POWER SYSTEM FREQUENCY AND TIME DEVIATION MONITORING

March 2011

PREPARED BY: Electricity System Operations Planning and Performance

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Contents

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1 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 March 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 March 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 Guidelines is available from http://aemo.com.au/reports/performance_monitoring.html

2 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	1	45
	HIGH	0	21
Load Event	LOW	0	77
	HIGH	0	208
Generation Event	LOW	3	12
	HIGH	0	2
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

3 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.

There were no events in Mainland and Tasmania Regions during March 2011 that did not meet the frequency operating standards.

4 Statistical analysis

The frequency distribution for the mainland regions was within the frequency operating standards in the month of March 2011.

Frequency in the mainland regions was within the range 49.92 to 50.07 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 March 2011 was 50 Hz with a standard deviation of 0.030 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 March 2011 was 50 Hz with a standard deviation of 0.039 Hz.

4.1.1 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. With exception of major power system disturbances, which are excluded, the frequency standard deviation shown in Figure 1 and Figure 2 do not exclude load and contingency events

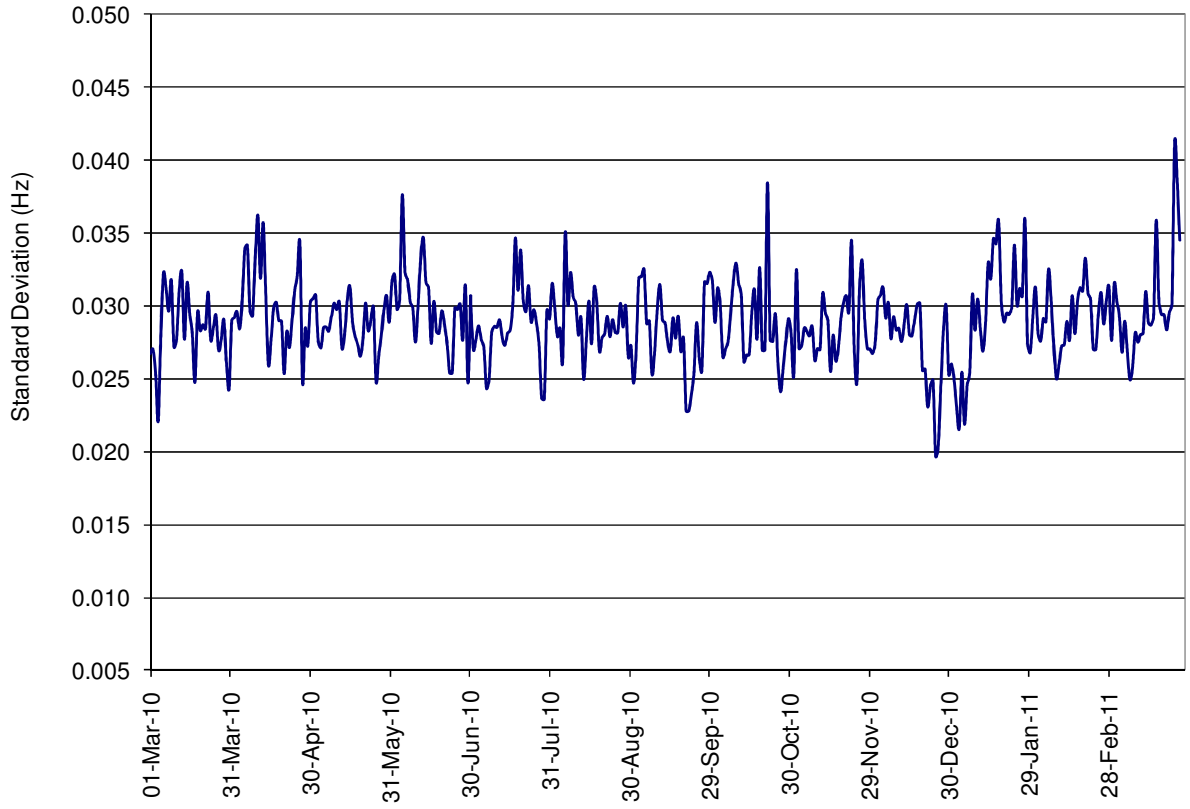

Figure 1: Daily standard deviation of mainland frequency

Daily standard deviation of frequency in Tasmania for the past 13 months is shown in Figure 2 below.

