

**THE AUSTRALIAN BASELINE SEA LEVEL  
MONITORING PROJECT**

**MONTHLY DATA REPORT**

**APRIL 2011**



**Australian Government**

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**Bureau of Meteorology**

This report was prepared under the Australian Climate Change Science Program for the Department of Climate Change and Energy Efficiency, supported by the National Tidal Centre, Bureau of Meteorology.



**Australian Government**

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**Bureau of Meteorology**

**National Tidal Centre  
Bureau of Meteorology  
Australia**

GPO Box 421  
Kent Town, SA 5071  
Australia

Tel: (+618) 8366 2730  
Fax: (+618) 8366 2651  
Website: <http://www.bom.gov.au/oceanography/>

**Quality Certification:**

I authorise the issue of this Australian Baseline Sea Level Monitoring Project Monthly Data Report for April 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**

**APRIL 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 APRIL 2011**

Sea level data return (Figures 1 and 17) was good for most operative stations during April 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 17 hours of Broome sea level and ancillary data during April. Intermittent noise on the Stony Point telephone line, along with a power failure on the 30<sup>th</sup>, resulted in the loss of 21 hours of data. Some data were recovered from the near real-time data feed to the port office. The Stony Point wind data have been removed while suspect high wind speeds and gusts are investigated further. Wind data received from the Groote Eylandt and Spring Bay stations indicate instrument failure and the entire month's wind data for both locations have been removed from the records. Erroneous Burnie wind speed data from the 14<sup>th</sup> to the 26<sup>th</sup> of April have been excised from the wind record. No water temperatures have been recorded for Darwin since the water temperature sensor failed in January.

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 (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 April 2011 with the long-term values. Note that the long-term ranges are calculated using the previous sets of April data for each station **excluding** the current month of data.

A new minimum April air temperature was established at Broome (20.8°C) this month. New maximum April water temperatures were recorded at Hillarys (23.8°C) and Esperance (21.5°C) whilst the April 2011 barometric pressures for all stations fell within the long-term April minimums and maximums.

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.

In April 2011 positive sea level anomalies (Figure 12) near or greater than 10cm were observed at Groote Eylandt, Darwin, Broome, Hillarys, Esperance, Rosslyn Bay and Cape Ferguson. Near zero anomalies were observed at all other locations.

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.

Barometric pressure anomalies (Figure 14) greater than 2 hPa were observed at Burnie, Spring Bay and Port Kembla but they were near zero for all other locations during April 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 April 2011 positive water temperature anomalies near or greater than 1°C were observed at Hillarys, Esperance and Port Kembla whilst negative anomalies below -1°C were observed at Groote Eylandt and Broome. A positive air temperature anomaly greater than 1°C was observed at Hillarys whilst negative anomalies less than -0.5°C were observed at Groote Eylandt, Darwin, Broome, Thevenard, Rosslyn Bay and Cape Ferguson.

The number of hits to the Australian Baseline Sea Level Monitoring Project (ABSLMP) web pages from January 2008 to April 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*

