POWER SYSTEM FREQUENCY AND TIME DEVIATION MONITORING

August 2011

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2 Introduction

AEMO is required to maintain the power system frequency and time deviation within the limits specified in the frequency operating standards determined for the mainland and the Tasmania Region by the Reliability Panel. This document reports on the frequency and time deviation performance observed during August 2011 in all regions of the NEM. Regions QLD, NSW, VIC and SA will be referred to as the mainland regions throughout the report.

The frequency operating standards for the mainland regions and the Tasmania region are available on the AEMC web site[1].

The "Power System Frequency and Time Deviation Monitoring Report – Reference Guidelines[2]" outlines the calculation processes used by AEMO in the preparation of the monthly Power System Frequency and Time Deviation Monitoring reports.

The analysis of the delivery of slow raise service, slow lower service, delayed raise service and delayed lower service presented in this report are based on 4-second resolution data. Data for mainland regions is sourced from the Sydney PI server and data for Tasmania region is sourced from the Brisbane PI server. The analysis of fast raise service and fast lower service delivered is based on high-speed (50-millisecond or higher resolution) data and is only presented in this report for events where the appropriate data is available.

Table 1 below summarises events in the mainland and Tasmanian regions for the month August 2011 with frequency excursions outside the normal operating frequency band. Any events in Table 1 that are identified with frequency excursions that did not meet the frequency operating standards are evaluated in section 4 of the report.

[1] The frequency operating standards for the mainland and Tasmania regions are available from http://www.aemc.gov.au/Panels-and-Committees/Reliability-Panel/Guidelines-and-standards.html

[2] The Power System Frequency and Time Deviation Monitoring Report – Reference Guide is available from http://www.aemo.com.au/Electricity/Market-and-Power-Systems/NEM-Reports/Power-System-Performance-Monitoring

3 Summary of Events

Table 1: Events in the mainland and Tasmanian regions with frequency excursions outside the normal frequency operating band

EVENT	LOW/HIGH FREQUENCY EVENT	NUMBER OF EVENTS	
		MAINLAND	TASMANIA
No contingency or load event/Normal event	LOW	2	39
	HIGH	0	18
Load Event	LOW	0	92
	HIGH	2	189
Generation Event	LOW	7	9
	HIGH	0	1
Network Event	LOW	0	0
	HIGH	0	0
Separation Event	LOW	0	0
	HIGH	0	0
Multiple Contingency Event	LOW	0	0
	HIGH	0	0

4 Events in the Mainland and Tasmania Regions that did not meet the Frequency Operating Standards

In this section, details are provided of those events identified in Table 1 as not meeting the frequency operating standard applicable to each event.

4.1 Frequency Events in Mainland Regions

There were no events recorded in Mainland Regions that did not meet the mainland frequency operating standards from those identified in Table 1 during August 2011.

4.2 Frequency Events in Tasmania Region

There were no events recorded in Tasmania Regions that did not meet the Tasmania Frequency Operating Standards from those identified in Table 1 during August 2011.

5 Statistical analysis

With exception of load, generation, network, separation and multiple contingency events which are excluded, the frequency distribution for the mainland and Tasmanian regions were not within the frequency operating standards in the month of August 2011.

Frequency in the mainland regions was within the range 49.91 Hz to 50.08 Hz for 99% of the time. The frequency was within the range 49.75 Hz – 50.25 Hz for 99.93% of the time. The mean value of frequency during August 2011 was 50 Hz with a standard deviation of 0.110 Hz.

Frequency in the Tasmania region was within the range 49.90 – 50.09 Hz for 99% of the time. The frequency was within the range 49.75 Hz – 50.25 Hz for 100 % of the time. The mean value of frequency during August 2011 was 50 Hz with a standard deviation of 0.039 Hz.

5.1.1 Daily Frequency Standard Deviation

Figure 1 and Figure 2 below plot the daily standard deviation of the Mainland and Tasmanian frequency for the past 13 months, and do not exclude contingency events.

