

**THE AUSTRALIAN BASELINE SEA LEVEL
MONITORING PROJECT**

MONTHLY DATA REPORT

DECEMBER 2011



Australian Government

Bureau of Meteorology

This report was prepared by the National Tidal Centre, Bureau of Meteorology.



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Bureau of Meteorology

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Quality Certification:

I authorise the issue of this Australian Baseline Sea Level Monitoring Project Monthly Data Report for December 2011 in accordance with National Tidal Centre Quality Assurance procedures.

William Mitchell
Manager - National Tidal Centre

The Australian Baseline Sea Level Monitoring Project

Monthly Data Report

DECEMBER 2011

INTRODUCTION

The mission of the Australian Baseline Sea Level Monitoring Project (ABSLMP) is to monitor changes in sea level around Australia. It involves the operation and maintenance of an array of high-resolution sea level gauges and associated meteorological instruments (see Figure B) and management of a quality-controlled national database of observations that is made available to the scientific and wider communities.

This report is one of a series of monthly data reports that provide tables and figures summarising the data collected to date. The accompanying text relates primarily to the quality of the data rather than its interpretation. Periodic scientific evaluation of the data in the context of climate variability and climate change is provided in an annual data report.

The trends are derived from the sea level record. However, readers are cautioned against drawing any conclusions from short duration records, particularly when used in isolation from other phenomena. The sea level record includes natural variability, such as El Niño events and the effects of atmospheric, oceanographic and geological processes. It is important to note that as the sea level record becomes longer, the short-term trend estimate becomes more stable and reliable. Vertical movement of the instrumentation relative to local topography is monitored and the results are listed on the Geoscience Australia web site.

NOTES ON THE DATA FOR DECEMBER 2011

Sea level data return (Figures 1 and 17) was good for most operative stations during December 2011. Please note that no data exists for Port Stanvac since November 2010 as the station was removed to allow the former owners of the site (Mobil Refining Australia) to rehabilitate and vacate the Port Stanvac oil refinery precinct. Re-establishment of the gauge depends on the long-term future of the wharf. The Broome Port Authority's policy of switching off the power when fuel ships are in dock resulted in the loss of 41 hours of Broome sea level and ancillary data during December. Tele-communications issues at Cocos Islands resulted in the loss of 19 days of data since the 12th of December. No wind data was received from Esperance, Cape Ferguson and Groote Eylandt, indicating continued failure of the wind monitoring equipment at these sites. The Hillarys station recorded intermittent periods of zero wind direction and all data have been removed from the record whilst the cause of the error is investigated. No water temperatures have been recorded for Darwin since the water temperature sensor failed in January 2011.

The residuals (Figures 2 and 3), being the difference between the observations and the tidal predictions, are the non-tidal components of the sea level. They are primarily the consequence of short-term meteorological effects shown in Figures 5 and 9, and can also

indicate the passage of a tsunami. The meteorological convention is followed in Figure 5 where the vector indicates the direction from which the wind is blowing.

Figure 10 compares the mean, maximum and minimum values for air temperature, water temperature and barometric pressure for December 2011 with the long-term values. Note that the long-term ranges are calculated using the previous sets of December data for each station *excluding* the current month of data.

Maximum December water temperatures were recorded at Burnie (19.3°C) and Spring Bay (20.0°C) during December 2011. Air temperatures and barometric pressures for all sites fell within the long-term December ranges.

Figure 11 shows the monthly mean sea levels with respect to an arbitrary fixed offset from the zero of the tide gauge. The monthly mean sea levels contain seasonal variations, in contrast to the sea level anomalies (Figure 12), which have the seasonal signals and trends removed from the data. A record mean sea level was recorded at Cocos Islands but must be placed in the context of the limited data available in December 2011. The sea level anomaly for Cocos Islands was +15.7cm for December 2011, an anomaly that has been surpassed on several occasions previously. Sea level anomalies greater than +5cm were also observed at Groote Eylandt (13cm), Darwin (7cm) and Hillarys (10cm) whilst sea level anomalies were near zero for all other sites.

Figure 13 shows the history of the short-term sea level trend for each site during the life of the Australian Baseline Sea Level Monitoring Project. Table 1 lists the commencement of operation, the latest sea level trend and the change in trend with respect to the previous month's analysis. It is important to stress that as the sea level record becomes longer, the short-term trend estimate becomes more stable and reliable. Observed trends in sea level include natural variability, for example, events such as El Niño and effects due to many other atmospheric, oceanographic and geological processes. Longer-term data sets for all stations are required in order to separate the effects of the different signals. ***Please exercise caution in interpreting the short-term trends in the table below*** – they will almost certainly change over the coming years as the data set increases in length.

Positive barometric pressure anomalies (Figure 14) near or greater than 3 hPa were recorded at Burnie (+2.9 hPa), Spring Bay (+4.1 hPa) and Port Kembla (+2.6 hPa), whilst negative anomalies around -3 hPa were recorded at Cocos Islands (-3.5 hPa) and Hillarys (-3.0 hPa) in December 2011. It is difficult to relate the water and air temperature anomalies (Figures 15 and 16) directly to those of barometric pressure and sea level without considering other effects, such as localised currents, wind speeds and directions. The anomalies are primarily used to quality check the water and air temperature data. During December 2011 positive water temperature anomalies greater than +0.5°C were observed at Broome (+0.5°C), Esperance (+0.5°C), Portland (+1.3°C), Burnie (+1.3°C) and Spring Bay (+0.5°C). Negative water temperature anomalies less than -0.5°C were observed at Port Kembla (-0.9°C) and Rosslyn Bay (-0.7°C). Positive air temperature anomalies greater than +0.5°C were observed at Hillarys (+1.7°C), Esperance (+0.5°C), Thevenard (+0.5°C), Portland (+0.9°C) and Burnie (+0.6°C). Negative anomalies less than -0.5°C were observed at Port Kembla (-1.3°C) and Rosslyn Bay (-0.7°C).

The number of hits to the Australian Baseline Sea Level Monitoring Project (ABSLMP) web pages from January 2008 to December 2011 are given in Figure A.

Please note: Tide gauges at Stony Point and Lorne do not record air temperature, water temperature and barometric pressure data and are not present in Figures 3,7,8,9,11,12,13 and 16. The tide gauge at Lorne does not record wind data and is not present in Figures 4, 5 and 6.

Table 1: Tide gauge position, data start date, short-term sea level trends and change in trend from the previous month for the Australian Baseline array through December 2011.

Recent short-term sea level trends in the project area based upon SEAFRAME data through December, 2011				
Location	Lat / Long	Installation Date	Trend (mm/yr)	Change from previous month
Cocos Islands	12°07'07.1"S / 96°53'30.9"E	Sep 1992	+8.6	+0.1
Groote Eylandt	13°51'36.2"S / 136°24'56.1"E	Sep 1993	+9.2	+0.2
Darwin	12°28'18.4"S / 130°50'45.1"E	May 1990	+8.7	+0.1
Broome	18°00'03.0"S / 122°13'07.1"E	Nov 1991	+9.1	+0.1
Hillarys	31°49'32.0"S / 115°44'18.9"E	Nov 1991	+9.5	+0.1
Esperance	33°52'15.2"S / 121°53'43.3"E	Mar 1992	+6.1	0.0
Thevenard	32°08'56.2"S / 133°38'28.8"E	Mar 1992	+4.6	0.0
Port Stanvac	35°06'31.0"S / 138°28'1.3"E	Jun 1992	+4.7	0.0
Portland	38°20'36.4"S / 141°36'47.4"E	Jul 1991	+3.2	0.0
Lorne	38°32'49.4"S / 143°59'19.8"E	Jan 1993	+2.6	0.0
Stony Point	38°22'19.7"S / 145°13'28.9"E	Jan 1993	+2.6	-0.1
Burnie	41°03'0.3"S / 145°54'54.0"E	Sep 1992	+3.0	0.0
Spring Bay	42°32'45.1"S / 147°55'57.8"E	May 1991	+3.4	-0.1
Port Kembla	34°28'25.5"S / 150°54'42.7"E	Jul 1991	+3.1	0.0
Rosslyn Bay	23°09'39.7"S / 150°47'24.6"E	Jun 1992	+3.8	+0.1
Cape Ferguson	19°16'38.4"S / 147°03'30.4"E	Sep 1991	+4.8	+0.1

*Port Stanvac decommissioned November 2010

Figure A: Number of hits on the Australian Baseline Sea Level Monitoring Project web pages from 2008 to December 2011.