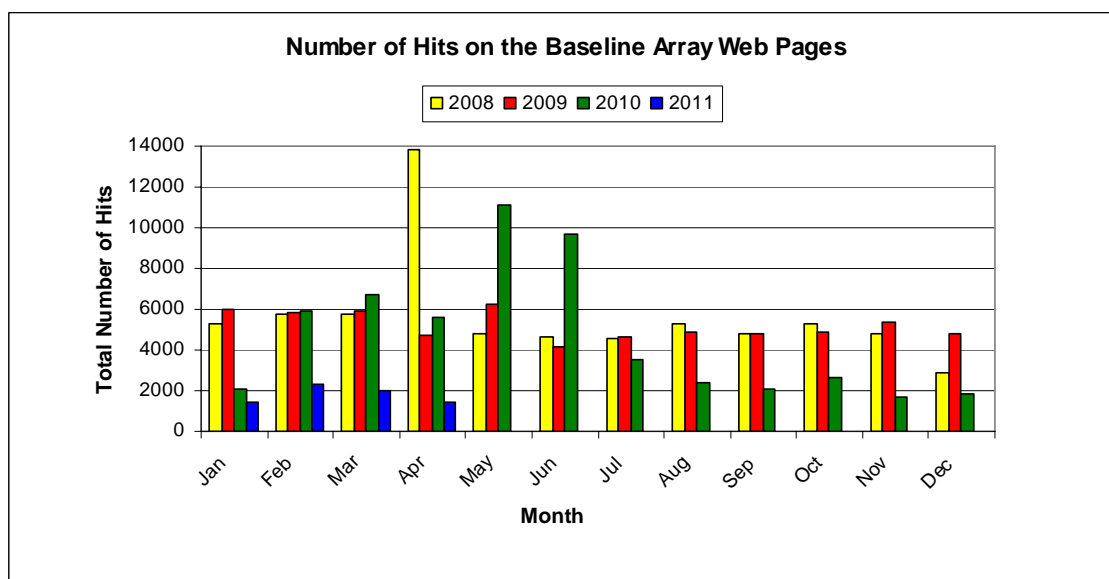
and 16. The tide gauge at Lorne does not record wind data and is not present in Figures 4, 5 and 6.