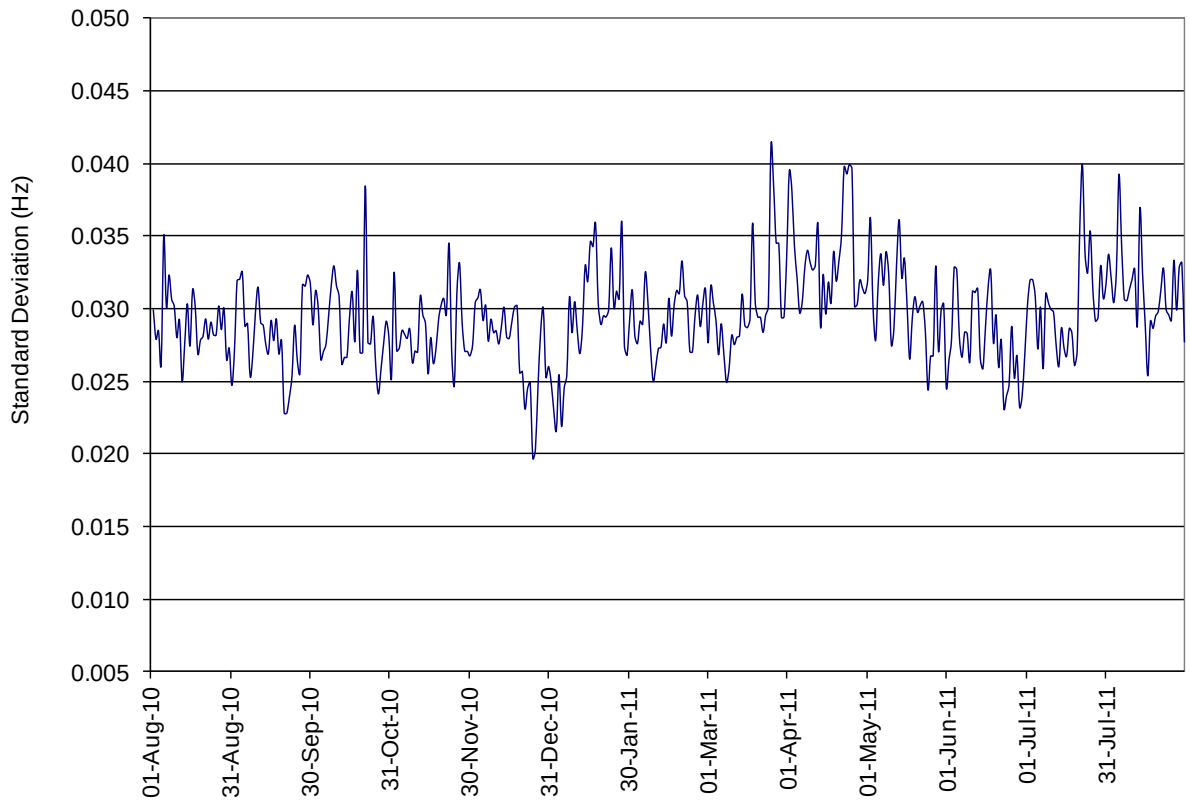

Figure 1: Daily standard deviation of mainland frequency

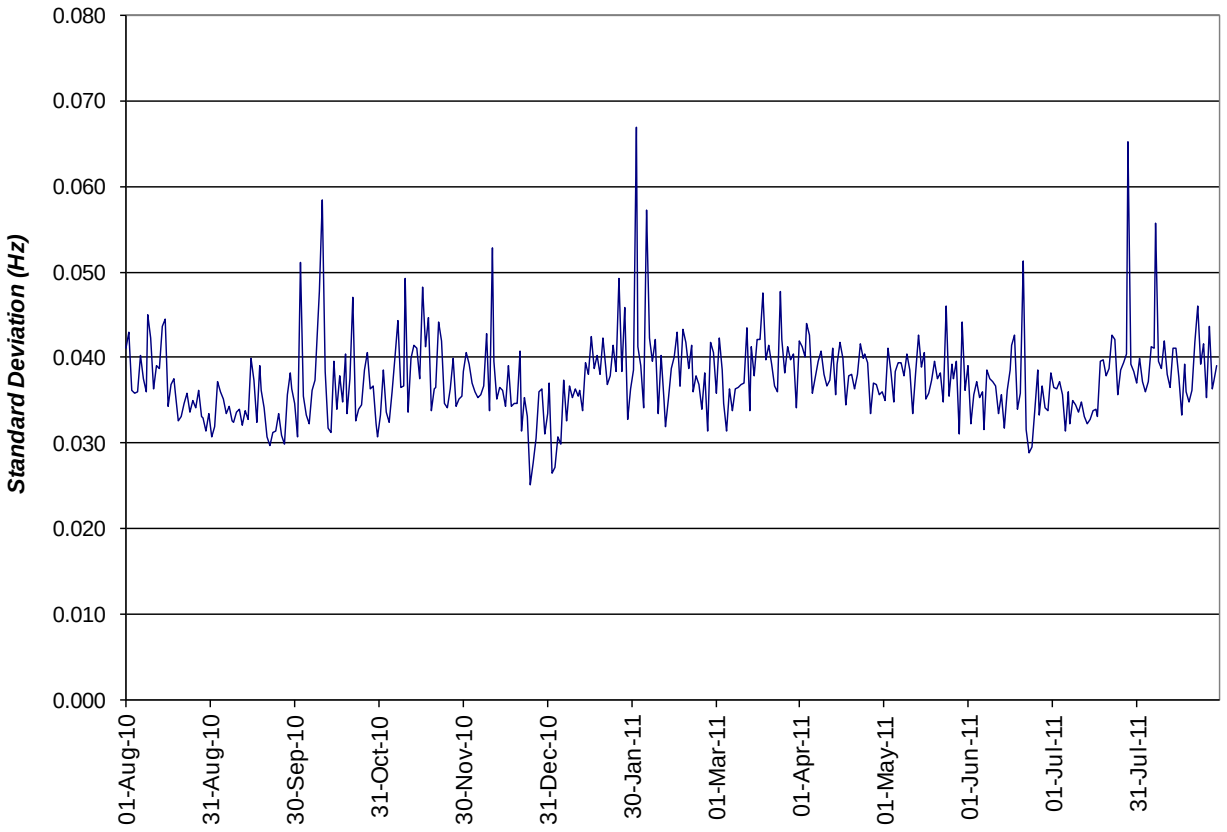

Figure 2: Daily standard deviation of frequency in Tasmania

5.1.2 Time of day Analysis

This section details the standard deviation of system frequency on a monthly and daily basis. Figure 3 and Figure 4 show the average half-hourly standard deviation of the Mainland regions and Tasmania frequency for Jun, Jul and Aug 2011. The effects of contingency events have not been filtered from this time of day analysis.

The theoretical limit of 0.049 Hz shown in Figure 3 and Figure 4 would ensure that 99% of observed values were in the range 49.85 - 50.15 Hz with a very small probability of being less than 49.75 Hz and greater than 50.25 Hz. (This assumes that the frequency distribution follows an ideal normal distribution).