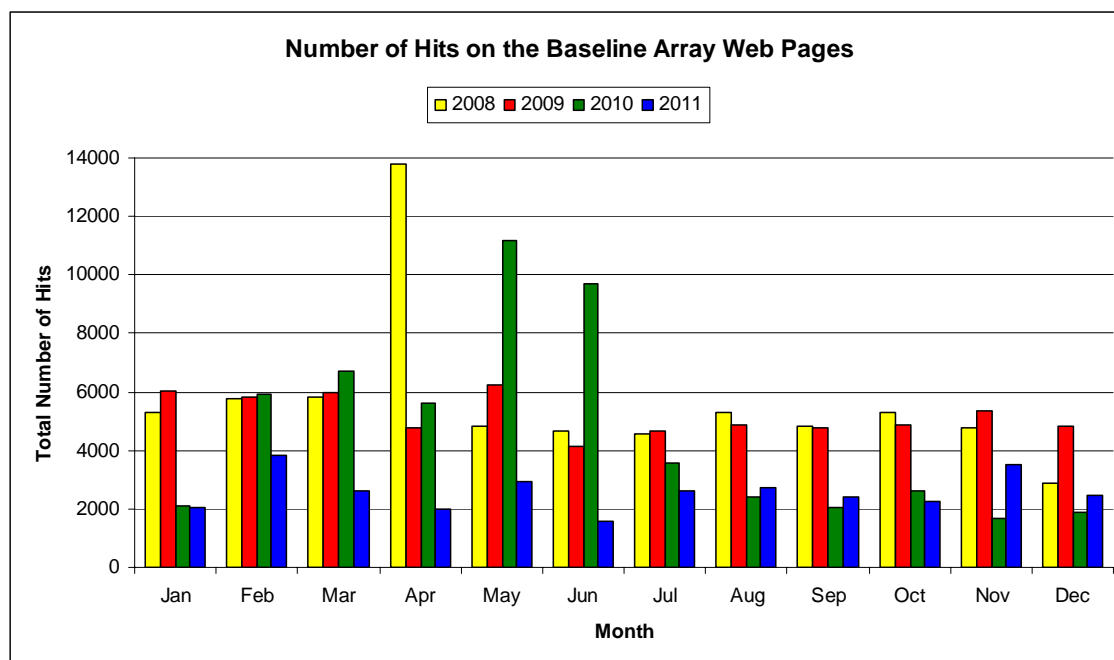
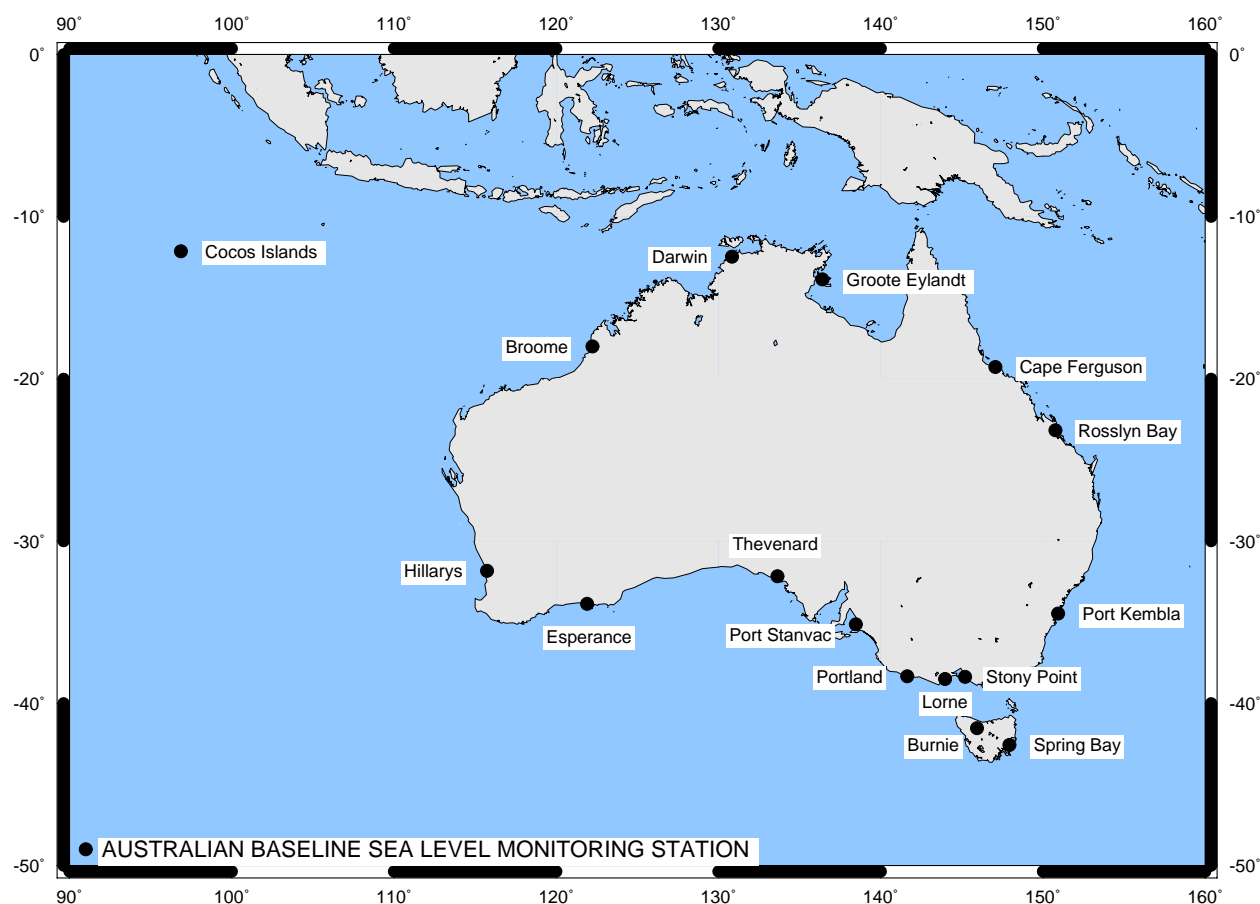


Figure B: Australian Baseline Sea Level Monitoring Project sites.



The *Monthly Data Report* is prepared by the NTC, Bureau of Meteorology. Staff members produce the text, plots and tables.

Further information on the *Monthly Data Report* and other projects conducted by the NTC, Bureau of Meteorology can be obtained from the following address.

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Please note the following:

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Figure 1

DECEMBER 2011
SIX MINUTE SEA LEVEL OBSERVATIONS (m)

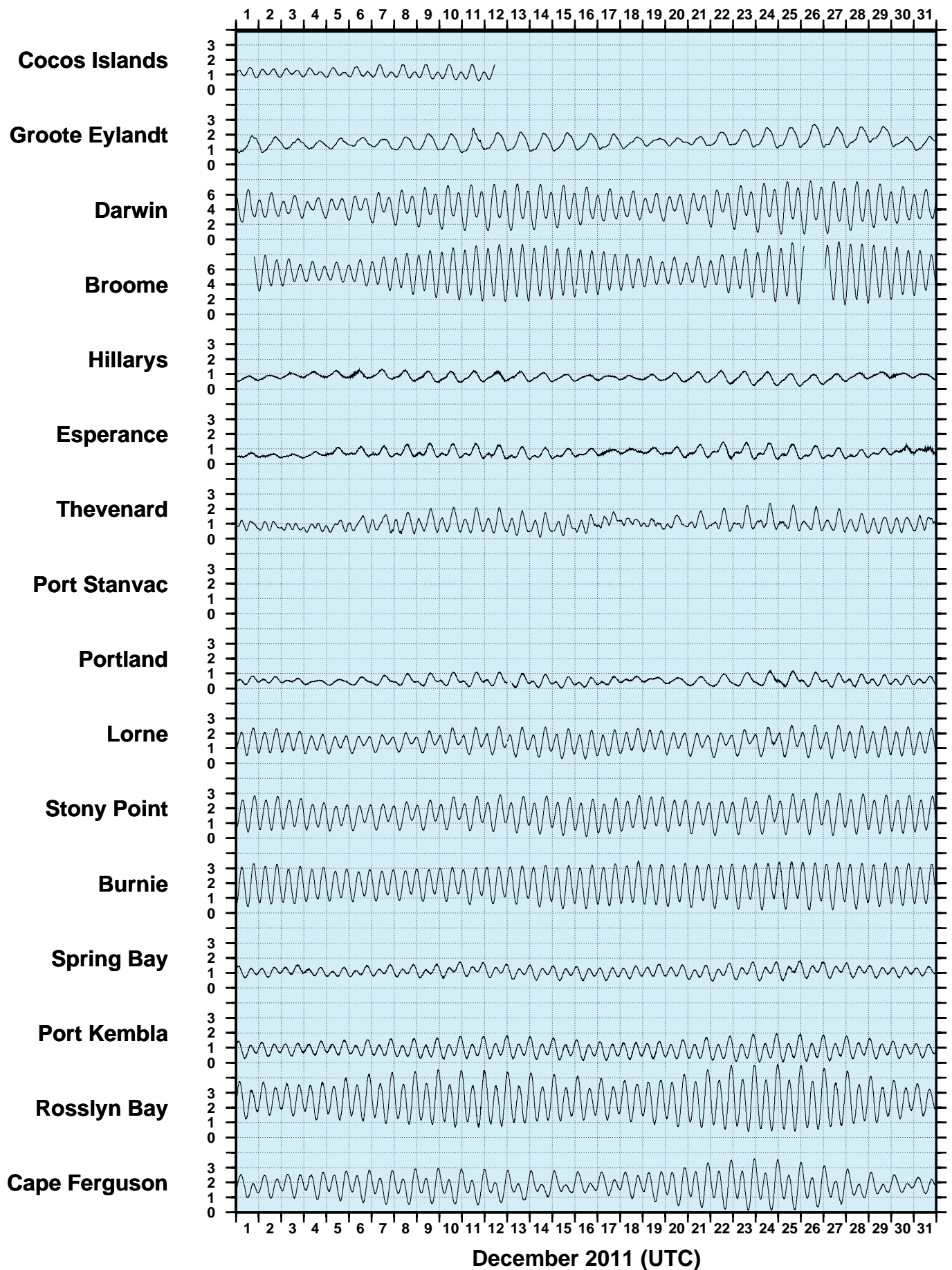


Figure 2

DECEMBER 2011
SIX MINUTE RESIDUAL WATER LEVELS (m)

