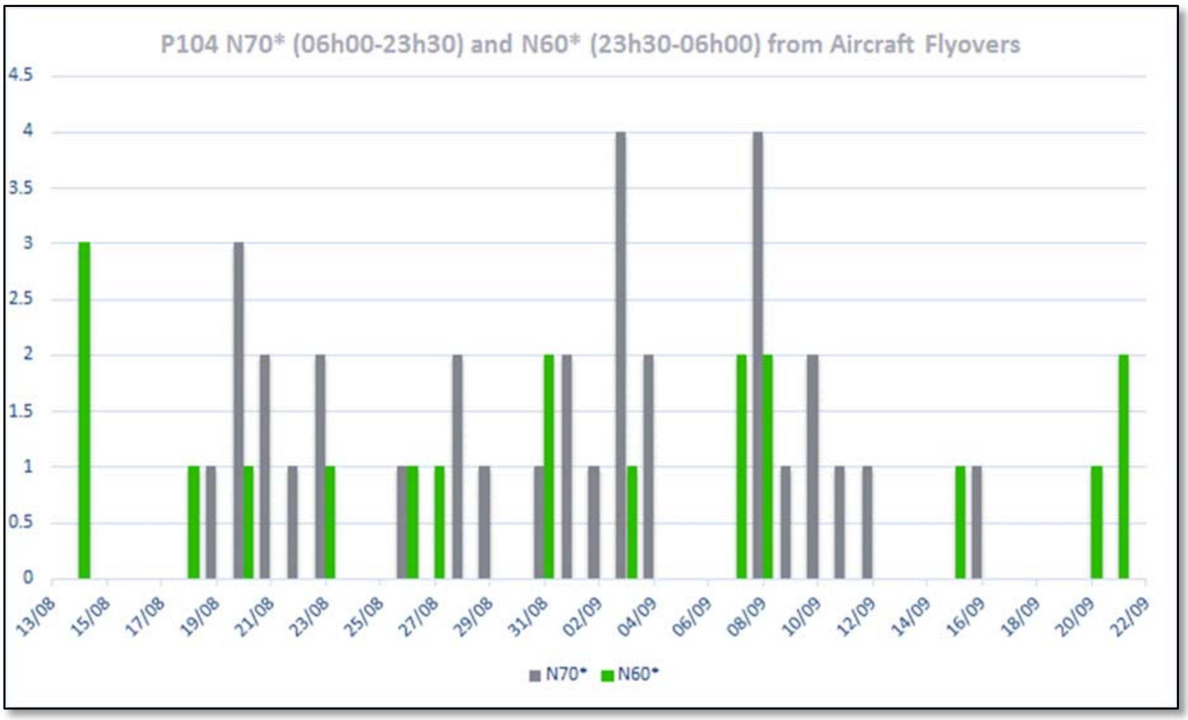
6.3.4 The number of exceedances of 70 dB L_{Amax} during the standard hours are referred to as N70* in the figures below while the number of exceedances of 60 dB L_{Amax} during the night time hours of 23h30 to 06h00 are referred to as N60*.

6.3.5 It can be seen from the figures below that the exceedance of 60 dB L_{Amax} due to aircraft outside of the standard airport permitted hours is low in number.

6.3.6 It must be emphasised that while the analyses of the number of flights above 70dB and 60dB during non-standard periods provides useful information on the distribution of noise events throughout a full 24 hour day, the numerical results cannot easily be interpreted with regard to the community response. It is for this reason that current guidance from the CAA, as contained in CAP 725[5], does not recommend the inclusion of such analyses when assessing the noise effects of airspace changes at UK airports.

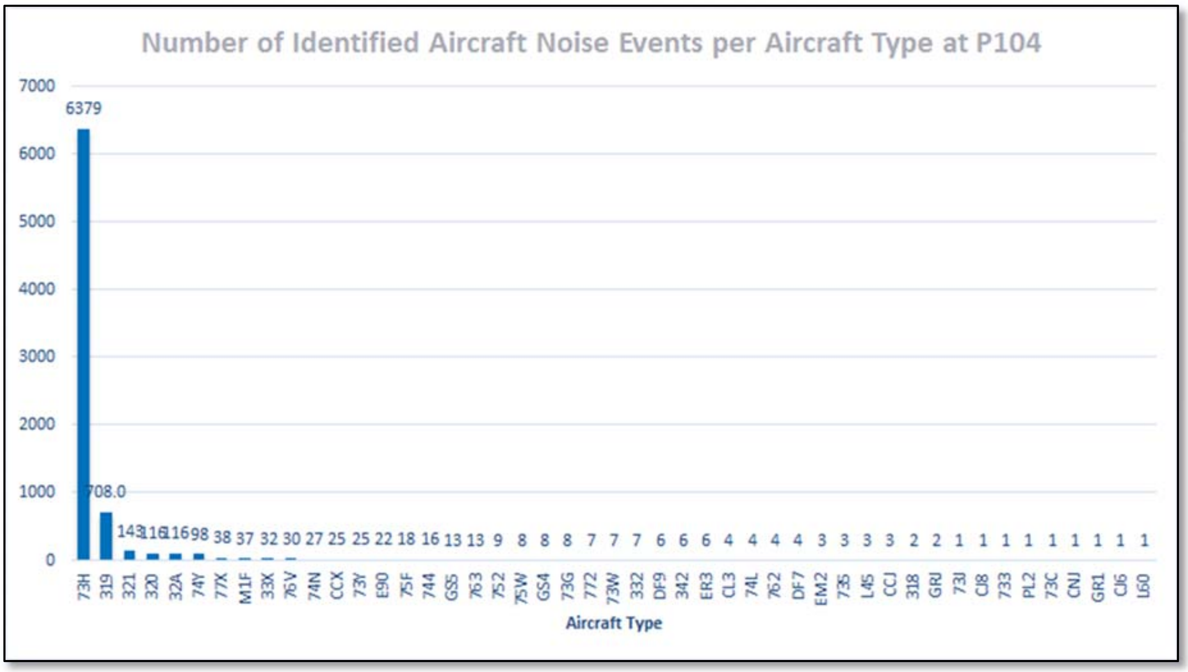
[5] CAA Guidance on the Application of the Airspace Change Process, CAP 725: March 2016


P104 N70* (06h00-23h30) and N60* (23h30-06h00) from Aircraft Flyovers
0
1
2
3
4
5
6
7
8
9
28/06
30/06
02/07
04/07
06/07
08/07
10/07
12/07
14/07
16/07
18/07
20/07
22/07
24/07
26/07
28/07
30/07
01/08
03/08
05/08
07/08
09/08
11/08
13/08
N70*
N60*

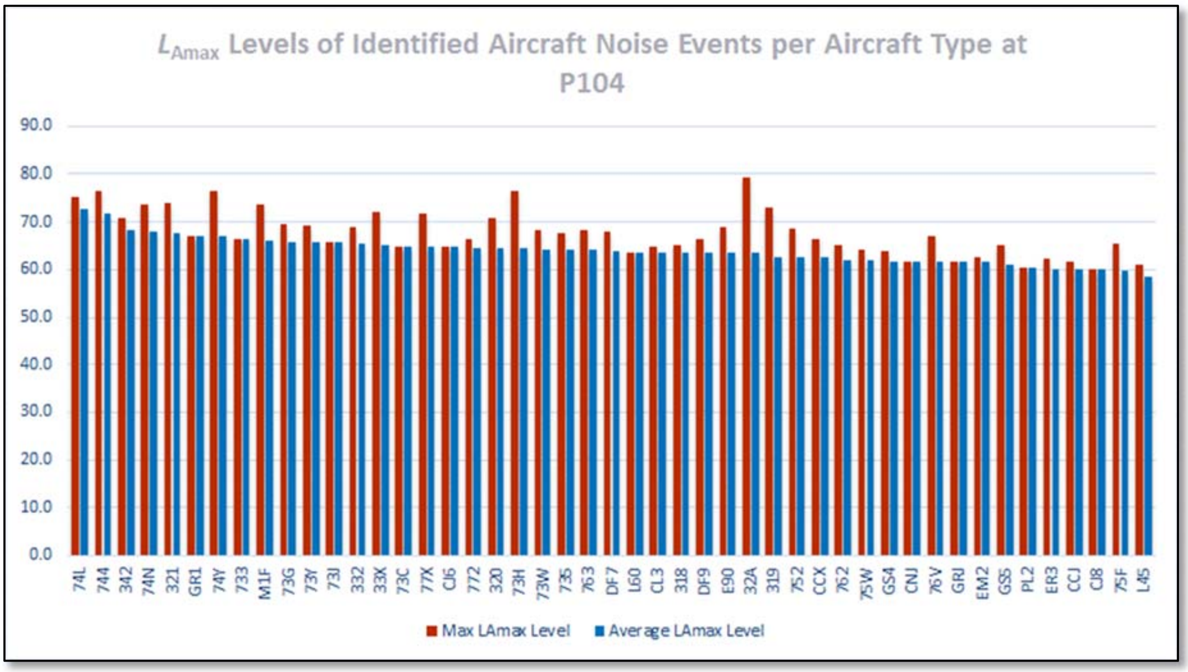

P104 N70* (06h00-23h30) and N60* (23h30-06h00) from Aircraft Flyovers
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
13/08
15/08
17/08
19/08
21/08
23/08
25/08
27/08
29/08
31/08
02/09
04/09
06/09
08/09
10/09
12/09
14/09
16/09
18/09
20/09
22/09
N70*
N60*

6.4 Noise Events by Aircraft Type

6.4.1 In the following graph it can be seen that aircraft type 73H (Boeing 737-800) undertake the majority of flights at this airport resulting in noise events at this site. Type 319 (Airbus 319) is the next most common aircraft.

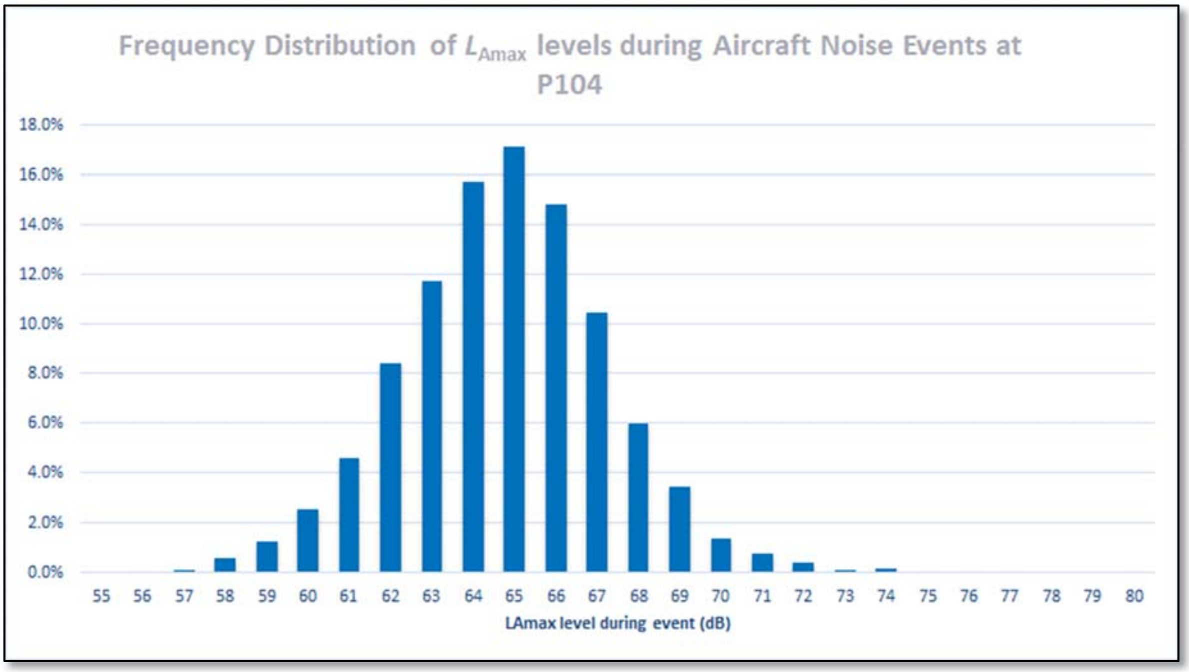


6.4.2 The graph below sets out the average and highest L_{Amax} level measured during flyovers attributed to the various aircraft. There is, inevitably, variation in the maximum levels generated with the A320 leading to the highest L_{Amax} flyover level at 79dB, and a number of smaller aircraft generating L_{Amax} flyover levels in the order of 60dB.



6.5 Noise Level Frequency Distribution

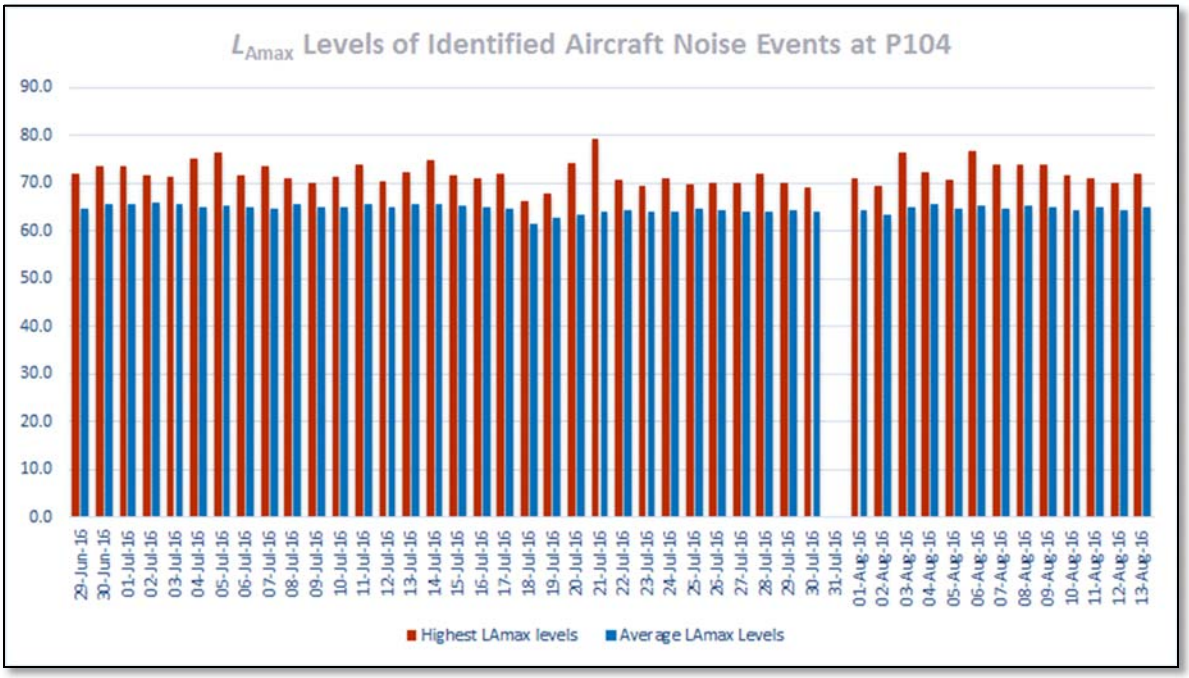
6.1 The graph below sets out the frequency distribution of L_{Amax} levels measured during correlated flyovers at this location. It can be seen that 78% of flyovers fall in the 62-67 dB L_{Amax} range.

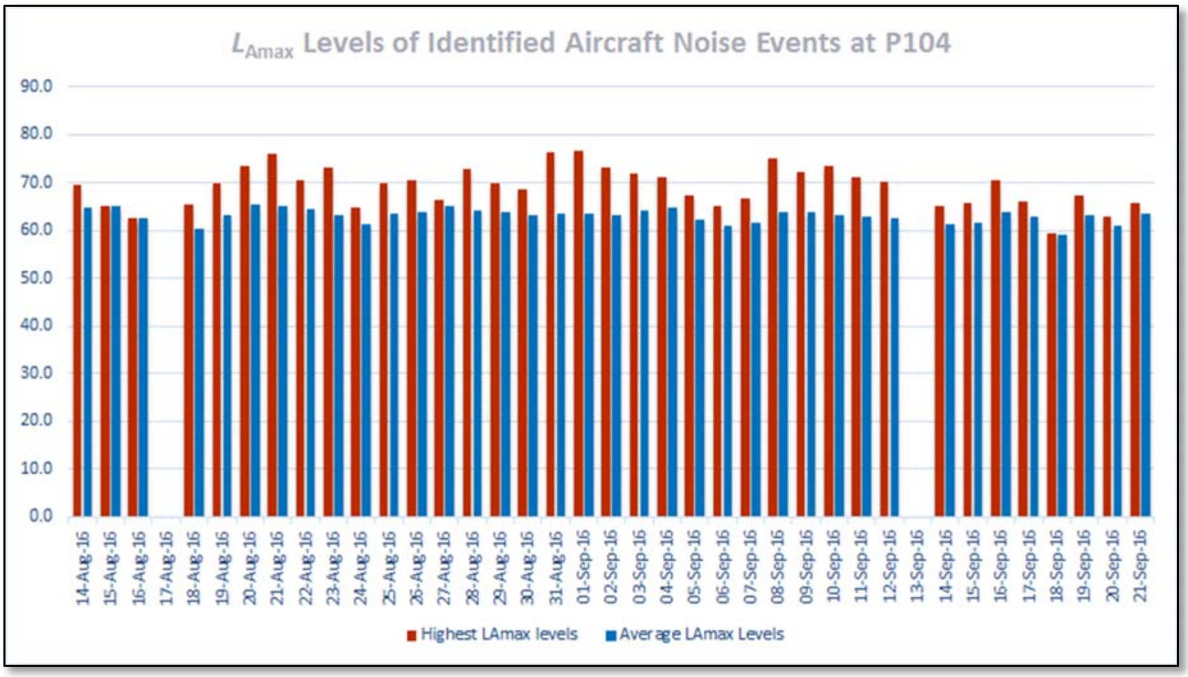


6.6 Aircraft Maximum Noise Levels

6.6.1 The following graphs show the highest and average measured L_{Amax} levels at P104 during the monitoring period. Due to the rural location, there were connectivity issues experienced in association with 3G bandwidth for data downloads. As a result, the meter did not collect valid data from 00:00 on 30 July until 11:00 on 1 August, and again from 14:00 on 16th August until 10:00 on 18th August. This can be seen via breaks in the graphs below.

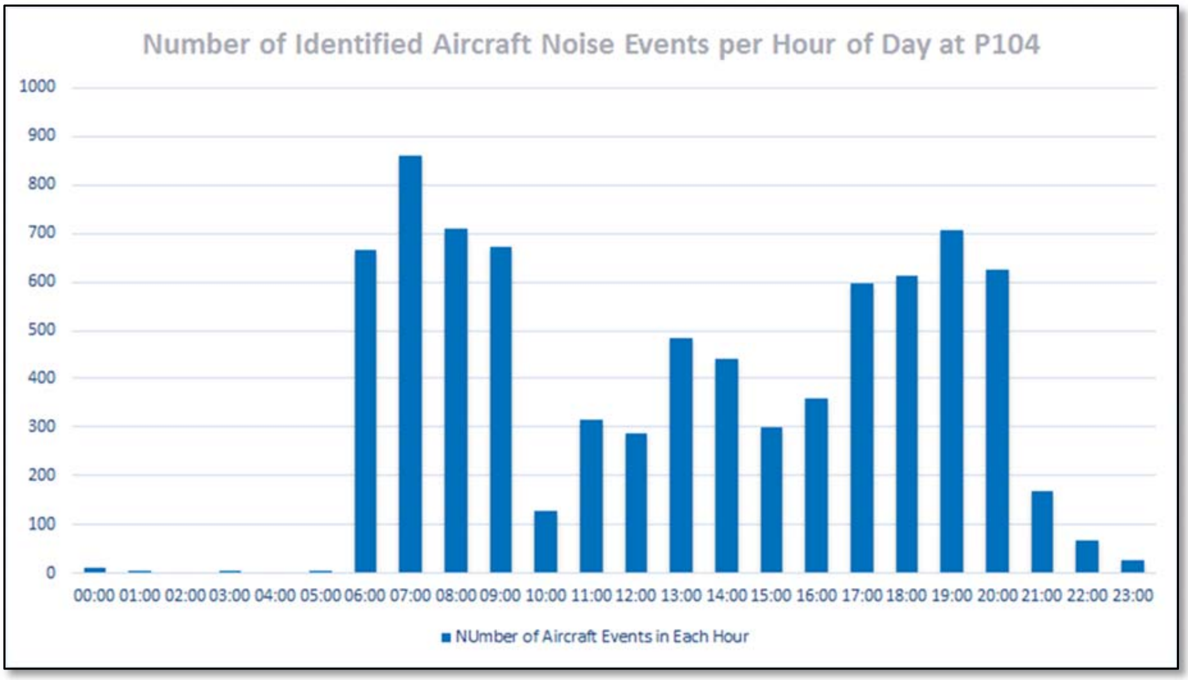
6.6.2 The range of levels is consistent with what is shown in the graph in paragraph 6.3.2 above, with 21st July having a highest L_{Amax} flyover level of 79dB (though it is expected that this noise event was not due to the aircraft) while 18th September has a highest L_{Amax} flyover level of just above 60dB.

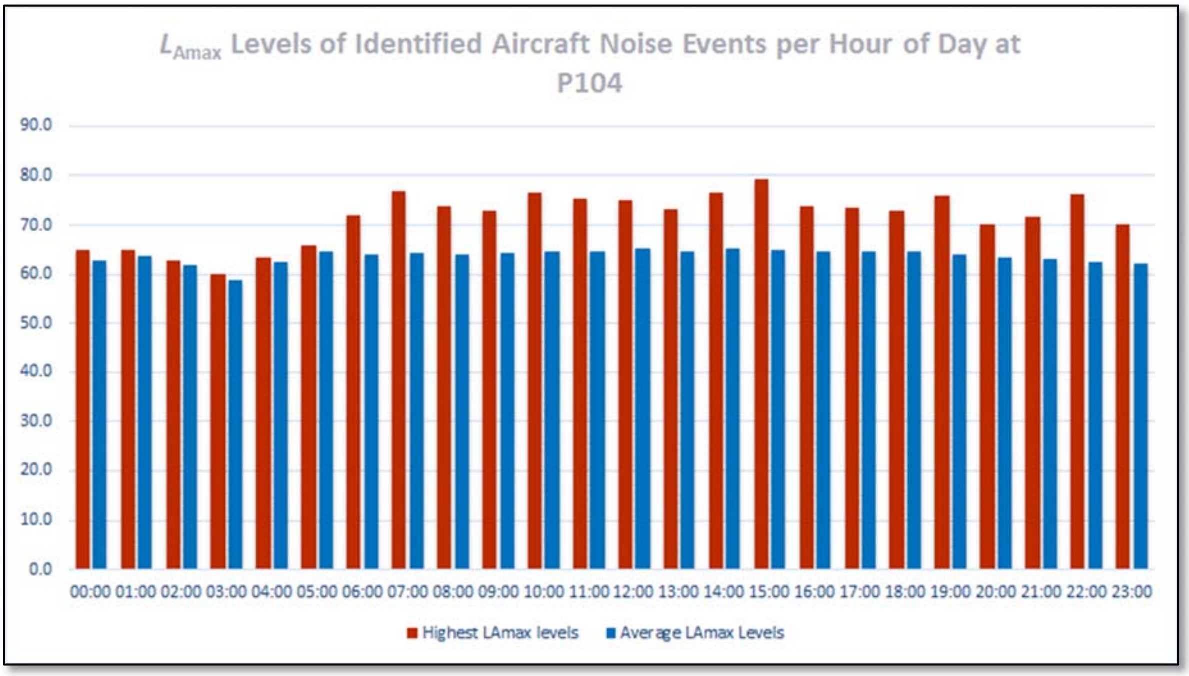




6.7 Noise Events Throughout the Day

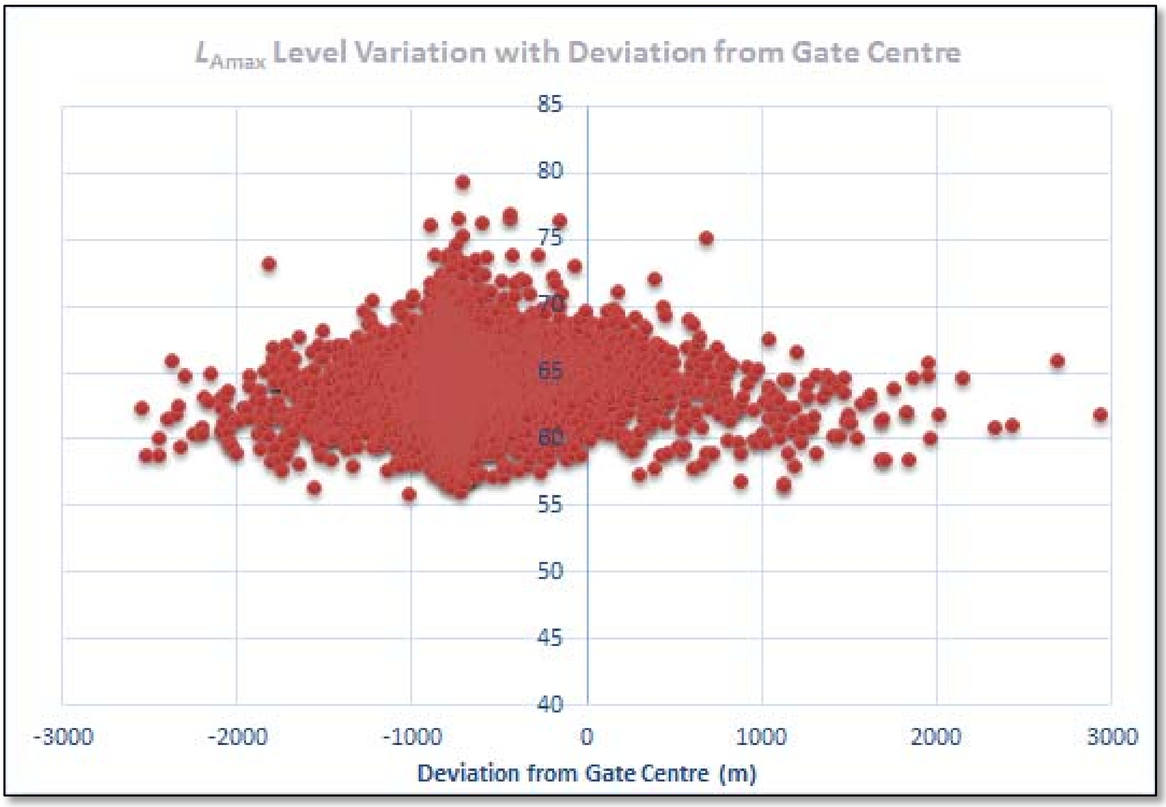
6.7.1 The following graphs provide a breakdown of the aircraft events measured during the 82 day monitoring period in terms of number of aircraft and in terms of highest and average L_{Amax} level measured during correlated events. It can be seen that 07:00, 08:00 and 19:00 are the busiest periods, while the average L_{Amax} level remains quite constant at approximately 65 dB L_{Amax}.

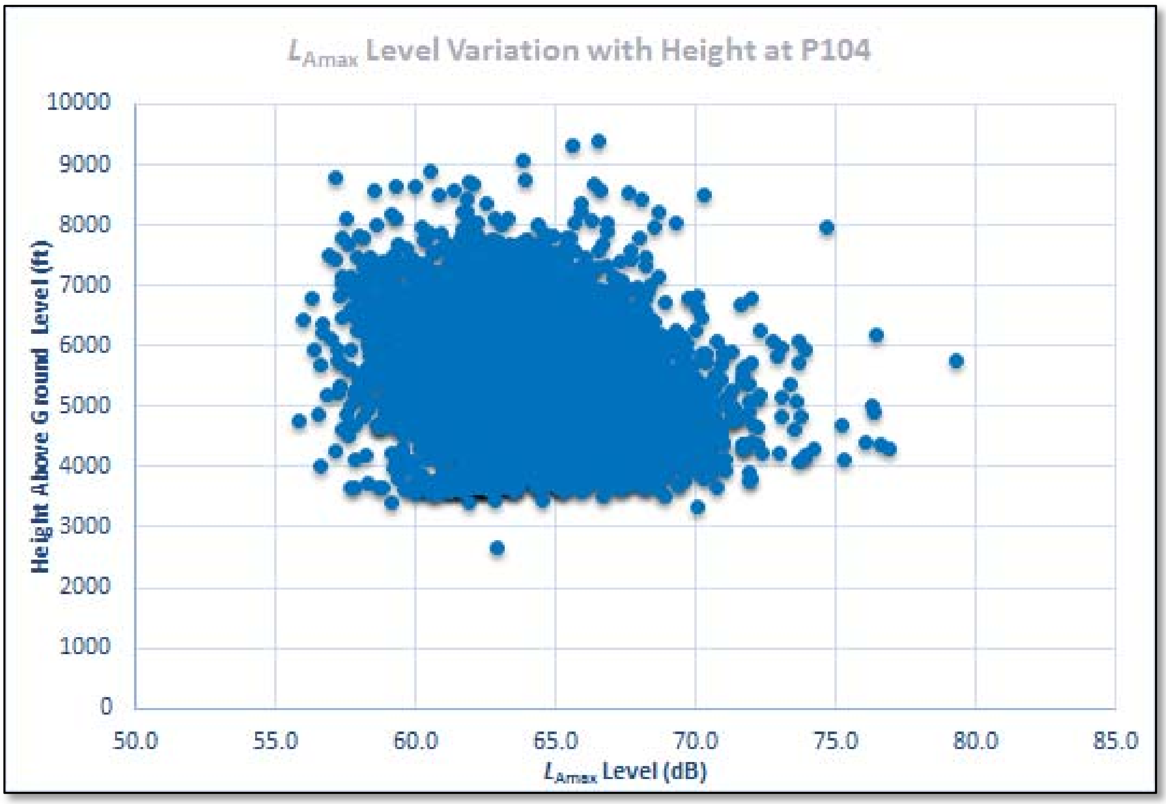




6.8 Aircraft Location

6.8.1 The following graphs set out the variation in measured L_{Amax} level with aircraft height and deviation from the gate centre point during flyovers, the gate being centred over the measurement position. Further information on the gate is set out in the attached Appendix A.

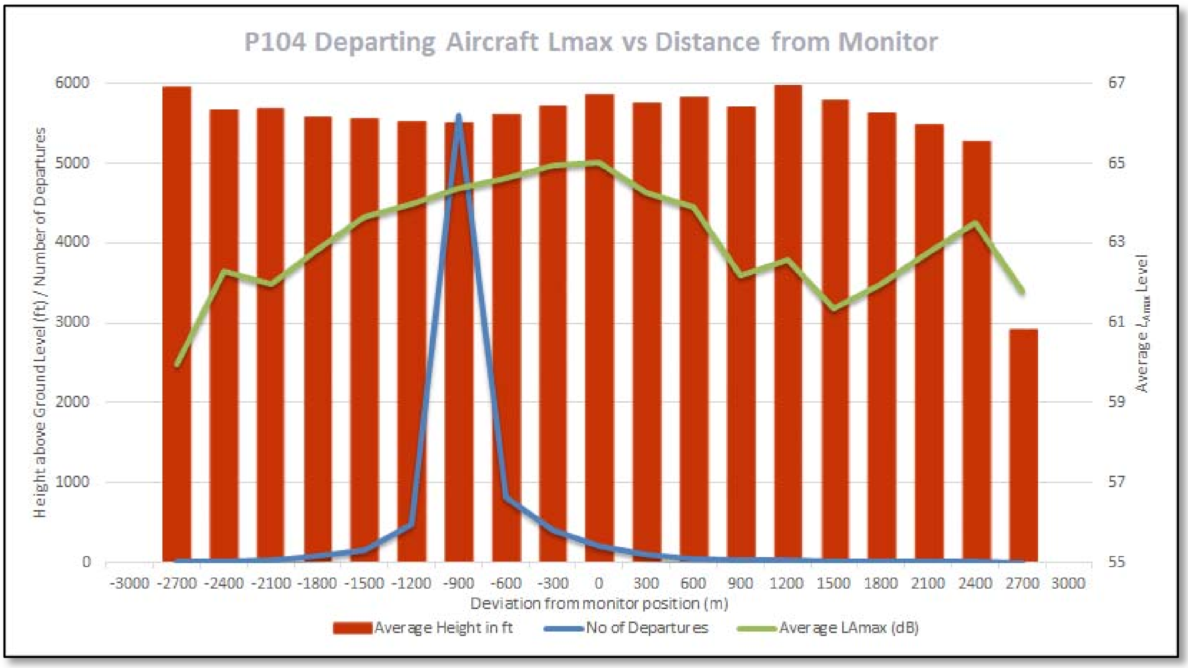

L_{Amax} Level Variation with Deviation from Gate Centre
85
80
75
70
65
60
55
50
45
40
-3000
-2000
-1000
0
1000
2000
3000
Deviation from Gate Centre (m)


L_{Amax} Level Variation with Height at P104
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Height Above Ground Level (ft)
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
L_{Amax} Level (dB)

6.8.2 It can be seen from the above that there is not a strong correlation between aircraft deviation from gate centre and measured L_{Amax} level. The second figure shows a general reduction in level with height. Gate position and geometry is shown in the attached Appendix A

6.8.3 The following figure sets out an analysis undertaken by the Stansted Flight Performance team of the variation in average L_{Amax} level with deviation from monitoring position. The analysis is undertaken on departure aircraft only with deviations grouped into 300m blocks.