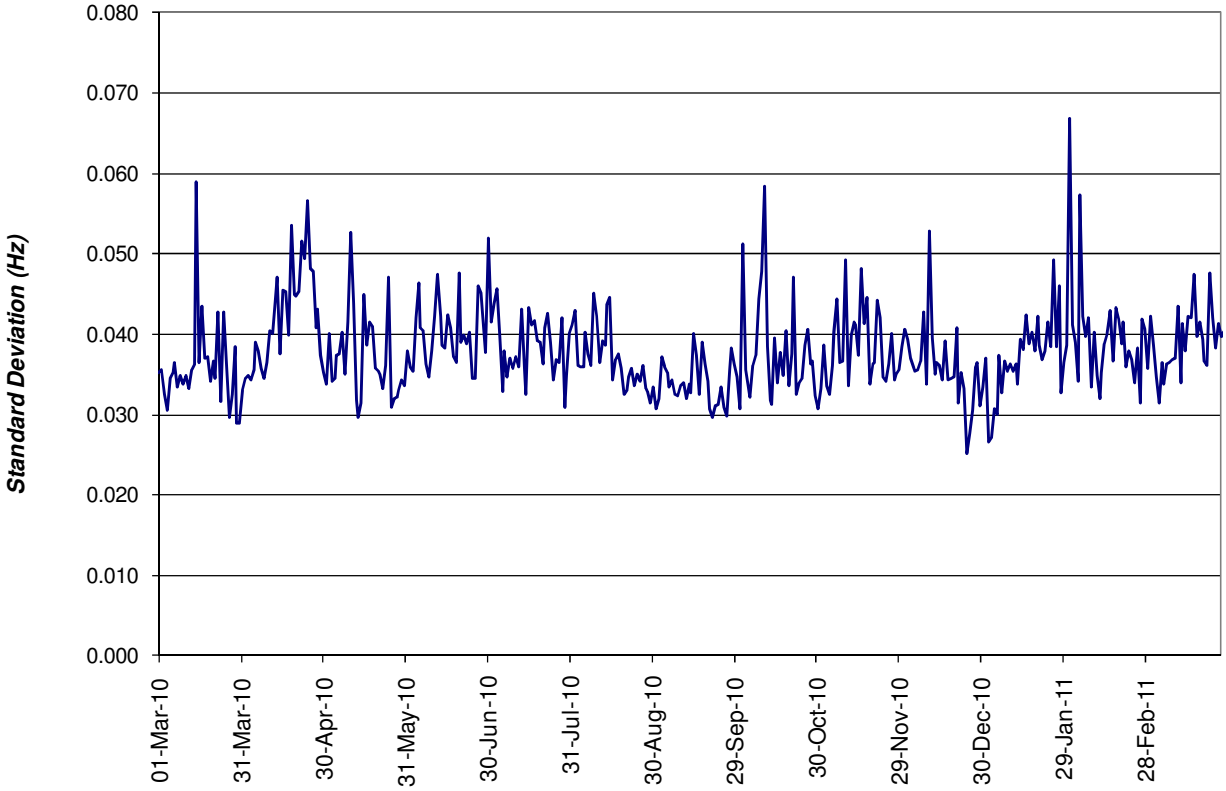

Figure 2: Daily standard deviation of frequency in Tasmania

4.1.2 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 January, February, and March 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 one in a million chance of being less than 49.75 and greater than 50.25 Hz. (This assumes that the frequency distribution follows an ideal normal distribution).