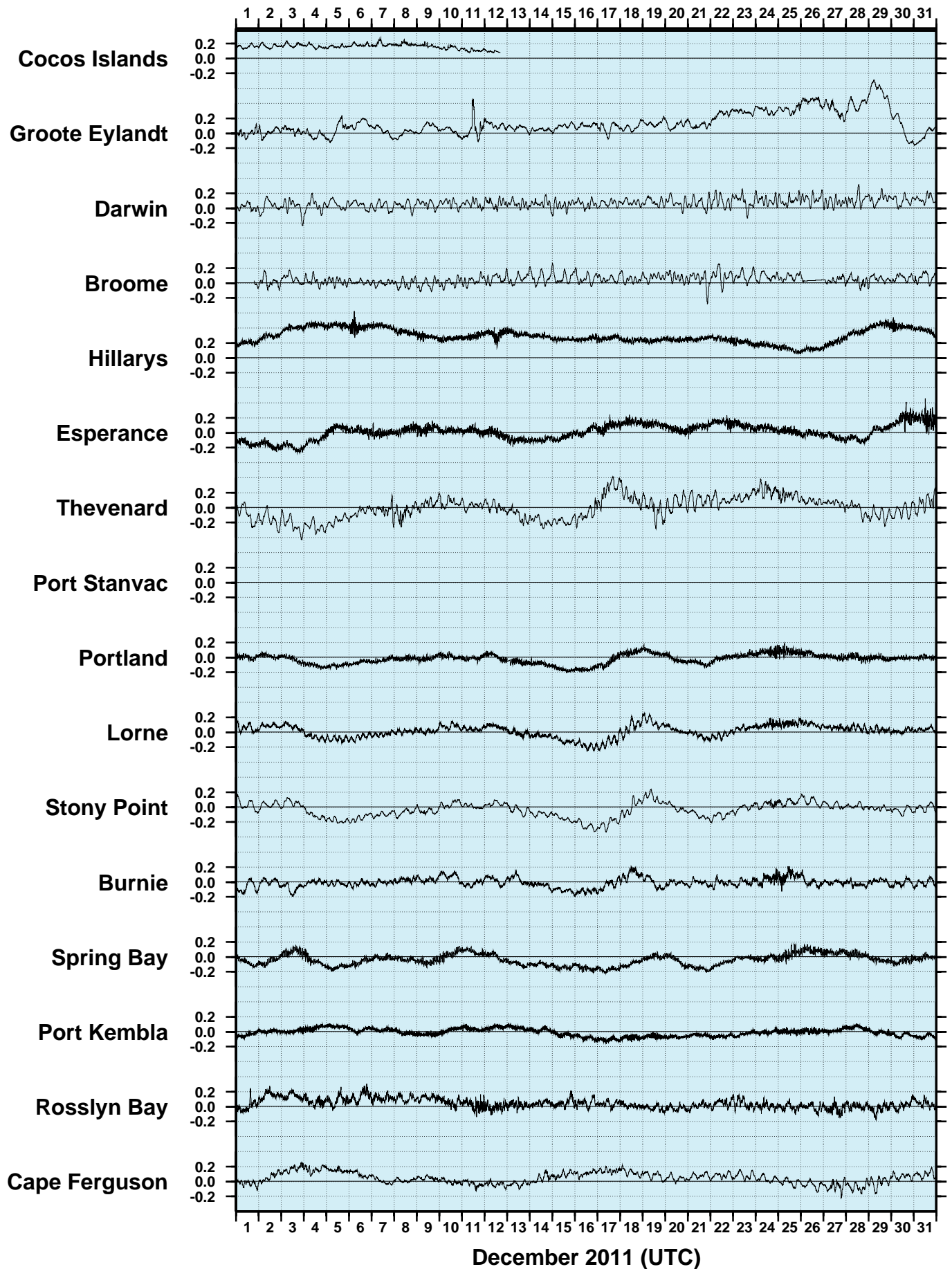


Figure 3
DECEMBER 2011
SIX MINUTE RESIDUALS
ADJUSTED FOR ATMOSPHERIC PRESSURE (m)

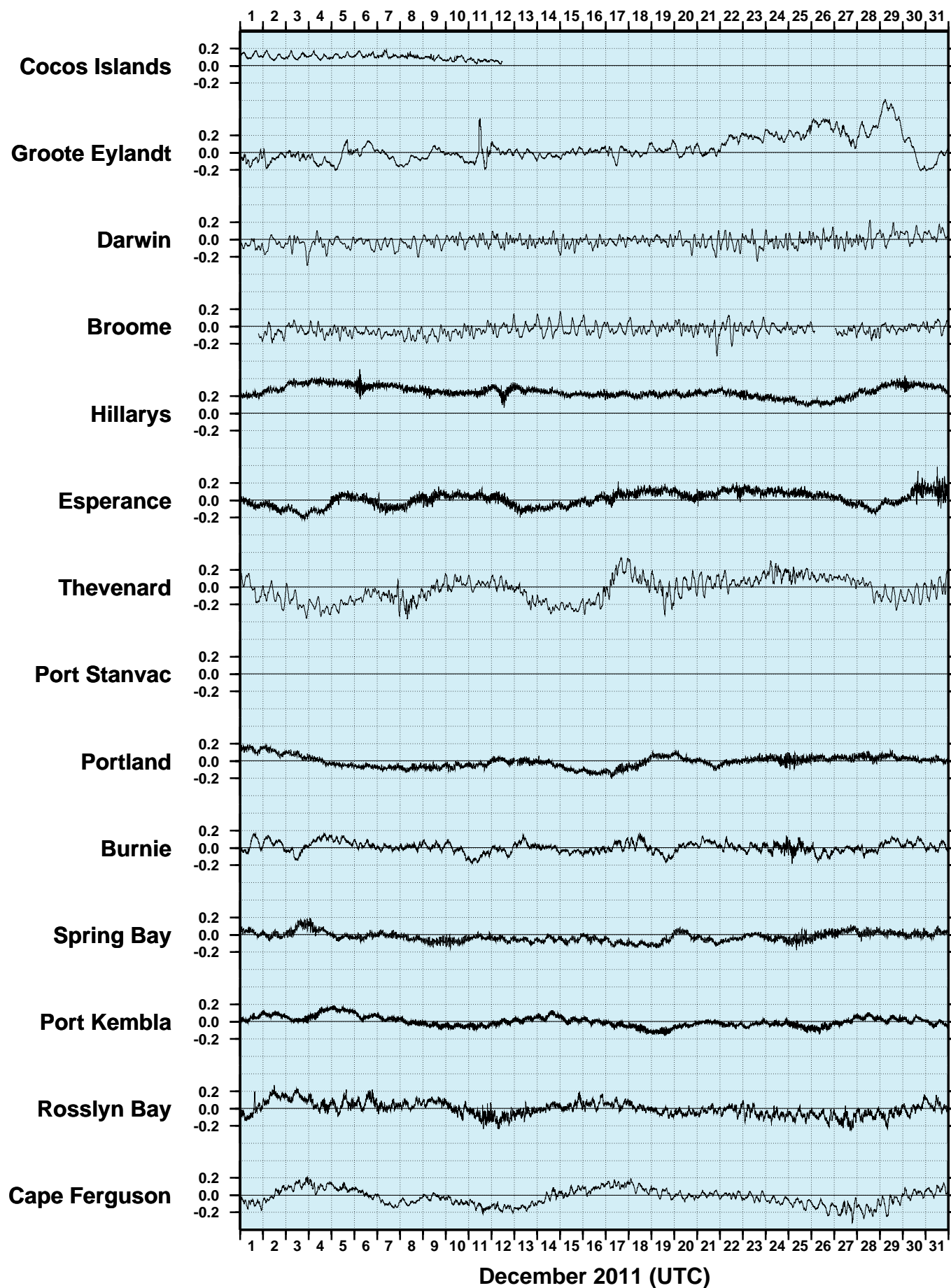


Figure 4

**DECEMBER 2011
HOURLY WIND SPEEDS (m/s)**

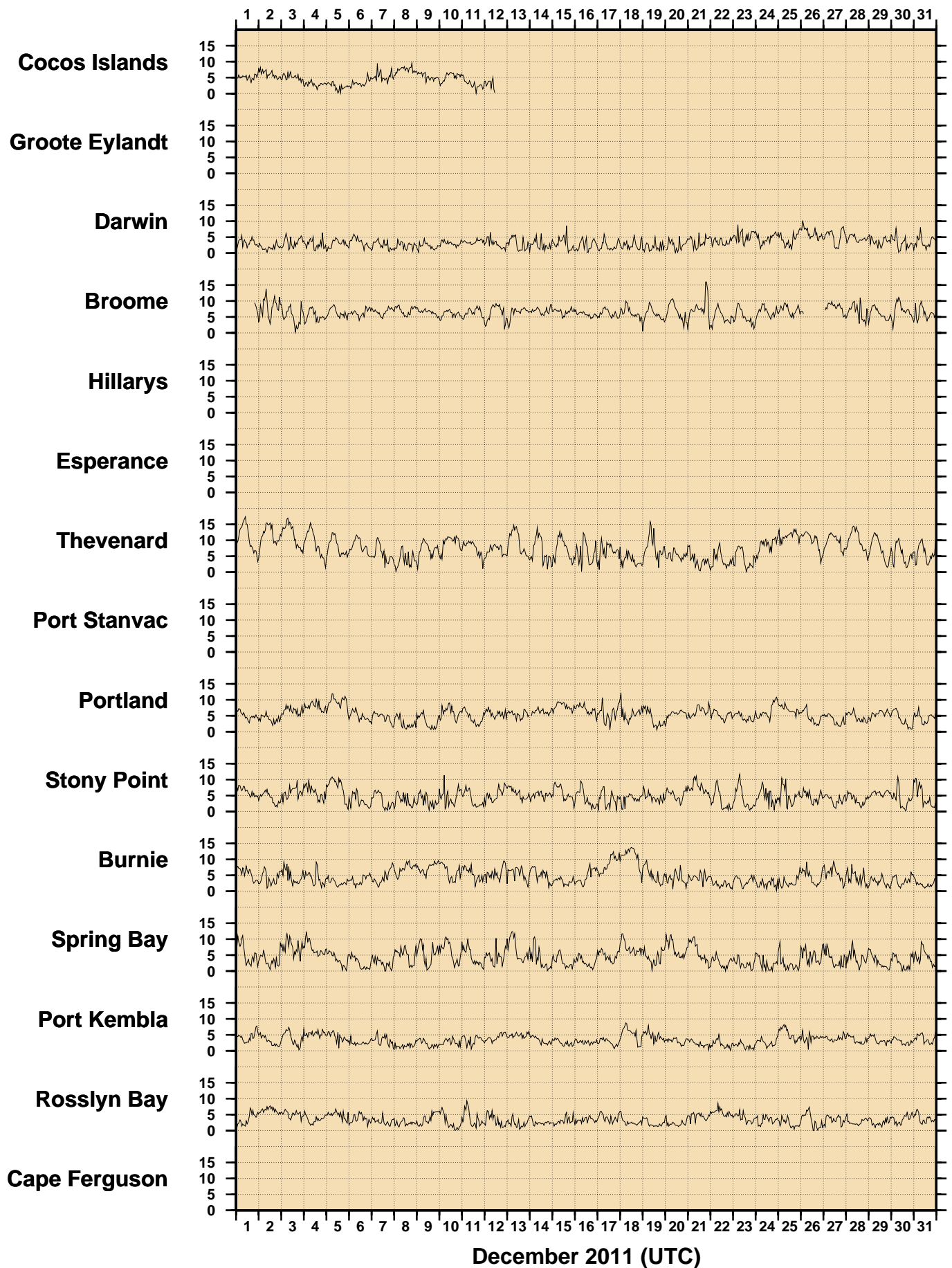


Figure 5

DECEMBER 2011
HOURLY INCIDENT WINDS (m/s, deg True)