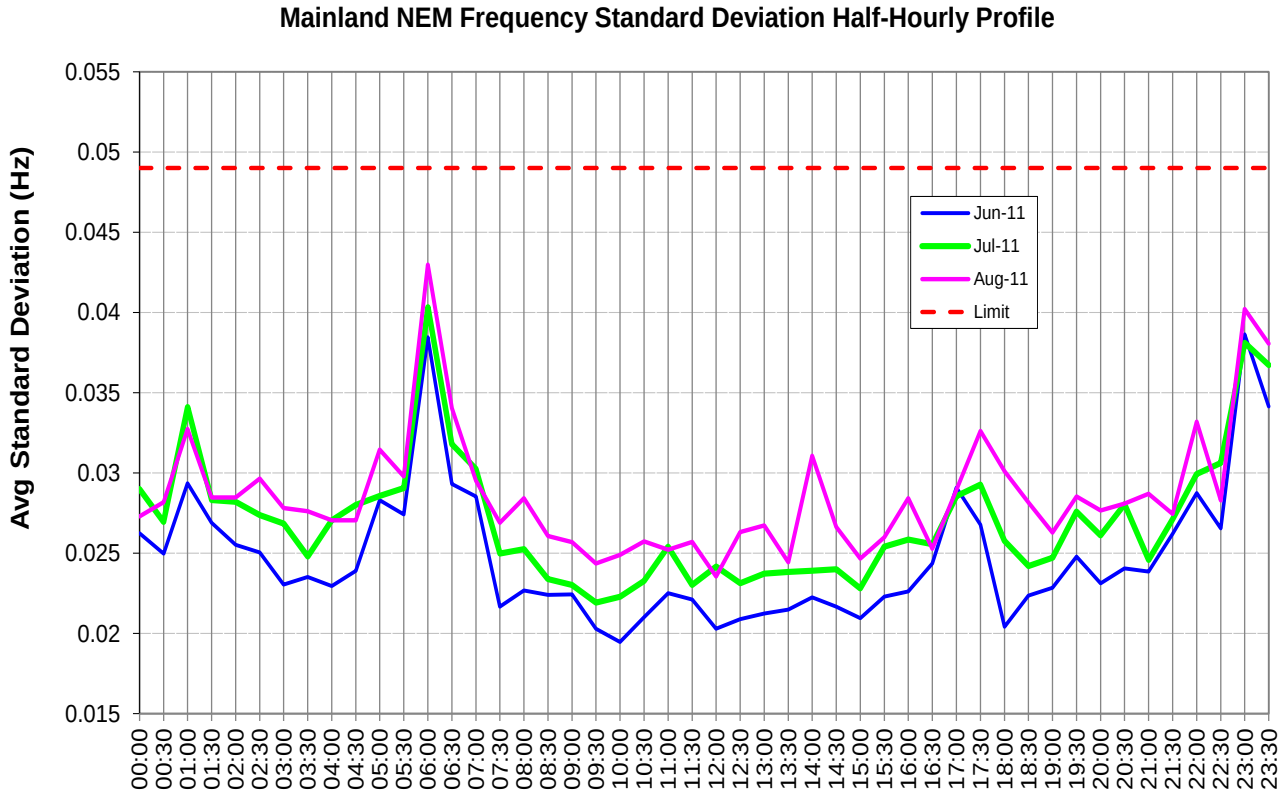

Figure 3: Daily profile of standard deviation for the frequency in the Mainland regions