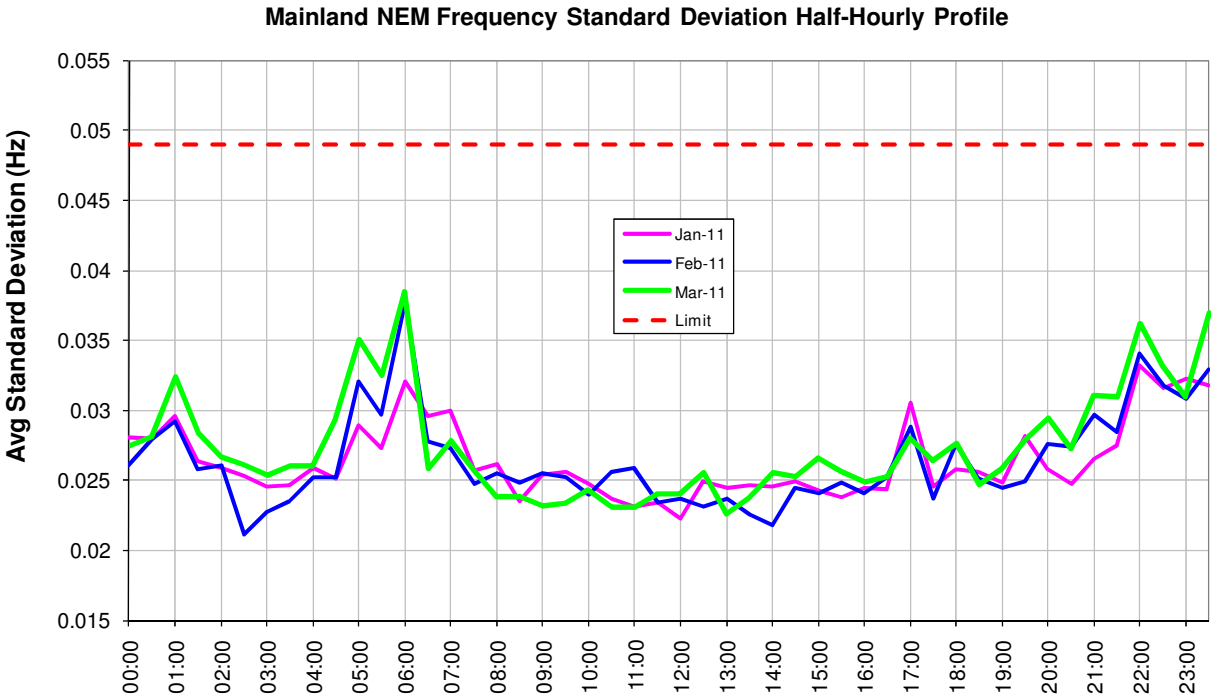

Figure 3: Daily profile of standard deviation for the frequency in the mainland regions