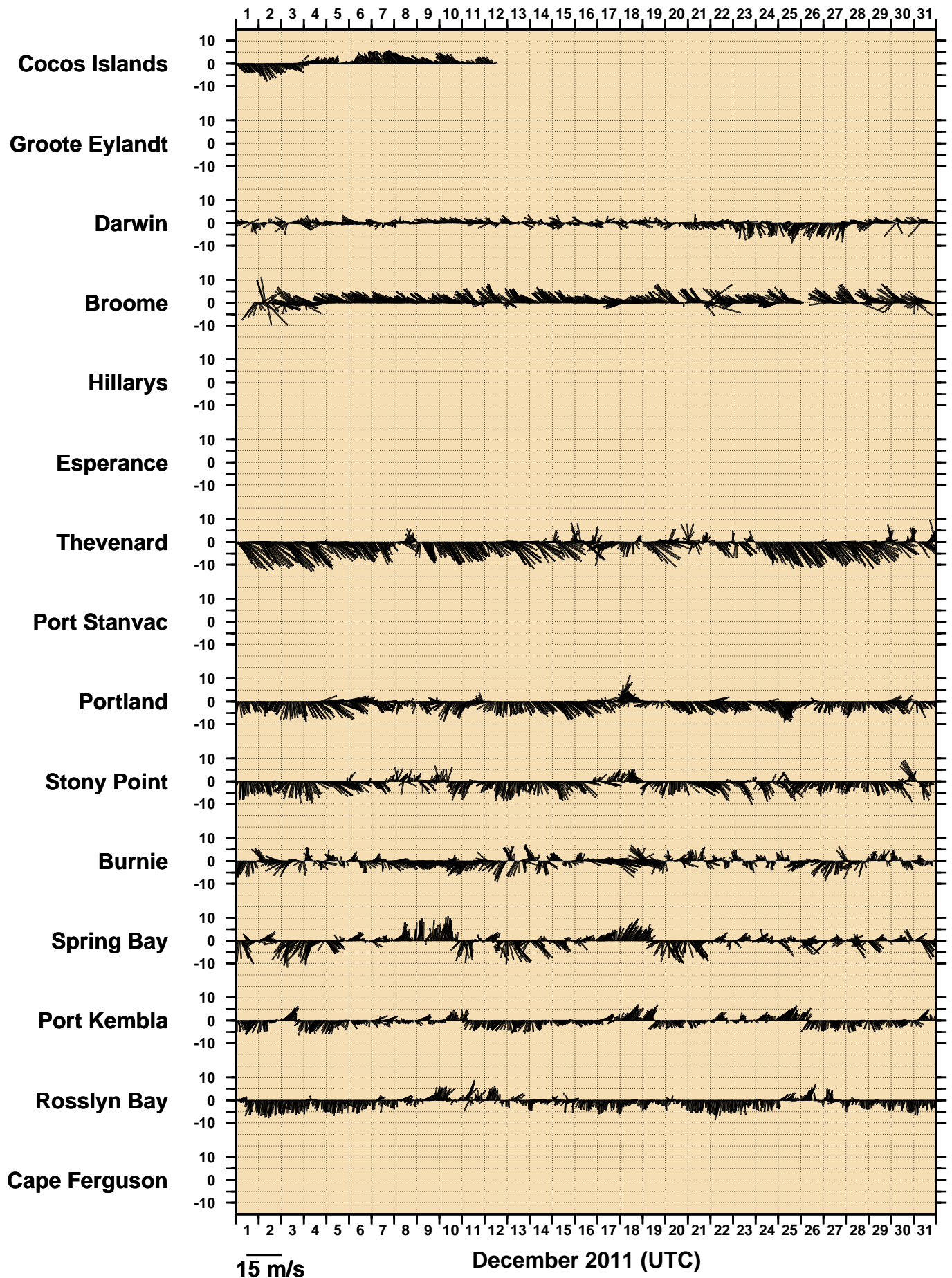


Figure 6

DECEMBER 2011
HOURLY MAXIMUM WIND GUSTS (m/s)

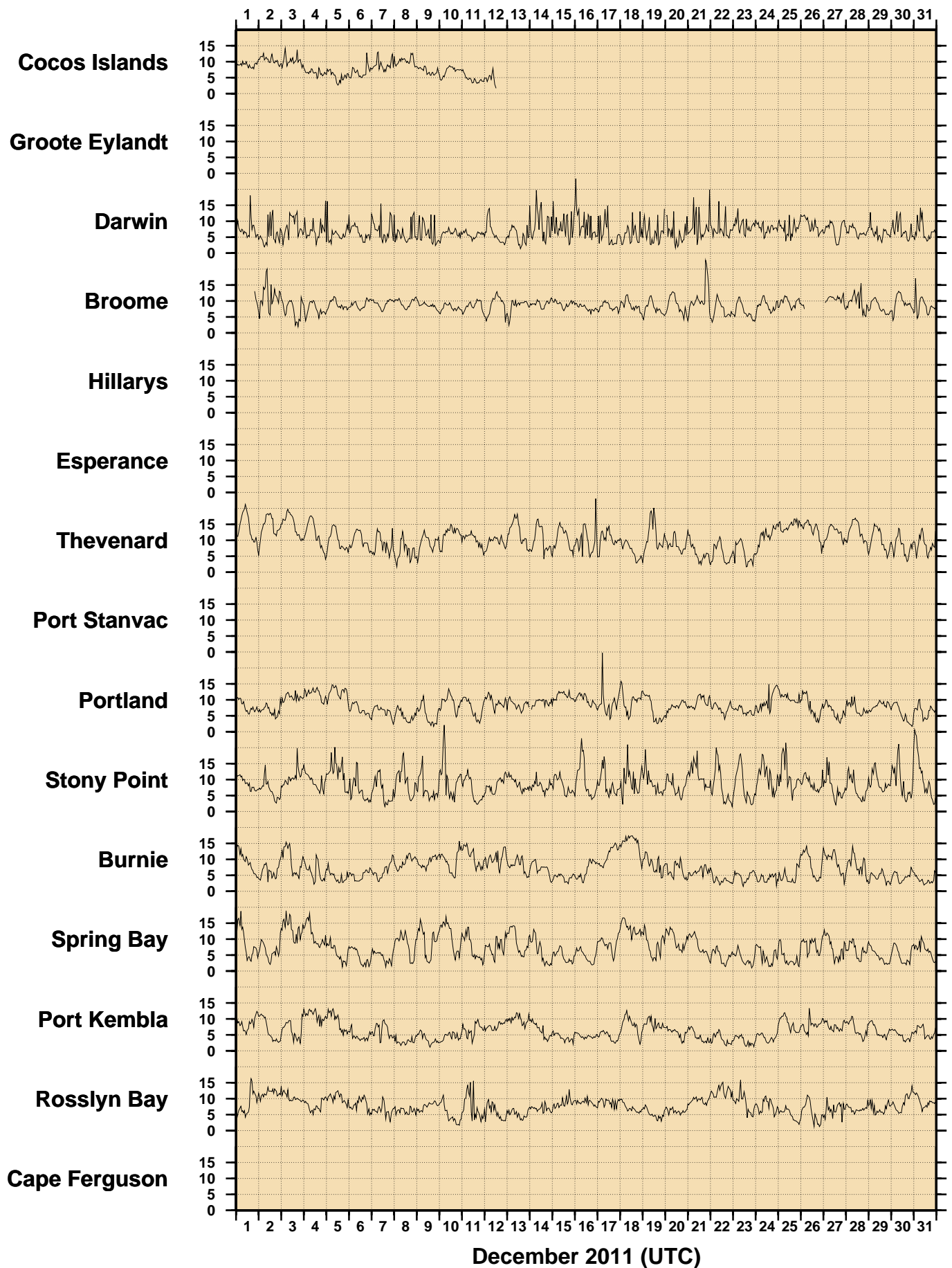


Figure 7

DECEMBER 2011
HOURLY AIR TEMPERATURES (°C)