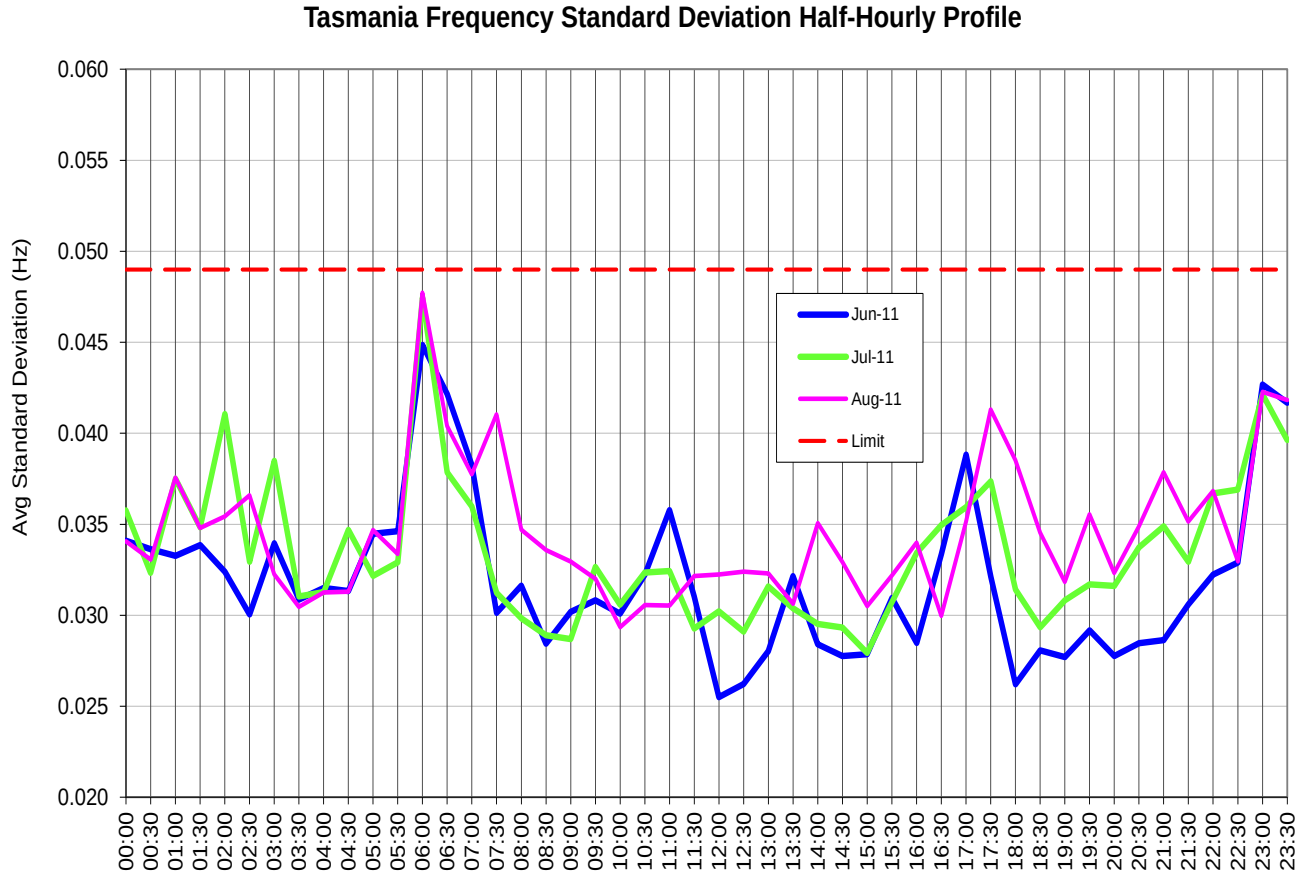

Figure 4: Daily profile of standard deviation for the frequency in Tasmania

6 Accumulated Time Deviation

The frequency operating standards require that the accumulated time deviation be maintained within the range ± 5 seconds in mainland regions and ± 15 seconds in Tasmania.

For a separation event there is no requirement in the frequency operating standards that time deviation be maintained within the ranges specified above.

The range of accumulated time deviations recorded throughout the NEM during August 2011 is provided in Table 2.

Table 2: Accumulated time deviation statistics

	QLD	NSW	VIC	SA	TAS
Maximum Positive Deviation (s)	2.17	2.24	2.01	1.81	3.54
Maximum Negative Deviation (s)	-3.73	-5.00	-3.96	-4.15	-9.49
Mean Value (s)	0.003	0.046	-0.196	-0.386	-0.383
Standard Dev (s)	0.700	0.698	0.698	0.698	1.706

The distribution of time deviations based on the mainland regions measurement is provided in Figure 5 below.