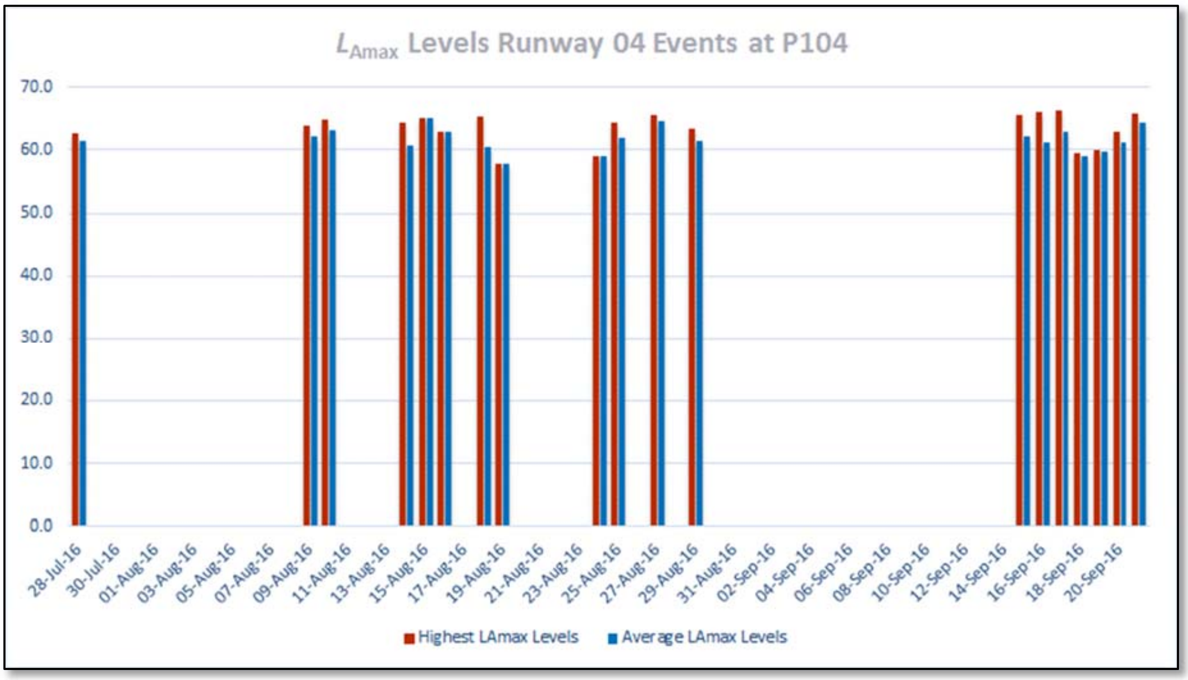
6.8.4 With the analysis being undertaken of average levels per deviation block, it can be seen that the general trend is for higher levels above the monitoring position with slight drop off in levels with deviation. It should be noted that the trends to both extremes become less valid due to the lower number of movements occurring for these blocks.

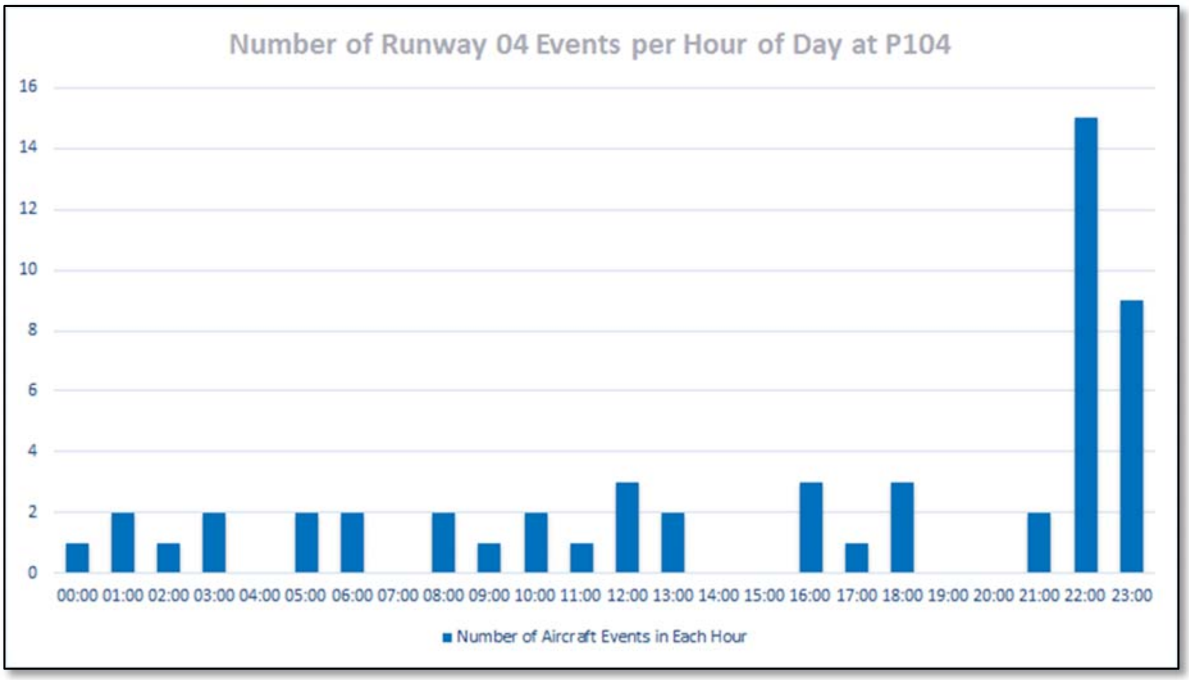


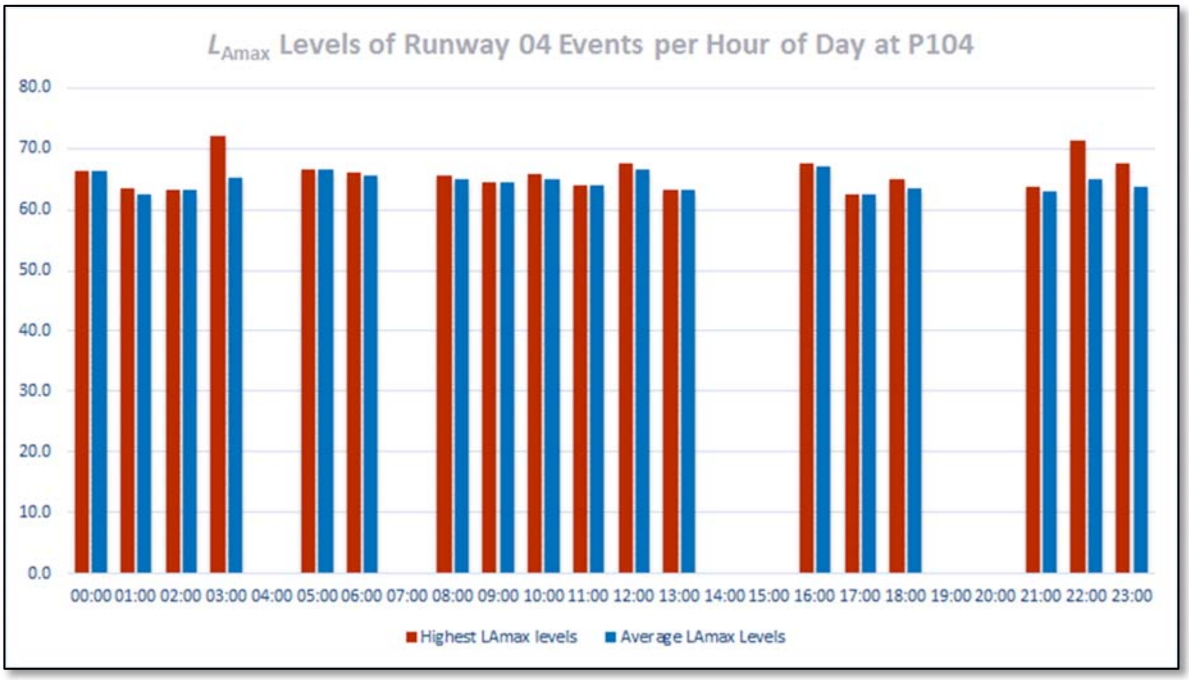
6.9 Weather and Runway Use

6.9.1 Due to the prevailing weather conditions, Runway 22 is in use the majority of the time at Stansted Airport as can be seen from the attached weather and runway use figures. To ensure sufficient analysis of levels from the lesser used Runway 04 a number of the above figures are reset below showing only data collected during Runway 04 movements.

6.9.2 Runway 22 was in use approximately 81% of the time during monitoring while Runway 04 was in use approximately 19% of the time. The split of gate penetrations, as set out in Appendix A below, was 97% associated with Runway 22 and 3% associated with Runway 04. The first use of Runway 04 during the monitoring period resulting in a correlated noise event was 28 July 2016.


LAmax Levels Runway 04 Events at P104
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
28-Jul-16
30-Jul-16
01-Aug-16
03-Aug-16
05-Aug-16
07-Aug-16
09-Aug-16
11-Aug-16
13-Aug-16
15-Aug-16
17-Aug-16
19-Aug-16
21-Aug-16
23-Aug-16
25-Aug-16
27-Aug-16
29-Aug-16
31-Aug-16
02-Sep-16
04-Sep-16
06-Sep-16
08-Sep-16
10-Sep-16
12-Sep-16
14-Sep-16
16-Sep-16
18-Sep-16
20-Sep-16
Highest LAmax Levels
Average LAmax Levels


Number of Runway 04 Events per Hour of Day at P104
16
14
12
10
8
6
4
2
0
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Number of Aircraft Events in Each Hour



6.9.3 It can be seen from the above that noise levels during Runway 04 correlated events fall below the typical levels measured over the entirety of the survey. Therefore, it can be taken that the data presentation does not under represent the effect of Runway 04 movements on the measurement position.

7 Conclusions

7.1 Noise levels have been measured over an extended period at two locations to the east of Stansted Airport. During the period, aircraft operated on south-westerly (Runway 22) movements for the majority of the time accounting for 97% of noted aircraft movements above the monitoring position. North-easterly (Runway 04) operations took place on a smaller number of occasions accounting for 3% of noted aircraft movements above the monitoring position. This reflects the prevailing weather conditions at Stansted. It has been shown that the levels due to correlated aircraft movements during Runway 04 associated operations are lower than those typically measured over the full monitoring period.

7.2 The measurements indicate that at High Easter the prevailing daytime noise levels are 52dB $L_{Aeq,16h}$ on average and the analysis indicates this is influenced by aircraft movements. It is worth noting that this level sits below the *WHO* guideline limit of external amenity areas of 55 dB $L_{Aeq,16h}$.

7.3 Average daily N60 and N70 events which have been correlated to aircraft movements are seen to sit notably below a level where impact would typically be considered. Additional visual representations of L_{Amax} levels during correlated aircraft flyovers are provided for reference.

End of Section

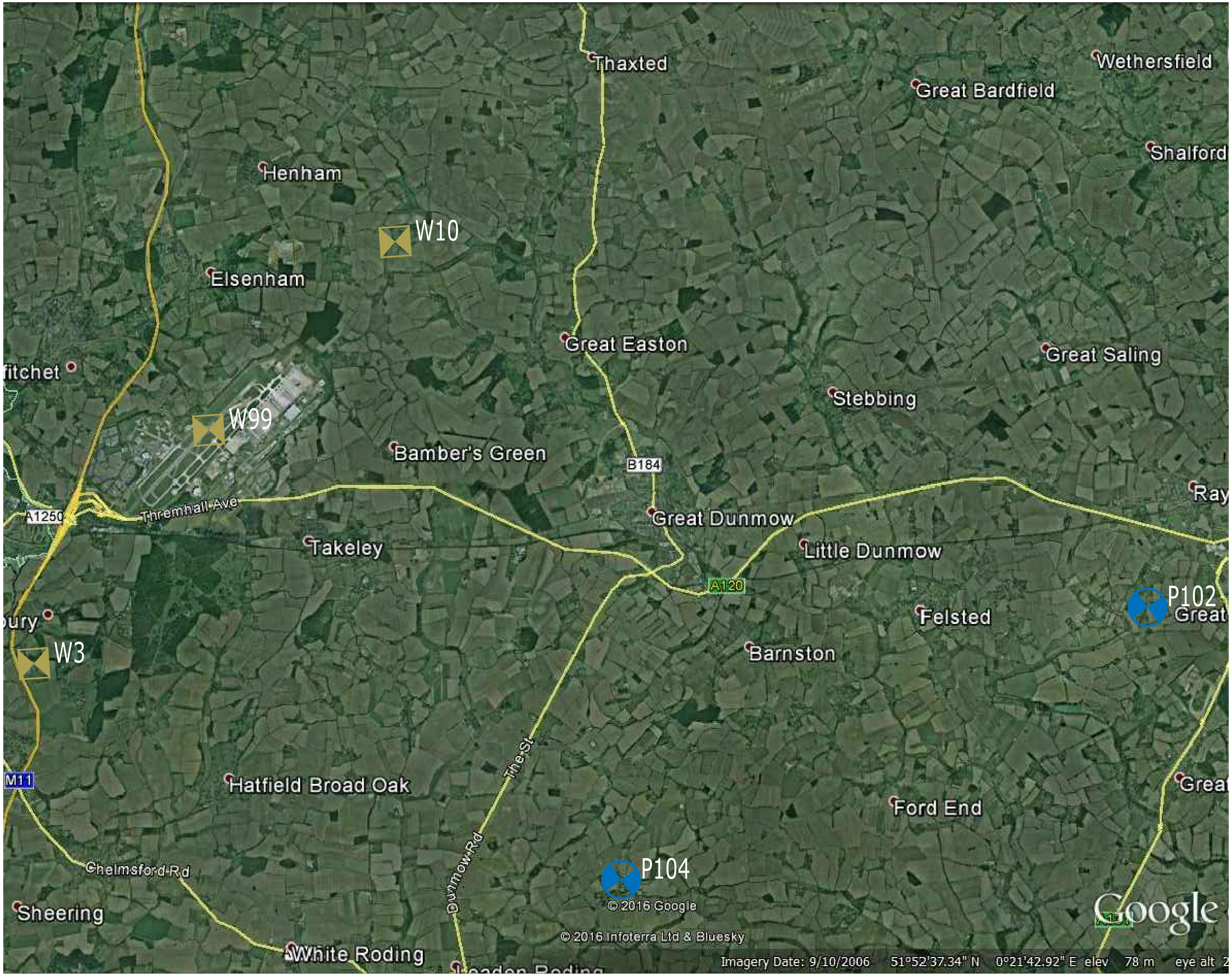


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Figure 16/0321/F1

Title:

Site Plan showing noise and weather monitoring locations

Figure Key

W Weather Monitoring Location

Noise Monitoring Locations

P102 Bartholomew Green

P104 High Easter

North

Project:

Stansted Airport Monitoring

Date:	Revision:
August 2016	-

Scale:

Not to scale

Cole Jarman Limited
t +44 (0)1932 829007 f +44 (0)1932 829003

John Cree House, 24B High Street, Addlestone, Surrey KT15 1TN
e info@colejarman.com w www.colejarman.com

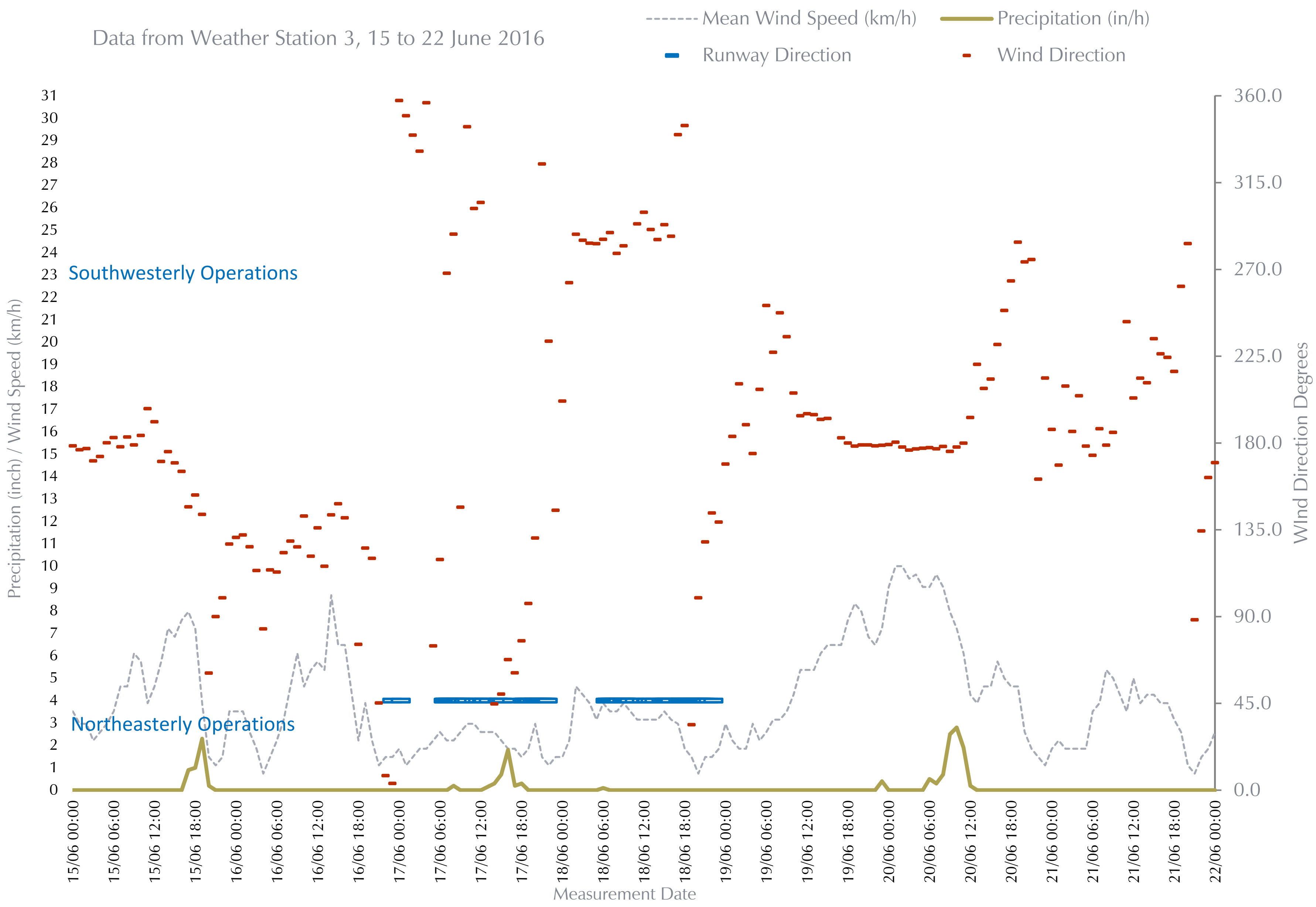
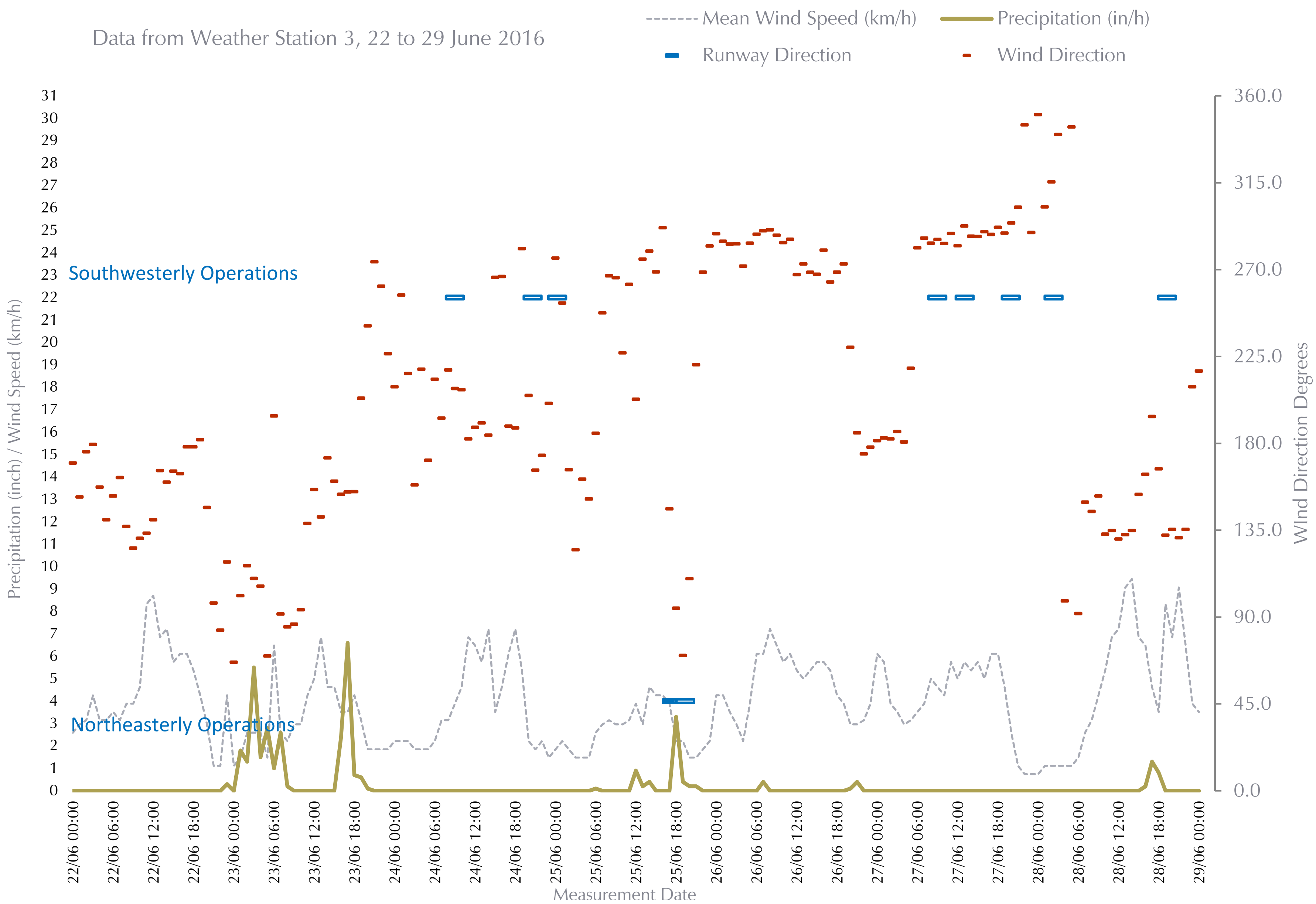


Figure 16/0321/W3A



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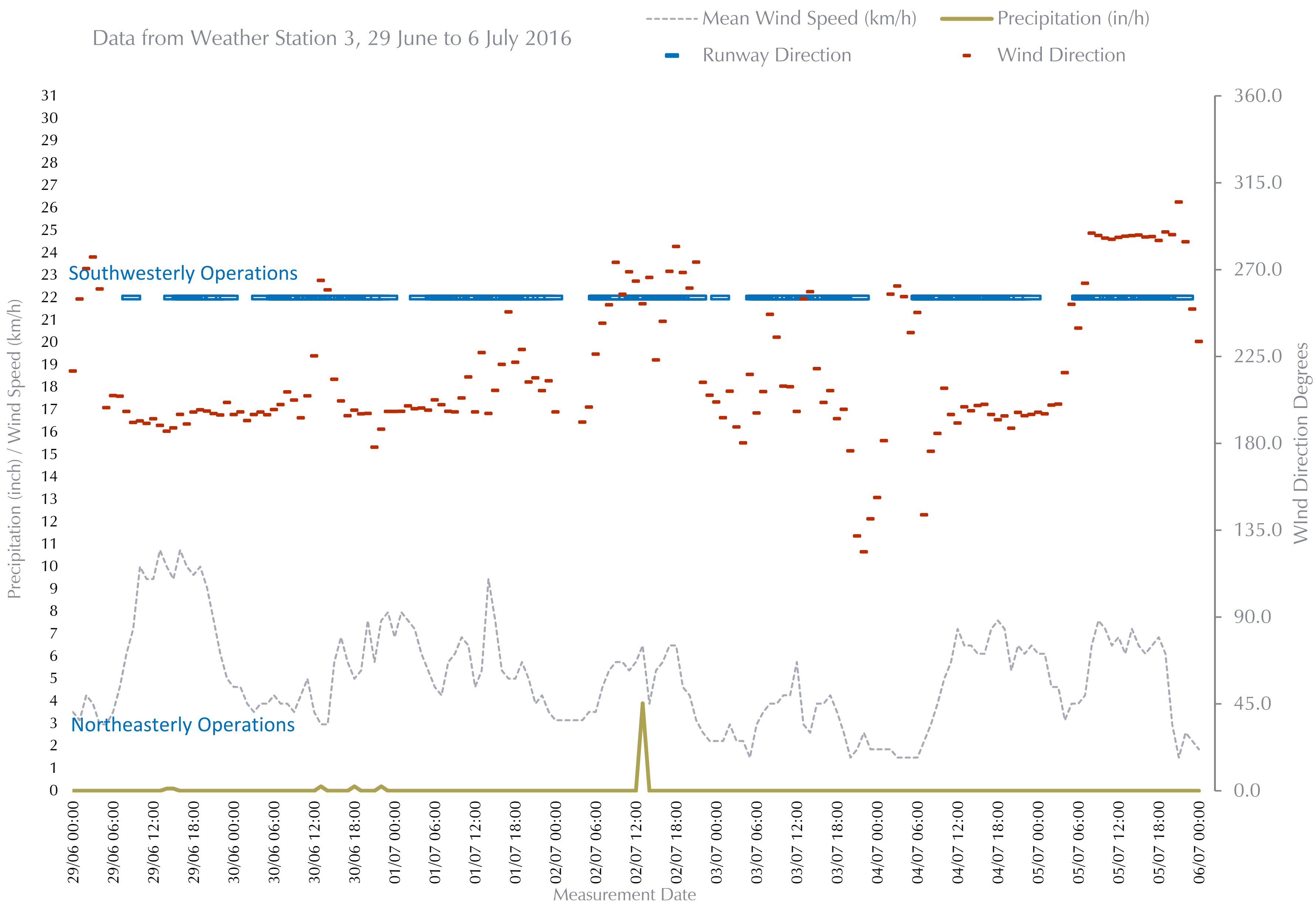

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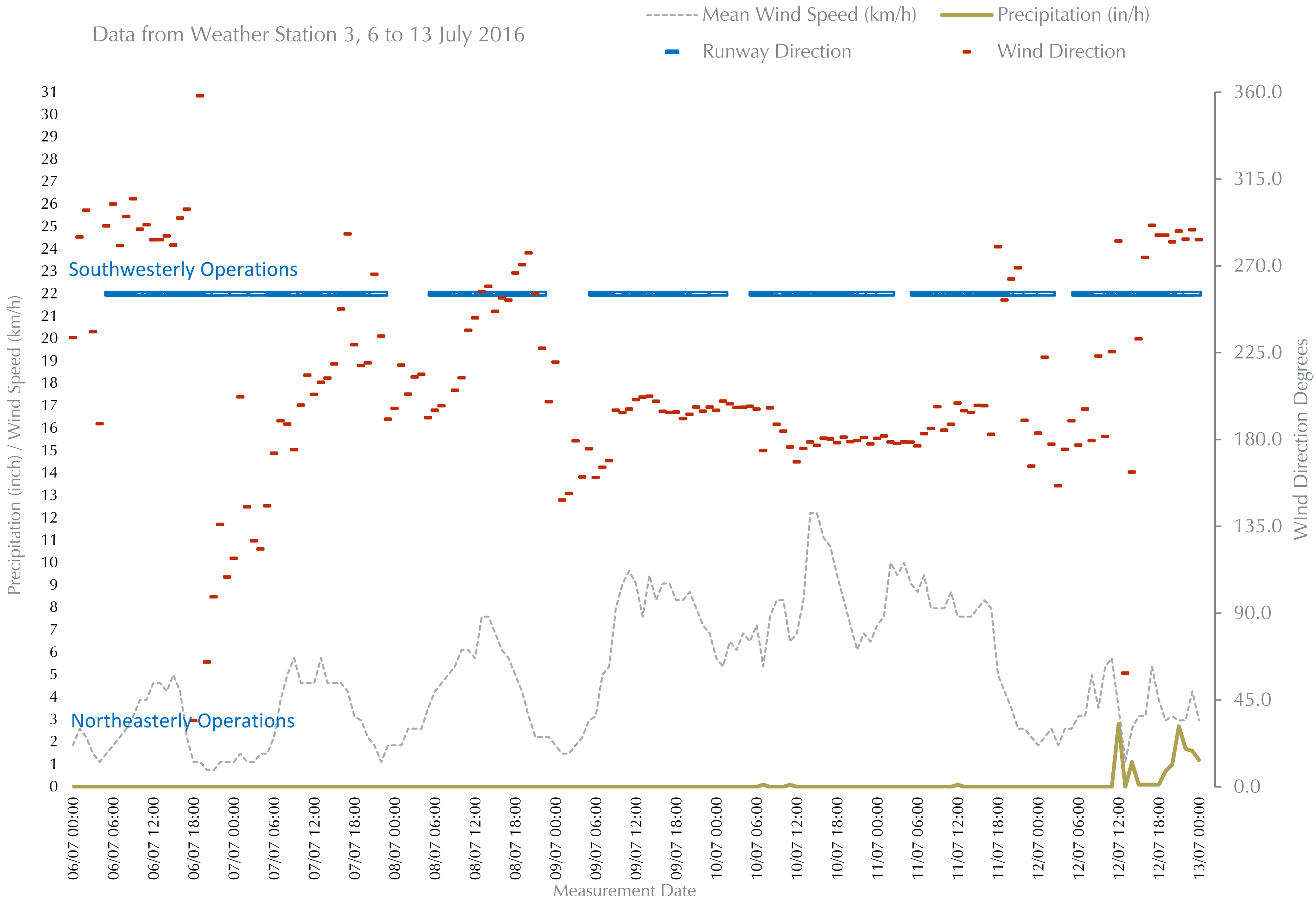