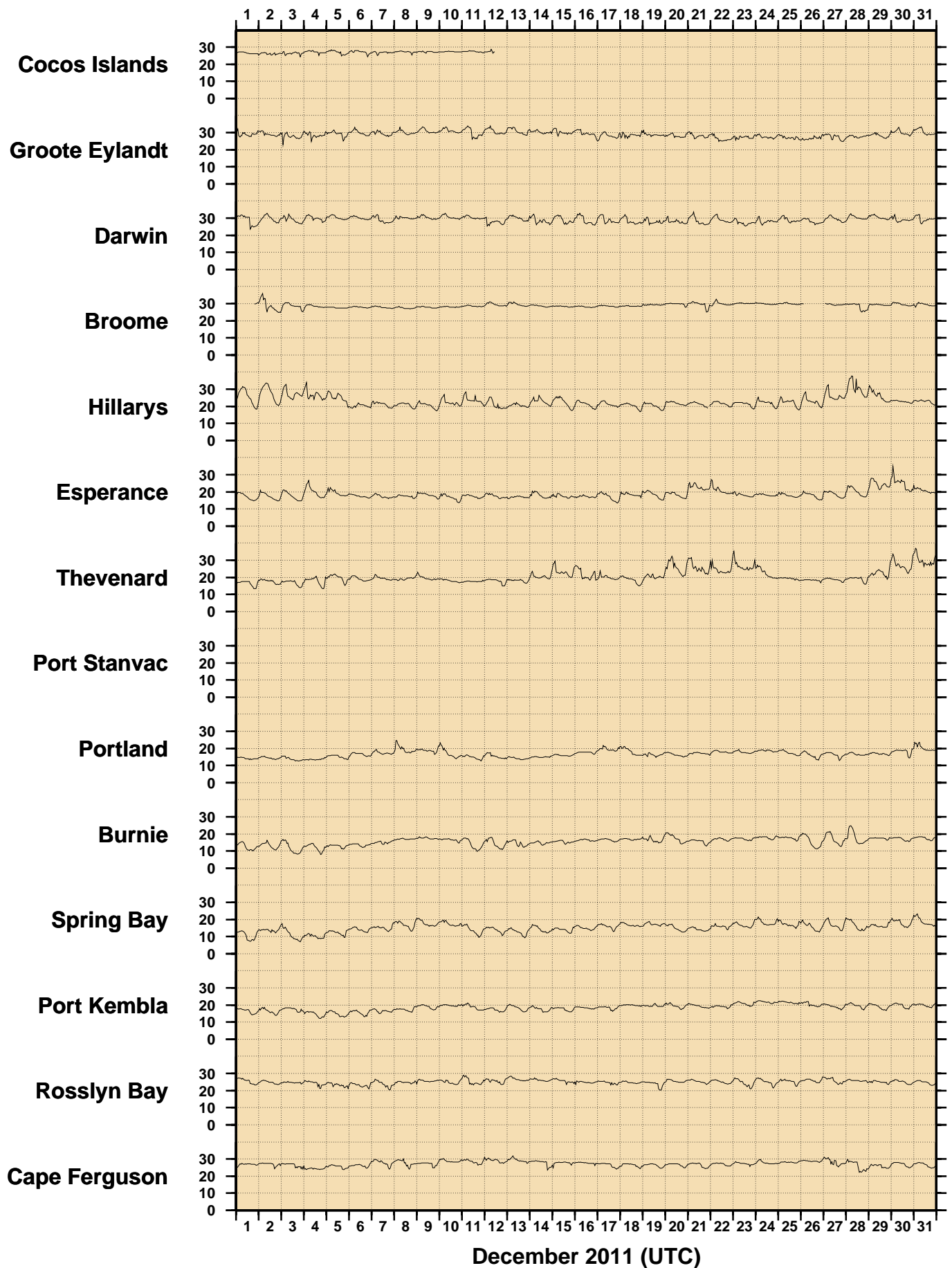


Figure 8

DECEMBER 2011
HOURLY WATER TEMPERATURES (°C)

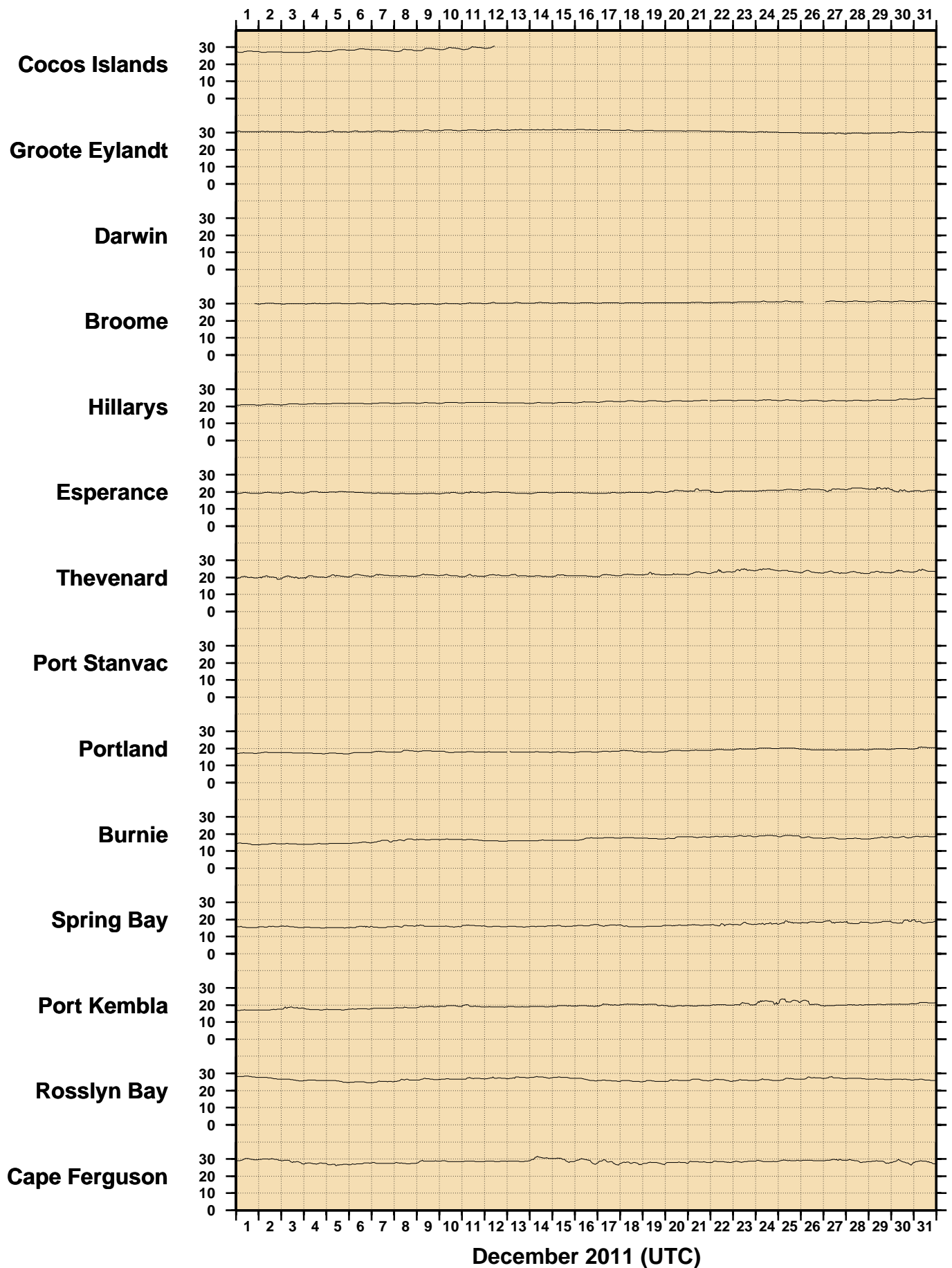


Figure 9

DECEMBER 2011
HOURLY ATMOSPHERIC PRESSURE (hPa)