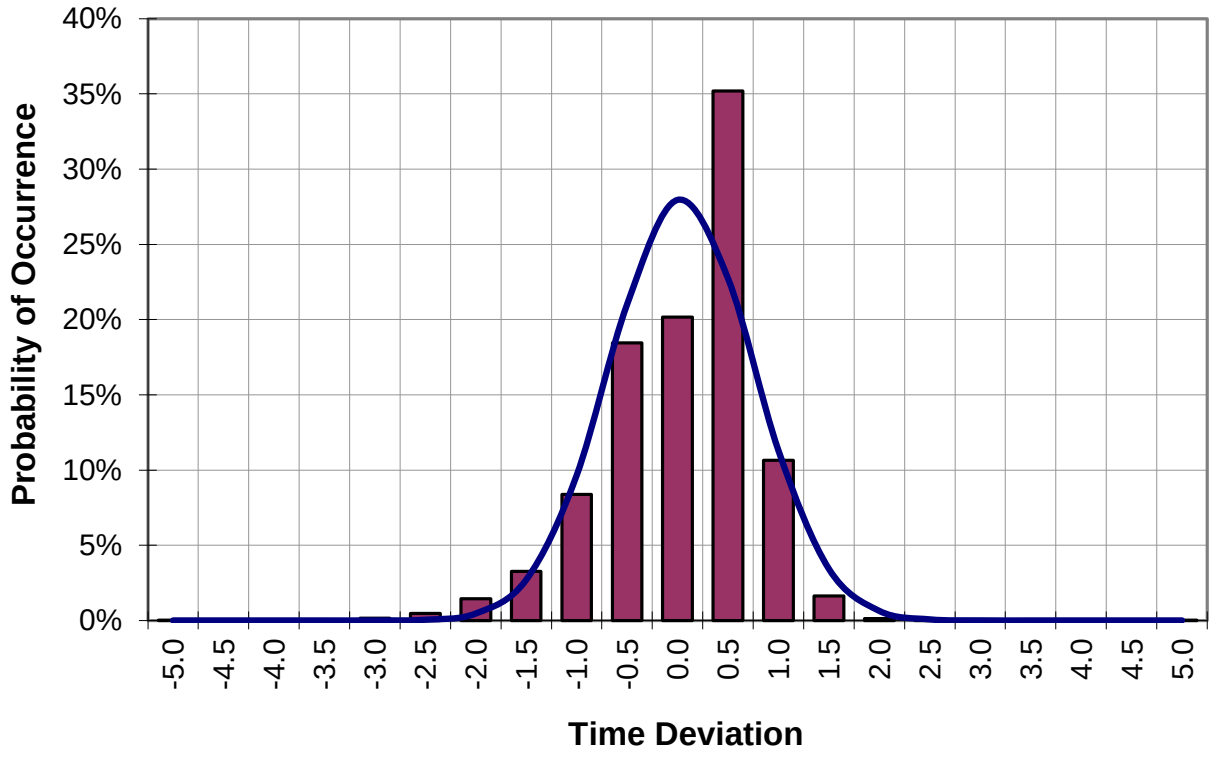

Figure 5: Mainland time deviation distribution for August 2011

The distribution of time deviations based on the Tasmania region measurement is provided below in Figure 6 below.