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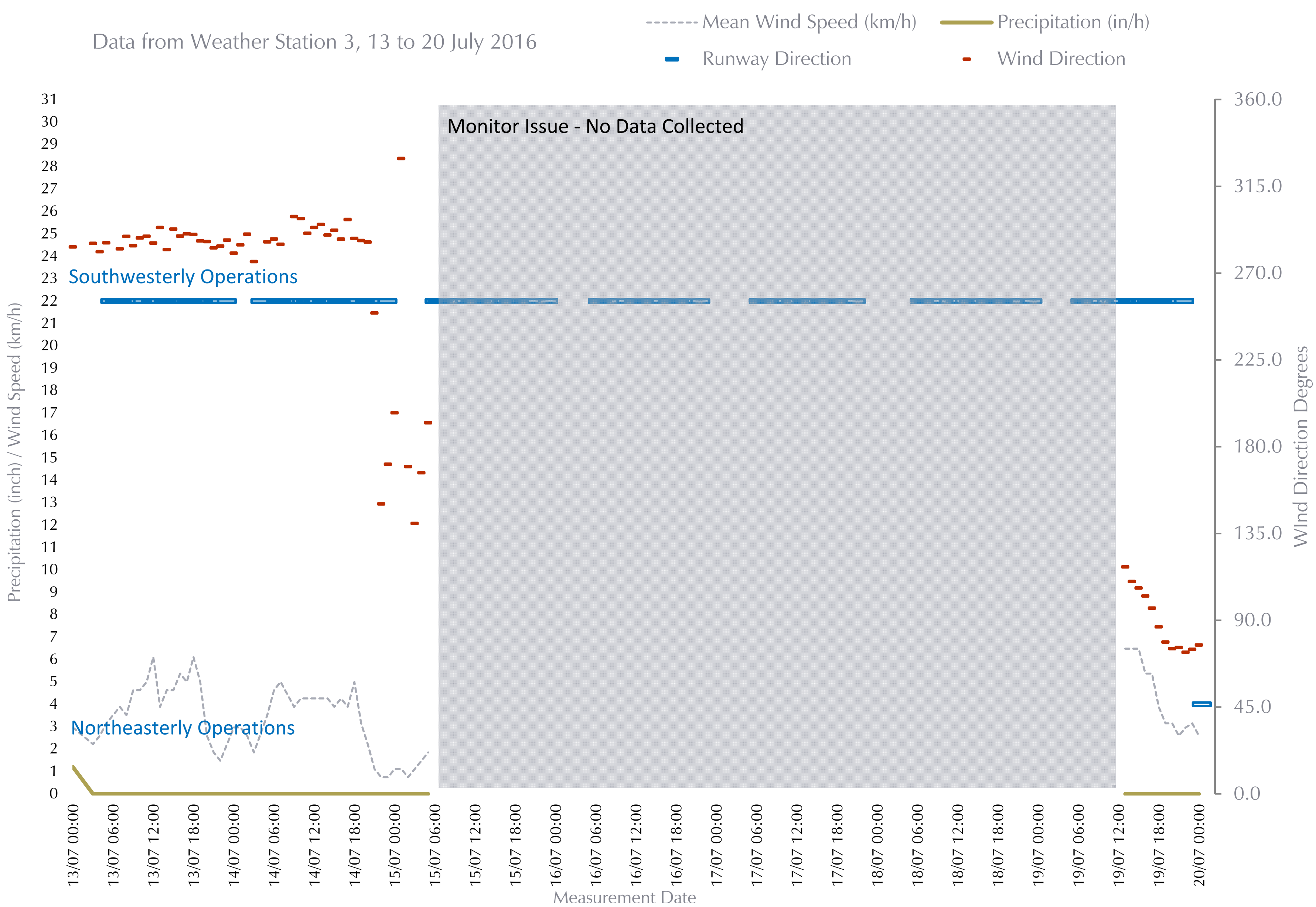
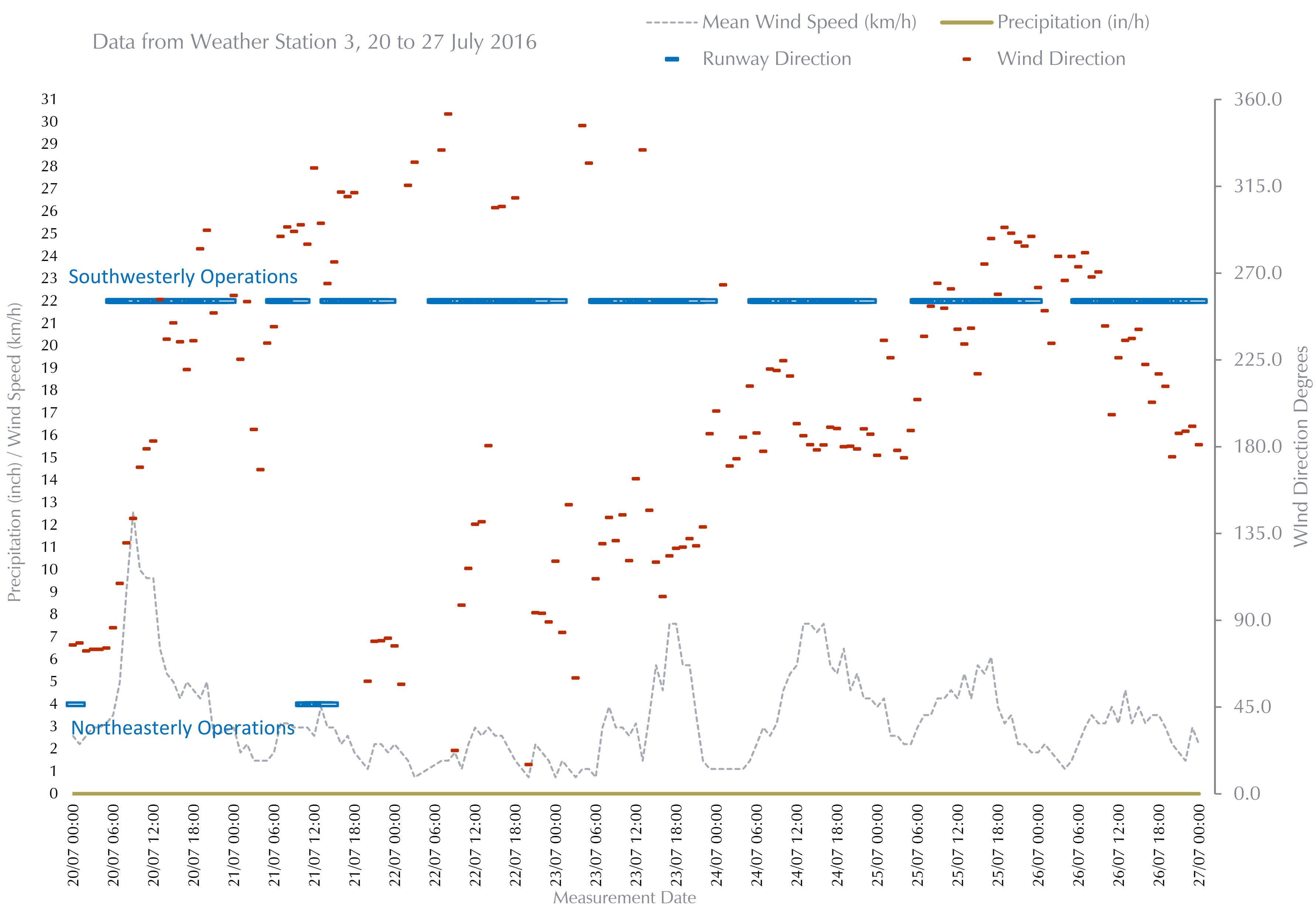


Figure 16/0321/W3E



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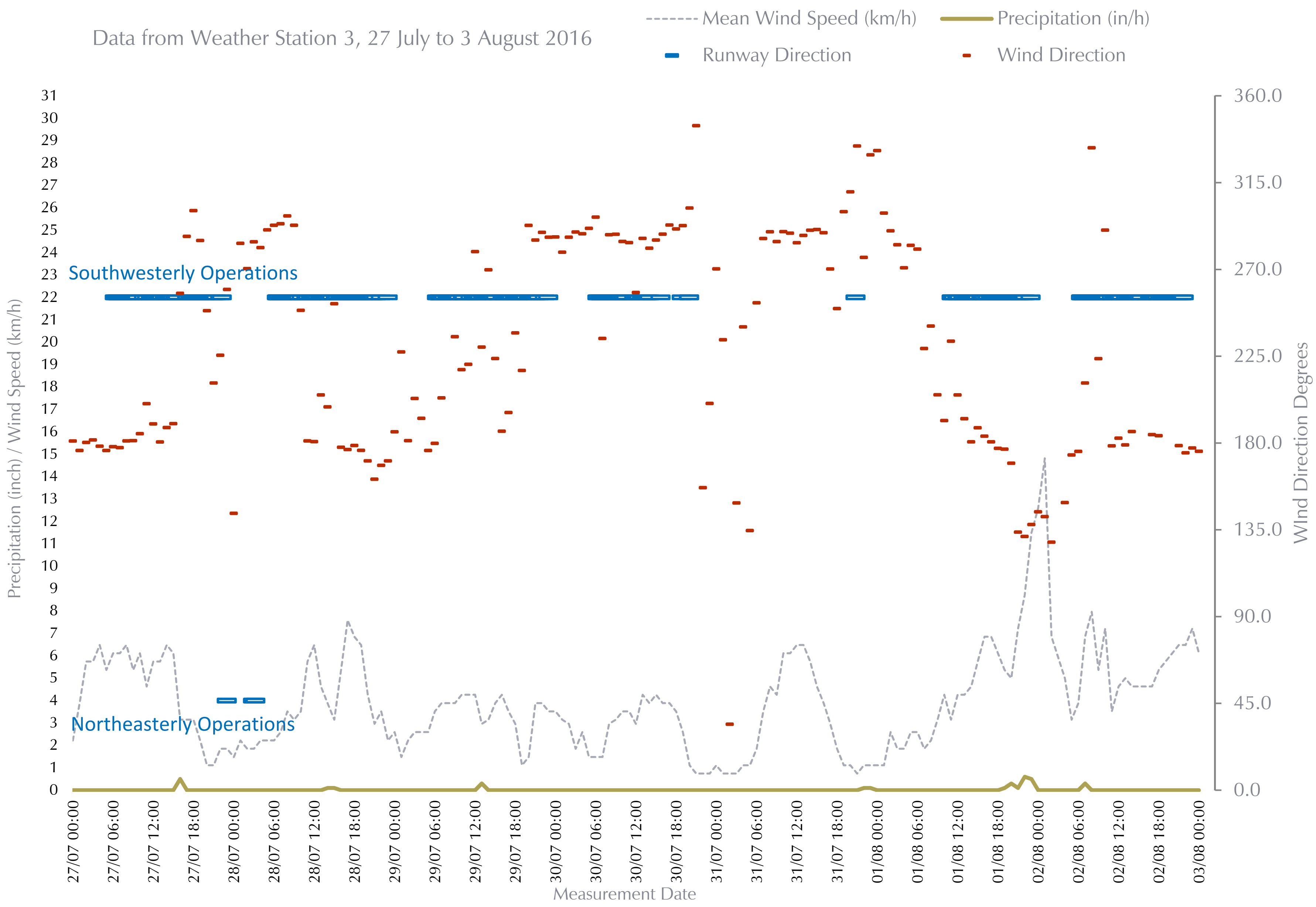

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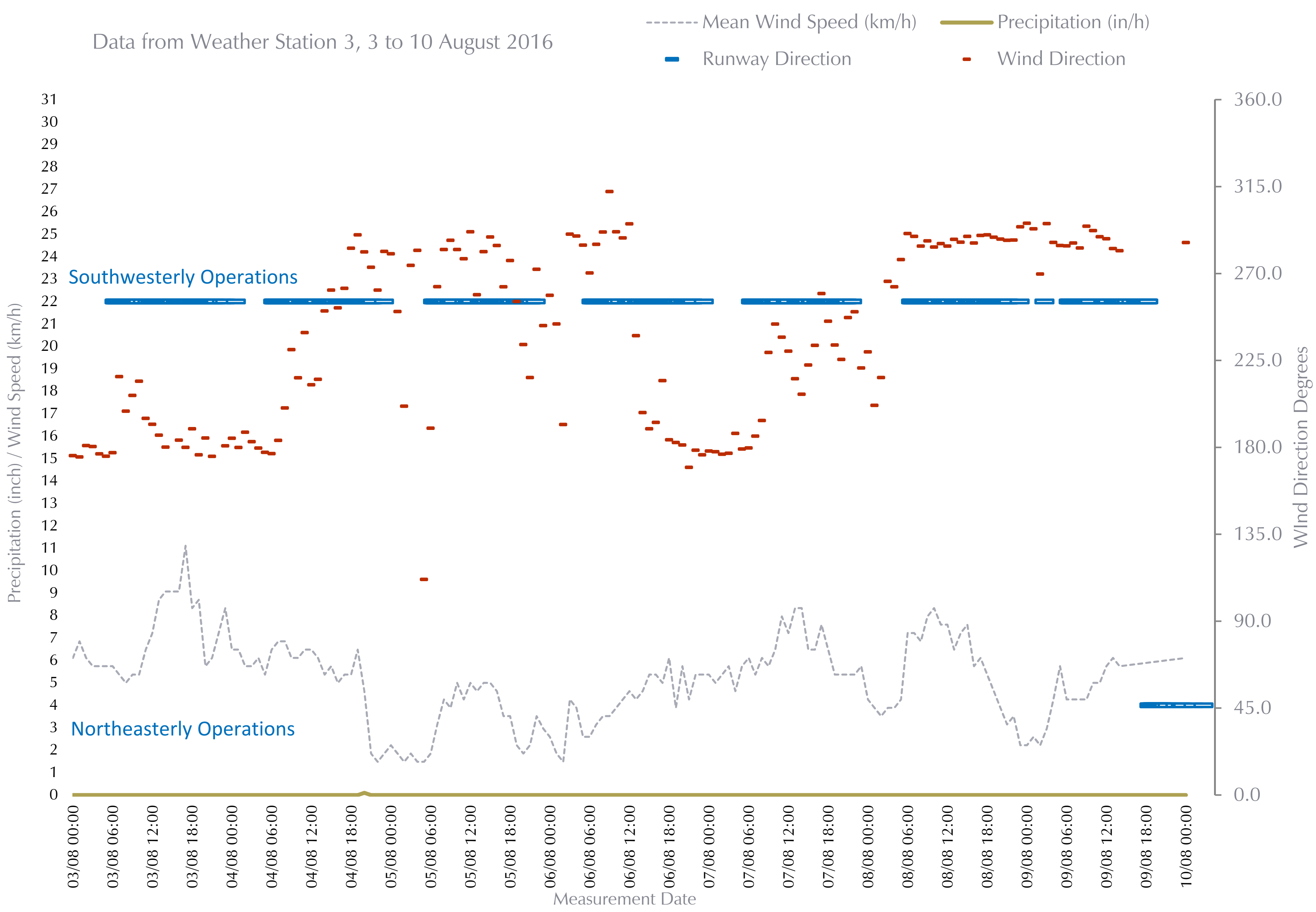

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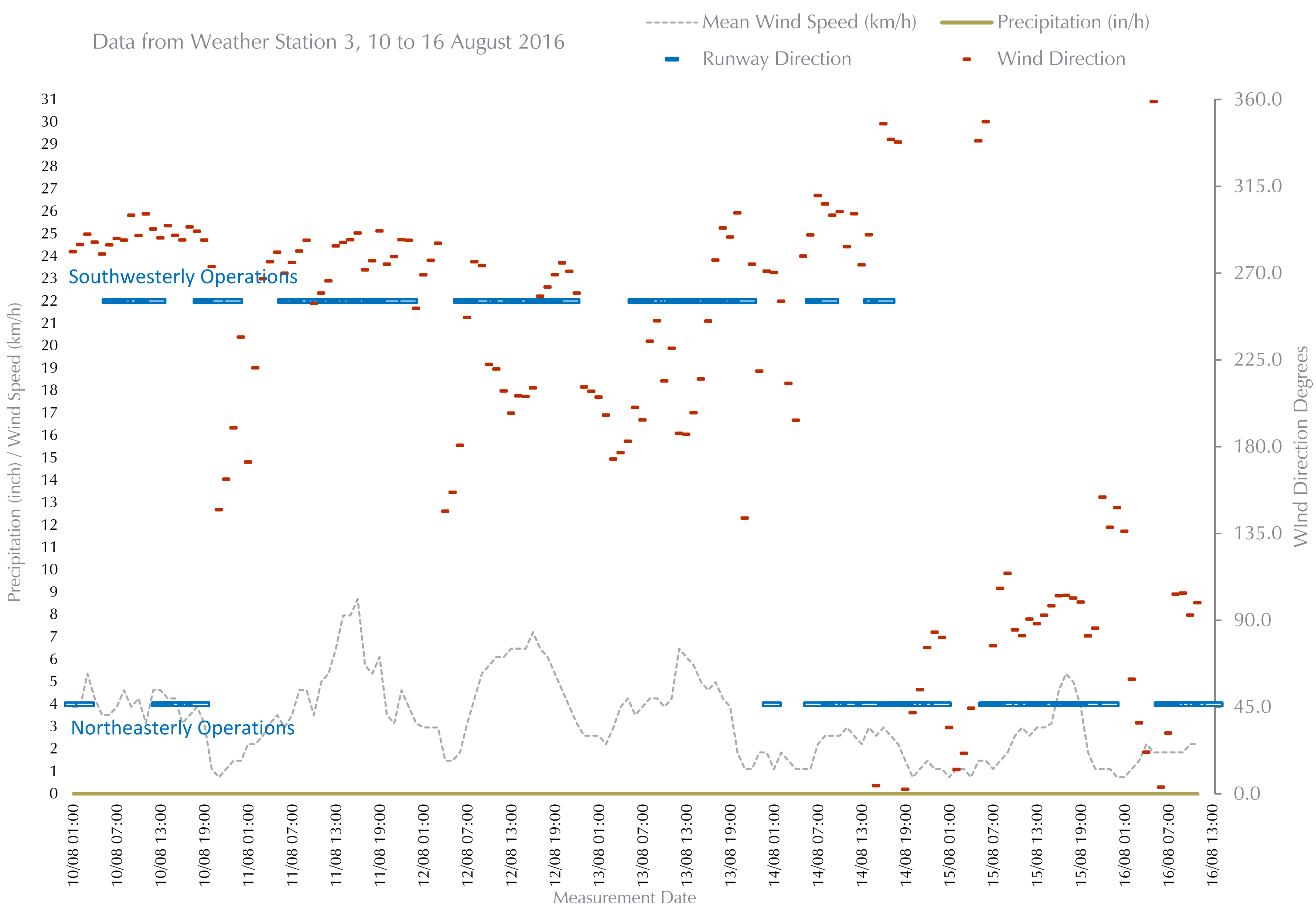

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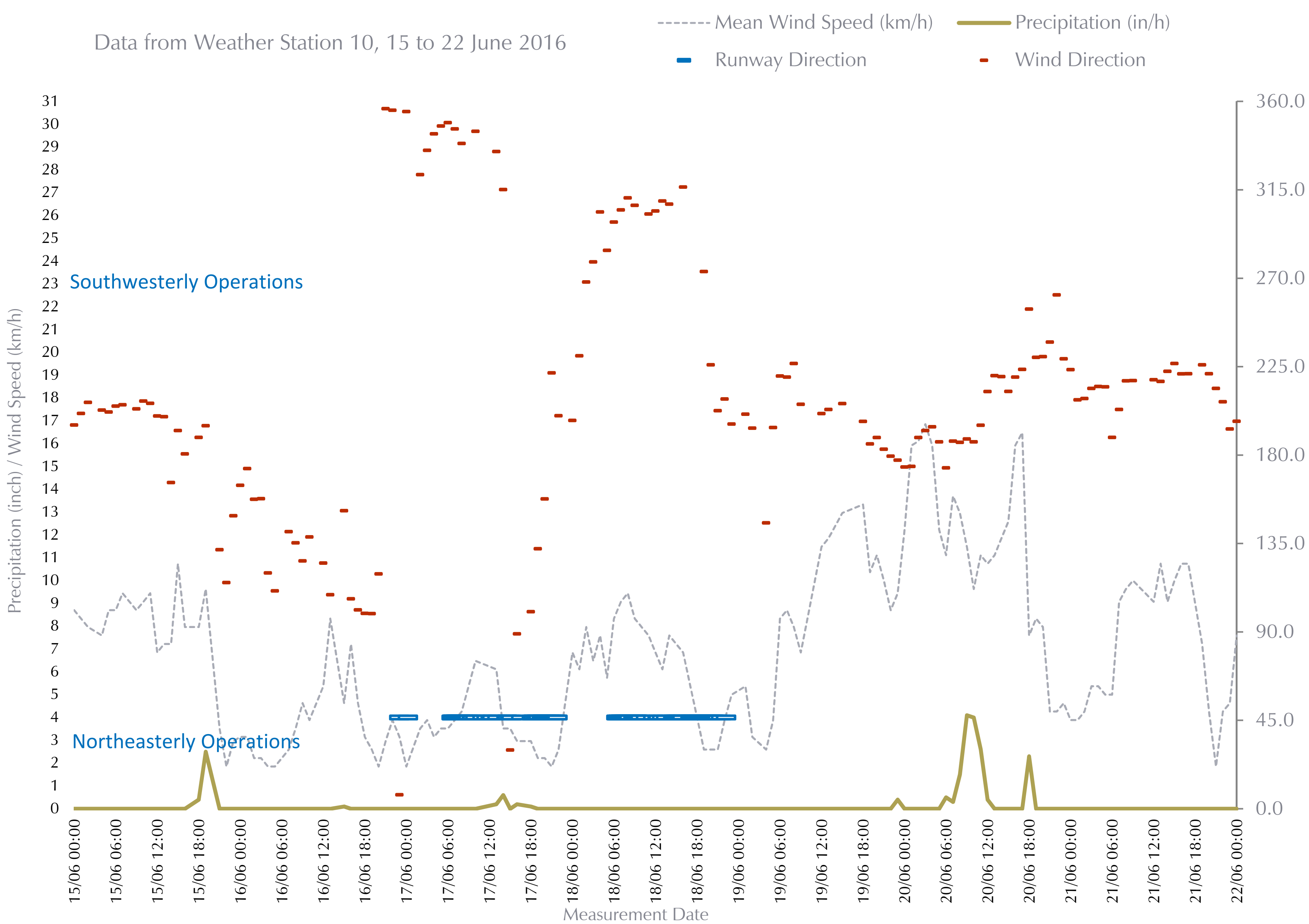

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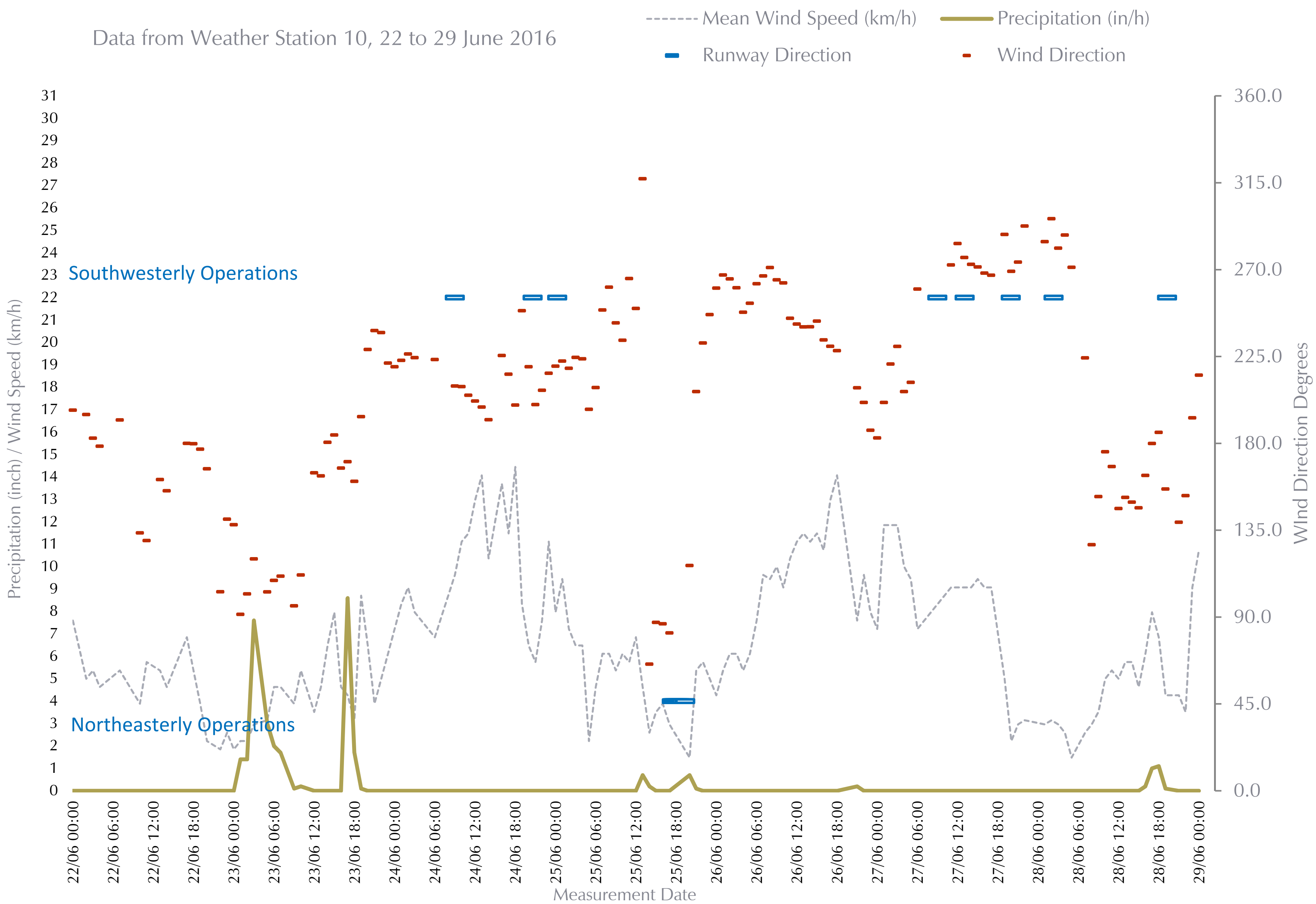

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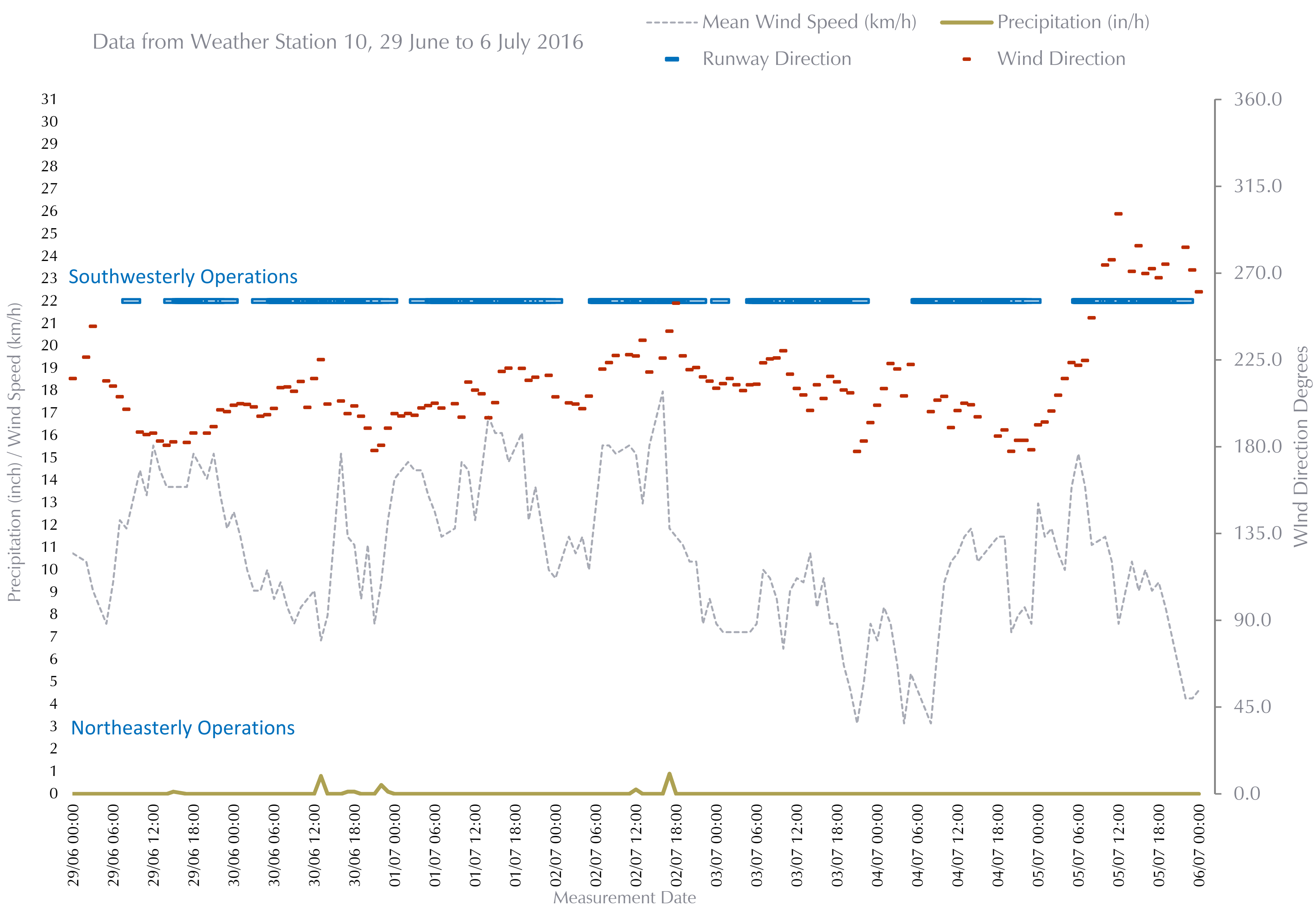

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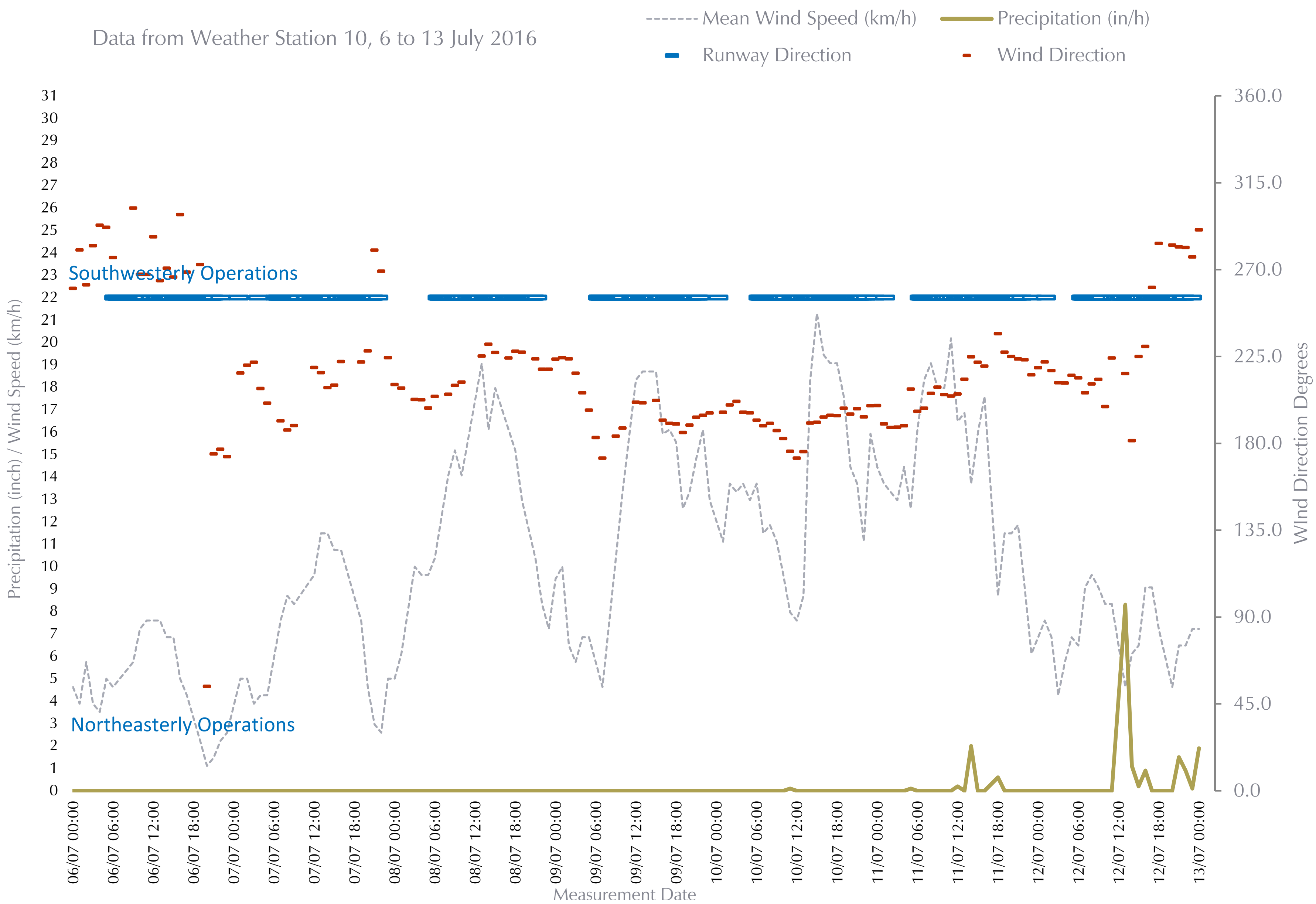