**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 April 2011.**

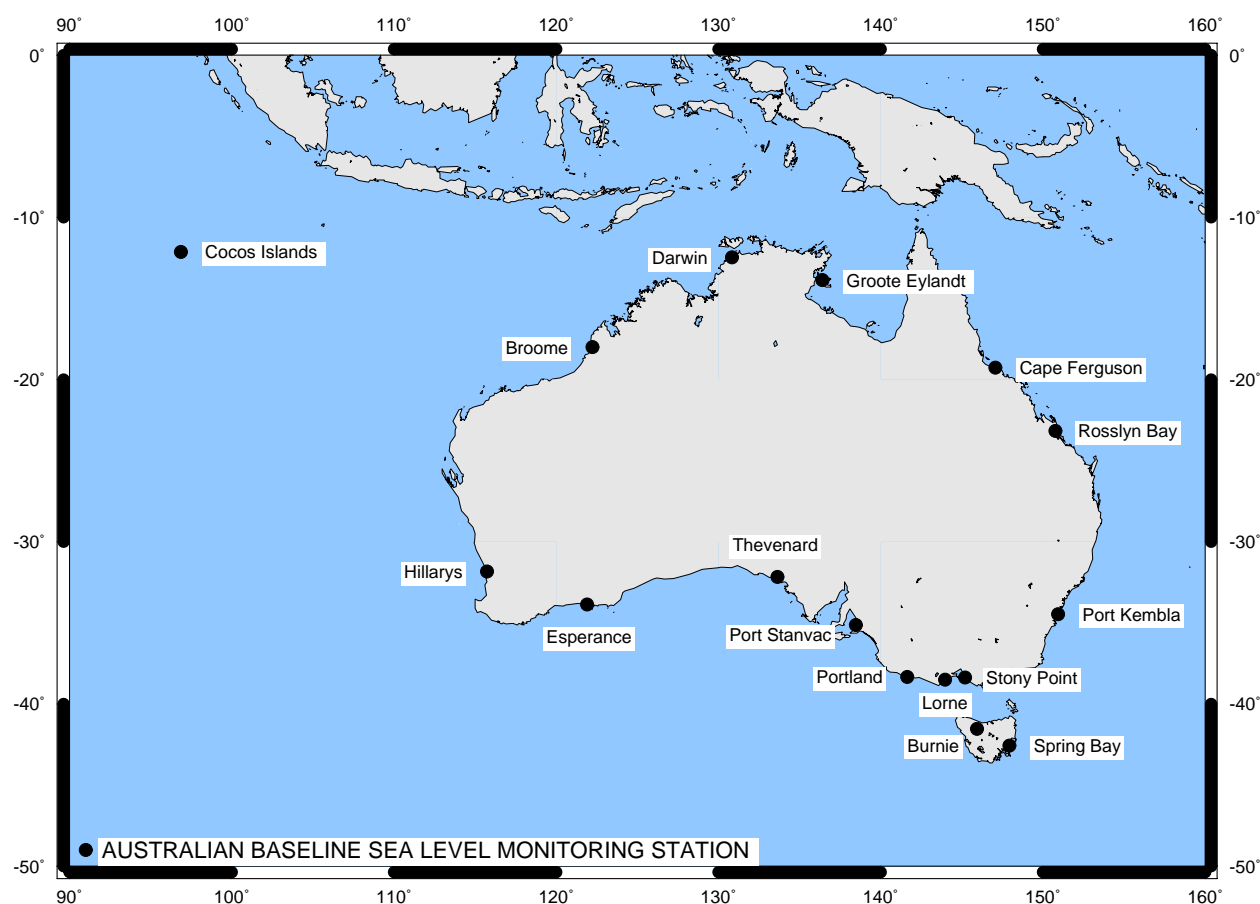
Recent short-term sea level trends in the project area based upon SEAFRAME data through April, 2011				
Location	Lat / Long	Installation Date	Trend (mm/yr)	Change from previous month
Cocos Islands	12°07'07.1"S / 96°53'30.9"E	Sep 1992	+8.2	0.0
Groote Eylandt	13°51'36.2"S / 136°24'56.1"E	Sep 1993	+9.0	+0.3
Darwin	12°28'18.4"S / 130°50'45.1"E	May 1990	+8.6	+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	+9.0	+0.2
Esperance	33°52'15.2"S / 121°53'43.3"E	Mar 1992	+5.9	+0.1
Thevenard	32°08'56.2"S / 133°38'28.8"E	Mar 1992	+4.5	+0.1
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	+1.4	0.0
Stony Point	38°22'19.7"S / 145°13'28.9"E	Jan 1993	+2.5	0.0
Burnie	41°03'0.3"S / 145°54'54.0"E	Sep 1992	+3.1	0.0
Spring Bay	42°32'45.1"S / 147°55'57.8"E	May 1991	+3.5	0.0
Port Kembla	34°28'25.5"S / 150°54'42.7"E	Jul 1991	+3.1	+0.1
Rosslyn Bay	23°09'39.7"S / 150°47'24.6"E	Jun 1992	+3.7	+0.2
Cape Ferguson	19°16'38.4"S / 147°03'30.4"E	Sep 1991	+4.7	+0.2

\*Port Stanvac decommissioned November 2010

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



**Figure B: Australian Baseline Sea Level Monitoring Project sites.**



The *Monthly Data Report* is prepared by the NTC, Bureau of Meteorology for the Department of Climate Change and Energy Efficiency. 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.