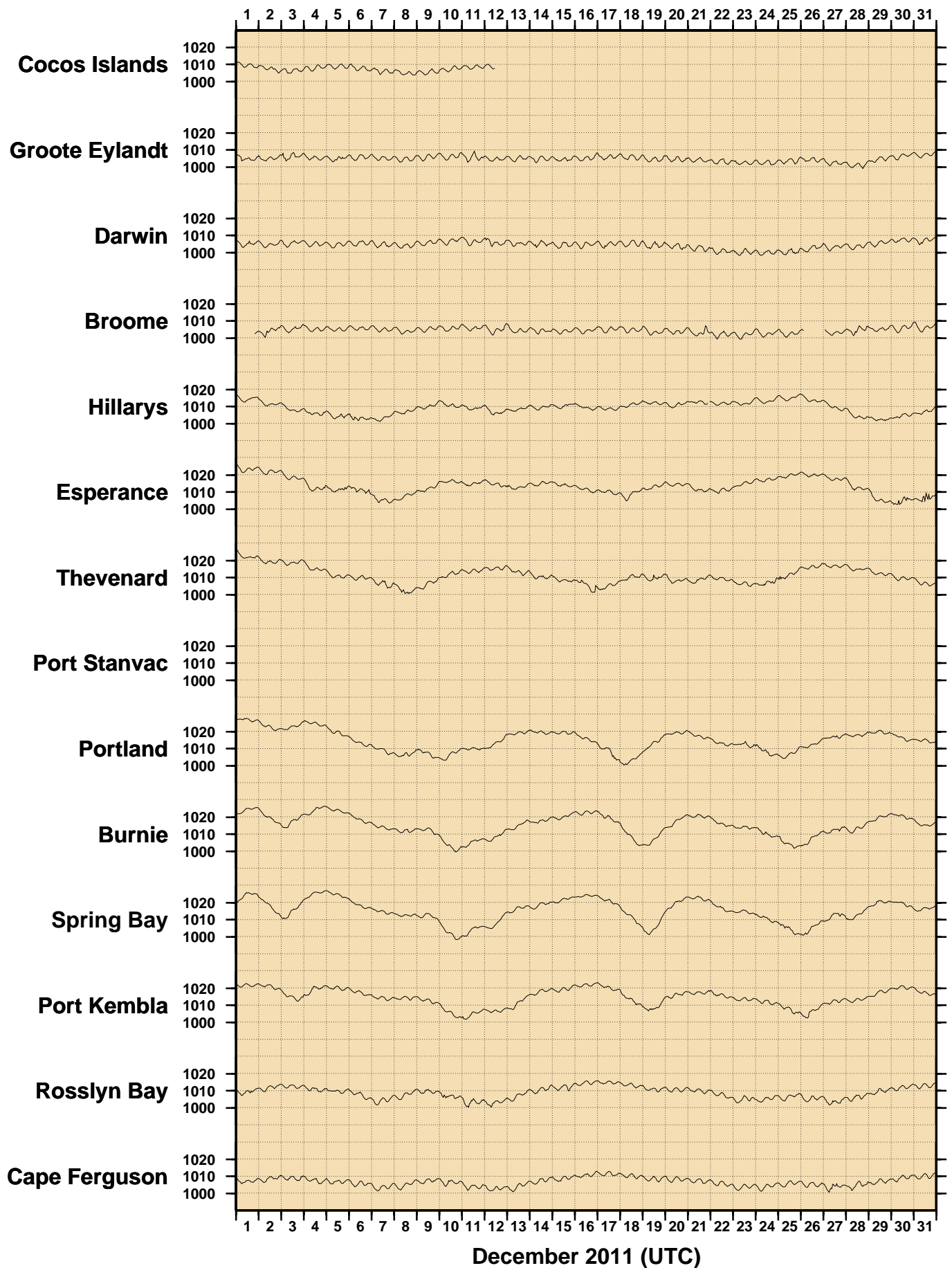
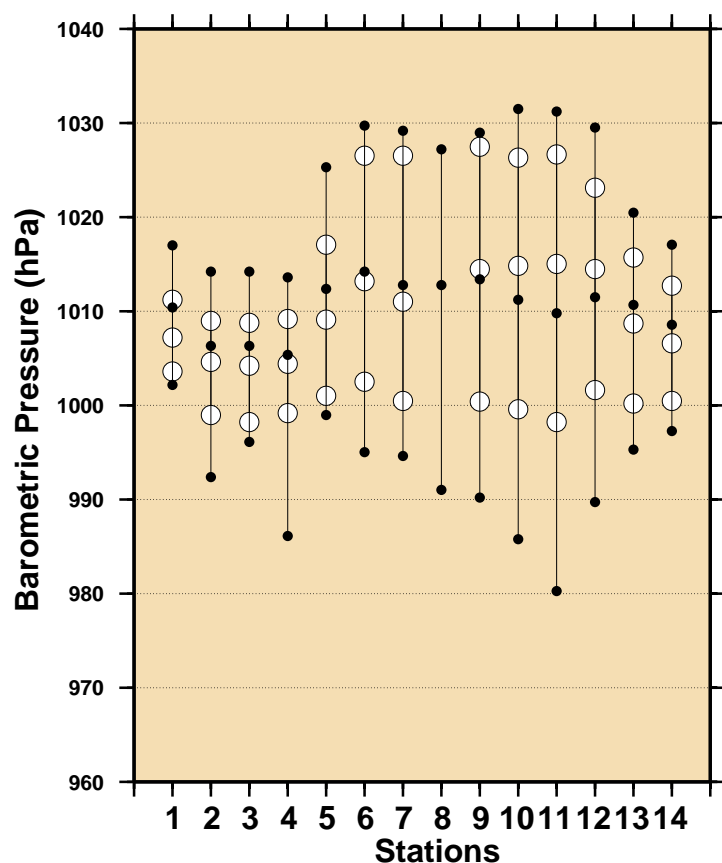
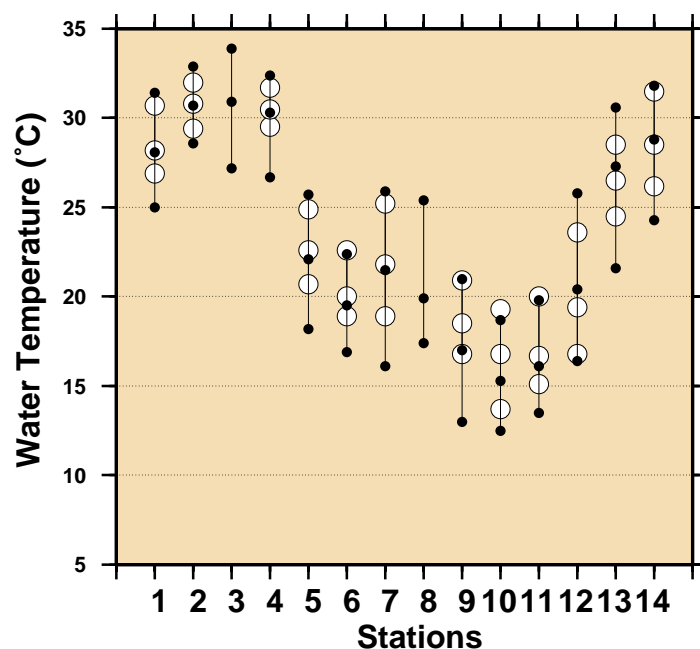
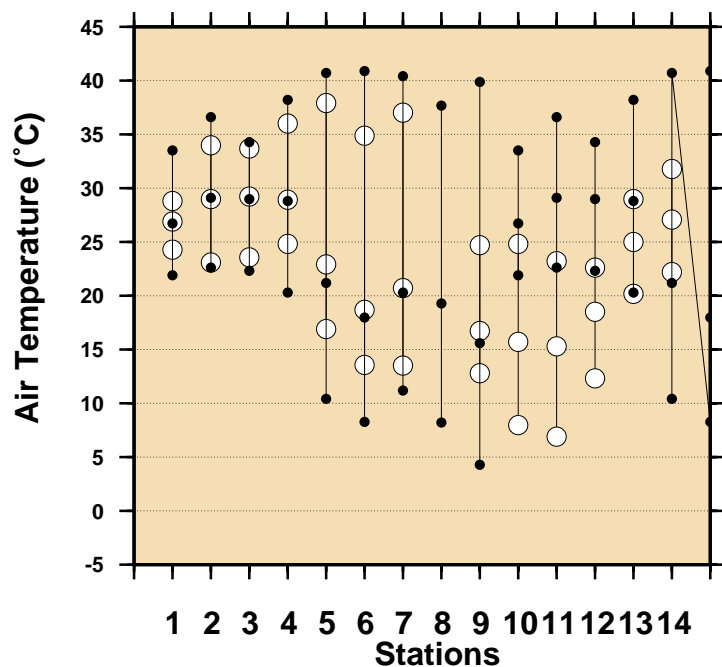


Figure 10
Comparison of December 2011 Max, Min & Mean with
Long Term December Values.



Stations

- 1 - Cocos Islands
- 2 - Groote Eylandt
- 3 - Darwin
- 4 - Broome
- 5 - Hillarys
- 6 - Esperance
- 7 - Thevenard
- 8 - Port Stanvac
- 9 - Portland
- 10 - Burnie
- 11 - Spring Bay
- 12 - Port Kembla
- 13 - Rosslyn Bay
- 14 - Cape Ferguson

- December 2011 Maximum
- December 2011 Mean
- December 2011 Minimum
- Long Term December Maximum
- Long Term December Mean
- Long Term December Minimum

Figure 11

MONTHLY MEAN SEA LEVELS TO DECEMBER 2011 (m)

The zero line represents an arbitrary fixed offset from the zero of the tide gauge.

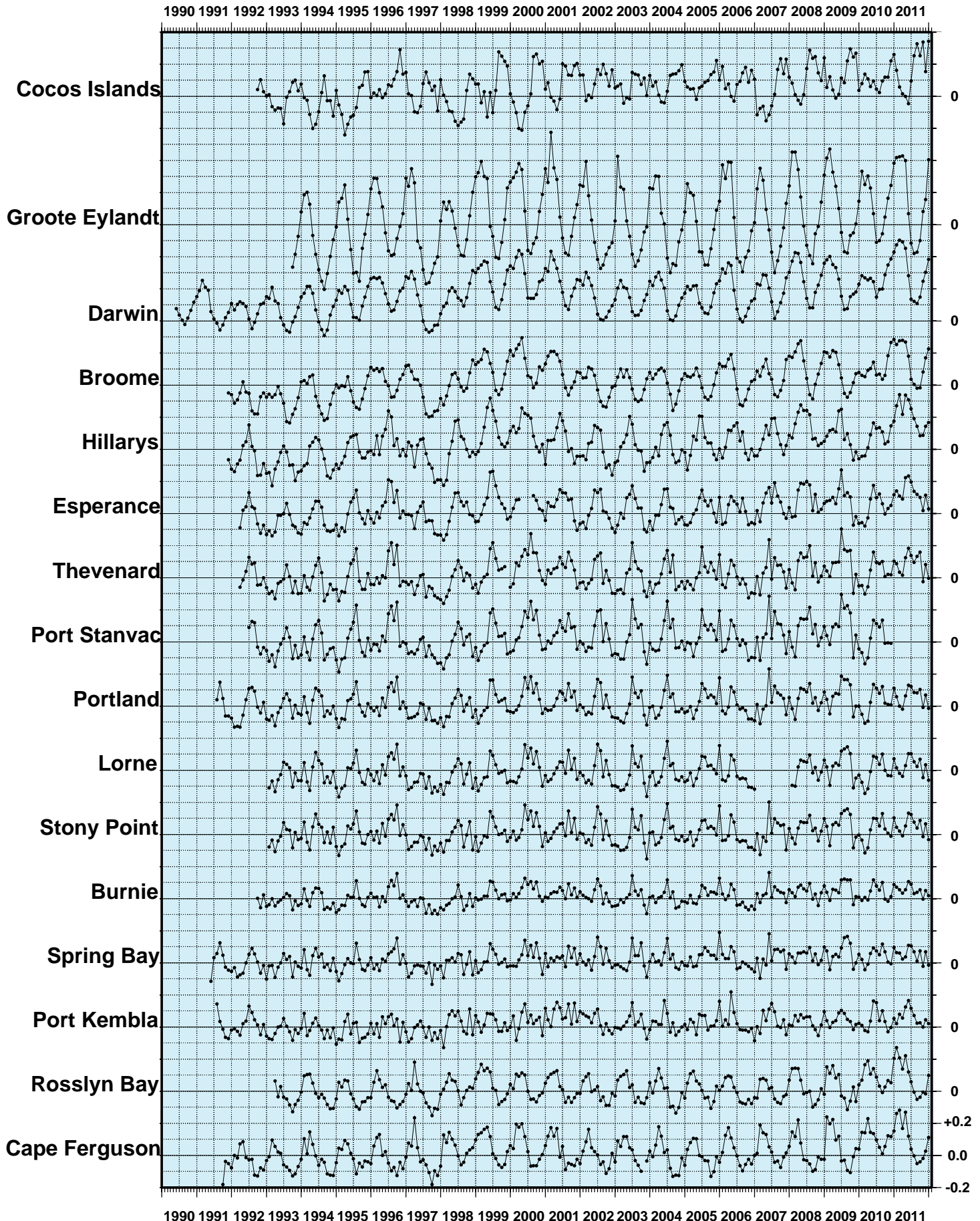


Figure 12
SEA LEVEL ANOMALIES THROUGH DECEMBER 2011 (m)