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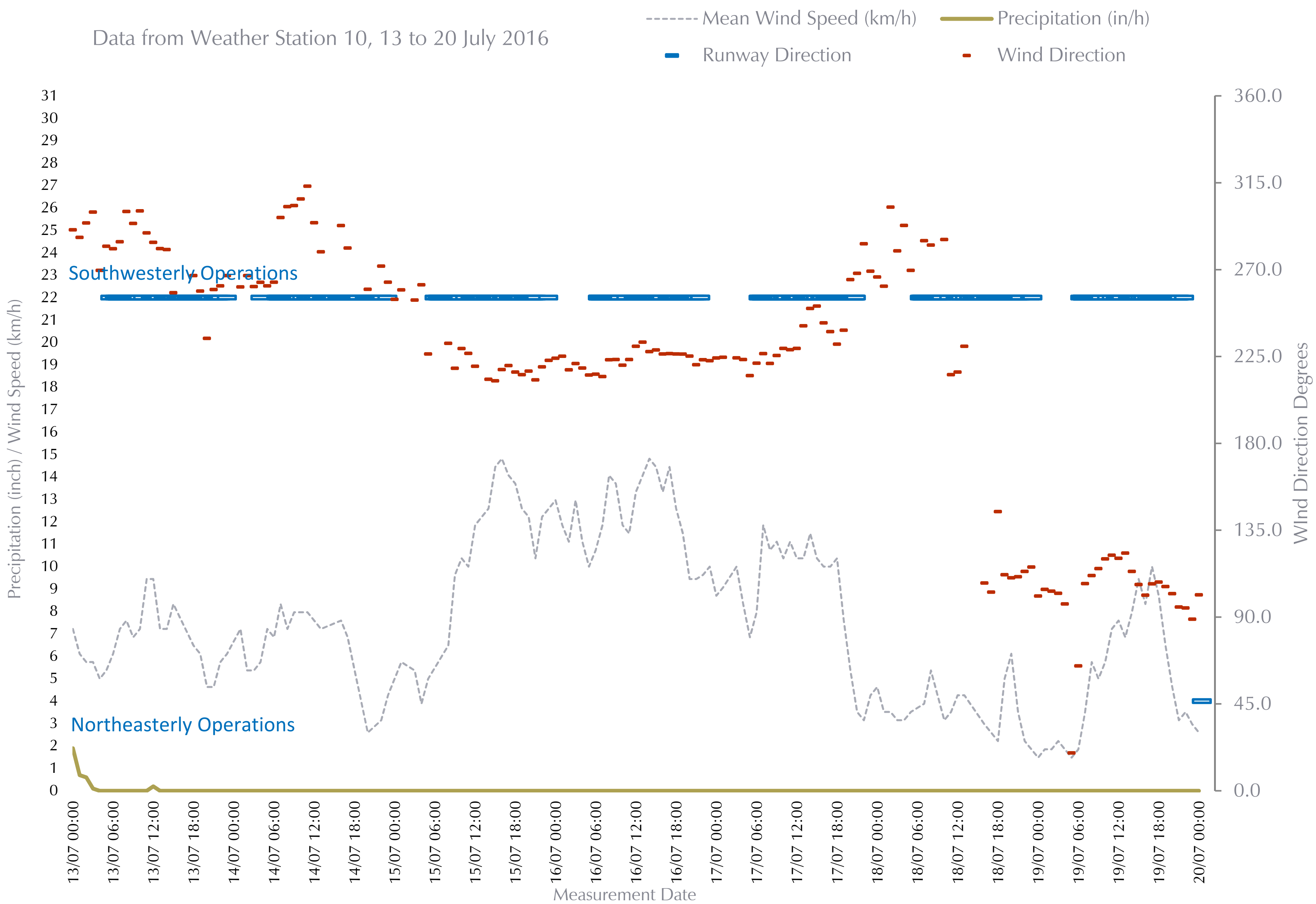

Figure 16/0321/W10E

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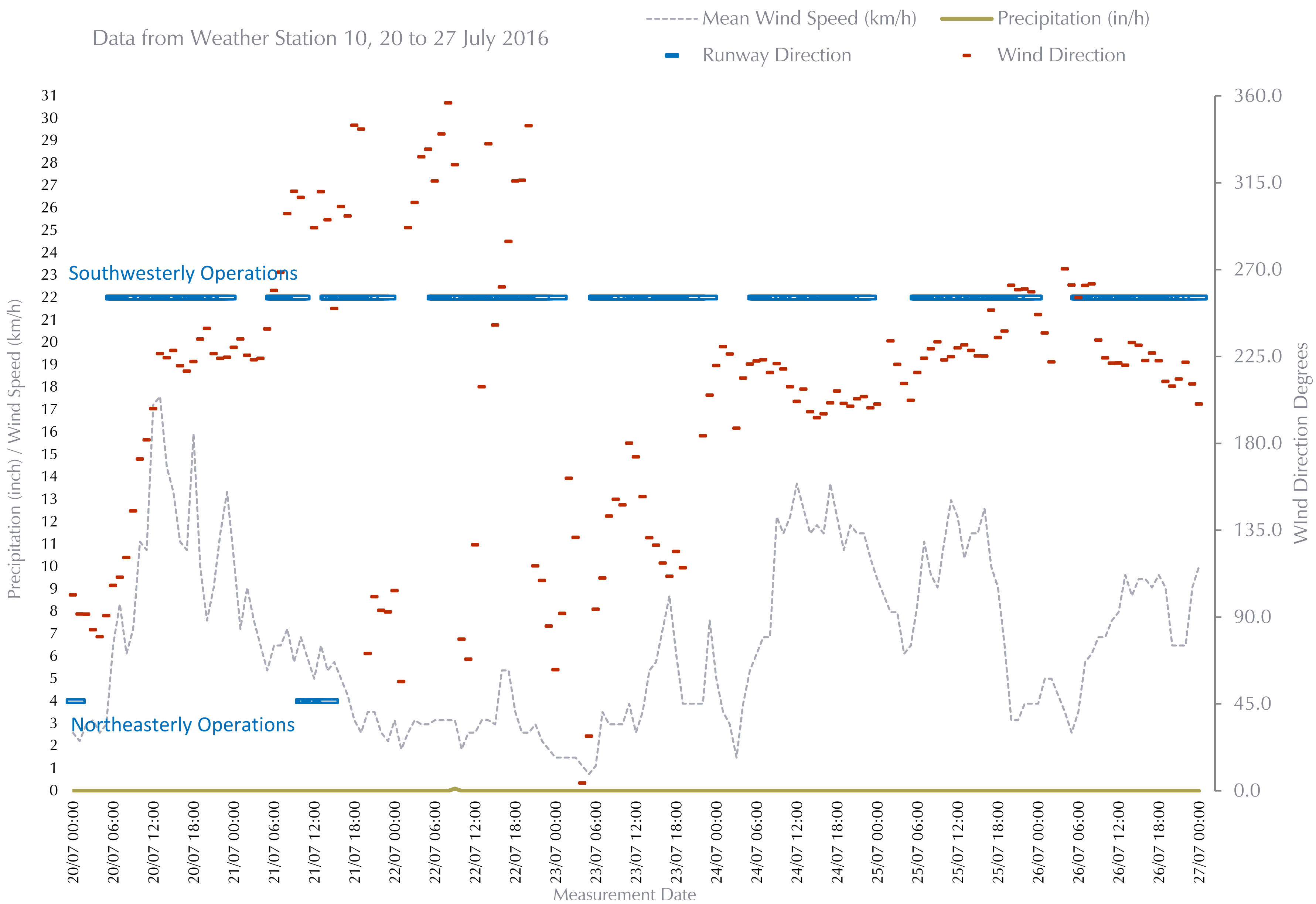

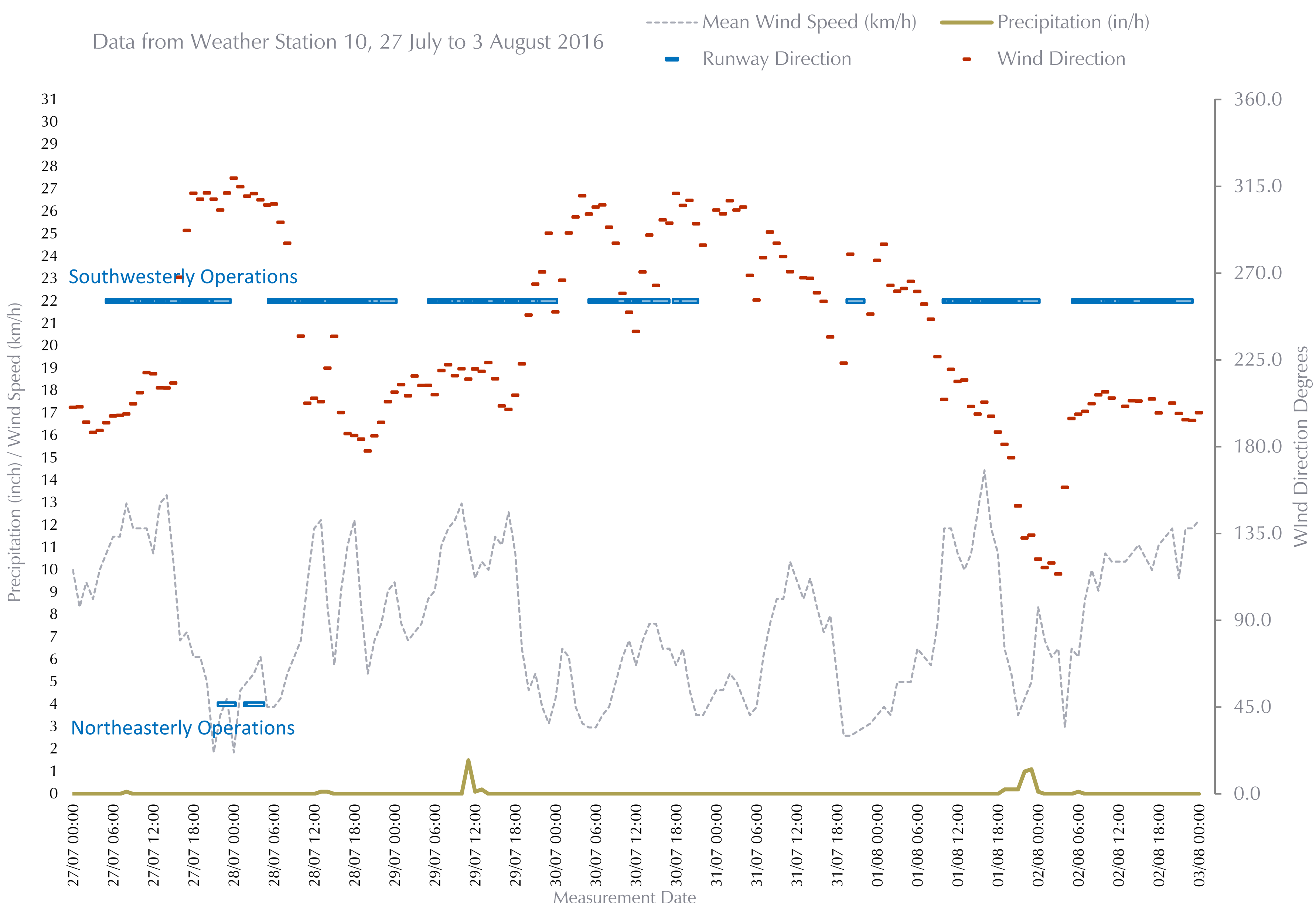

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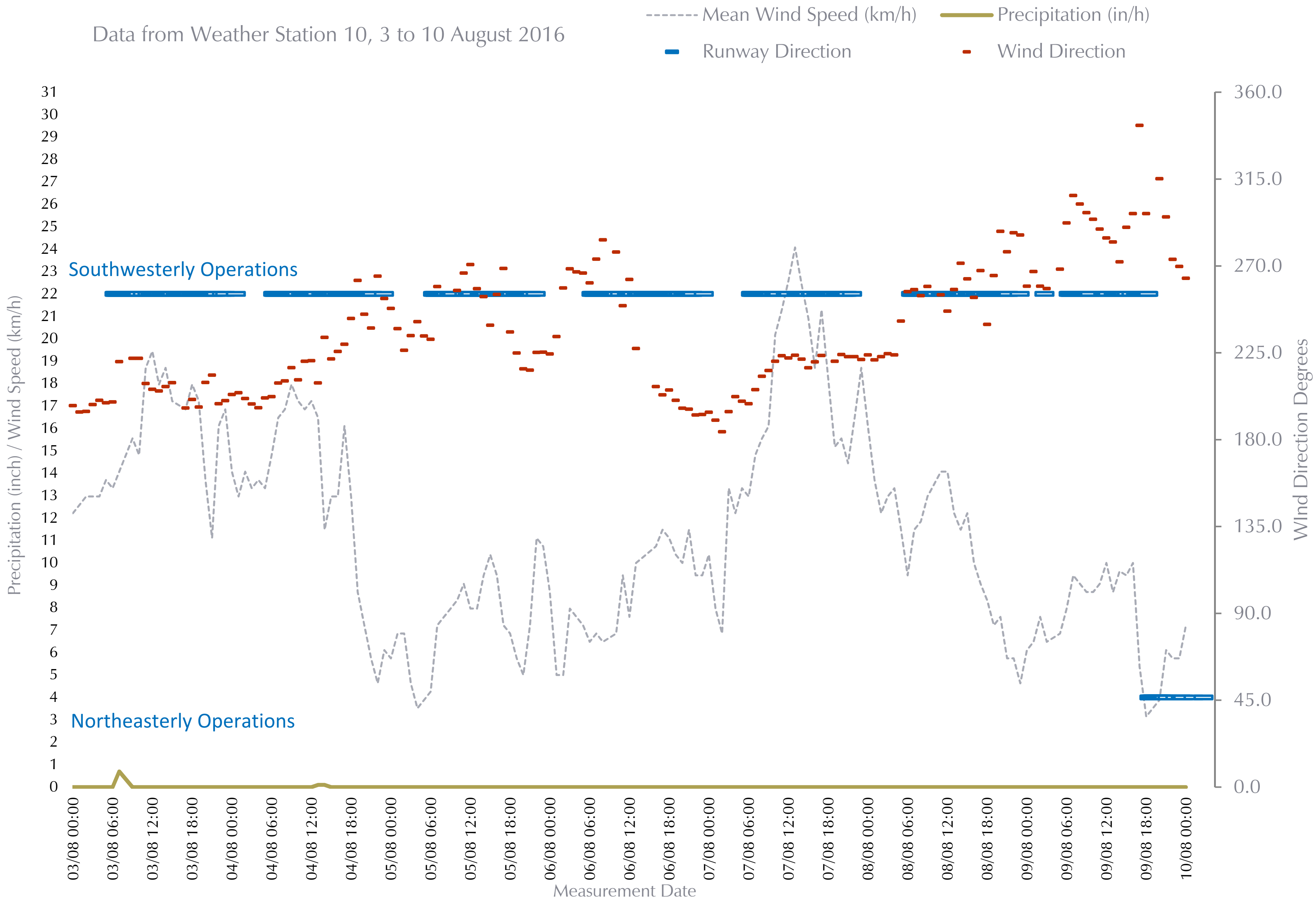

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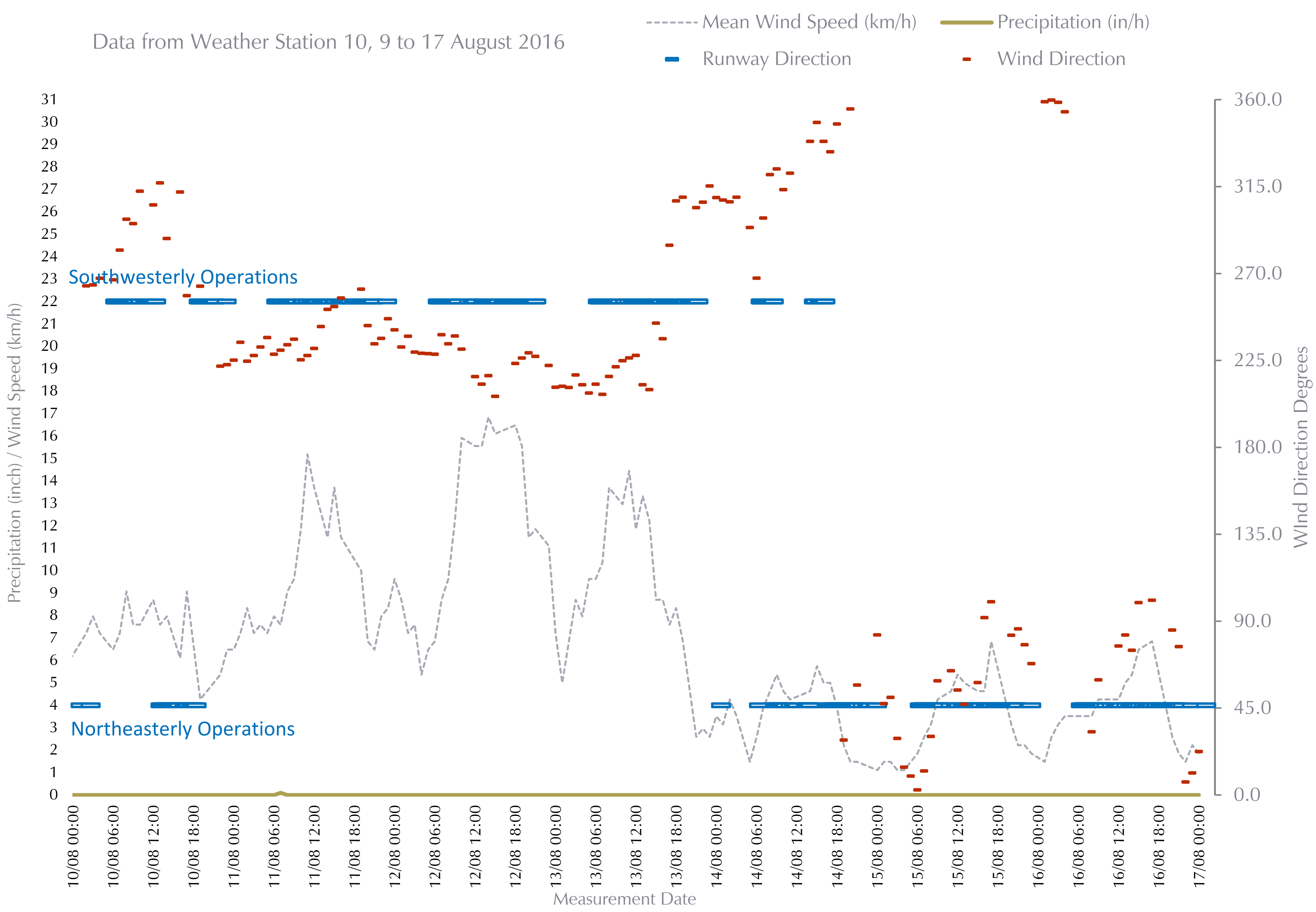

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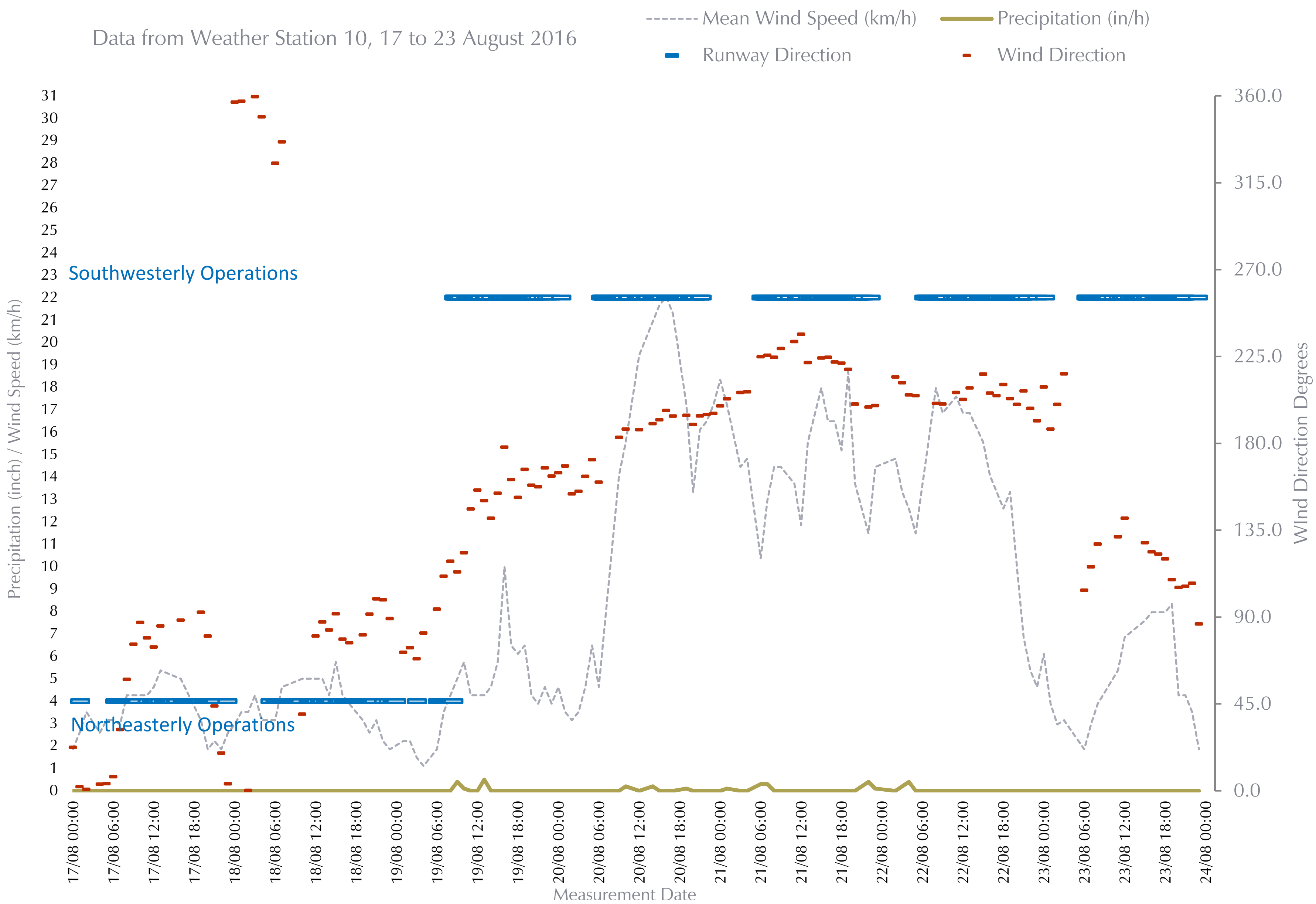

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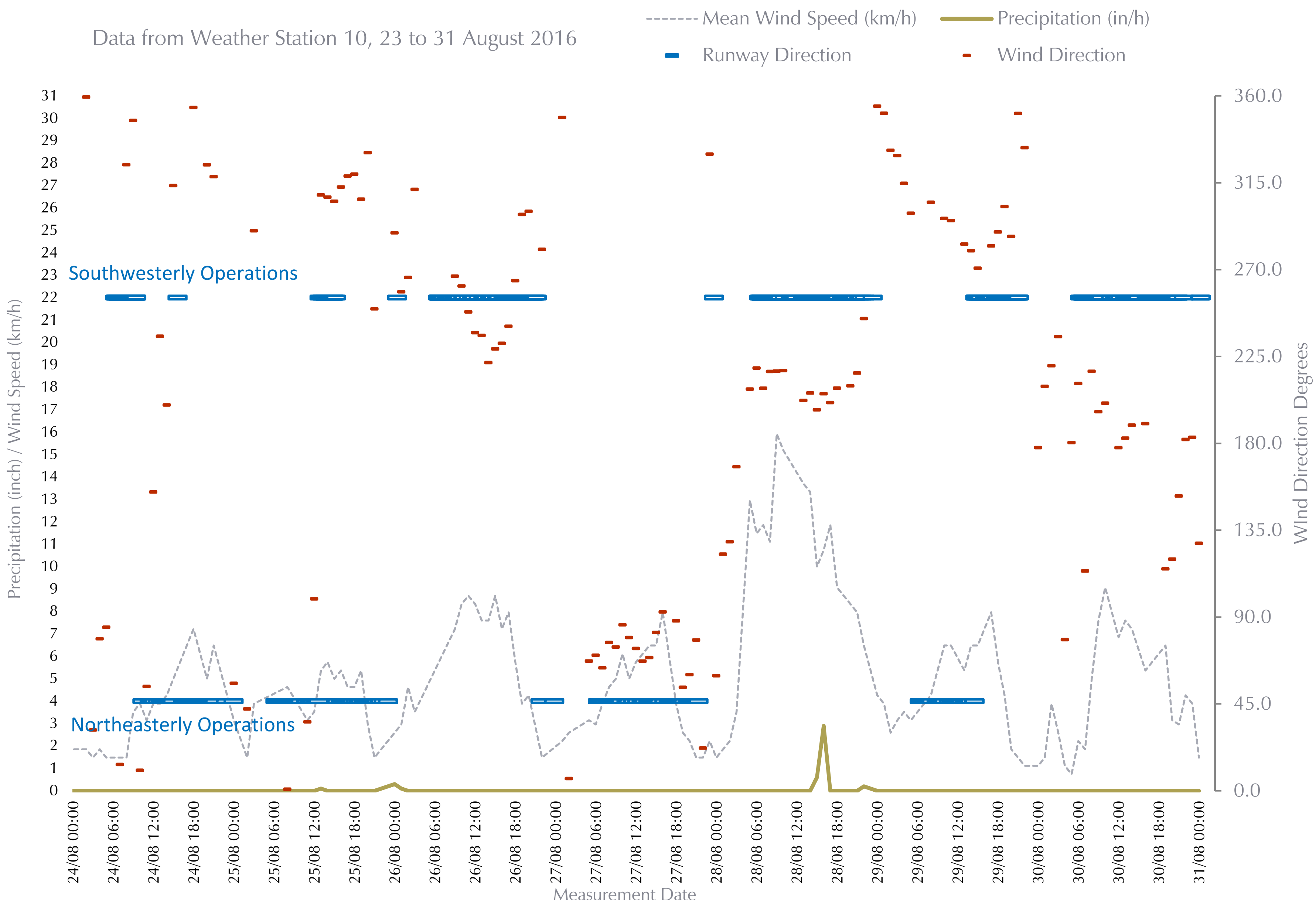

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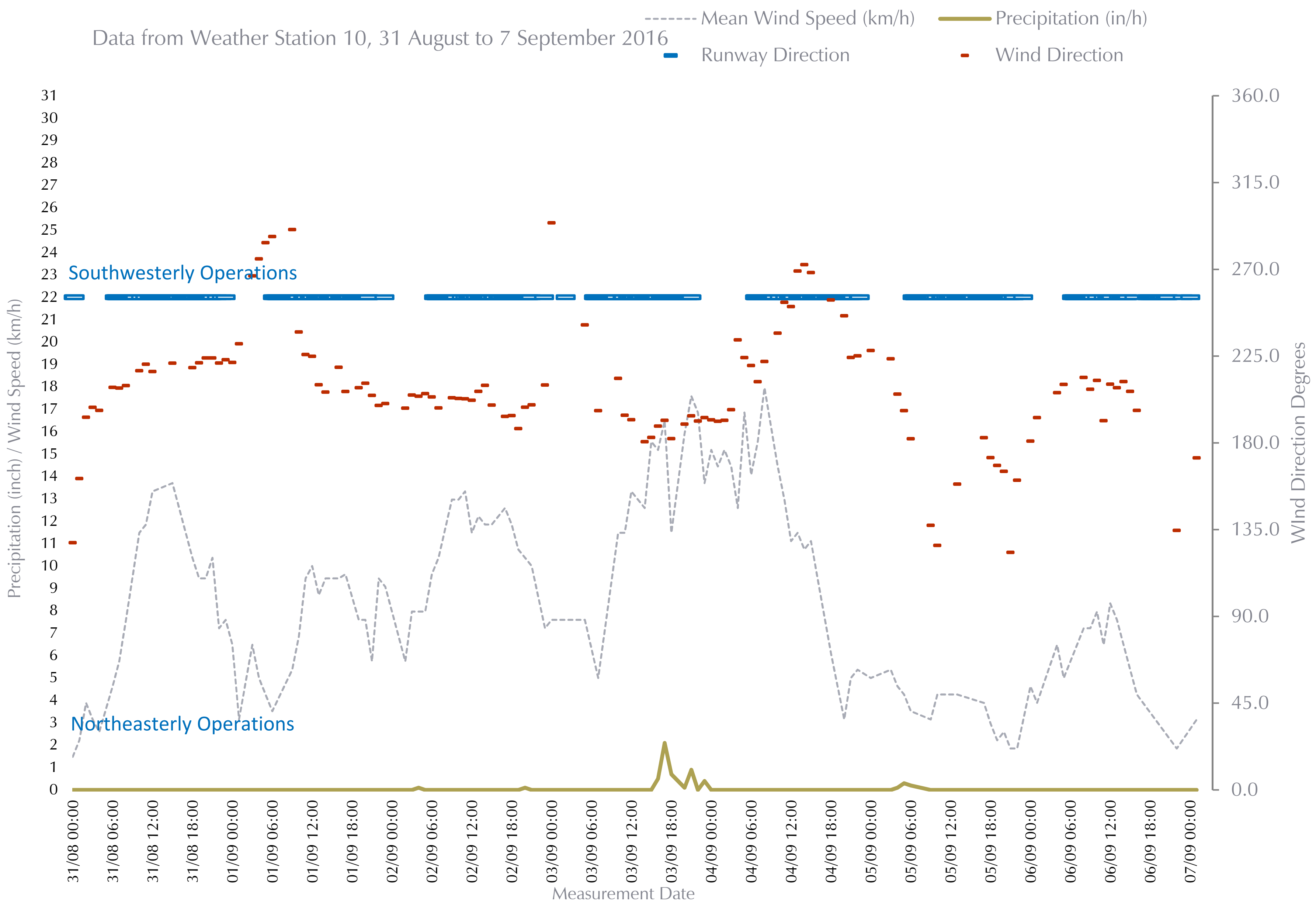

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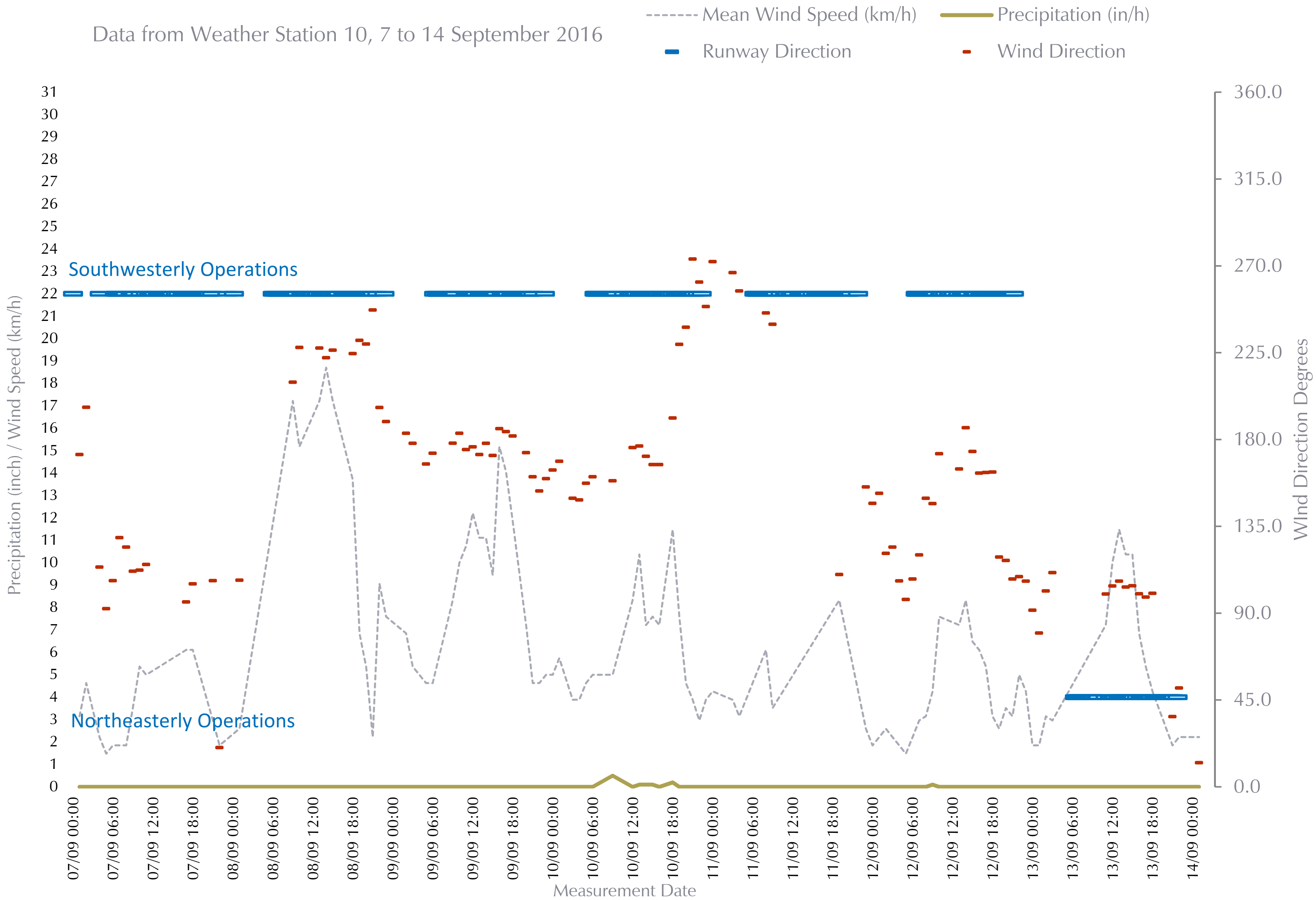