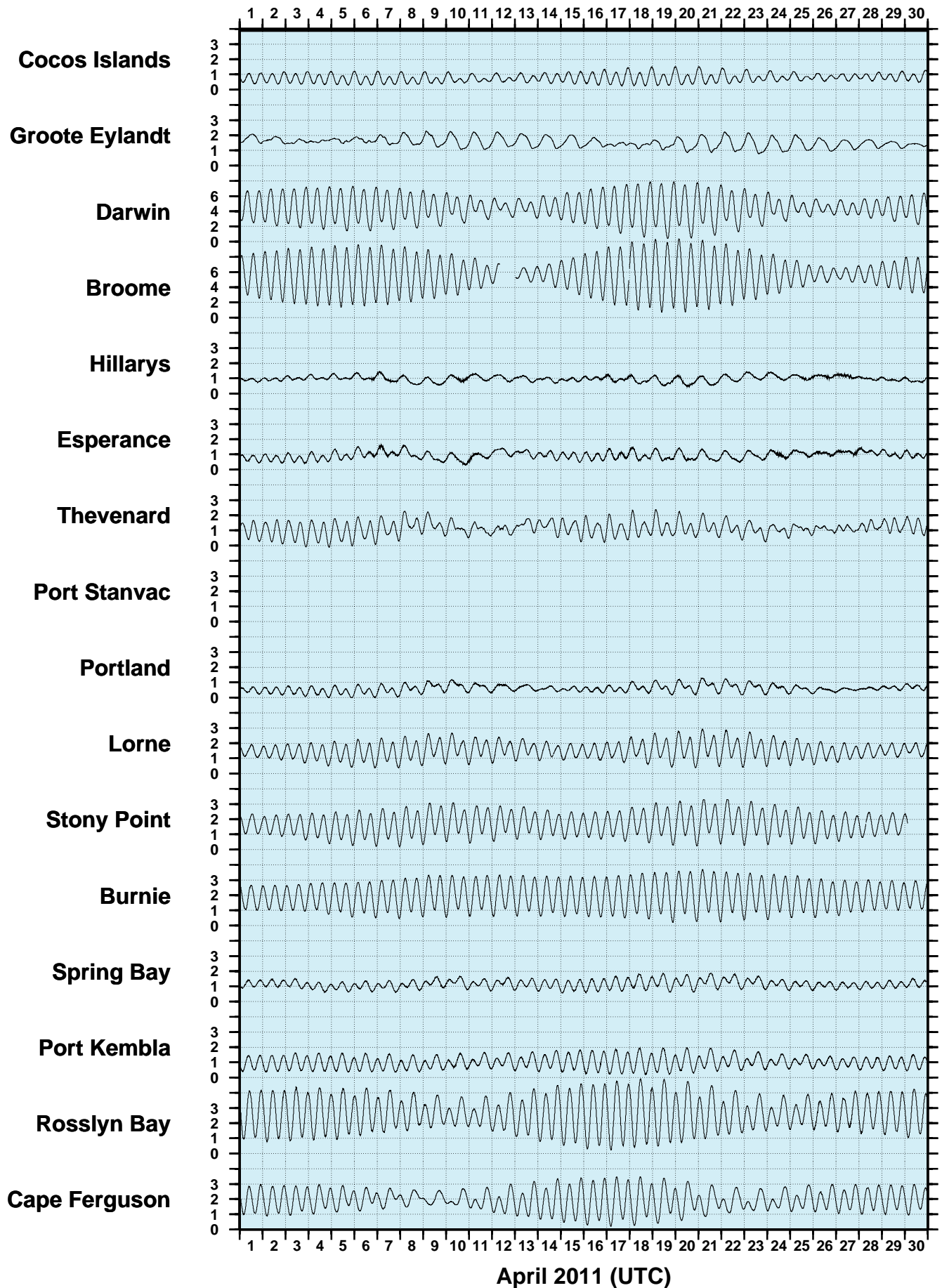
National Tidal Centre  
Bureau of Meteorology  
GPO BOX 421, Kent Town SA 5071  
Tel: [+61 8] 8366 2730  
Fax: [+61 8] 8366 2651  
Website: <http://www.bom.gov.au/oceanography/>