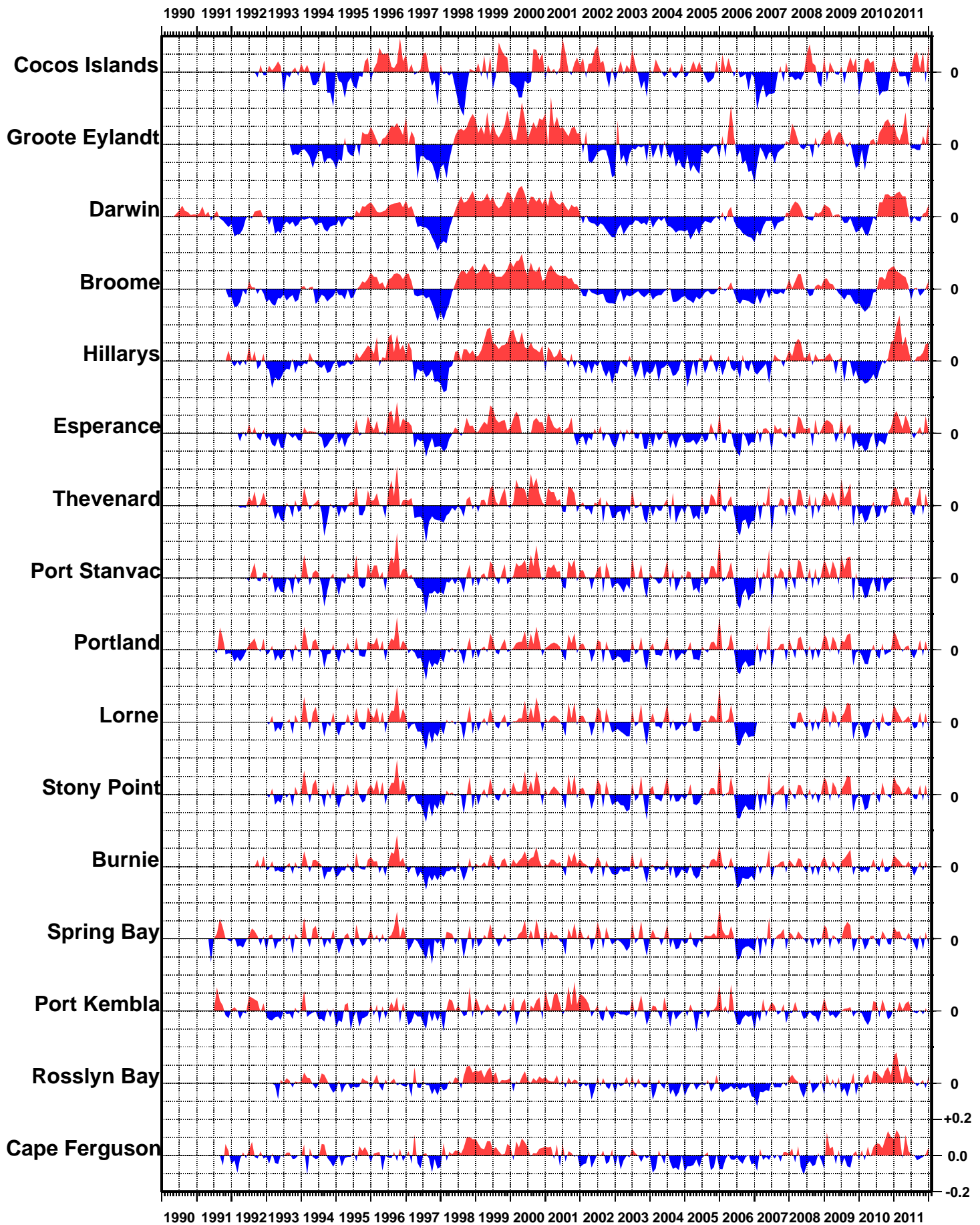


Figure 13

SEA LEVEL TRENDS THROUGH DECEMBER 2011 (mm/year)

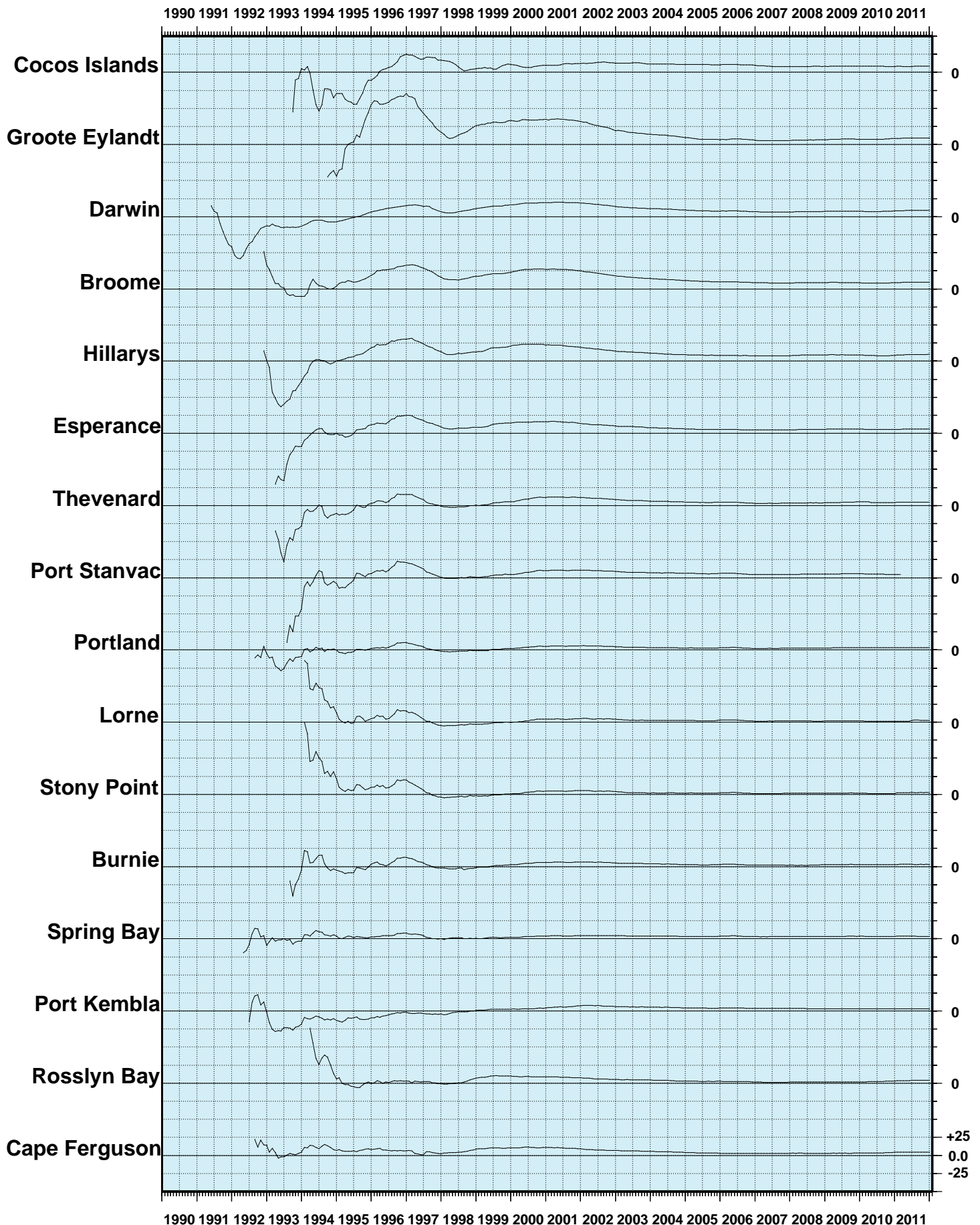


Figure 14

BAROMETRIC PRESSURE ANOMALIES THROUGH DECEMBER 2011 (hPa)