Figure 16/0321/W10M

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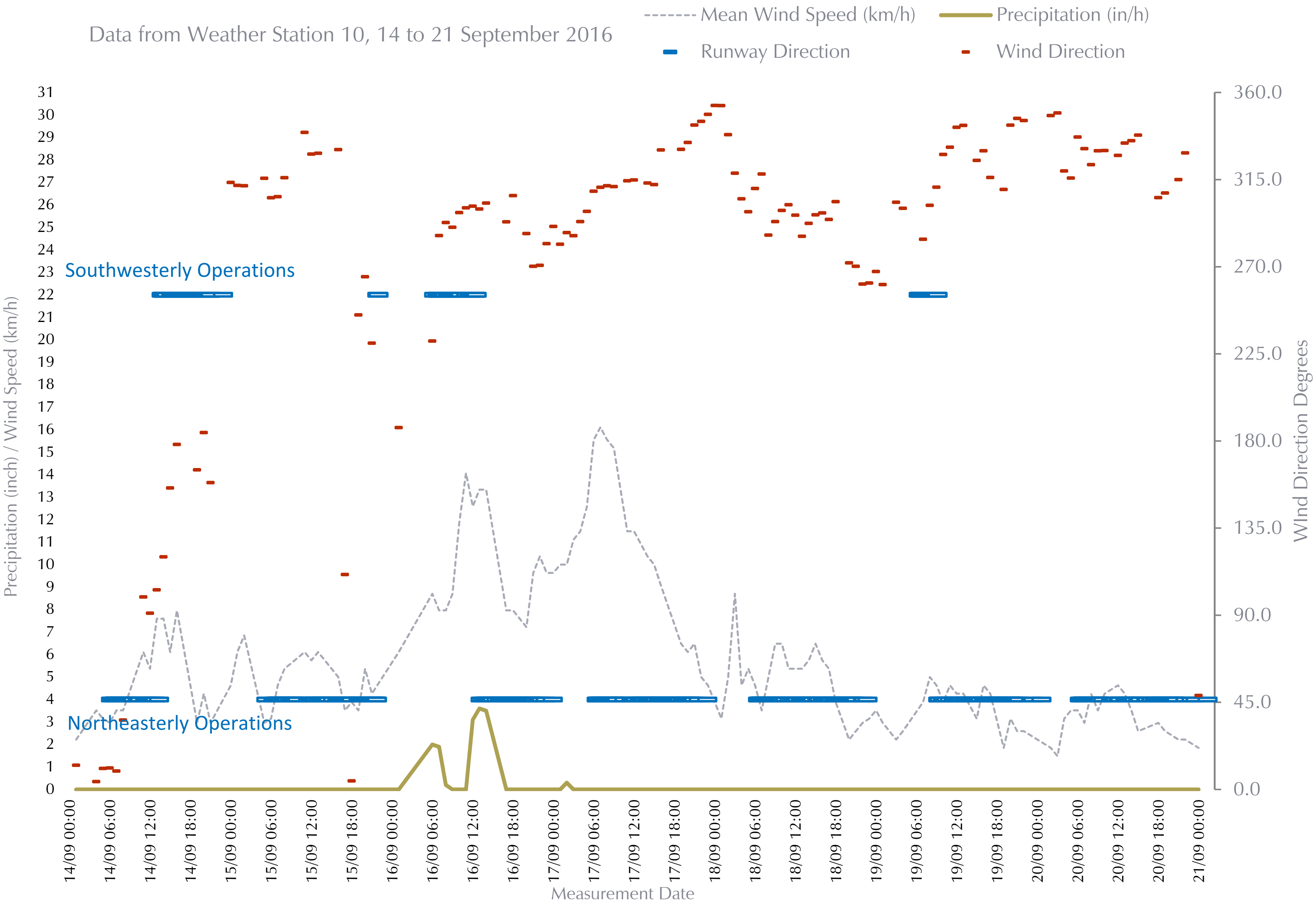

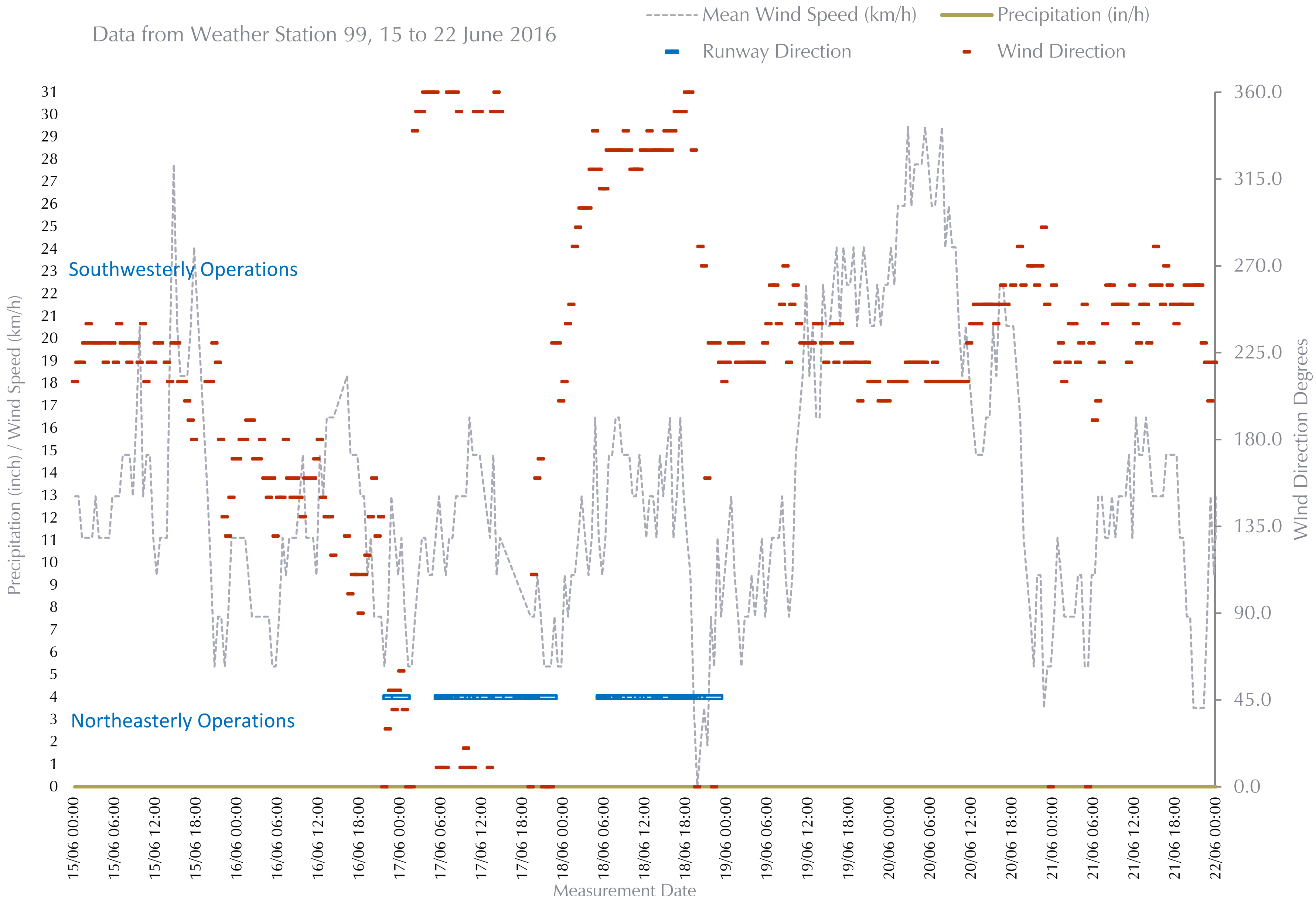

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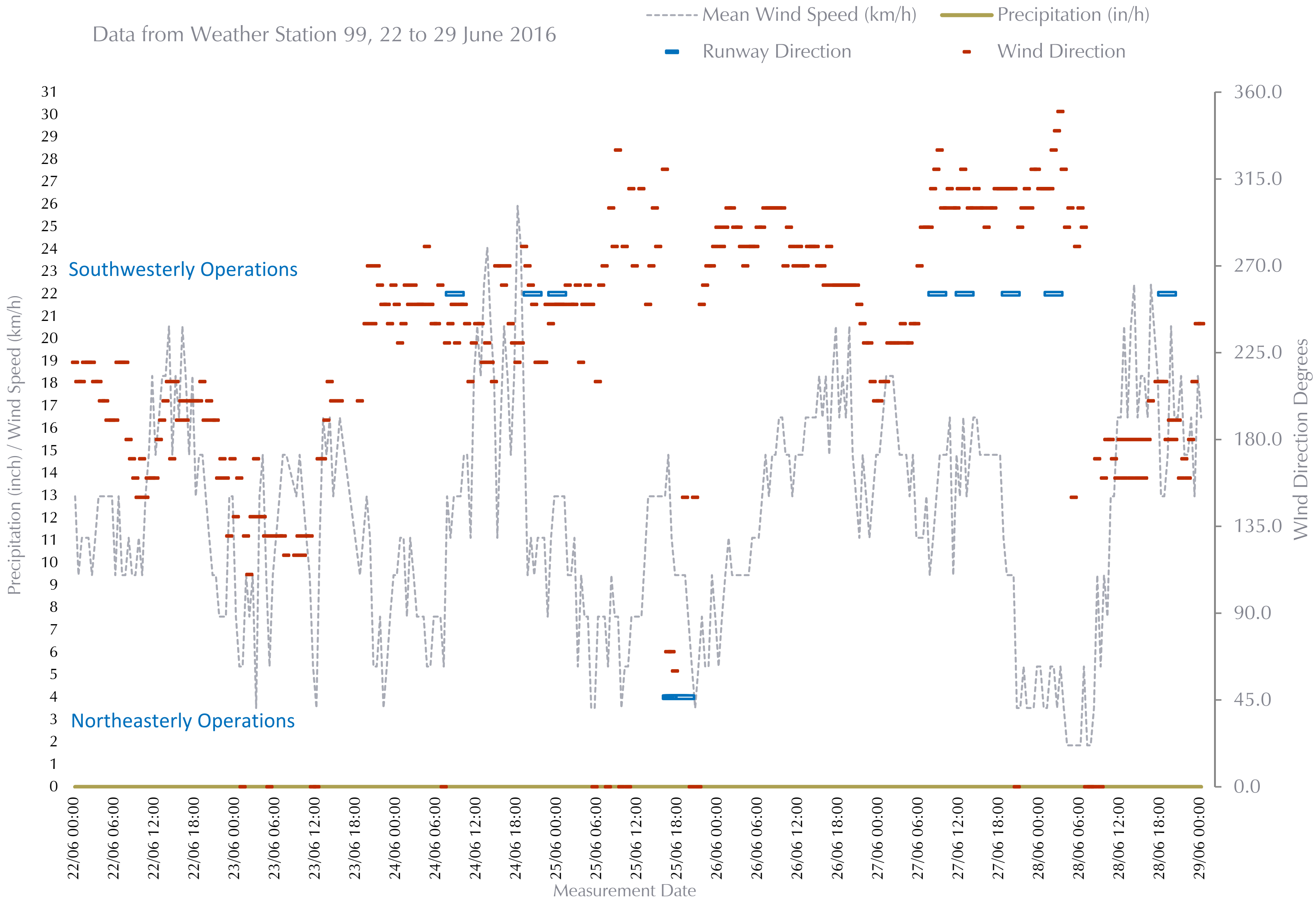

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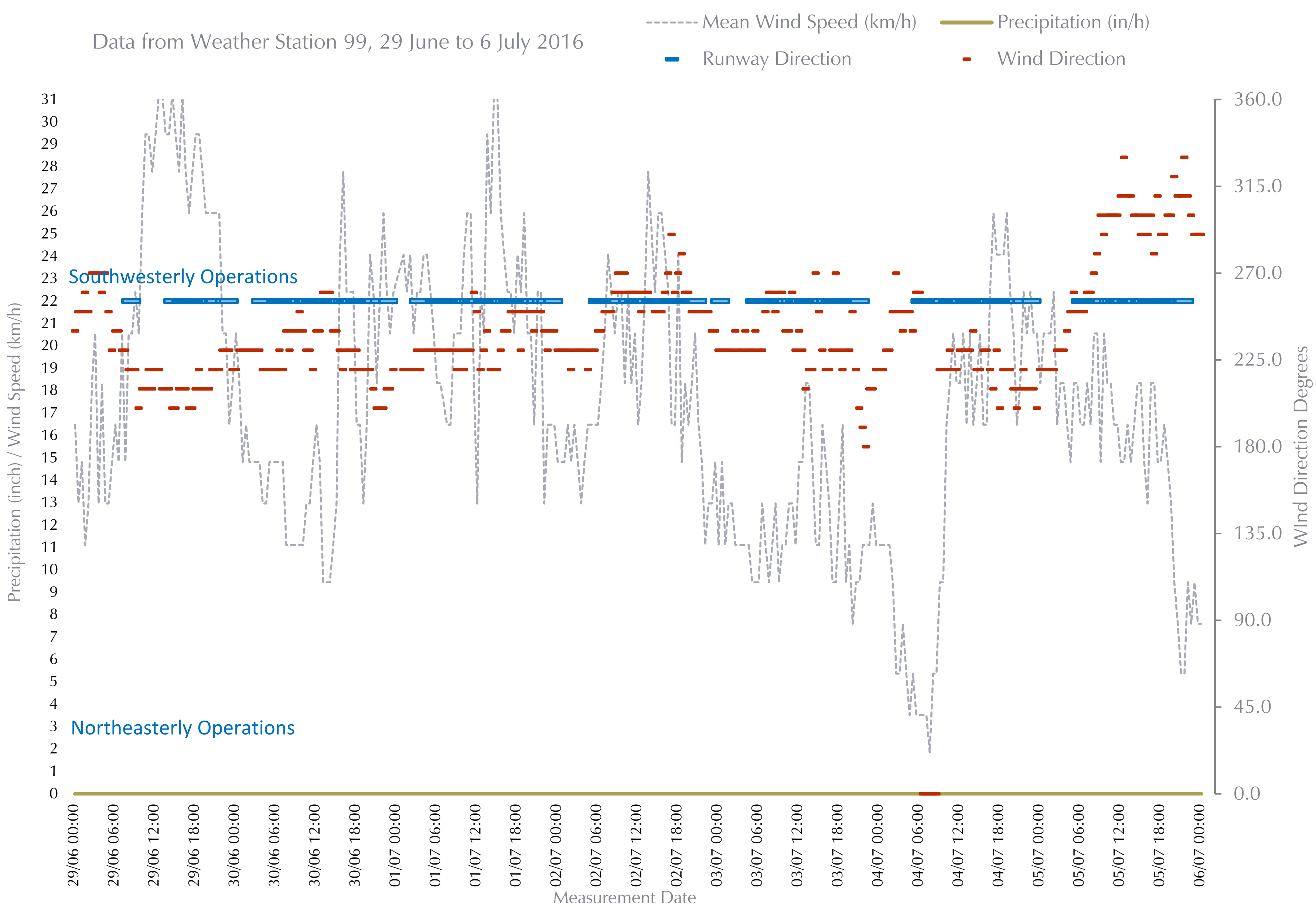

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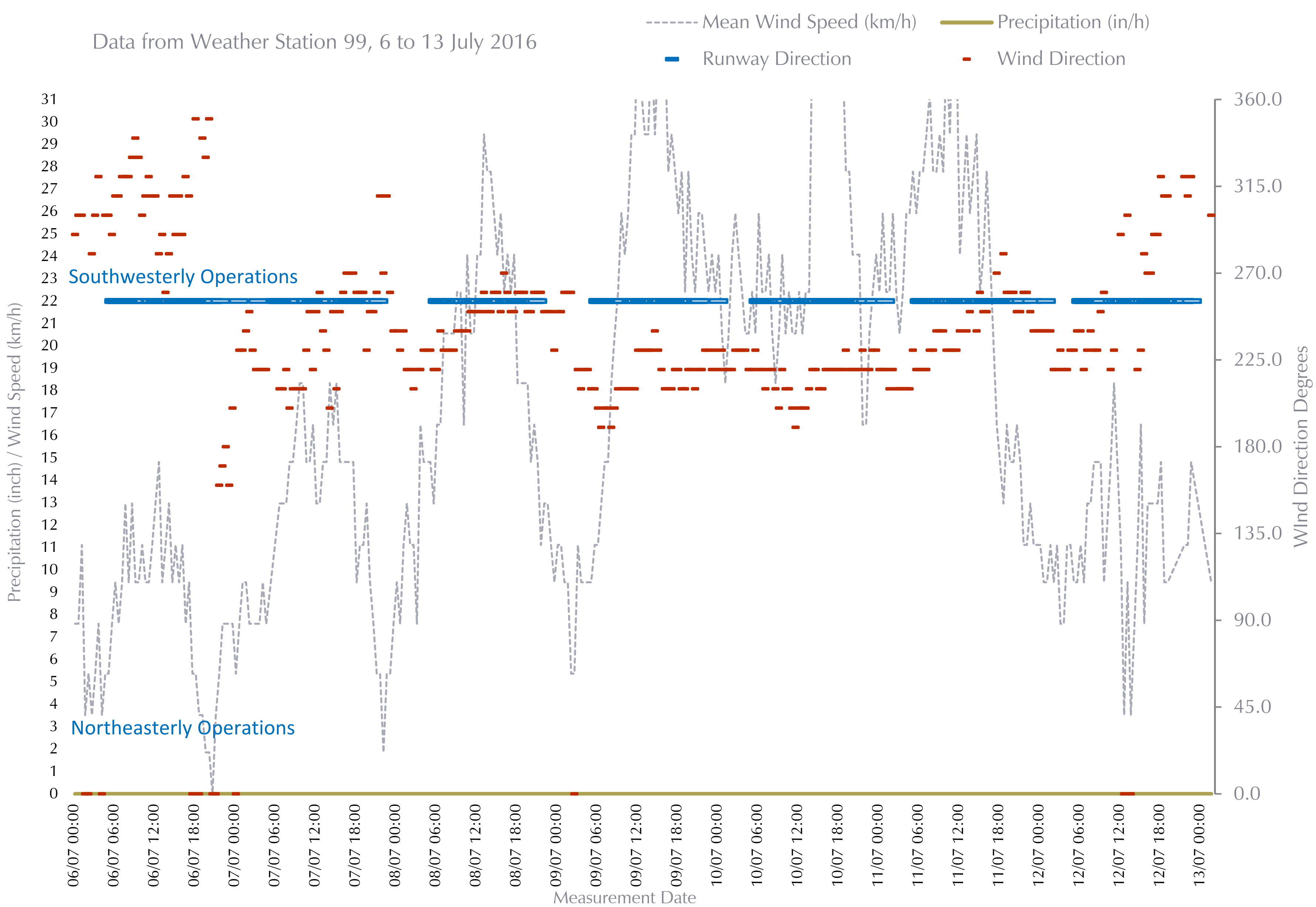

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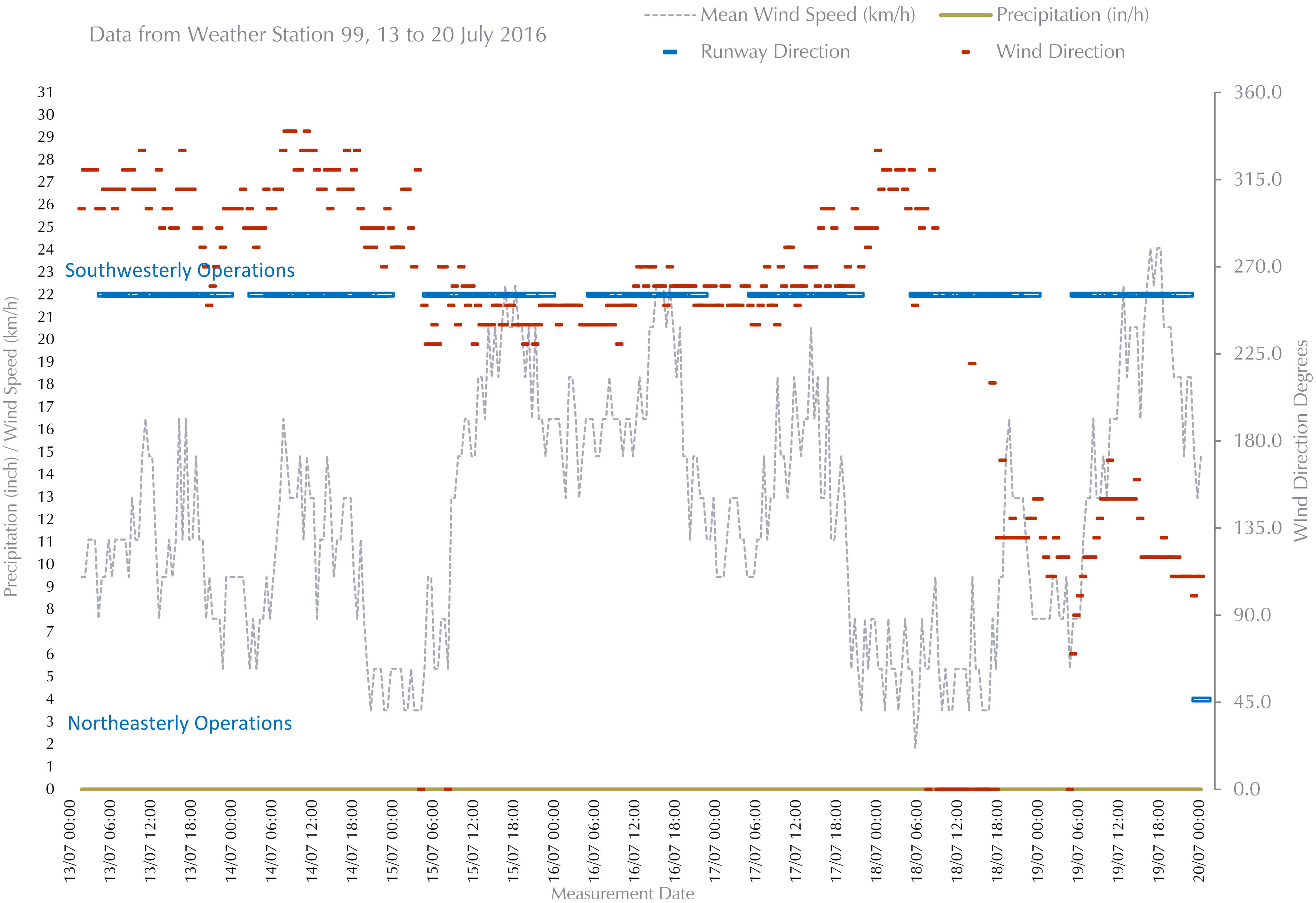

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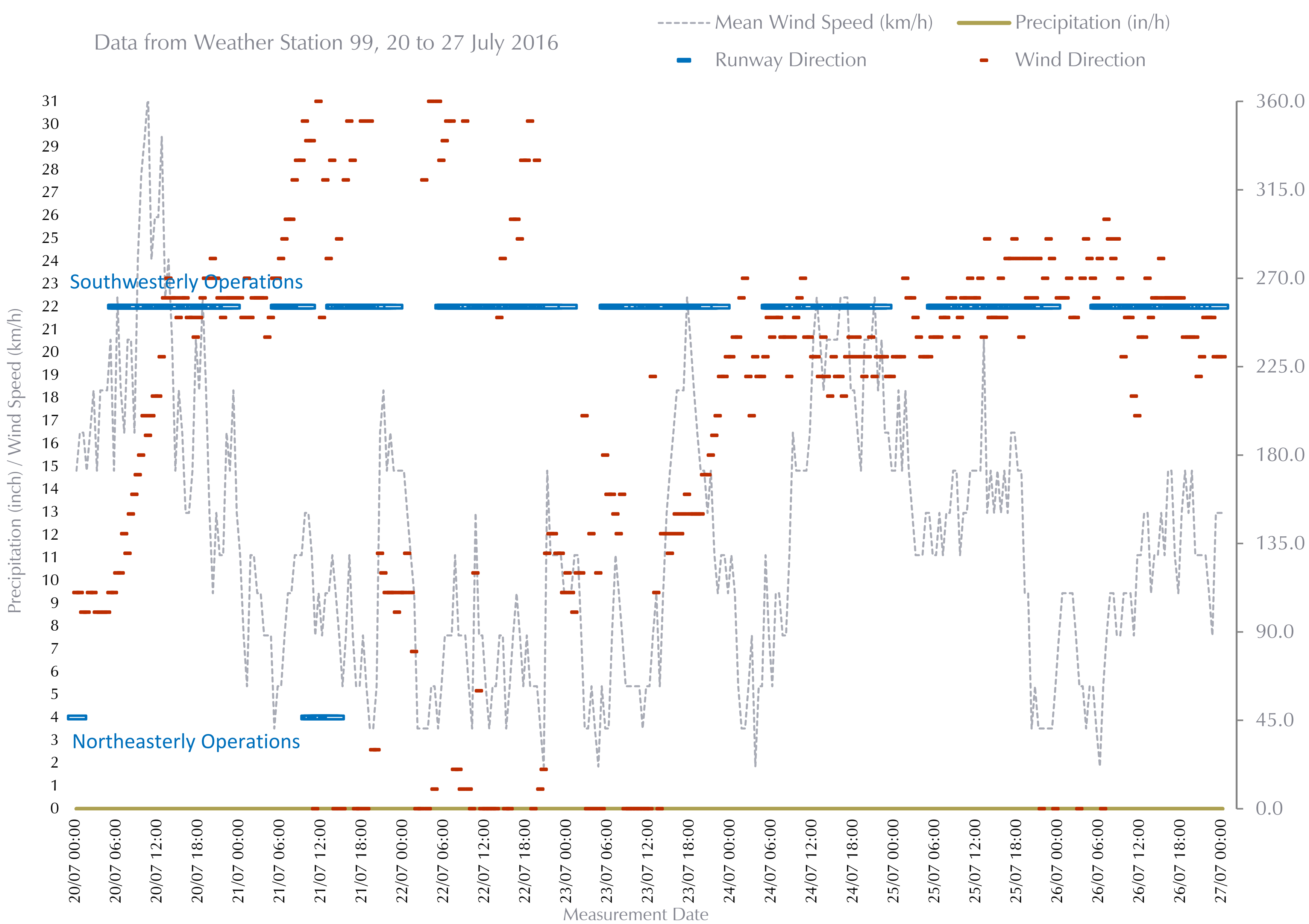

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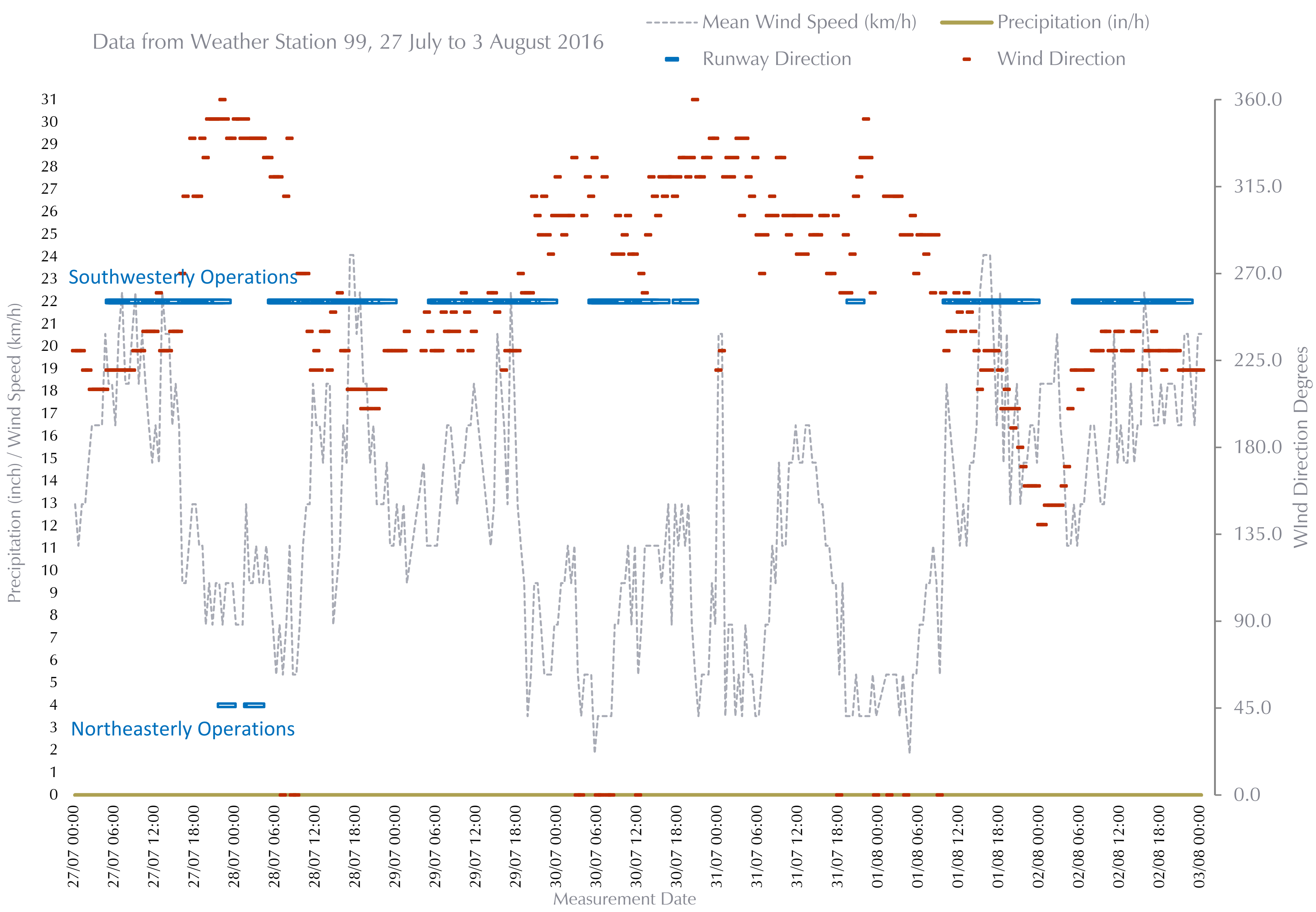

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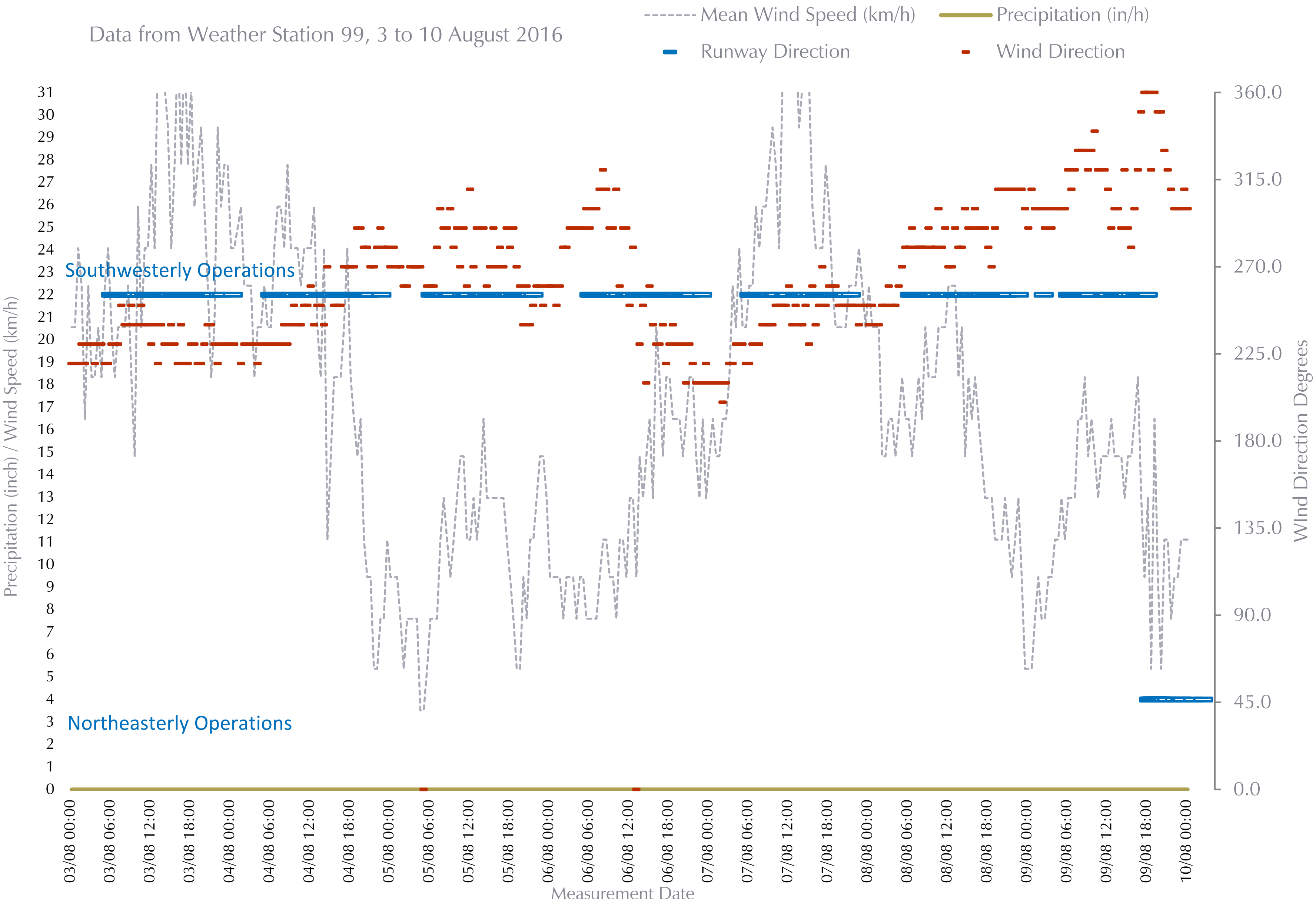