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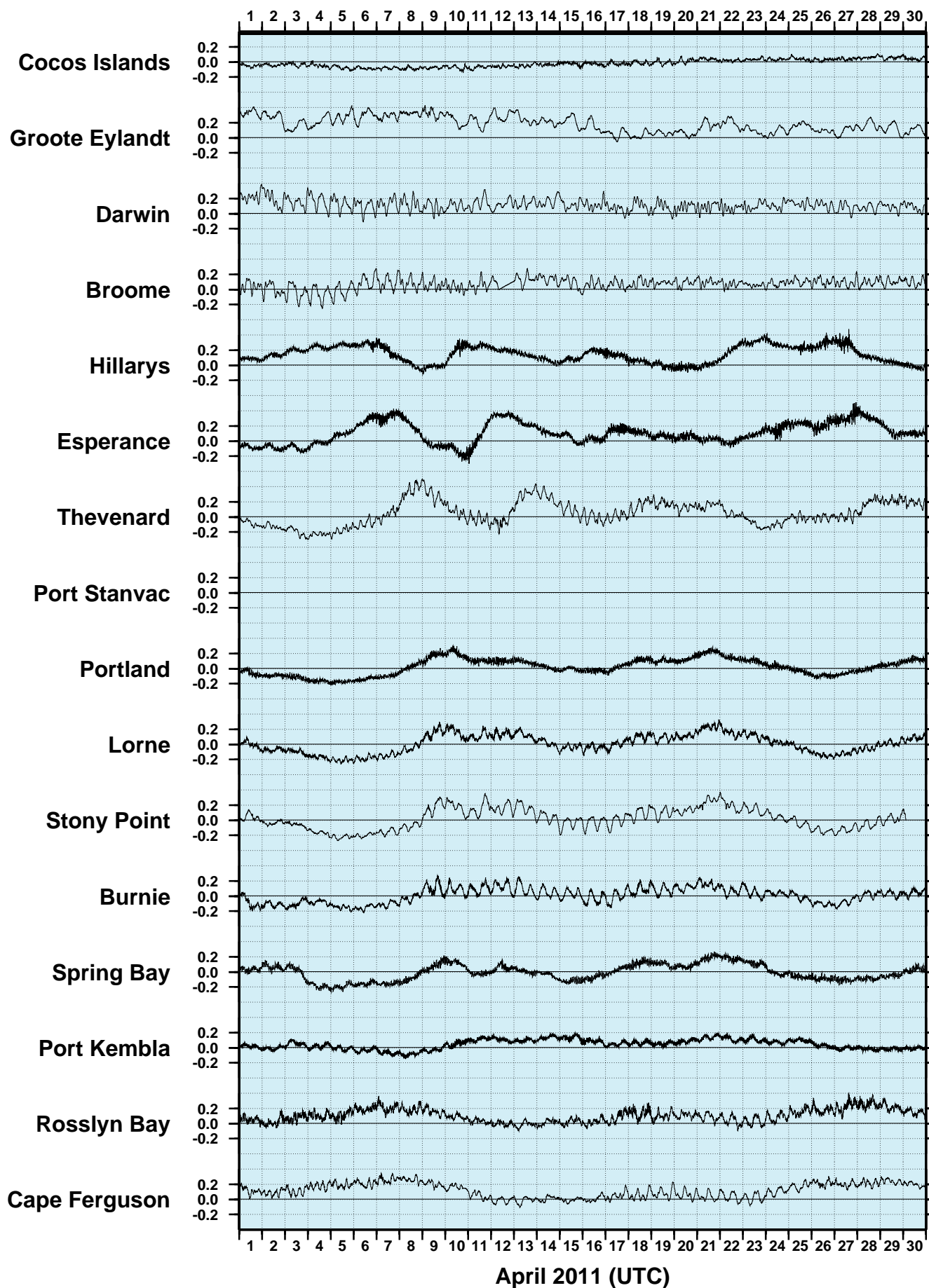
**Figure 1**