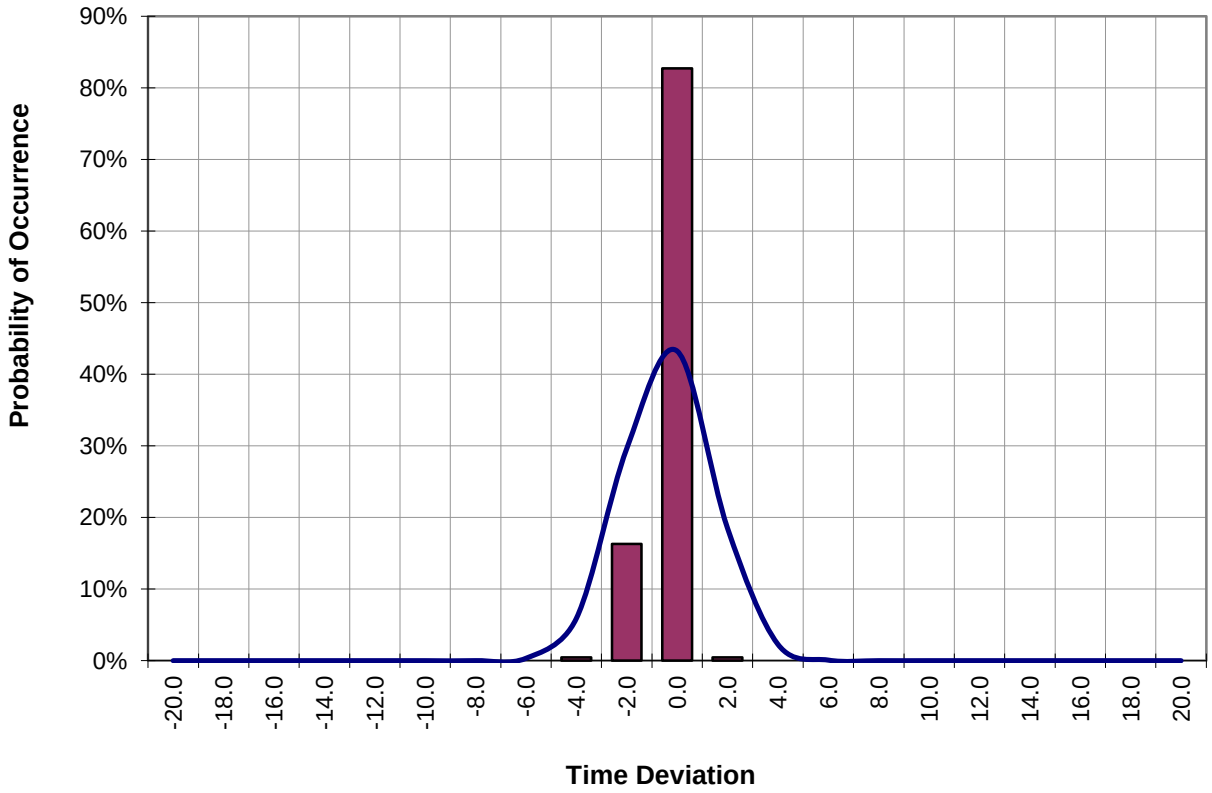

Figure 6: Tasmania time deviation distribution for August 2011

6.1 Time Error Performance

Figure 7 below presents the daily maximum and minimum values of the mainland regions time error observed for the past 13 months.