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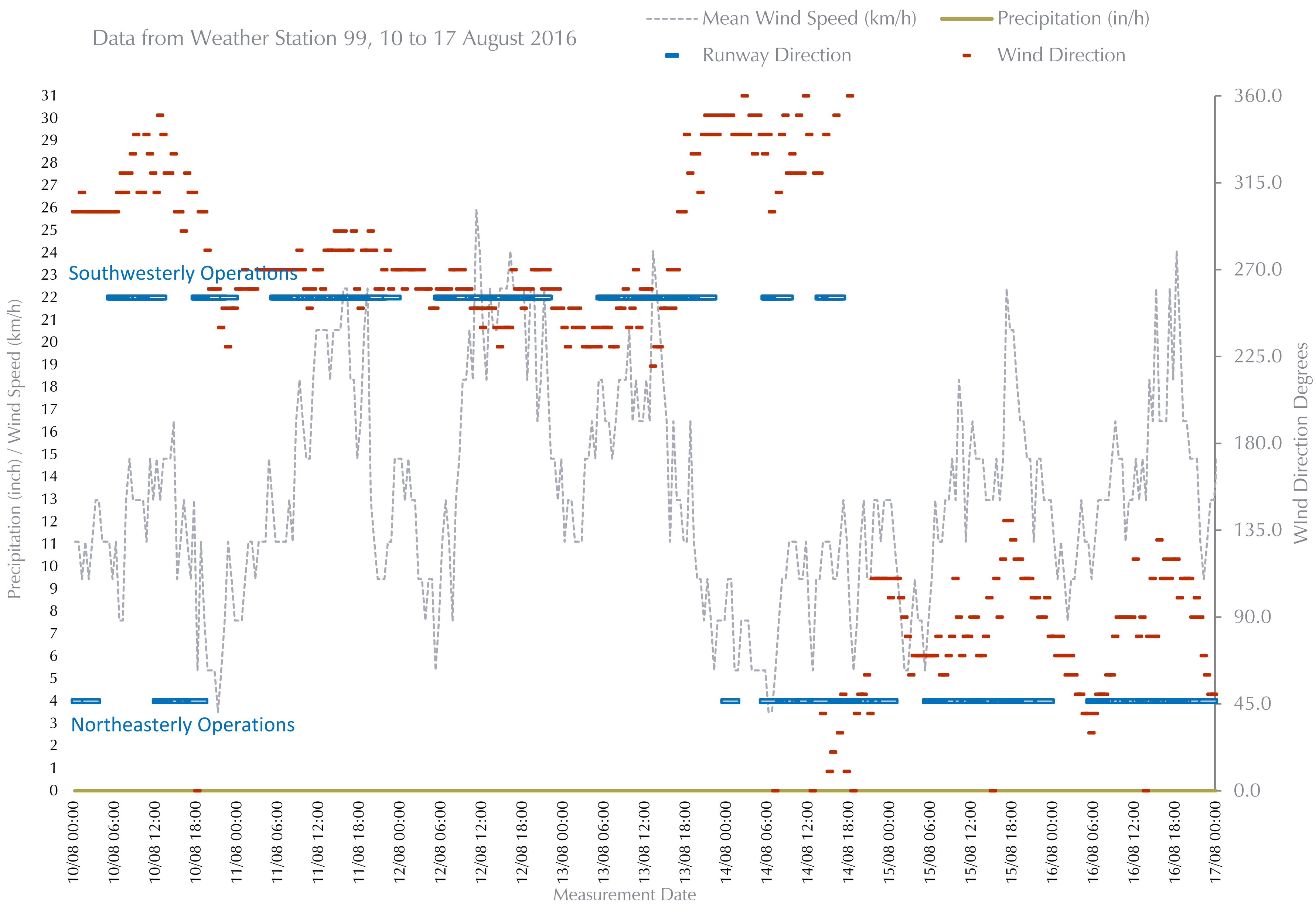

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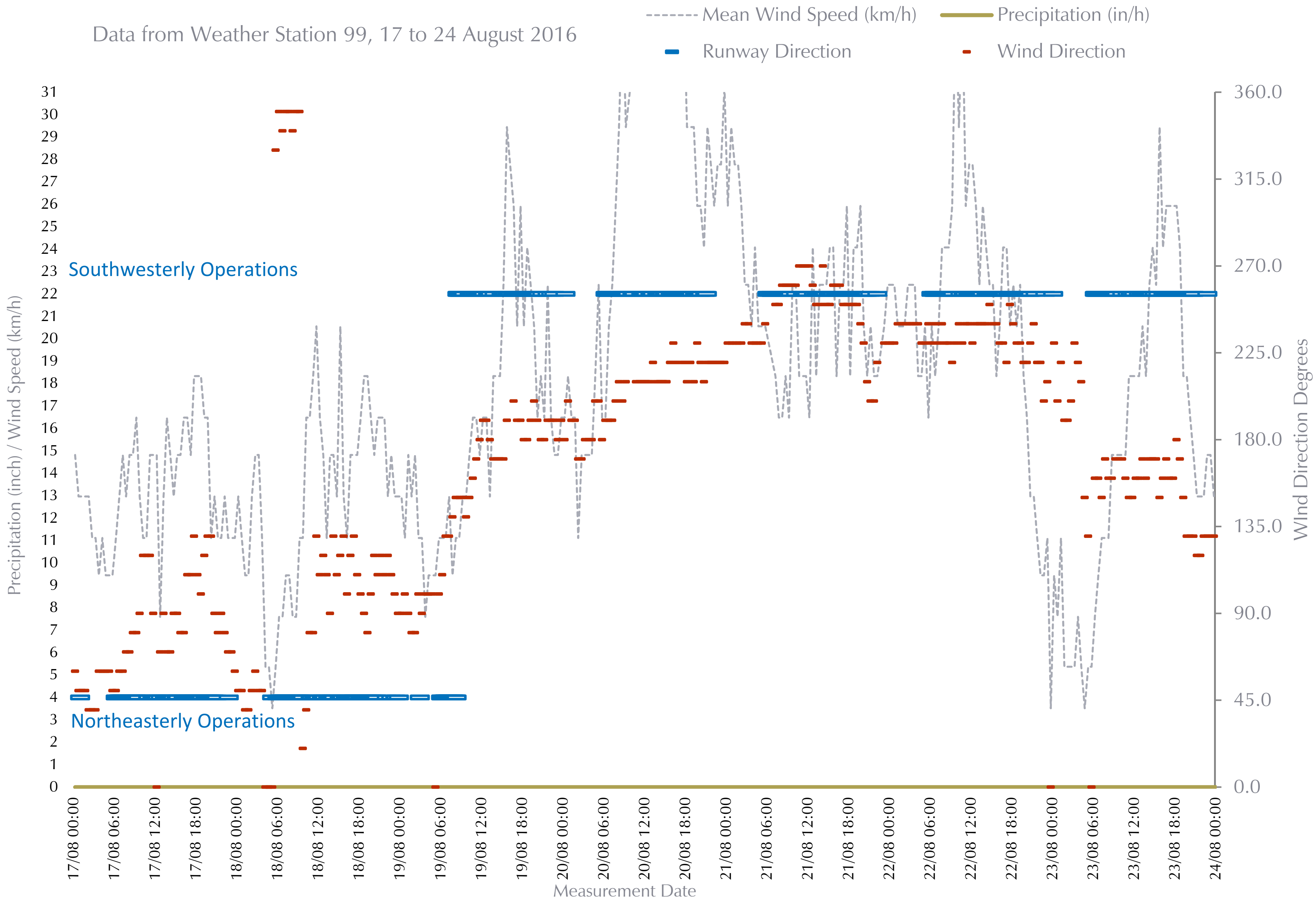

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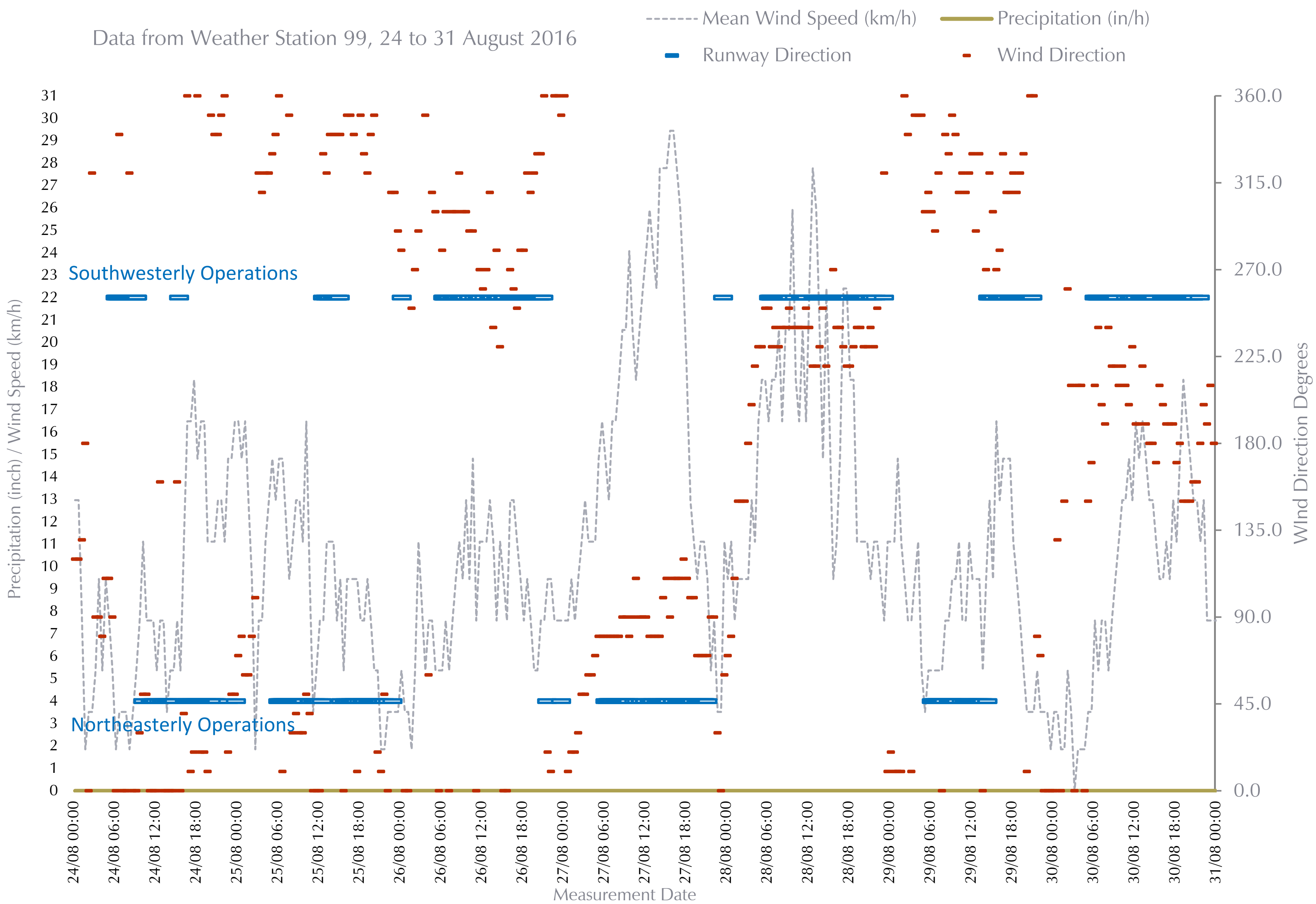

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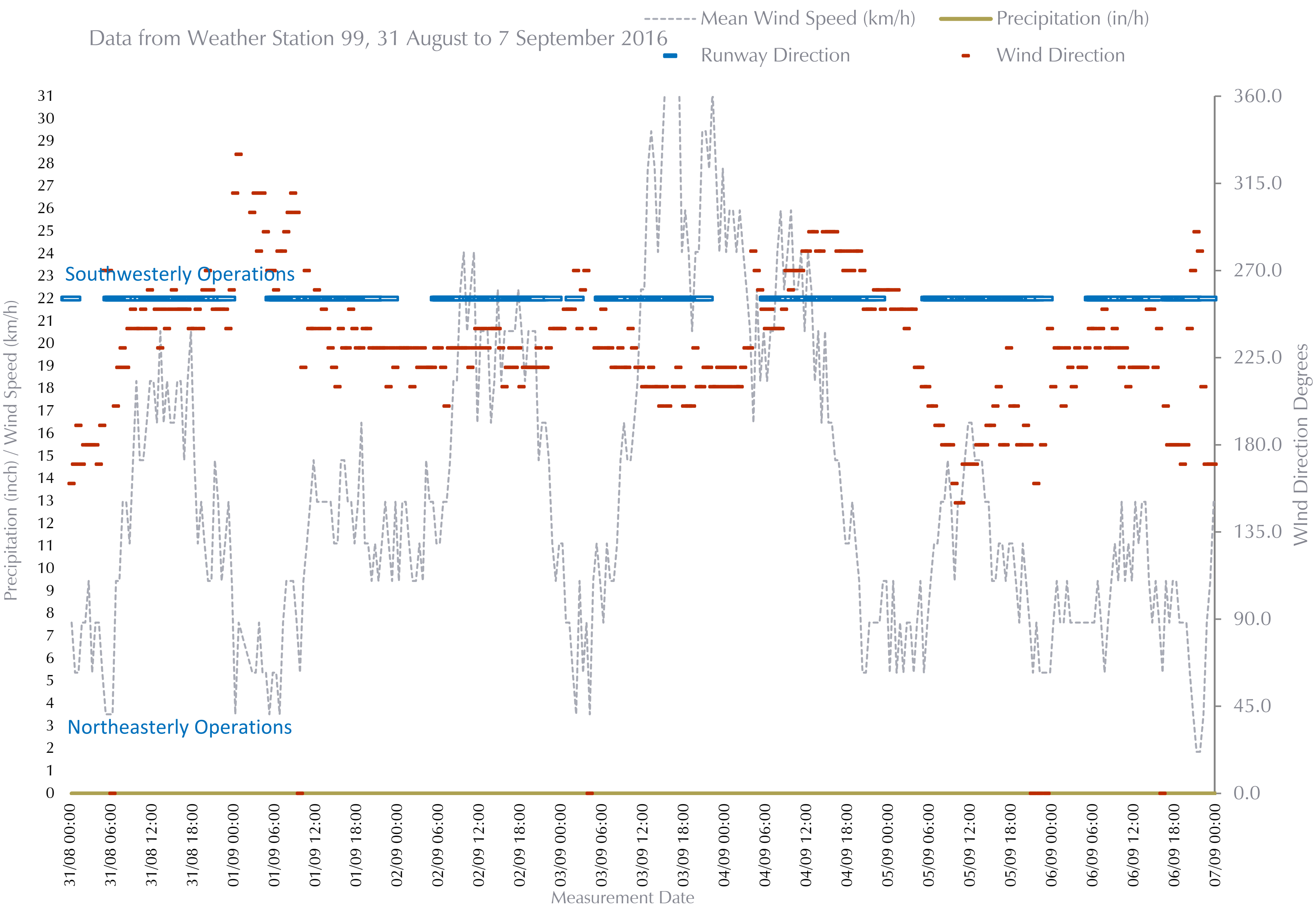

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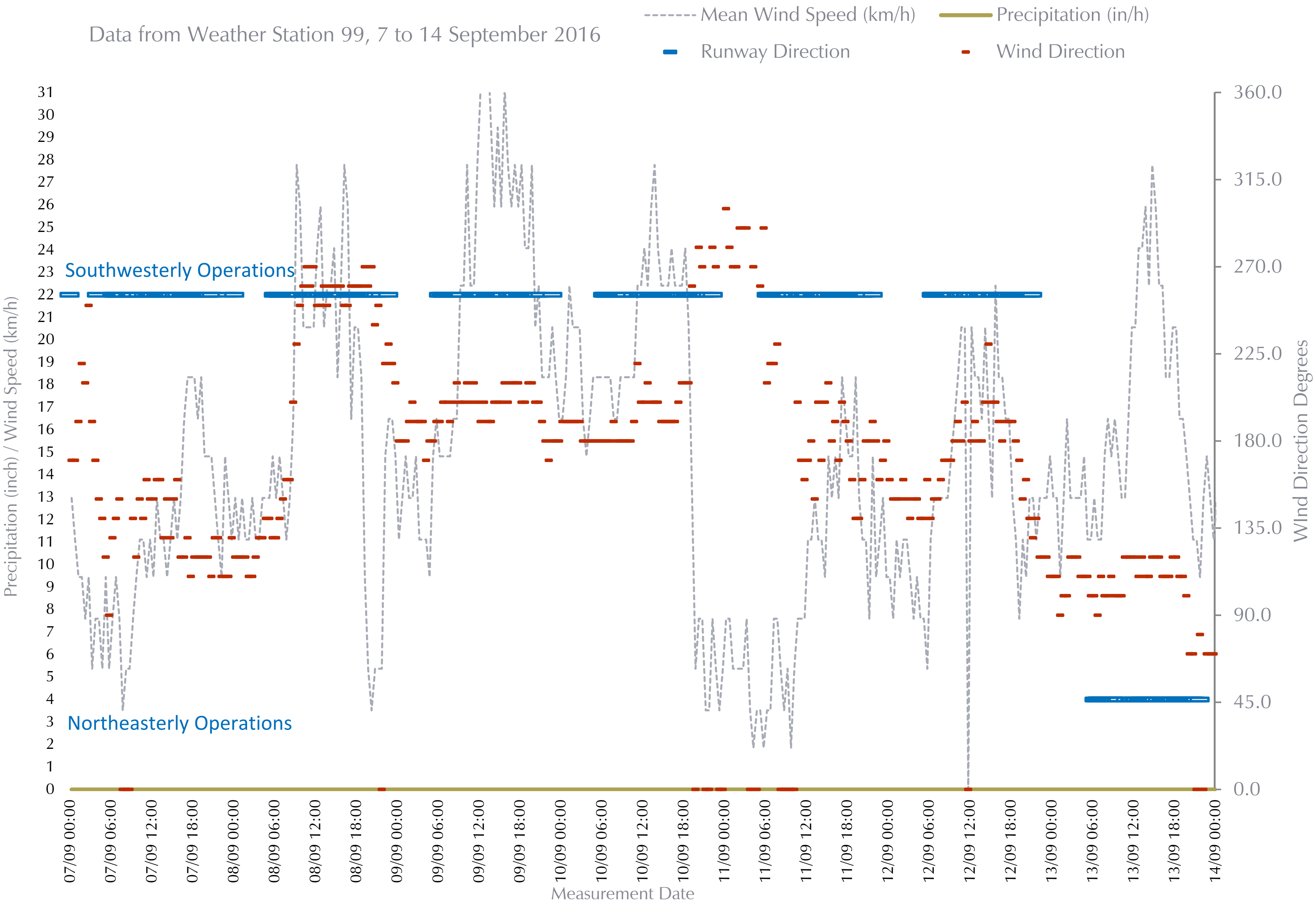

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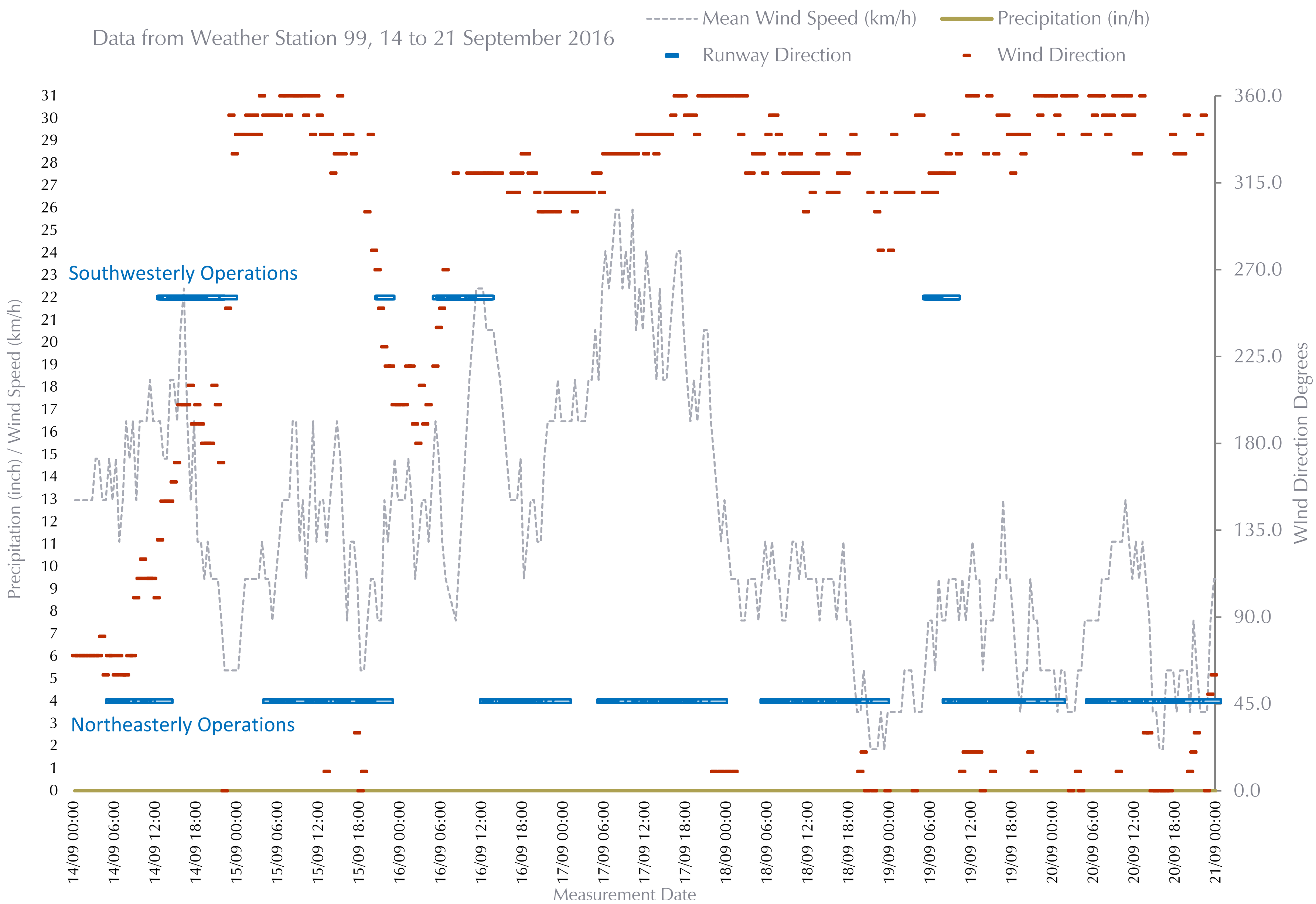

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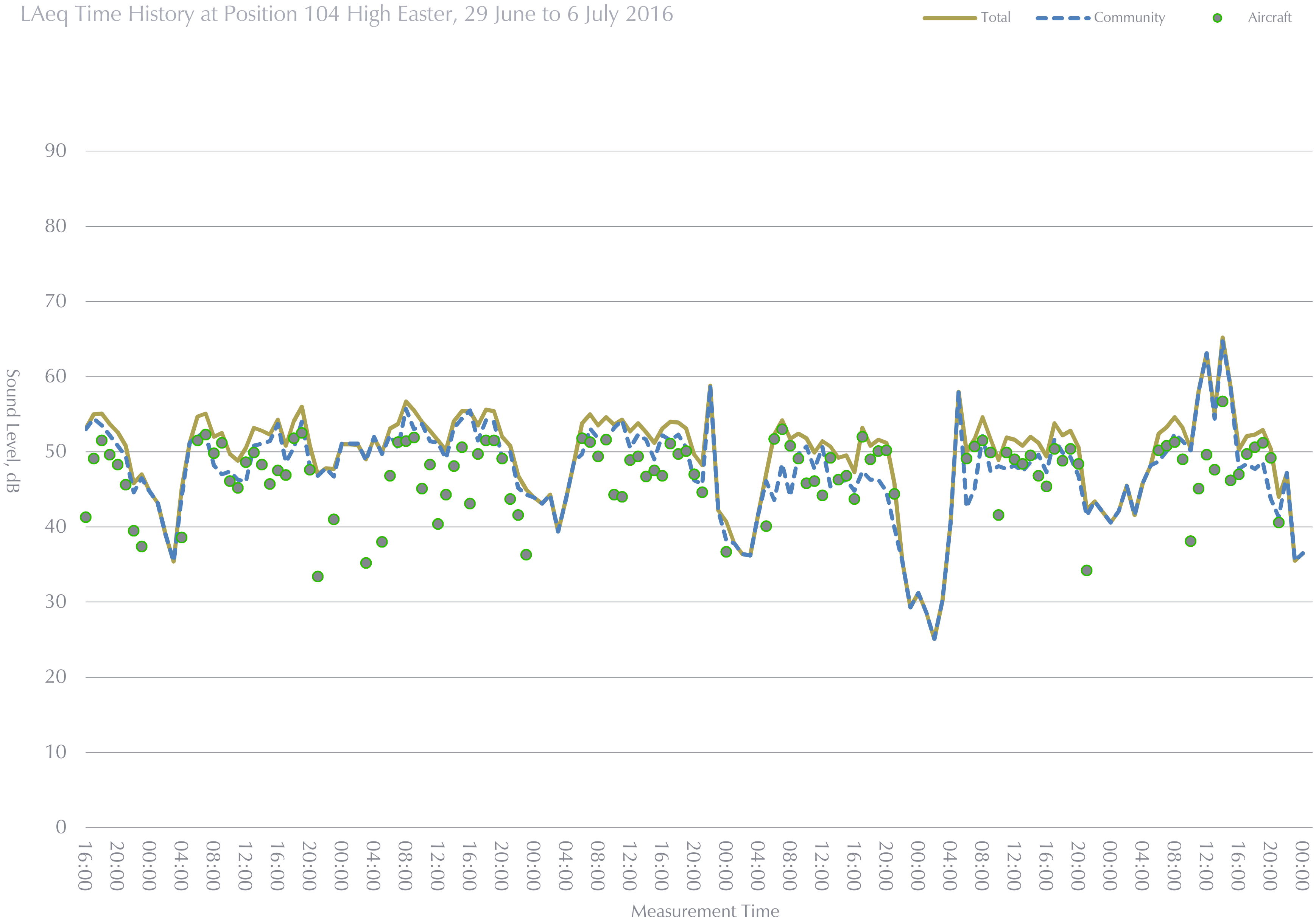
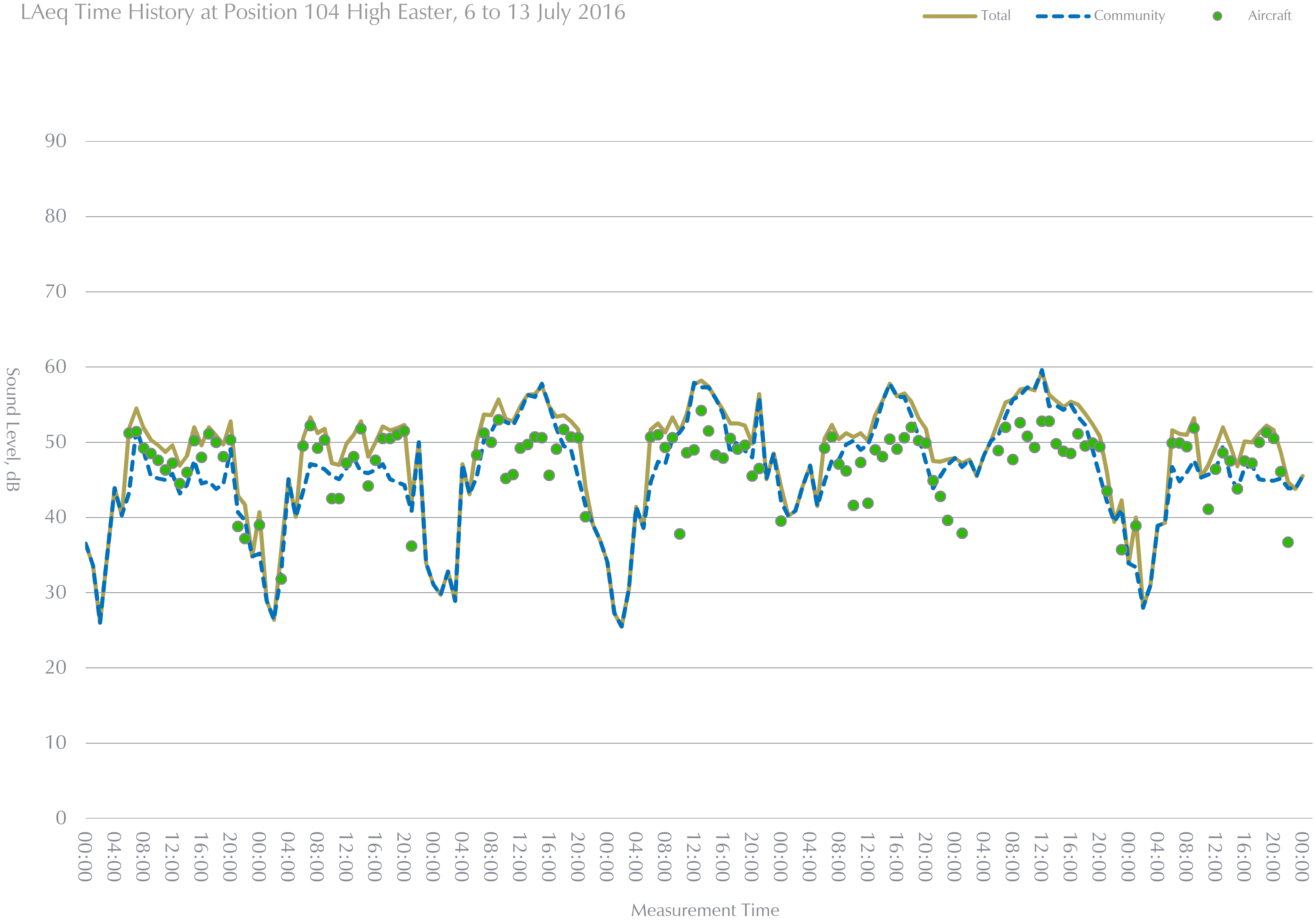
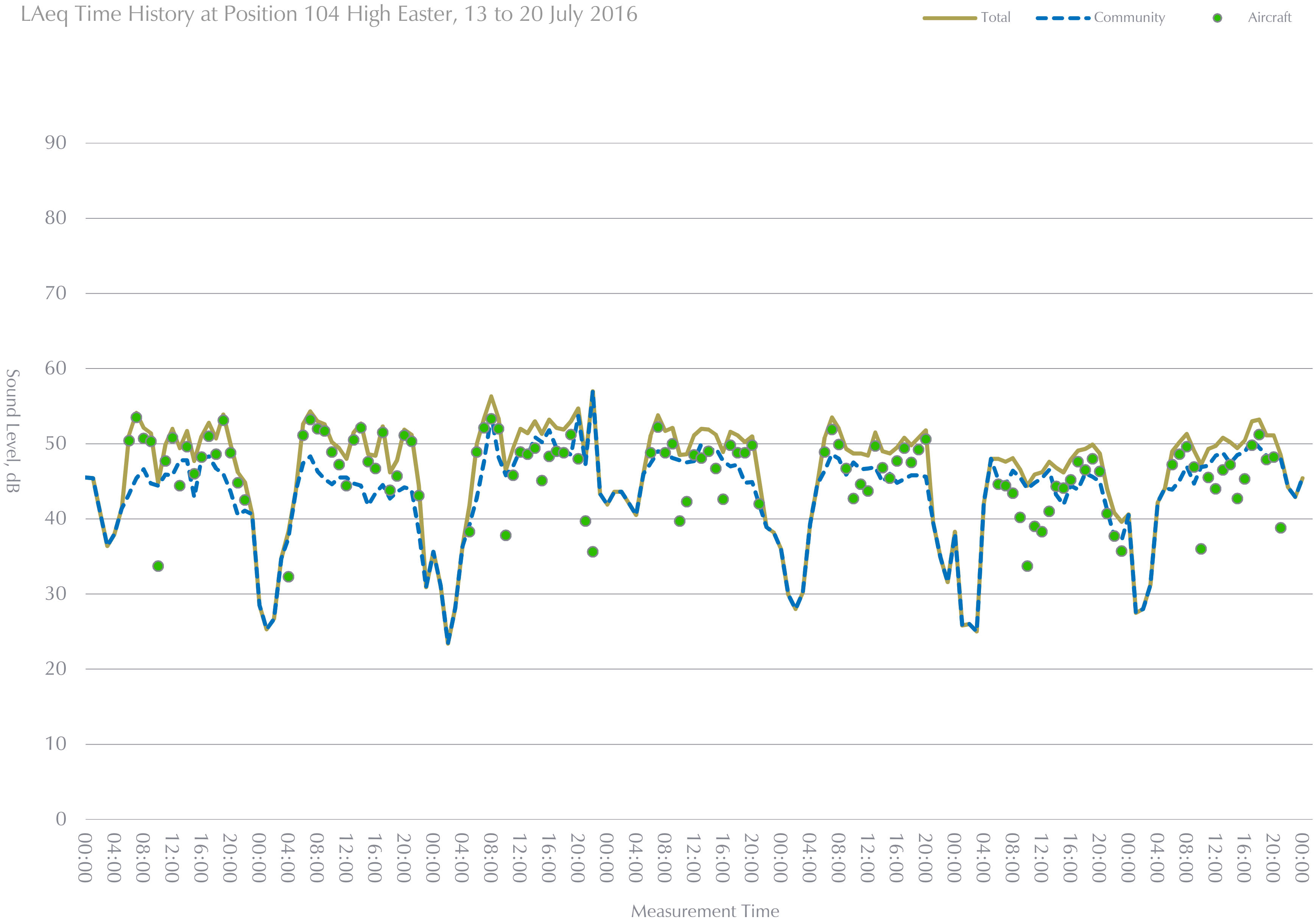
Figure 16/0321/L1A