**APRIL 2011  
SIX MINUTE SEA LEVEL OBSERVATIONS (m)**





**Figure 2**  
**APRIL 2011**  
**SIX MINUTE RESIDUAL WATER LEVELS (m)**



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

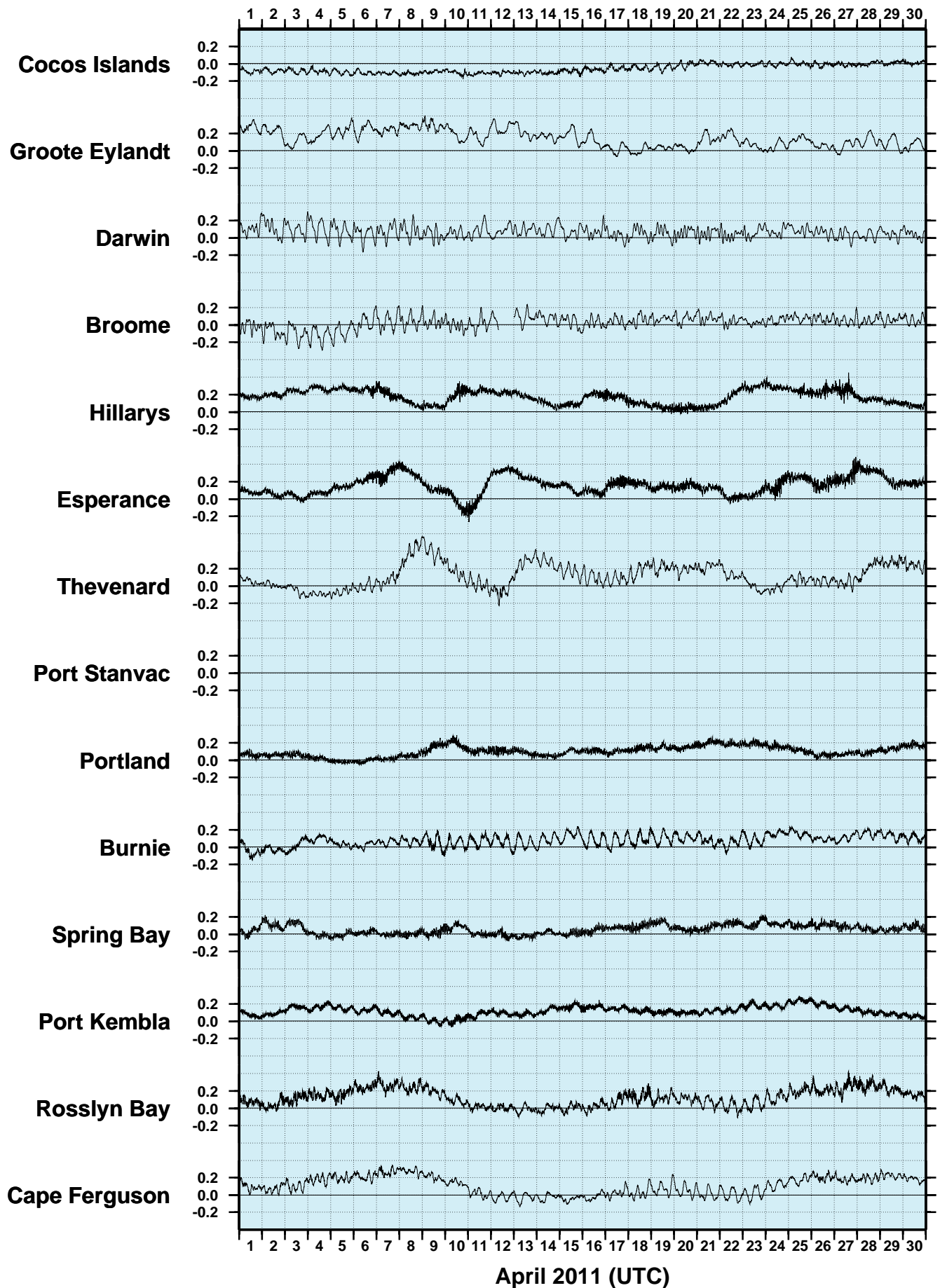


Figure 4

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

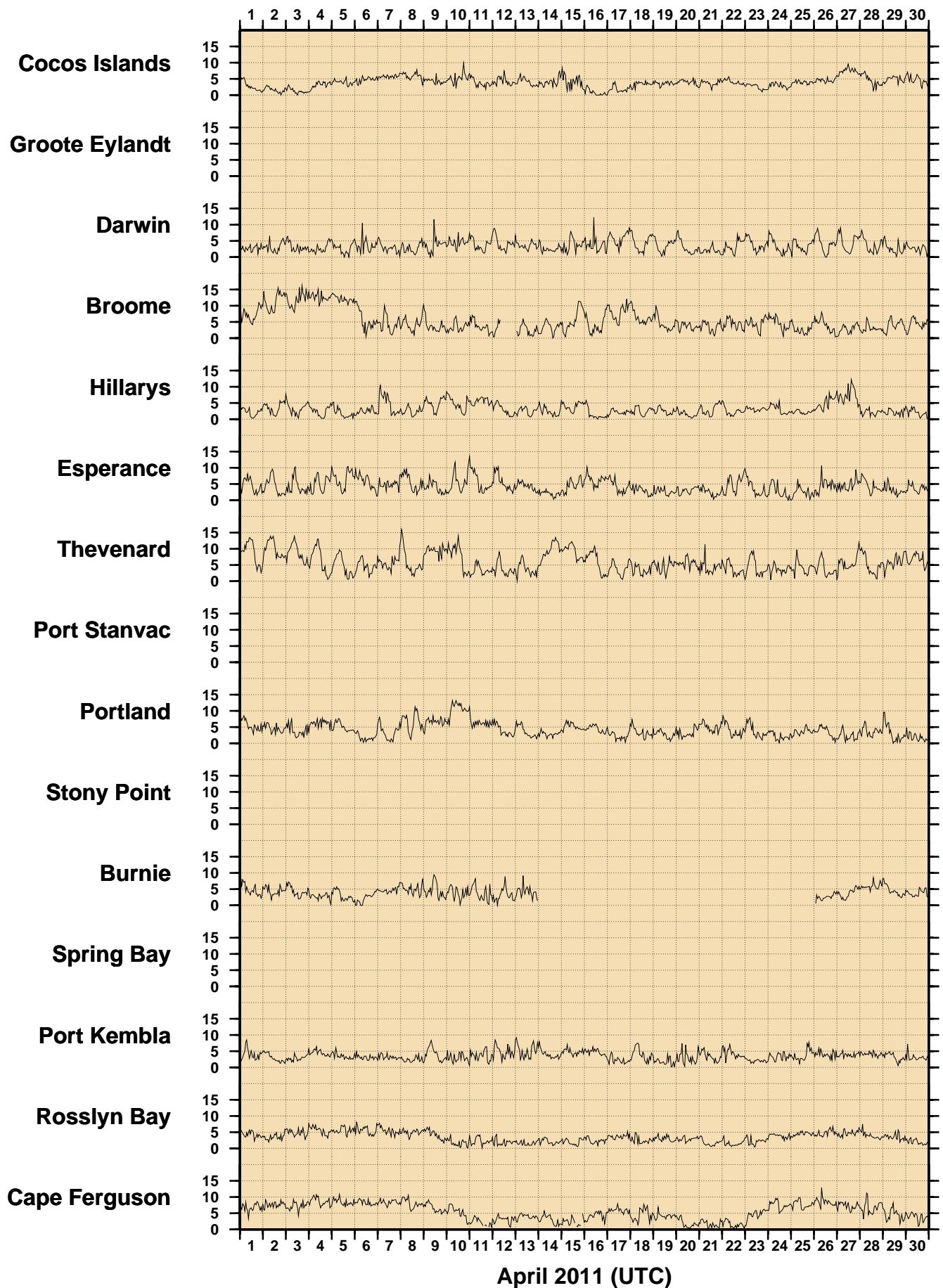