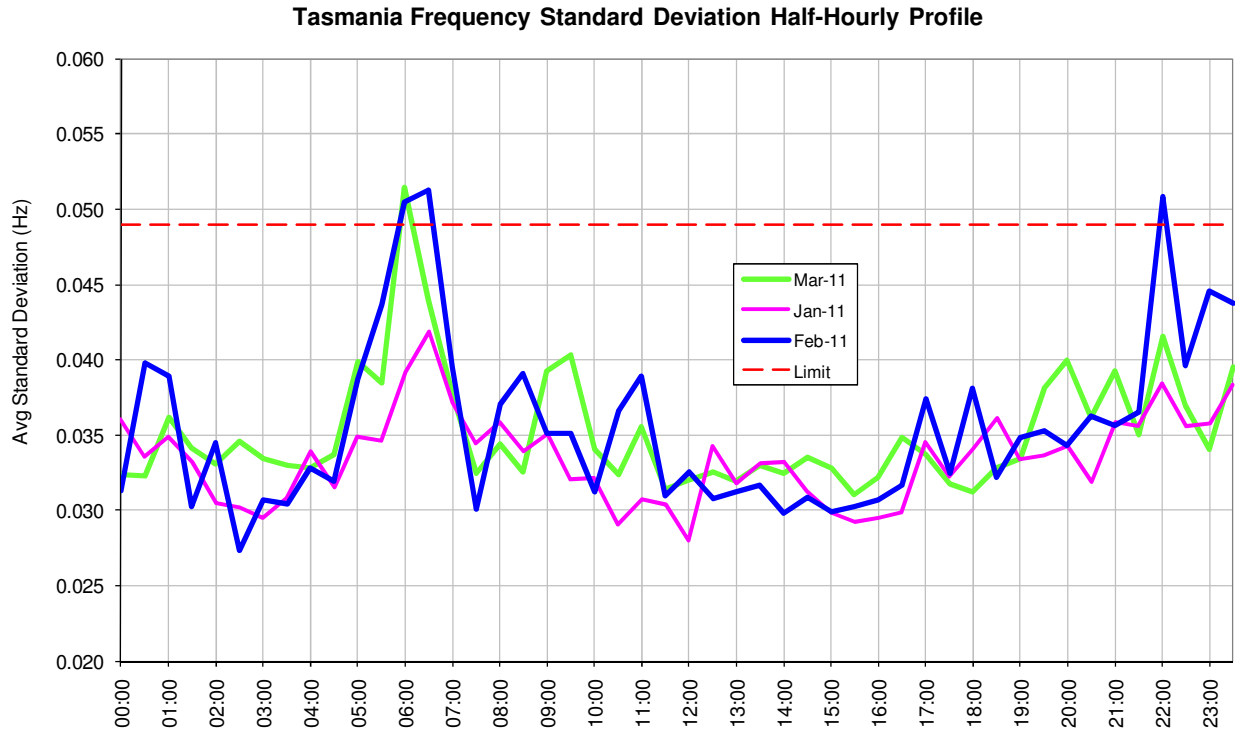

Figure 4: Daily profile of standard deviation for the frequency in Tasmania

5 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 March 2011is provided in Table 3.

Table 2: Accumulated time deviation statistics

	QUEENSLAND	NSW	VIC	SA	TAS
Maximum Positive Deviation (s)	2.08	2.18	2.17	1.93	3.51
Maximum Negative Deviation (s)	-3.35	-3.16	-3.82	-3.45	-5.42
Mean Value (s)	-0.067	0.036	-0.573	-0.200	-0.118
Standard Dev (s)	0.657	0.657	0.751	0.658	1.379