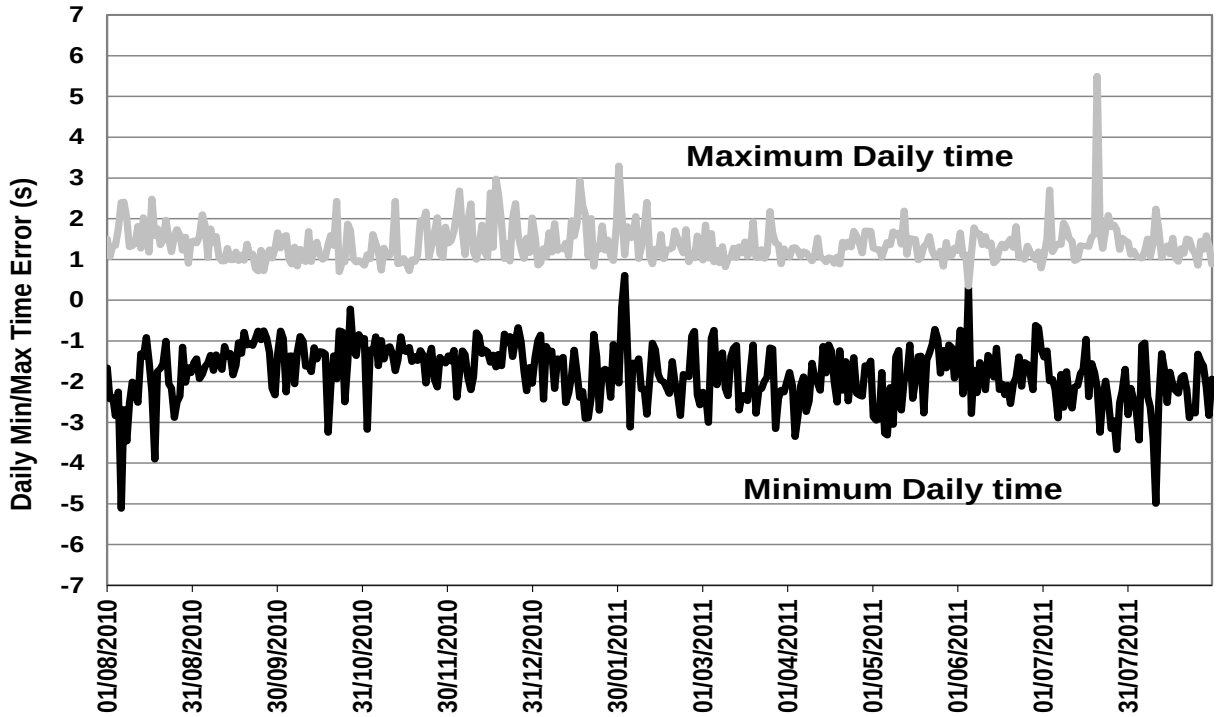

Figure 7: Mainland regions daily maximum and minimum time deviation

Figure 8 below presents the daily maximum and minimum values of Tasmania time error observed for the past 13 months.

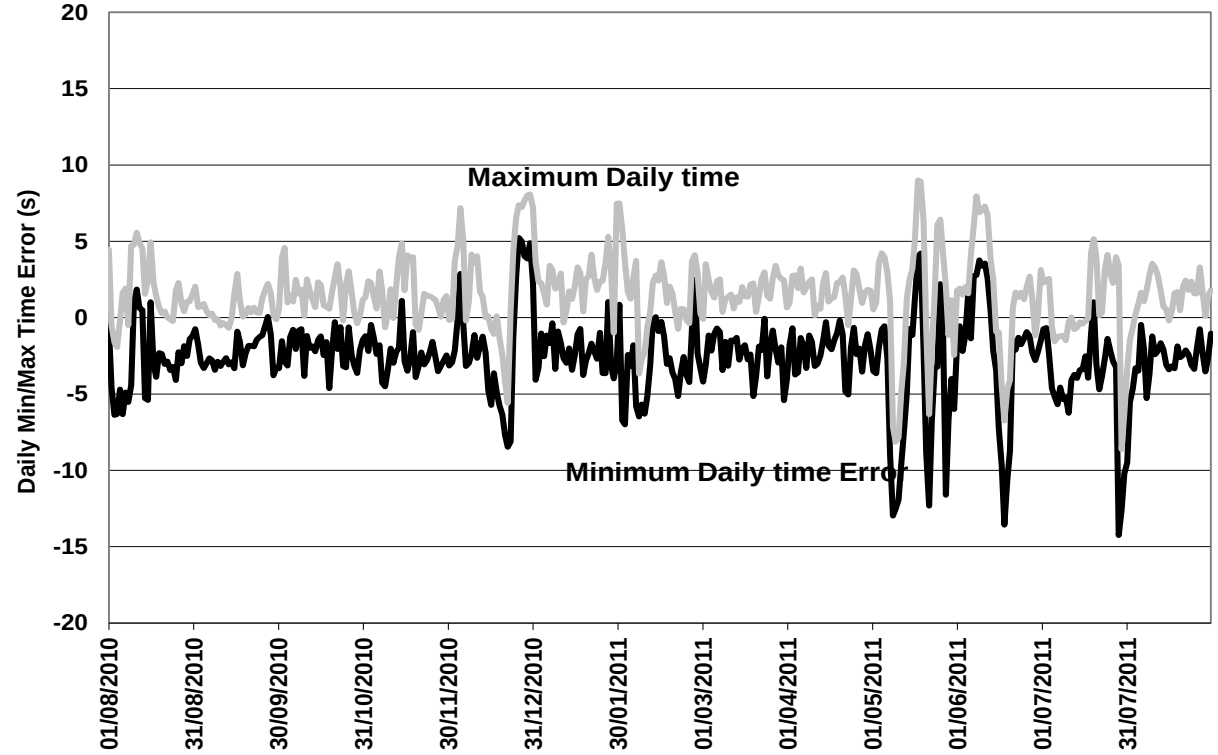

Figure 8: Tasmania daily maximum and minimum time deviation