LAeq Time History at Position 104 High Easter, 6 to 13 July 2016




LAeq Time History at Position 104 High Easter, 13 to 20 July 2016
Total
Community
Aircraft
Sound Level, dB
0
10
20
30
40
50
60
70
80
90
00:00
04:00
08:00
12:00
16:00
20:00
Measurement Time

LAeq Time History at Position 104 High Easter, 20 to 27 July 2016

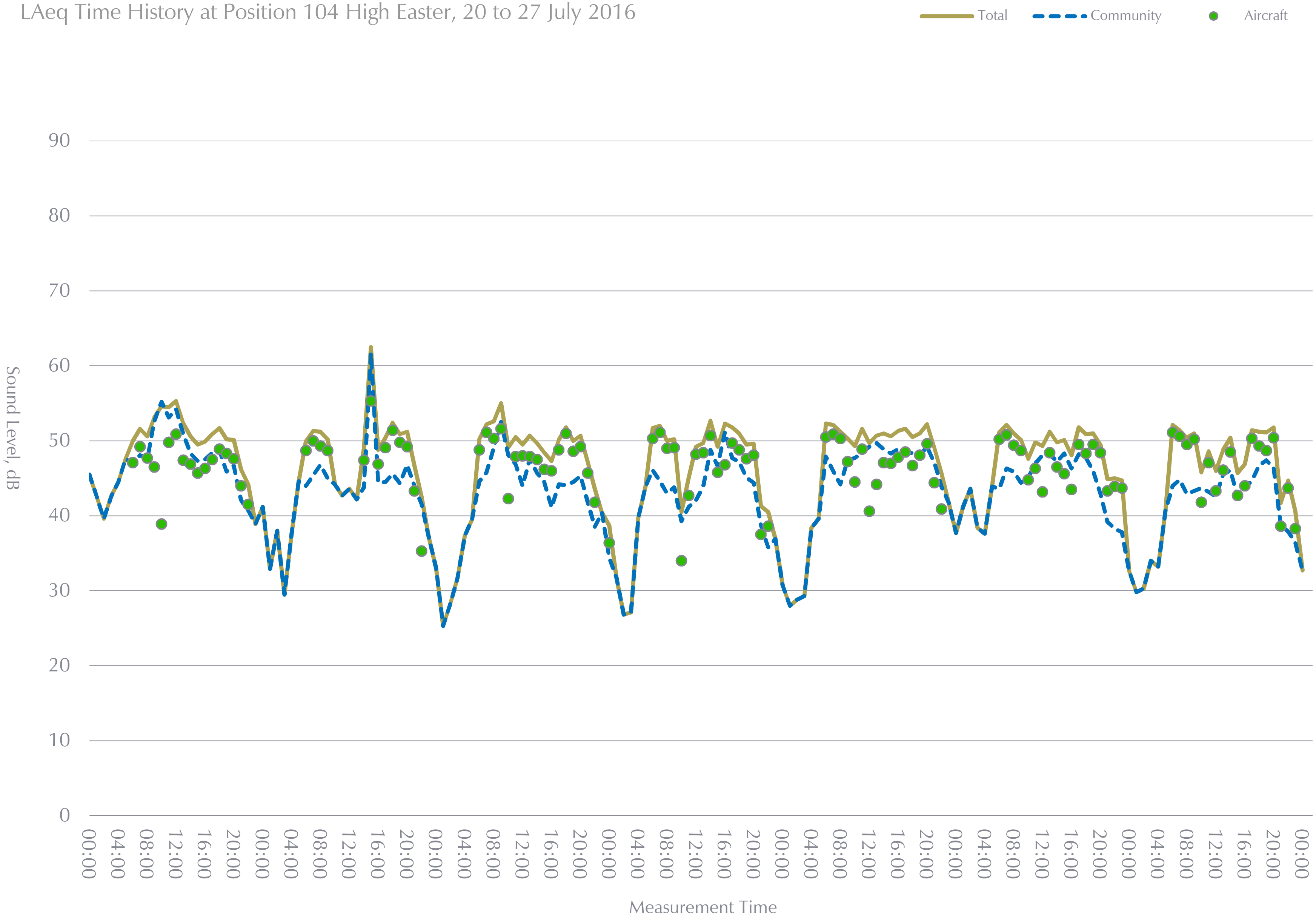
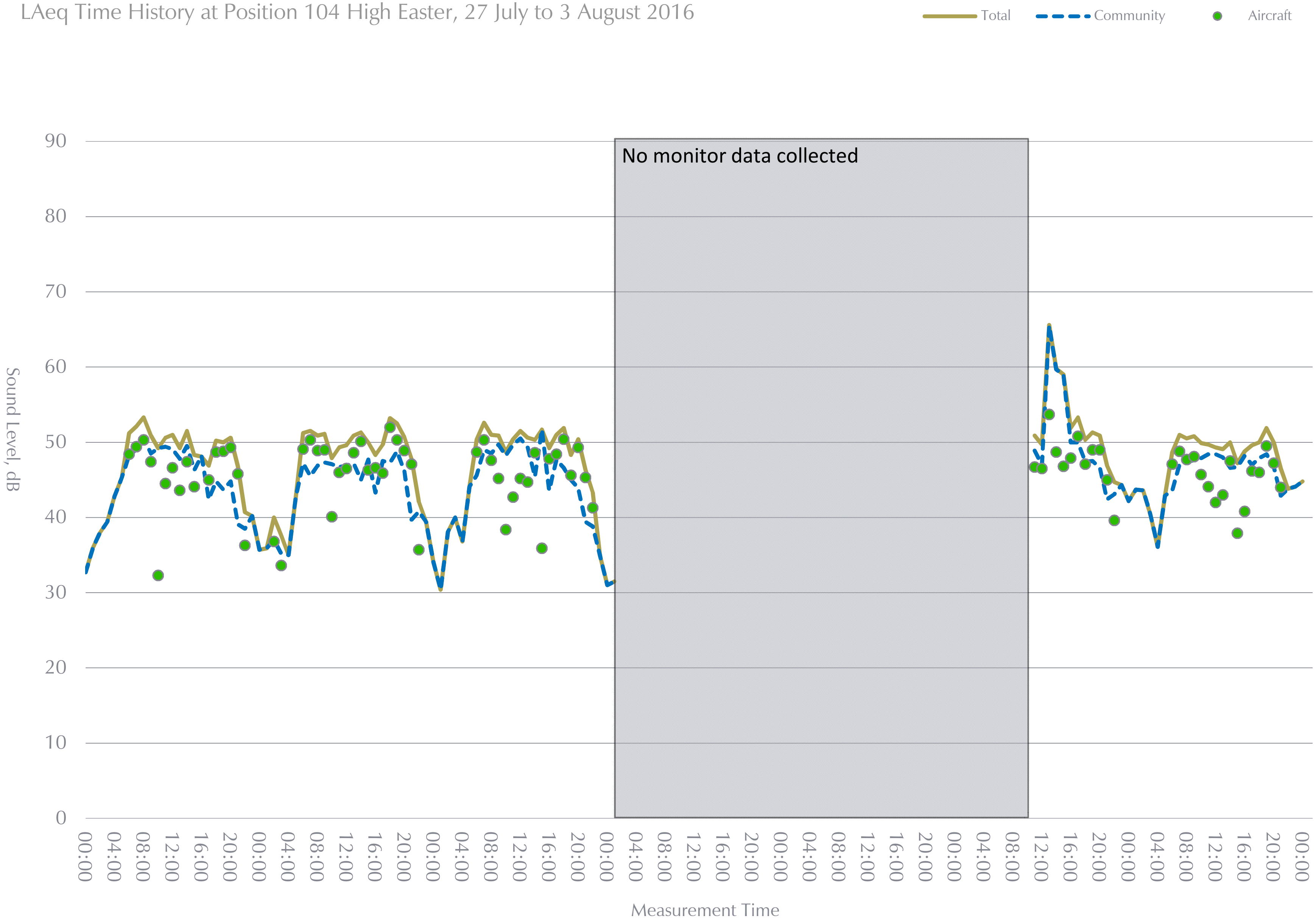


Figure 16/0321/L1D

Figure 16/0321/L1E

LAeq Time History at Position 104 High Easter, 27 July to 3 August 2016



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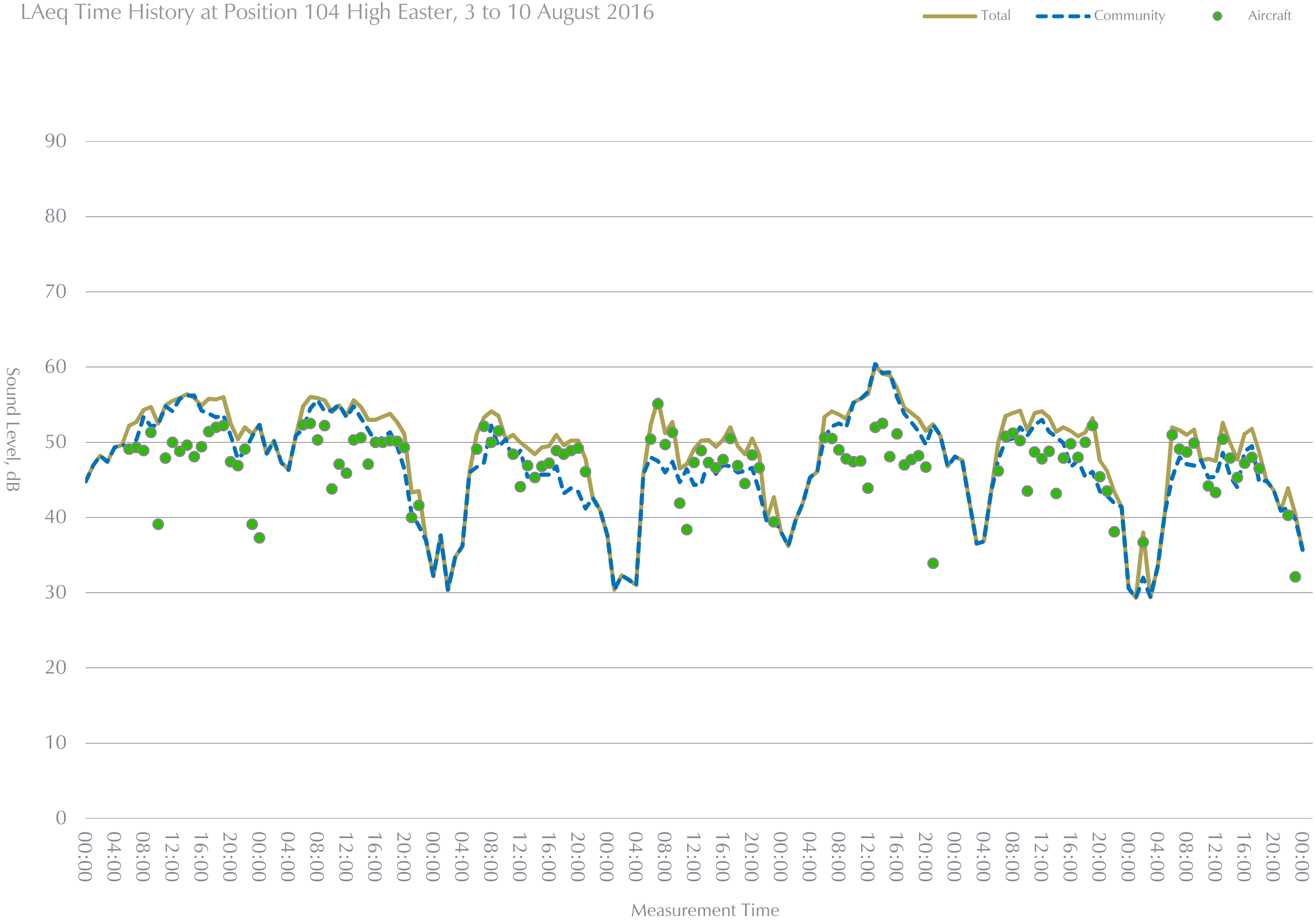

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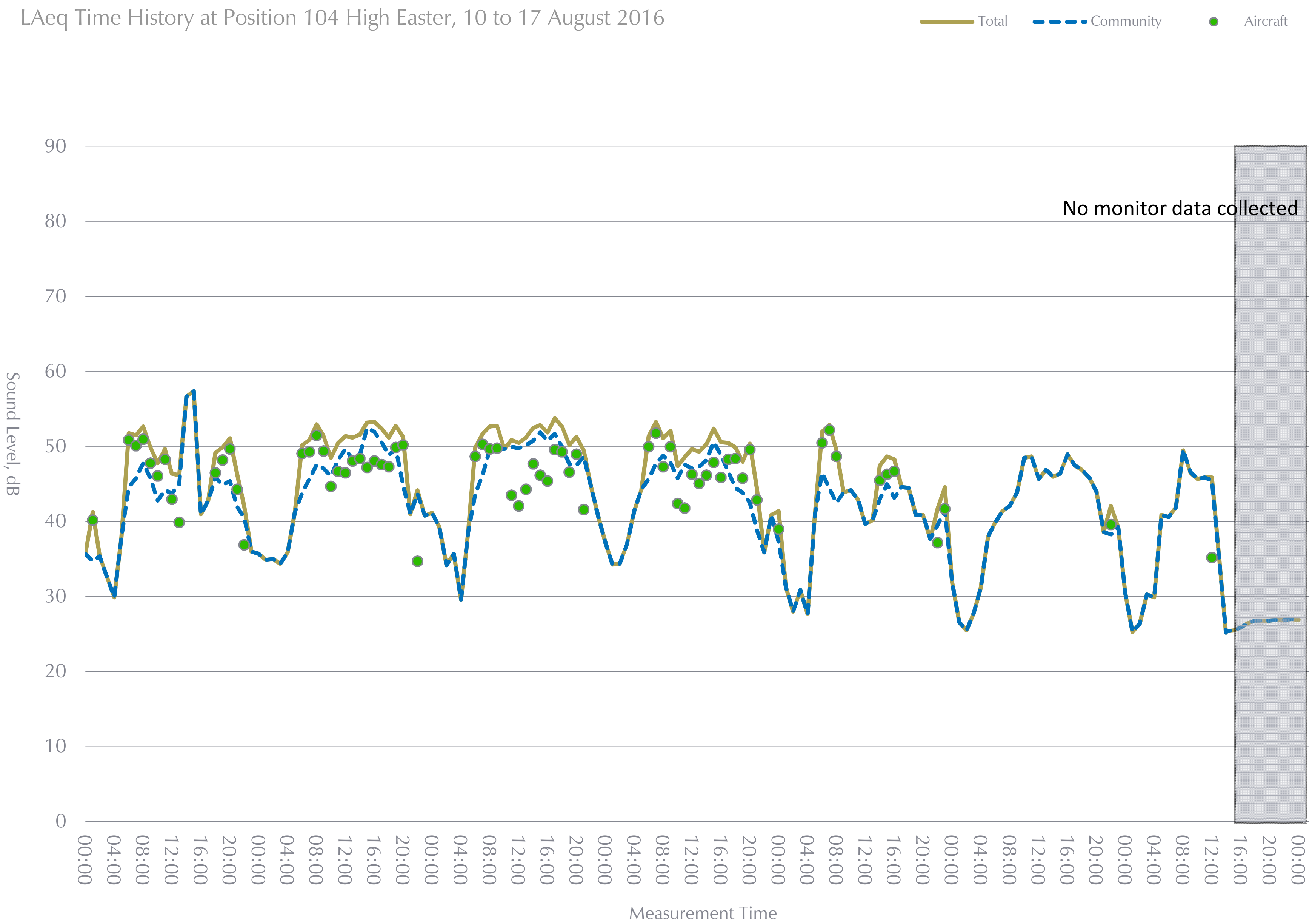

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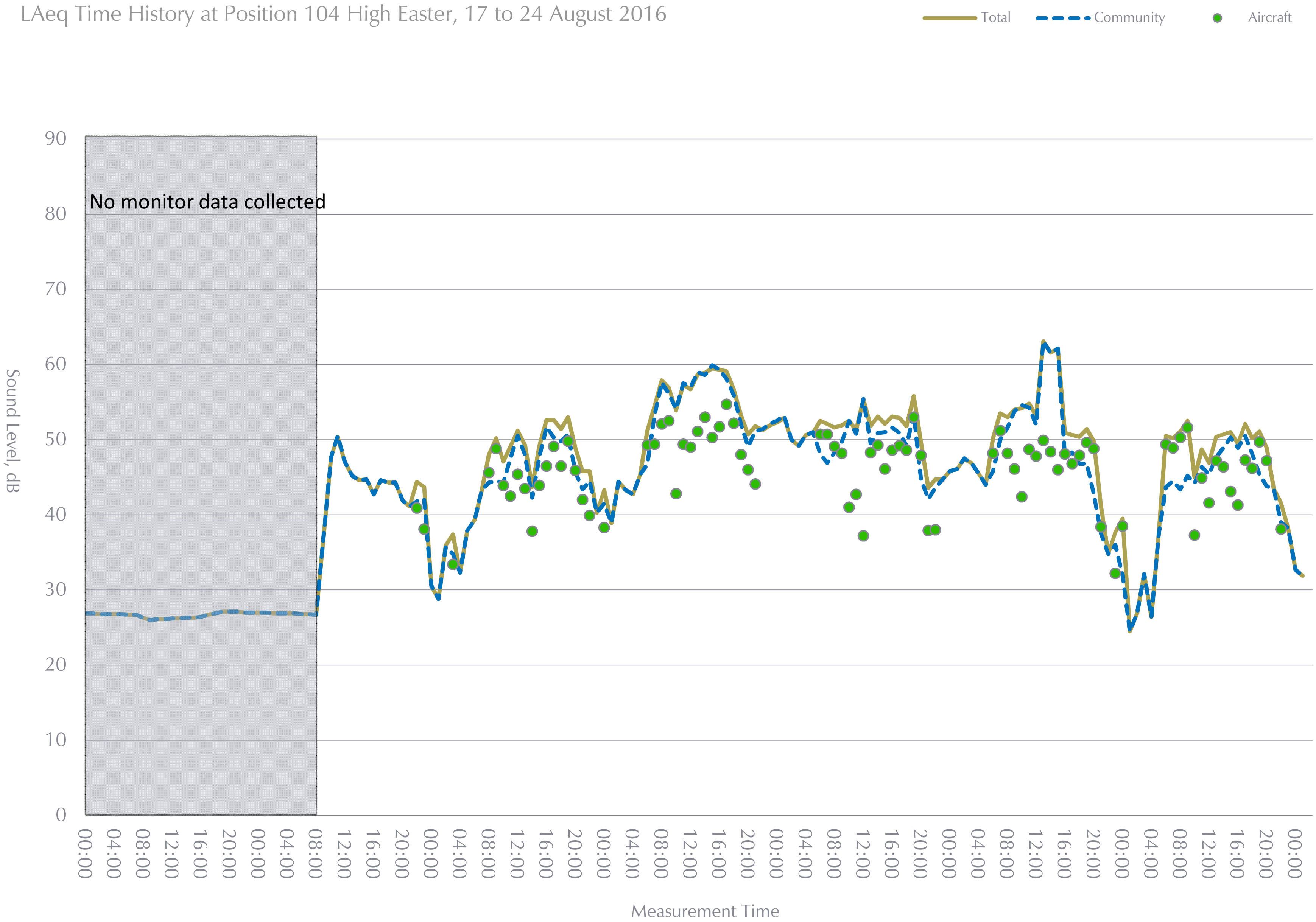

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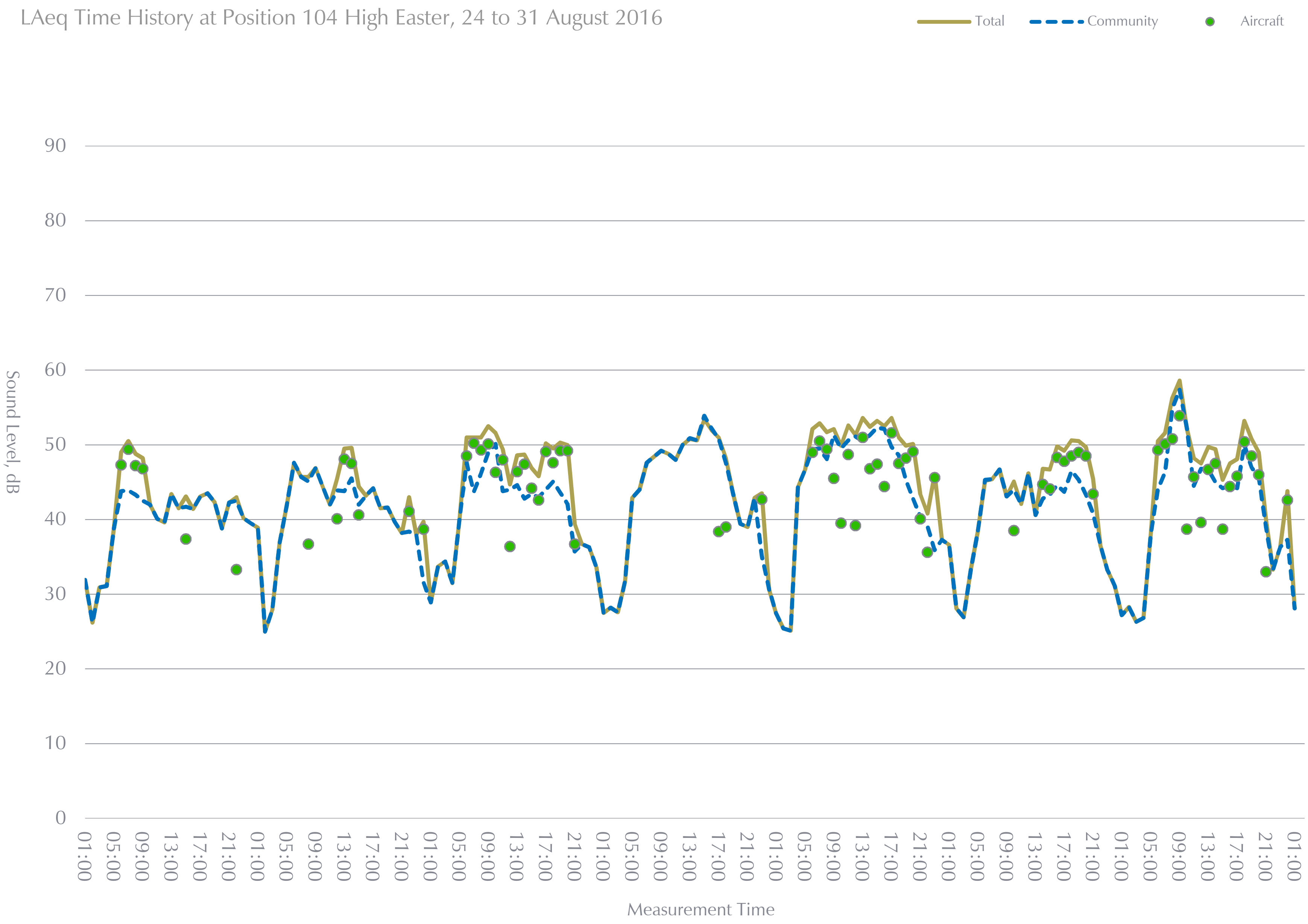


Figure 16/0321/L11

Figure 16/0321/L1J

LAeq Time History at Position 104 High Easter, 31 August to 7 September 2016

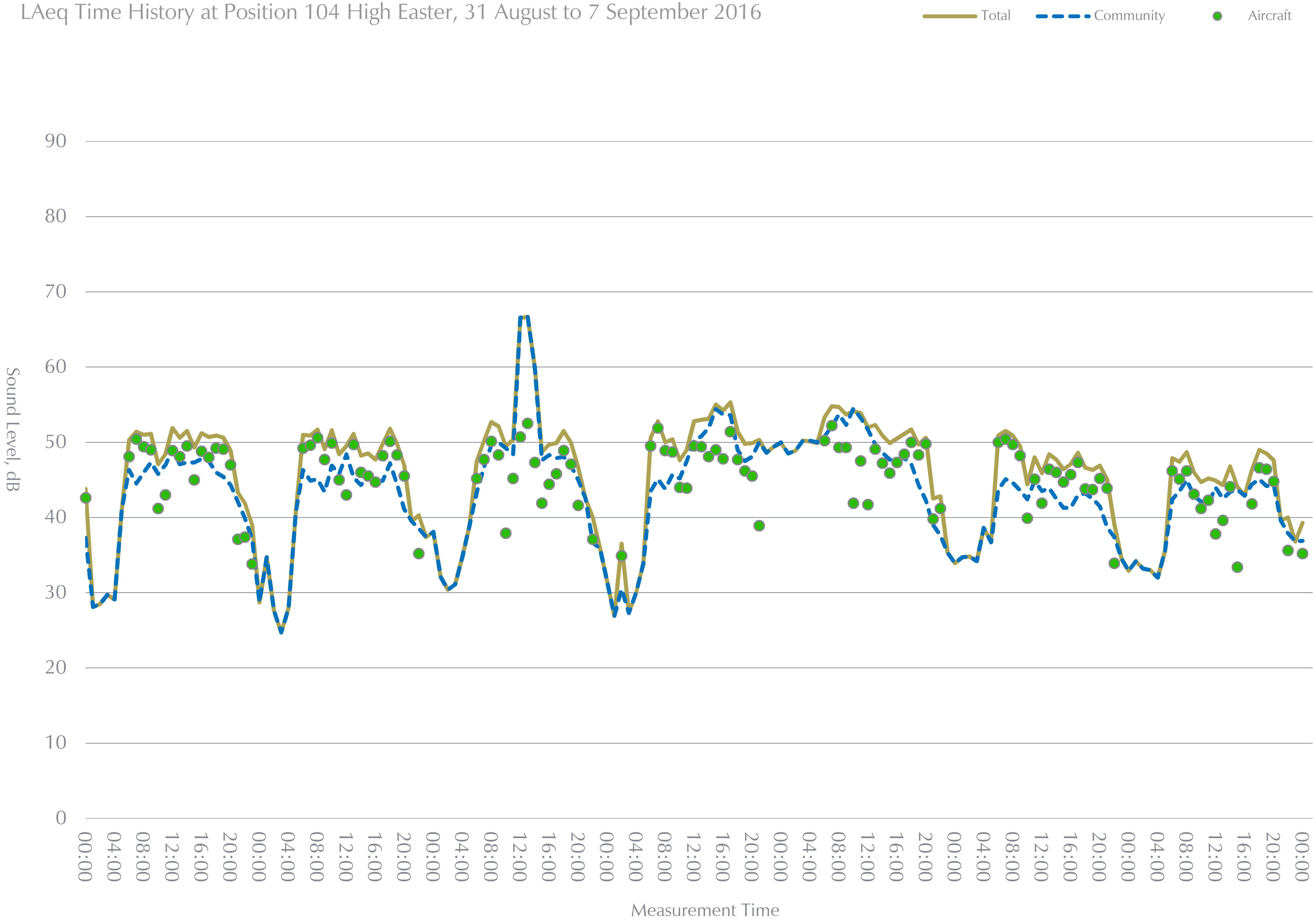
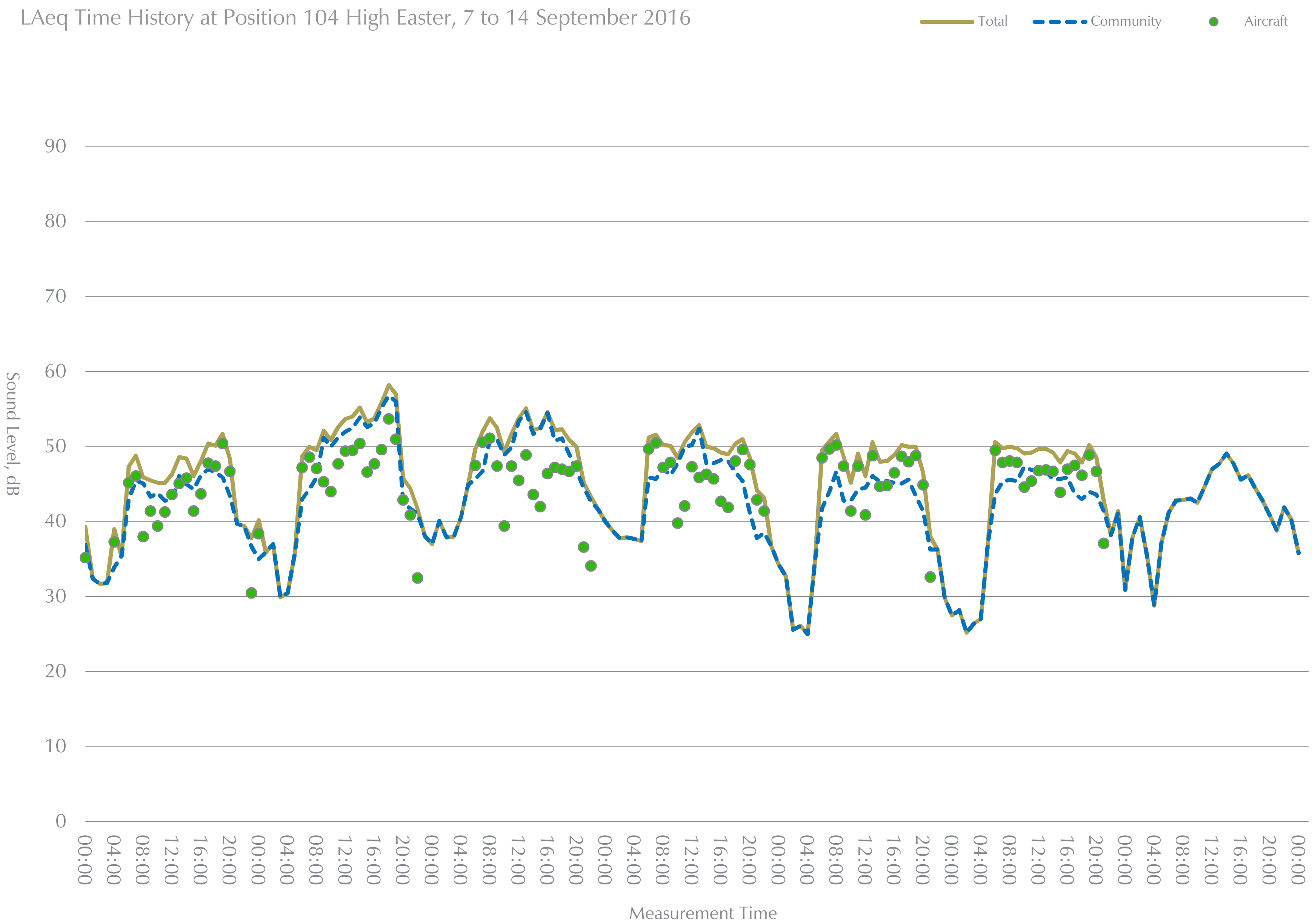