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

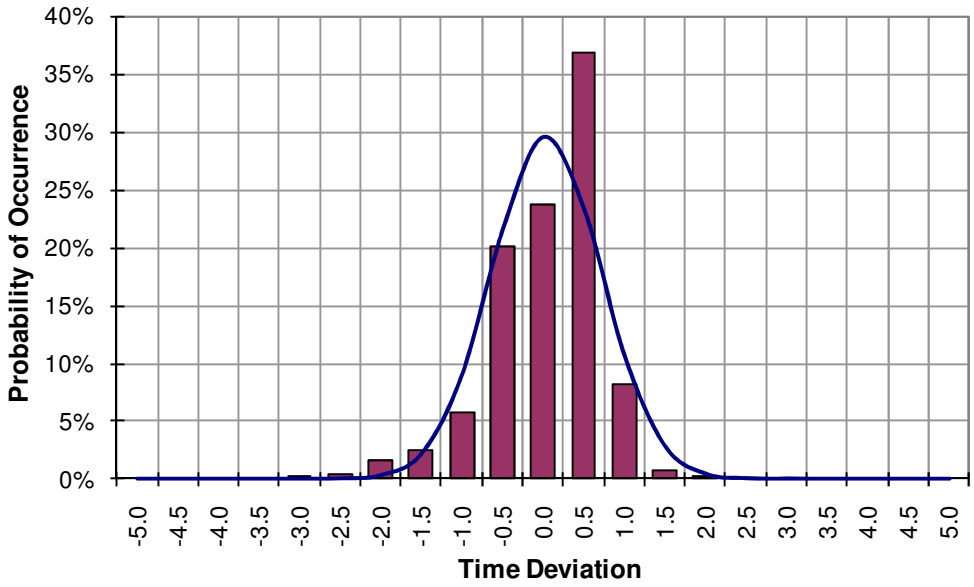

Figure 5: Mainland time deviation distribution for March 2011

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

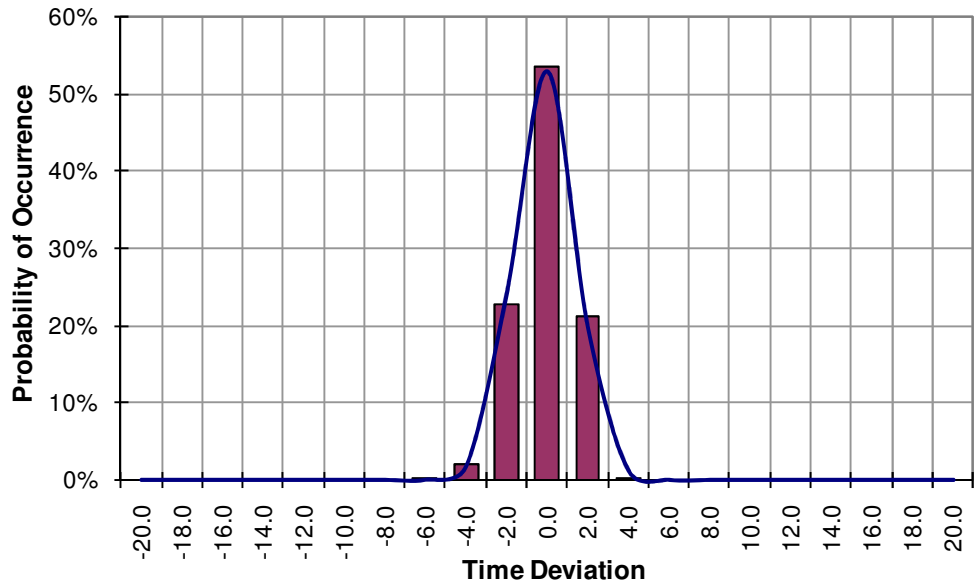

Figure 6: Tasmania time deviation distribution for March 2011

5.1 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 8 presents the daily maximum and minimum values of Tasmania time error observed for the past 13 months.