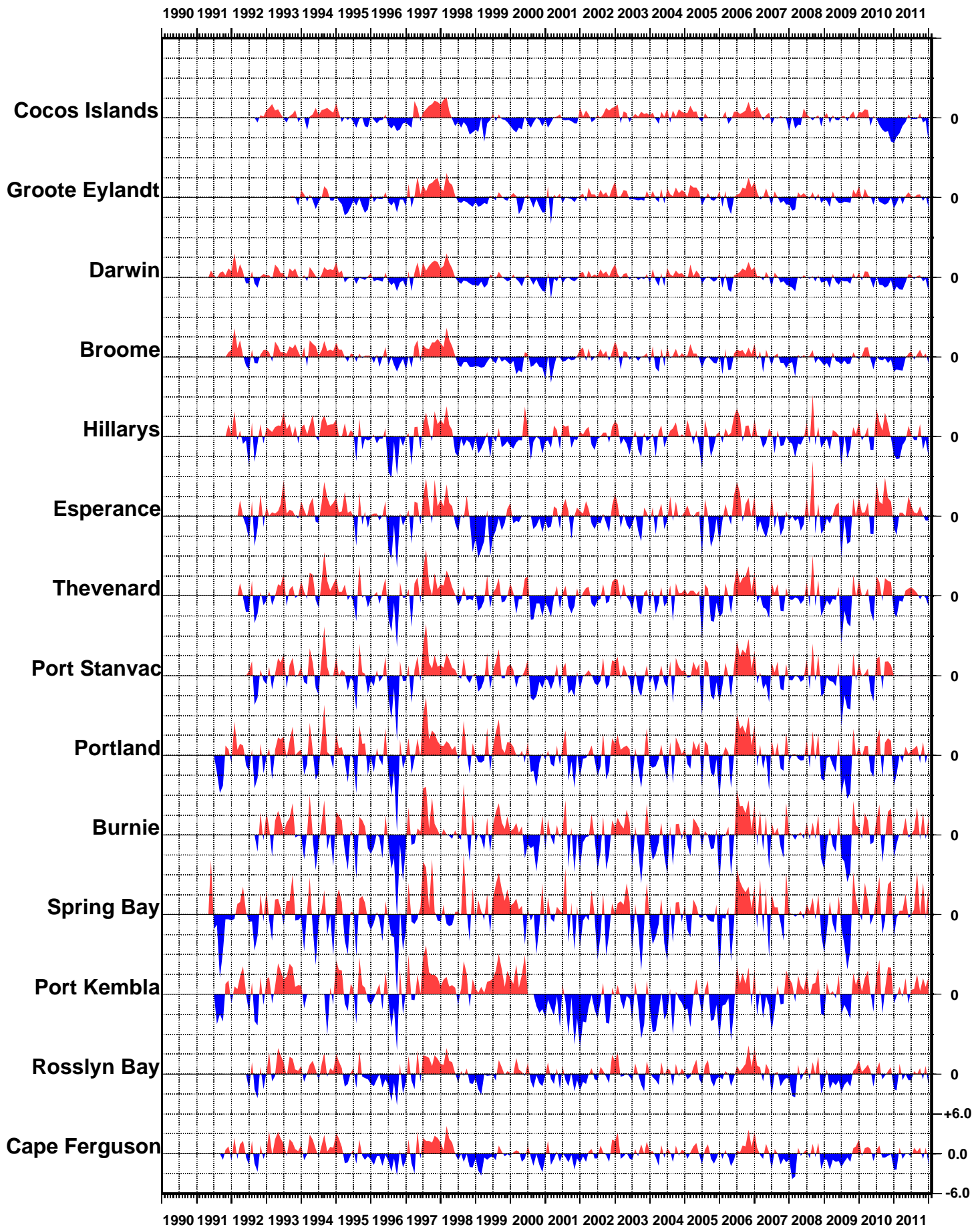


Figure 15

WATER TEMPERATURE ANOMALIES THROUGH DECEMBER 2011 (°C)

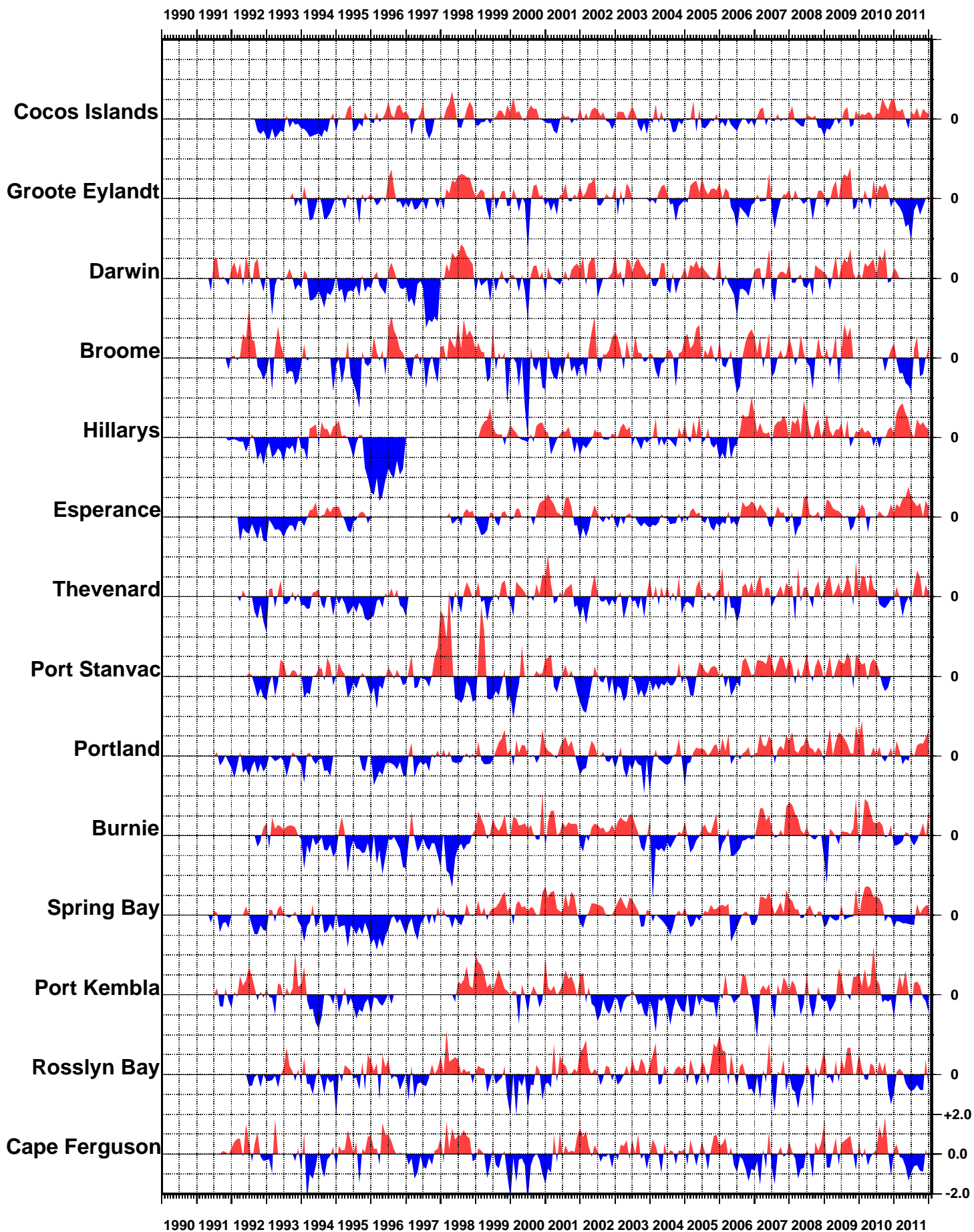


Figure 16

AIR TEMPERATURE ANOMALIES THROUGH DECEMBER 2011 (°C)

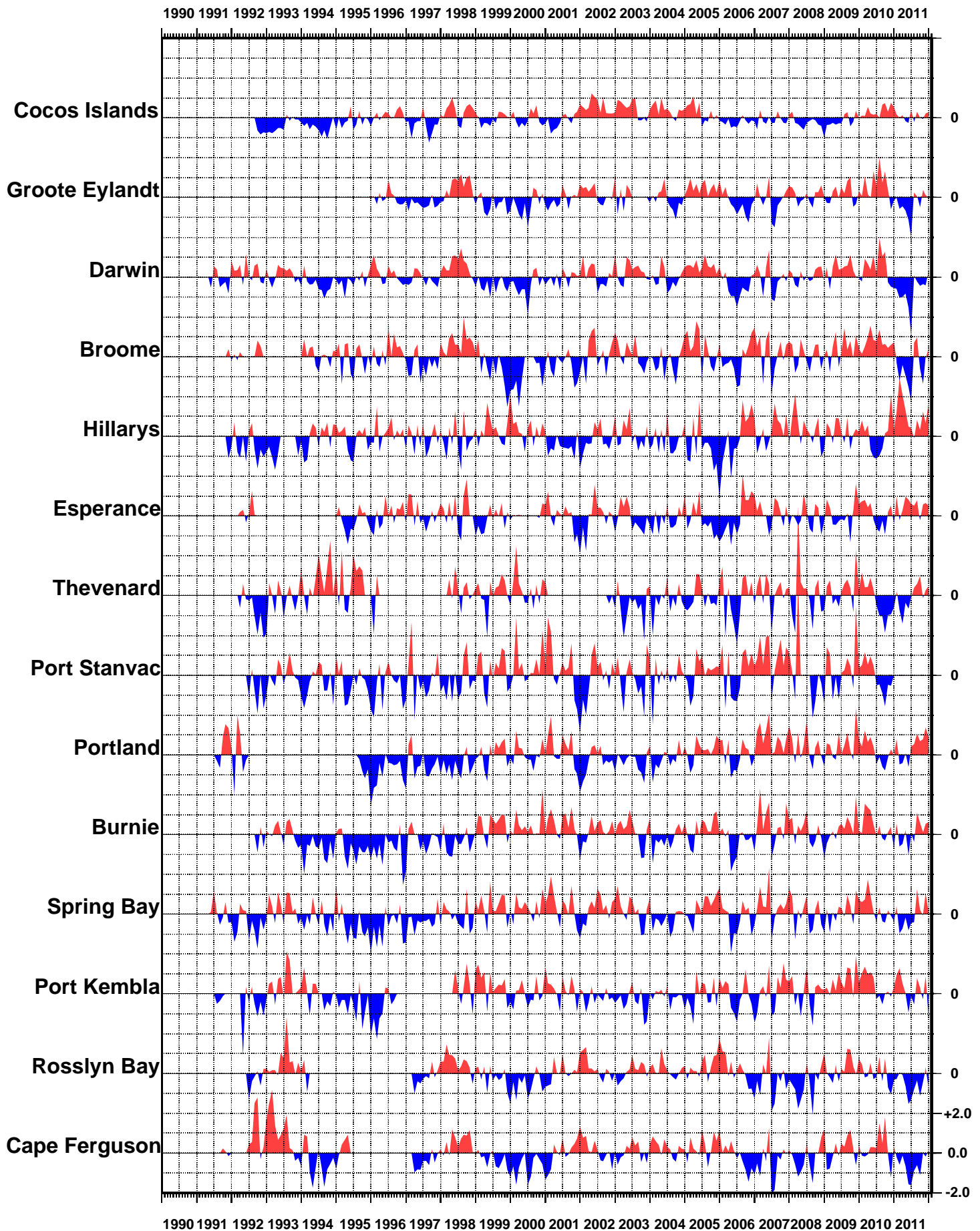


Figure 17 SEA LEVEL DATA RETURN

THE NUMBER OF DAYS OF MISSING DATA ARE INDICATED
GAPS INCLUDE TRANSMISSION, POWER AND LOGGER FAILURE

* Patchy record