Figure 16/0321/L1K



LAeq Time History at Position 104 High Easter, 14 to 21 September 2016

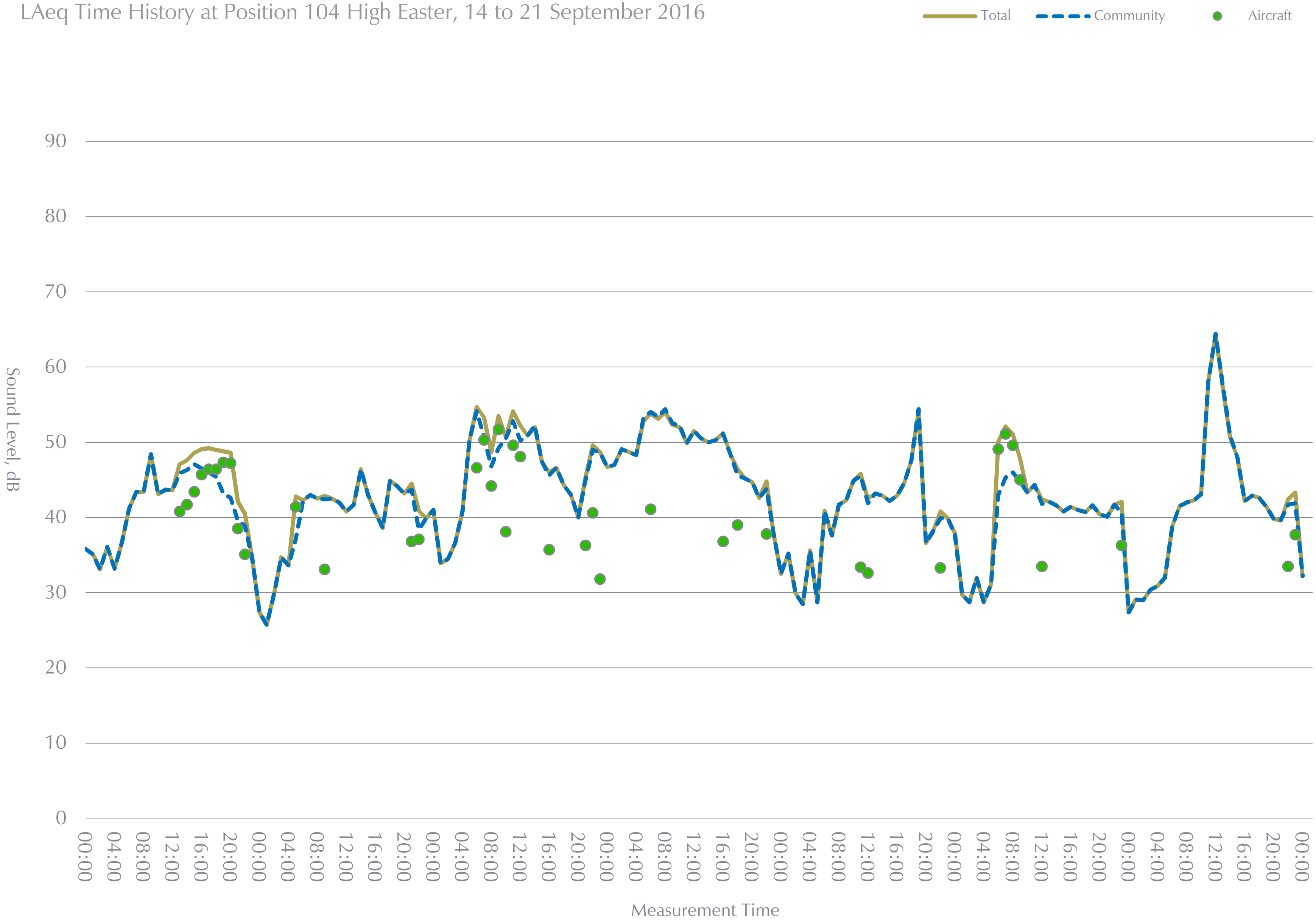


Figure 16/0321/L1L

Noise Levels at High Easter (P104) as Measured

Period	$L_{Aeq,16h}$ [i]	L_{Day} [ii]	$L_{Evening}$ [iii]	L_{Night} [iv]	L_{den} [v]
Average	**52**	**52**	**50**	**45**	**54**
29-30 June	-	-	51.7	48.6	-
30 June - 1 July	52.5	52.6	52.1	50.9	57.7
1-2 July	54.0	54.5	52.4	47.6	56.3
2-3 July	54.0	53.7	54.6	45.5	55.9
3-4 July	51.0	51.5	49.1	49.8	56.4
4-5 July	51.5	52.0	49.4	46.8	54.5
5-6 July	57.4	58.5	49.9	44.2	56.9
6-7 July	50.5	50.9	49.1	43.5	52.5
7-8 July	50.9	51.0	50.5	43.7	53.0
8-9 July	54.2	55.0	49.8	43.6	54.5
9-10 July	54.5	55.0	52.7	46.1	55.9
10-11 July	53.7	54.3	50.8	49.1	56.7
11-12 July	55.4	56.4	49.4	43.9	55.4
12-13 July	50.3	50.3	50.3	45.3	53.5
13-14 July	51.0	51.3	50.3	44.7	53.5
14-15 July	51.0	51.3	49.8	42.0	52.3
15-16 July	53.1	52.6	54.3	45.5	55.5
16-17 July	50.8	51.4	48.4	43.4	52.5
17-18 July	50.0	50.4	48.6	42.9	52.0
18-19 July	47.4	47.4	47.3	42.7	50.7
19-20 July	50.5	50.7	49.6	45.6	53.6
20-21 July	51.8	52.6	48.5	43.2	53.0
21-22 July	52.8	53.6	49.1	42.2	53.3
22-23 July	50.7	51.2	48.7	44.1	52.8
23-24 July	49.8	50.4	47.2	44.0	52.2
24-25 July	50.8	51.0	50.2	44.5	53.3
25-26 July	50.0	50.4	48.5	44.3	52.6
26-27 July	49.5	49.6	49.2	44.4	52.6
27-28 July	50.1	50.6	48.5	43.8	52.4
28-29 July	50.4	50.6	49.8	43.3	52.5
29-30 July	50.4	51.0	47.9	-	-
30-31 July	-	-	-	-	-
31 July-1 August	-	-	-	-	-
1-2 August	57.1	58.5	49.3	44.0	56.8
2-3 August	49.7	49.9	49.2	48.6	55.2
3-4 August	54.8	55.2	53.3	51.0	58.4
4-5 August	53.9	54.7	49.6	43.8	54.4
5-6 August	50.8	51.3	48.7	44.7	53.1
6-7 August	50.6	51.1	48.2	46.5	53.9
7-8 August	56.0	56.7	52.2	46.1	56.6

Period	$L_{Aeq,16h}$ [i]	L_{Day} [ii]	$L_{Evening}$ [iii]	L_{Night} [iv]	L_{den} [v]
8-9 August	52.2	52.9	49.3	44.0	53.5
9-10 August	49.4	50.4	43.7	43.9	51.7
10-11 August	51.2	51.9	48.6	42.5	52.4
11-12 August	51.4	51.8	49.7	42.7	52.7
12-13 August	51.7	52.2	49.6	44.2	53.4
13-14 August	50.2	50.8	47.2	44.1	52.4
14-15 August	46.4	47.3	40.6	38.0	47.3
15-16 August	46.1	46.7	43.5	36.7	47.1
16-17 August	42.3	43.6	-	-	-
17-18 August	-	-	-	-	-
18-19 August	45.0	45.5	43.3	38.2	47.1
19-20 August	49.8	49.9	49.6	45.4	53.3
20-21 August	57.0	57.9	52.0	51.6	59.4
21-22 August	52.4	52.7	51.3	46.8	55.1
22-23 August	56.6	57.7	48.0	42.4	55.9
23-24 August	49.9	50.4	47.9	41.1	51.1
24-25 August	44.7	45.4	42.0	41.3	48.5
25-26 August	45.2	46.0	41.1	43.1	49.8
26-27 August	49.3	49.8	47.5	38.4	50.0
27-28 August	49.2	50.3	41.7	45.2	52.3
28-29 August	51.7	52.5	47.8	40.8	52.1
29-30 August	47.3	47.0	48.0	42.0	50.5
30-31 August	51.8	52.6	47.3	42.9	52.7
31 August – 1 September	50.1	50.7	47.7	42.9	51.9
1-2 September	49.5	50.2	46.2	40.3	50.4
2-3 September	58.6	59.8	46.5	42.2	57.5
3-4 September	52.1	52.7	49.8	50.4	57.1
4-5 September	52.1	52.9	48.0	42.8	52.9
5-6 September	47.9	48.5	45.3	40.0	49.4
6-7 September	46.2	46.3	45.8	40.3	48.9
7-8 September	47.9	47.9	47.8	41.3	50.3
8-9 September	53.6	54.0	51.7	43.4	54.4
9-10 September	52.2	53.0	48.5	43.8	53.4
10-11 September	50.1	50.6	48.0	41.2	51.3
11-12 September	48.8	49.4	46.0	42.0	50.7
12-13 September	48.9	49.4	47.1	38.5	49.7
13-14 September	45.2	45.9	41.4	37.5	46.6
14-15 September	47.0	47.1	46.5	37.7	48.4
15-16 September	43.1	42.9	43.5	47.5	53.2
16-17 September	50.3	51.1	46.0	50.2	56.4
17-18 September	50.4	51.3	44.5	35.7	49.8
18-19 September	45.6	43.9	48.6	42.0	50.1

Period	$L_{Aeq,16h}$ [i]	L_{Day} [ii]	$L_{Evening}$ [iii]	L_{Night} [iv]	L_{den} [v]
19-20 September	45.5	46.3	41.1	35.8	46.1
20-21 September	54.4	55.6	41.1	39.2	53.3

[i] Equivalent continuous sound pressure level (L_{Aeq}) over the 16-hour day period of 0700h to 2300h
[ii] Equivalent continuous sound pressure level (L_{Aeq}) over the 12-hour day period of 0700h to 1900h
[iii] Equivalent continuous sound pressure level (L_{Aeq}) over the 4-hour evening period of 1900h to 2300h
[iv] Equivalent continuous sound pressure level (L_{Aeq}) over the 8-hour night period of 2300h to 0700h
[v] Composite level to represent single day with weighting to represent impact during evening and night time periods

Community Noise Levels at High Easter (P104) – Aircraft Incidences Removed

Period	$L_{Aeq,16h}$ [vi]	L_{Day} [vii]	$L_{Evening}$ [viii]	L_{Night} [ix]	L_{den} [x]
Average	**49**	**49**	**46**	**42**	**51**
29-30 June	-	-	50.1	47.4	-
30 June - 1 July	50.2	50.2	50.4	50.7	57.0
1-2 July	52.8	53.3	50.8	45.8	54.7
2-3 July	52.7	52.2	53.9	41.7	54.2
3-4 July	47.1	47.9	43.4	49.3	55.1
4-5 July	48.6	49.1	46.4	45.5	52.6
5-6 July	56.8	57.9	46.2	39.6	55.6
6-7 July	46.4	46.7	45.2	39.8	48.6
7-8 July	46.5	46.5	46.3	41.6	49.7
8-9 July	53.1	54.1	45.4	38.9	52.4
9-10 July	53.6	54.1	51.6	44.7	54.8
10-11 July	52.6	53.5	47.7	48.4	55.7
11-12 July	54.8	55.9	45.6	40.2	54.0
12-13 July	46.1	46.4	44.9	42.9	50.1
13-14 July	46.0	46.6	43.5	41.1	48.9
14-15 July	44.7	45.2	43.1	36.9	46.4
15-16 July	51.1	49.9	53.4	44.2	54.0
16-17 July	47.6	48.5	43.4	40.8	49.4
17-18 July	46.1	46.7	43.4	41.9	49.4
18-19 July	44.7	45.0	43.5	40.4	48.1
19-20 July	48.0	48.1	47.6	44.8	52.1
20-21 July	50.3	51.2	44.6	40.6	50.8
21-22 July	50.9	51.8	44.6	38.3	50.5
22-23 July	46.6	47.3	43.3	40.7	48.9
23-24 July	45.6	46.3	42.6	40.4	48.3
24-25 July	48.1	48.3	47.6	41.7	50.5
25-26 July	46.4	47.2	42.8	38.2	47.7
26-27 July	44.5	44.5	44.6	42.7	49.6
27-28 July	47.6	48.5	42.5	41.1	49.4
28-29 July	46.5	46.8	45.5	40.9	49.2
29-30 July	48.0	48.9	42.7	-	-
30-31 July	-	-	-	-	-
31 July-1 August	-	-	-	-	-
1-2 August	56.7	58.1	45.5	42.8	56.1
2-3 August	47.4	47.7	46.1	48.0	54.2
3-4 August	53.7	54.3	51.0	50.3	57.5
4-5 August	52.6	53.6	45.9	41.4	52.6
5-6 August	47.3	48.1	43.0	42.0	49.8
6-7 August	46.1	46.4	44.8	44.8	51.4
7-8 August	55.7	56.5	51.3	45.5	56.2

Period	$L_{Aeq,16h}$[vi]	L_{Day}[vii]	$L_{Evening}$[viii]	L_{Night}[ix]	L_{den}[x]
8-9 August	49.7	50.6	44.0	39.3	50.0
9-10 August	46.5	47.2	43.1	38.7	47.9
10-11 August	49.6	50.5	43.7	38.7	49.7
11-12 August	48.8	49.4	46.1	39.6	49.8
12-13 August	49.8	50.3	47.5	41.3	51.1
13-14 August	47.0	48.0	41.4	40.0	48.6
14-15 August	42.9	43.5	40.0	36.5	45.0
15-16 August	46.1	46.7	43.0	36.7	46.9
16-17 August	42.3	43.6	-	-	-
17-18 August	-	-	-	-	-
18-19 August	45.0	45.6	42.6	37.2	46.6
19-20 August	47.9	48.1	47.2	43.7	51.4
20-21 August	56.8	57.7	51.1	51.2	59.0
21-22 August	50.7	51.2	48.7	46.0	53.8
22-23 August	56.2	57.4	42.9	36.8	54.8
23-24 August	47.0	47.7	43.6	37.6	47.8
24-25 August	42.3	42.5	41.8	41.3	47.9
25-26 August	43.6	44.4	39.8	40.3	47.4
26-27 August	45.0	45.8	40.8	38.4	46.8
27-28 August	49.3	50.4	41.7	43.3	51.3
28-29 August	49.6	50.7	42.7	38.7	49.7
29-30 August	44.1	44.5	42.6	36.8	46.0
30-31 August	49.8	50.8	43.9	39.4	50.1
31 August – 1 September	46.5	47.1	43.5	39.2	48.1
1-2 September	45.1	45.9	41.6	37.9	46.8
2-3 September	58.5	59.7	44.2	36.3	56.9
3-4 September	50.3	50.7	48.8	49.9	56.3
4-5 September	50.3	51.4	41.7	38.0	49.9
5-6 September	43.0	43.5	40.6	36.4	45.0
6-7 September	43.4	43.7	42.4	37.1	45.8
7-8 September	44.8	45.2	43.0	37.4	46.6
8-9 September	52.3	52.7	50.6	41.6	53.0
9-10 September	51.1	51.9	46.5	40.8	51.5
10-11 September	47.7	48.7	41.9	35.6	47.6
11-12 September	44.3	45.1	40.5	36.2	45.6
12-13 September	45.3	45.9	42.4	38.5	47.2
13-14 September	45.2	45.9	41.4	37.5	46.6
14-15 September	44.9	45.7	41.5	36.1	46.0
15-16 September	42.9	42.9	43.0	47.2	52.9
16-17 September	49.0	49.8	45.6	50.4	56.4
17-18 September	50.5	51.4	44.3	35.7	49.8
18-19 September	45.7	43.8	48.8	37.2	48.4

Period	$L_{Aeq,16h}$ [vi]	L_{Day} [vii]	$L_{Evening}$ [viii]	L_{Night} [ix]	L_{den} [x]
19-20 September	42.8	43.3	41.1	35.1	44.5
20-21 September	54.4	55.6	40.8	36.9	53.1

[vi] Equivalent continuous sound pressure level (L_{Aeq}) over the 16-hour day period of 0700h to 2300h
[vii] Equivalent continuous sound pressure level (L_{Aeq}) over the 12-hour day period of 0700h to 1900h
[viii] Equivalent continuous sound pressure level (L_{Aeq}) over the 4-hour evening period of 1900h to 2300h
[ix] Equivalent continuous sound pressure level (L_{Aeq}) over the 8-hour night period of 2300h to 0700h
[x] Composite level to represent single day with weighting to represent impact during evening and night time periods

Aircraft Noise Levels at High Easter (P104) – Aircraft Incidences only

Period	$L_{Aeq,16h}$ [xi]	L_{Day} [xii]	$L_{Evening}$ [xiii]	L_{Night} [xiv]	L_{den} [xv]
Average	**48**	**49**	**47**	**41**	**50**
29-30 June	-	-	47.2	42.9	
30 June - 1 July	49.0	49.3	47.8	39.5	50.2
1-2 July	49.1	49.3	48.2	43.0	51.6
2-3 July	48.6	49.1	46.7	43.2	51.3
3-4 July	48.8	49.0	47.8	40.2	50.3
4-5 July	48.7	49.2	46.7	41.3	50.5
5-6 July	49.9	50.4	47.6	42.3	51.5
6-7 July	48.4	48.9	46.7	41.0	50.2
7-8 July	49.0	49.2	48.4	39.4	50.3
8-9 July	49.6	50.0	47.9	41.8	51.2
9-10 July	49.5	50.1	46.4	40.7	50.5
10-11 July	48.7	48.9	48.1	40.7	50.5
11-12 July	50.2	50.9	47.2	41.5	51.3
12-13 July	48.3	48.1	48.7	41.5	50.7
13-14 July	49.5	49.5	49.2	42.2	51.6
14-15 July	49.8	50.2	48.8	40.3	51.1
15-16 July	49.1	49.6	47.3	39.9	50.3
16-17 July	48.1	48.4	46.8	40.0	49.7
17-18 July	47.8	48.0	47.0	35.7	48.5
18-19 July	44.1	43.7	45.0	38.6	47.2
19-20 July	47.0	47.5	45.4	38.2	48.4
20-21 July	47.6	47.9	46.2	39.8	49.3
21-22 July	48.6	49.0	47.2	39.9	50.0
22-23 July	48.6	49.0	47.3	41.5	50.6
23-24 July	47.9	48.4	45.4	41.6	50.0
24-25 July	47.6	47.8	47.0	41.3	50.1
25-26 July	47.6	47.8	47.2	42.9	50.9
26-27 July	47.9	48.0	47.4	39.9	49.7
27-28 July	46.7	46.6	47.2	40.5	49.4
28-29 July	48.3	48.4	47.9	39.8	50.0
29-30 July	46.9	47.1	46.4	-	-
30-31 July	-	-	-	-	-
31 July-1 August	-	-	-	-	-
		49.4	47.1	47.2	53.9
1-2 August	48.8				
2-3 August	46.3	45.9	47.5	49.2	55.1
3-4 August	49.6	49.7	49.5	48.0	54.8
4-5 August	49.4	49.9	47.3	49.2	55.5
5-6 August	48.8	48.9	48.4	50.5	56.5
6-7 August	49.0	49.4	46.8	48.0	54.5

Period	$L_{Aeq,16h}$ [xi]	L_{Day} [xii]	$L_{Evening}$ [xiii]	L_{Night} [xiv]	L_{den} [xv]
7-8 August	48.9	49.4	45.9	46.3	53.1
8-9 August	48.7	49.0	47.7	48.2	54.6
9-10 August	47.6	47.9	40.4	46.6	52.8
10-11 August	47.5	47.8	46.9	49.2	55.2
11-12 August	48.3	48.3	48.5	48.8	55.1
12-13 August	47.7	48.0	46.8	50.1	56.0
13-14 August	47.6	47.7	47.1	47.9	54.2
14-15 August	48.0	48.7	37.3	41.8	49.6
15-16 August	39.7	-	39.7	-	-
16-17 August	35.3	35.3	-	-	-
17-18 August	-	-	-	-	-
18-19 August	41.0	-	41.0	36.5	43.3
		45.8	46.1	46.7	52.9
19-20 August	45.9				
20-21 August	50.9	51.5	46.4	50.8	56.9
21-22 August	48.0	47.9	48.5	48.3	54.7
22-23 August	48.1	48.2	47.7	45.1	52.4
23-24 August	47.1	47.1	47.2	47.4	53.7
24-25 August	46.0	46.9	33.4	-	44.1
25-26 August	44.4	44.8	41.2	46.0	51.9
26-27 August	47.7	47.7	47.7	-	47.8
27-28 August	38.8	38.8	-	47.0	52.3
28-29 August	47.8	48.2	46.2	45.7	52.5
29-30 August	46.9	46.5	47.7	49.4	55.4
30-31 August	48.0	48.4	45.8	46.3	52.9
31 August – 1 September	47.8	48.3	45.6	46.4	53.0
1-2 September	47.8	48.2	45.6	45.3	52.2
2-3 September	47.6	48.2	43.8	46.7	53.0
3-4 September	48.4	49.0	44.6	50.3	56.1
4-5 September	48.1	48.4	46.8	50.1	56.0
5-6 September	46.1	46.7	43.3	46.3	52.5
6-7 September	43.5	43.3	44.2	41.5	48.6
7-8 September	45.5	44.5	49.0	43.1	50.9
8-9 September	48.5	49.1	46.1	47.6	54.0
9-10 September	46.9	47.5	44.4	49.8	55.6
10-11 September	46.5	46.5	46.7	48.6	54.6
11-12 September	47.1	47.4	45.7	49.6	55.5
12-13 September	46.8	46.8	46.5	-	46.8
13-14 September	-	-	-	-	-
14-15 September	44.7	44.7	44.7	41.5	48.9
15-16 September	36.1	33.2	37.1	46.7	52.0
16-17 September	47.2	48.2	39.1	38.7	47.9
17-18 September	38.1	38.1	37.9	-	38.1

Period	$L_{Aeq,16h}$ [xi]	L_{Day} [xii]	$L_{Evening}$ [xiii]	L_{Night} [xiv]	L_{den} [xv]
18-19 September	33.2	33.1	33.4	49.2	54.5
19-20 September	48.1	48.1	-	36.4	46.7
20-21 September	33.6	-	33.6	39.4	44.8

[xi] Equivalent continuous sound pressure level (L_{Aeq}) over the 16-hour day period of 0700h to 2300h
[xii] Equivalent continuous sound pressure level (L_{Aeq}) over the 12-hour day period of 0700h to 1900h
[xiii] Equivalent continuous sound pressure level (L_{Aeq}) over the 4-hour evening period of 1900h to 2300h
[xiv] Equivalent continuous sound pressure level (L_{Aeq}) over the 8-hour night period of 2300h to 0700h
[xv] Composite level to represent single day with weighting to represent impact during evening and night time periods

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly, L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n.

L_{AX}, L_{AE} or SEL

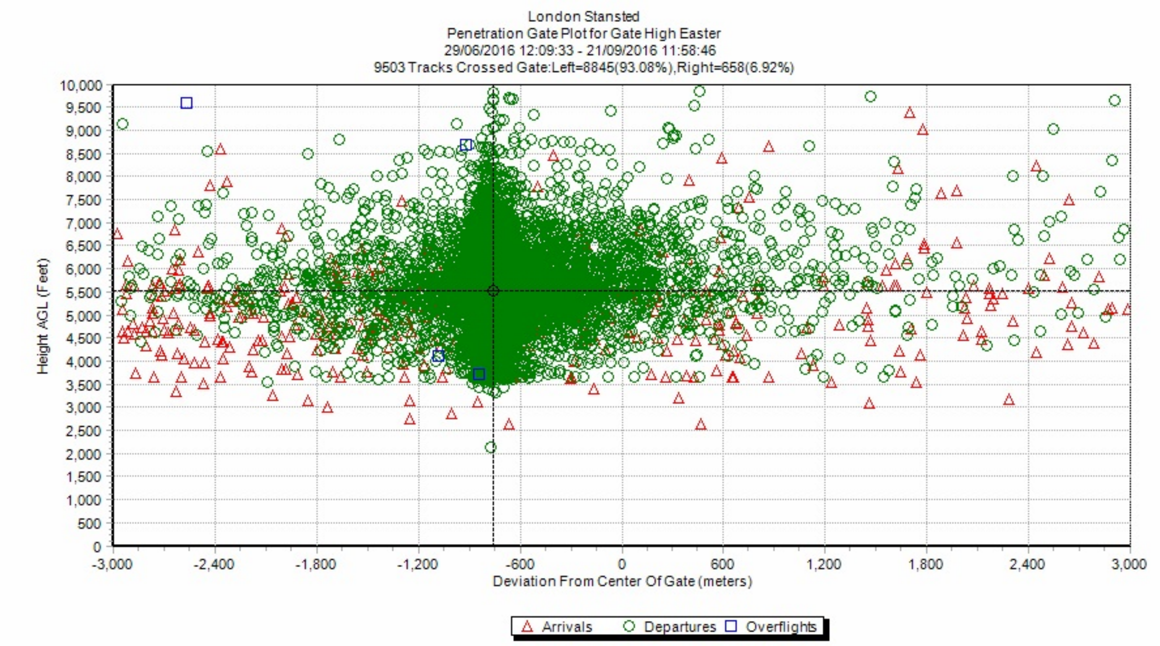
The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

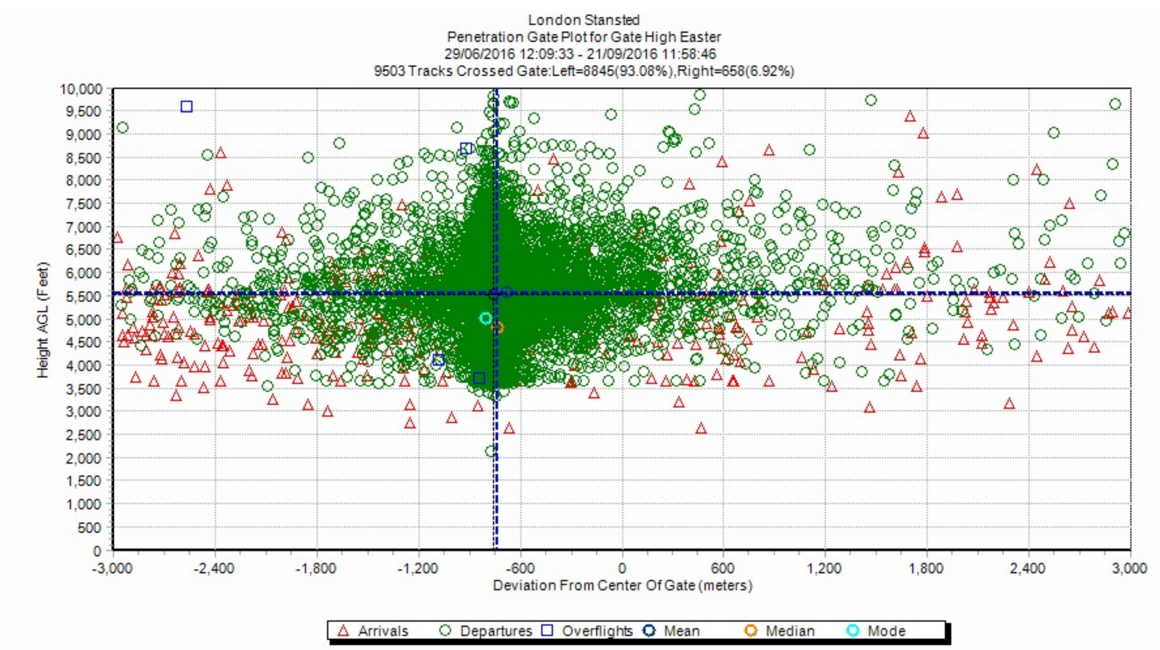
End of Section

Appendix A

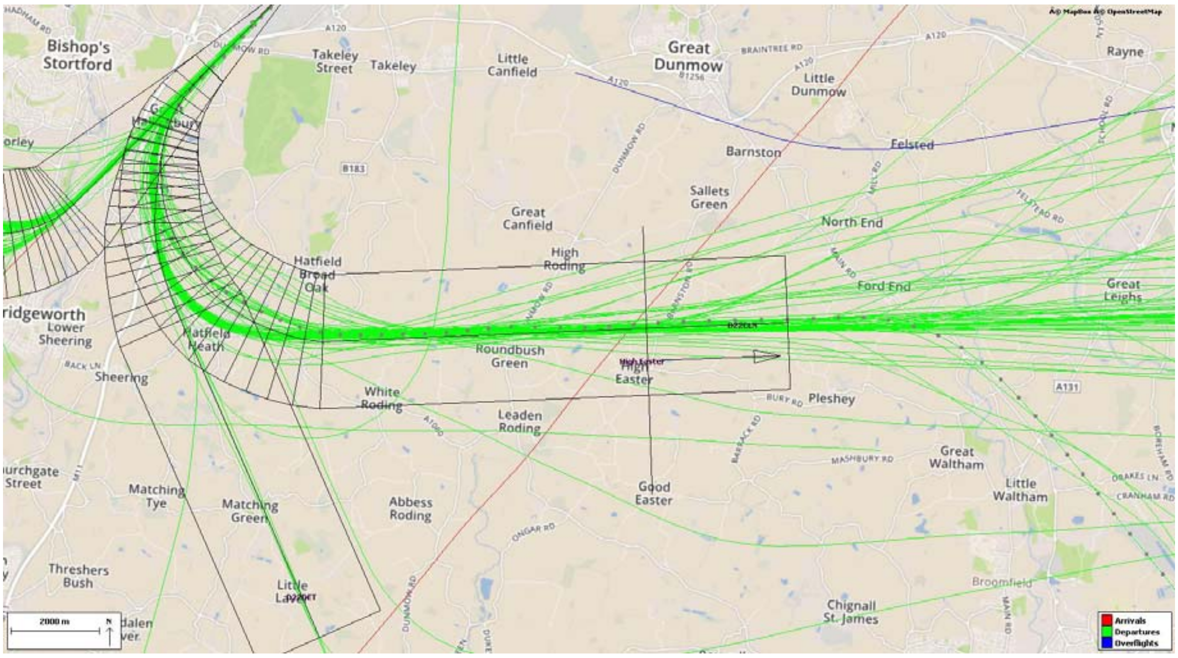
Gate Penetration Information for P104 High Easter

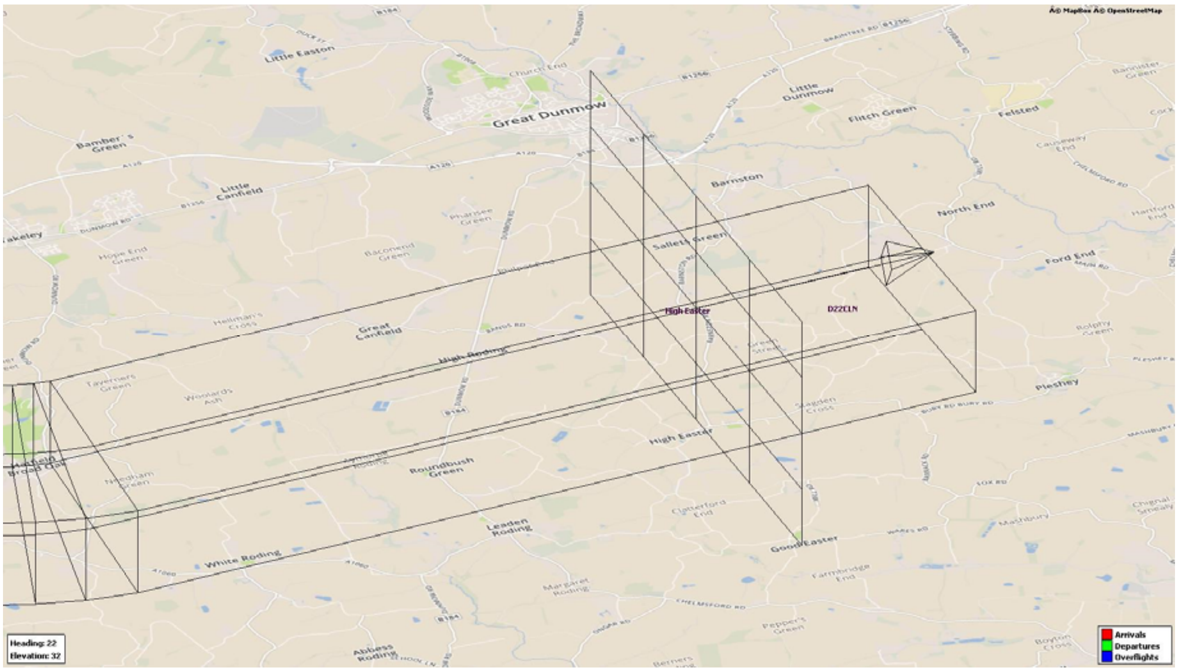
The following graphs set out the height and lateral position of aircraft passing through the gate above the measurement position at High Easter.





The following images set out the gate location at High Easter. The gate was centred above the monitor locations and was set to capture any movements associated with Stansted Airport from ground level to 10,000ft with a width of 6,000m (i.e. gat penetration is ± 3,000m.





End of Section

Cole Jarman Limited Reg. in England and Wales No. 7102436
Head Office +44 (0)1932 829007
John Cree House, 24B High Street, Addlestone, Surrey, KT15 1TN

info@colejarman.com www.colejarman.com
Manchester Office +44 (0)161 2093644
Peter House, 1 Oxford Street, Manchester, M1 5AN