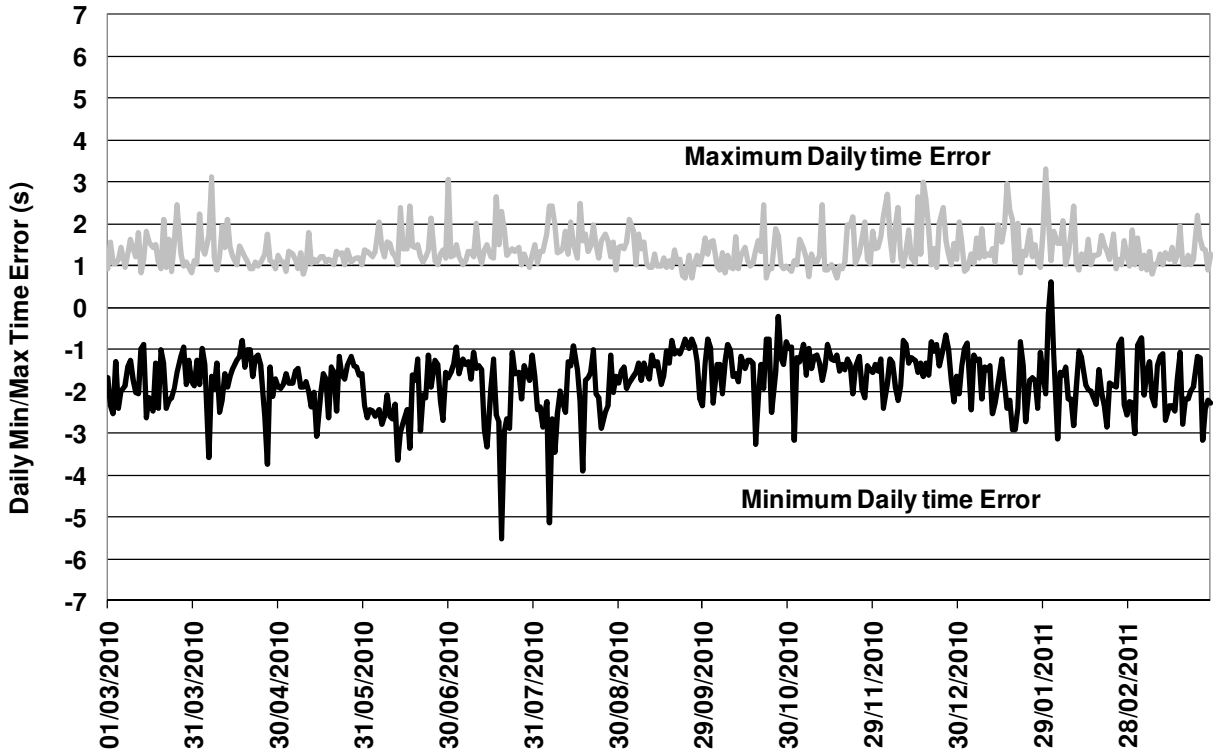

Figure 7: Mainland regions daily maximum and minimum time deviation

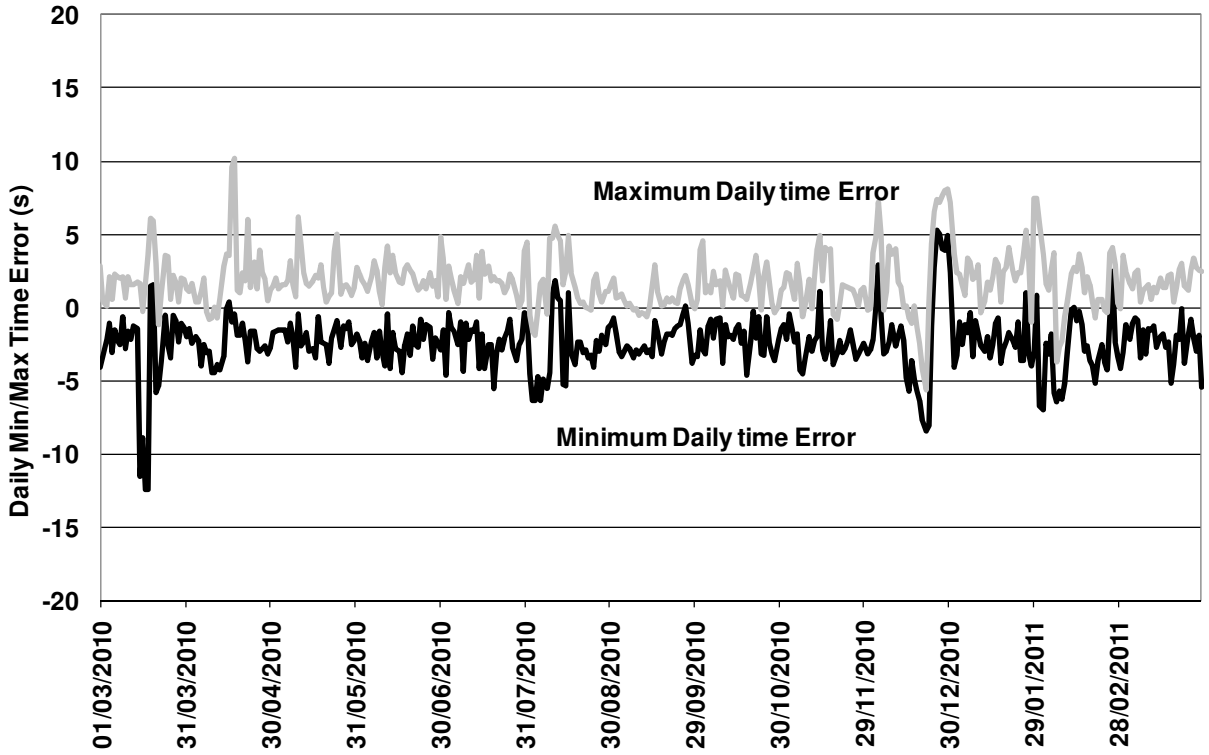

Figure 8: Tasmania daily maximum and minimum time deviation