Figure 5

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

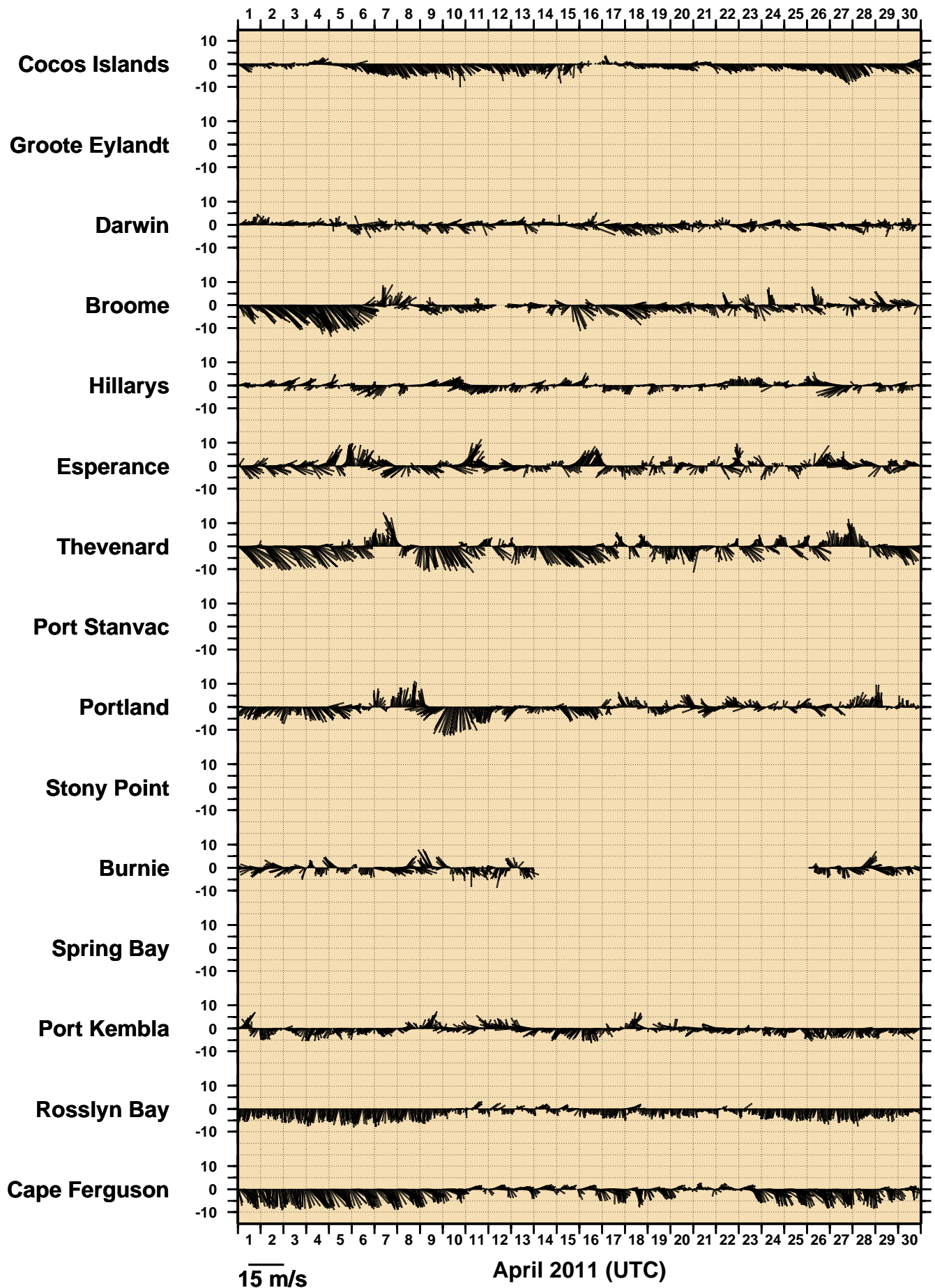


Figure 6

APRIL 2011  
HOURLY MAXIMUM WIND GUSTS (m/s)

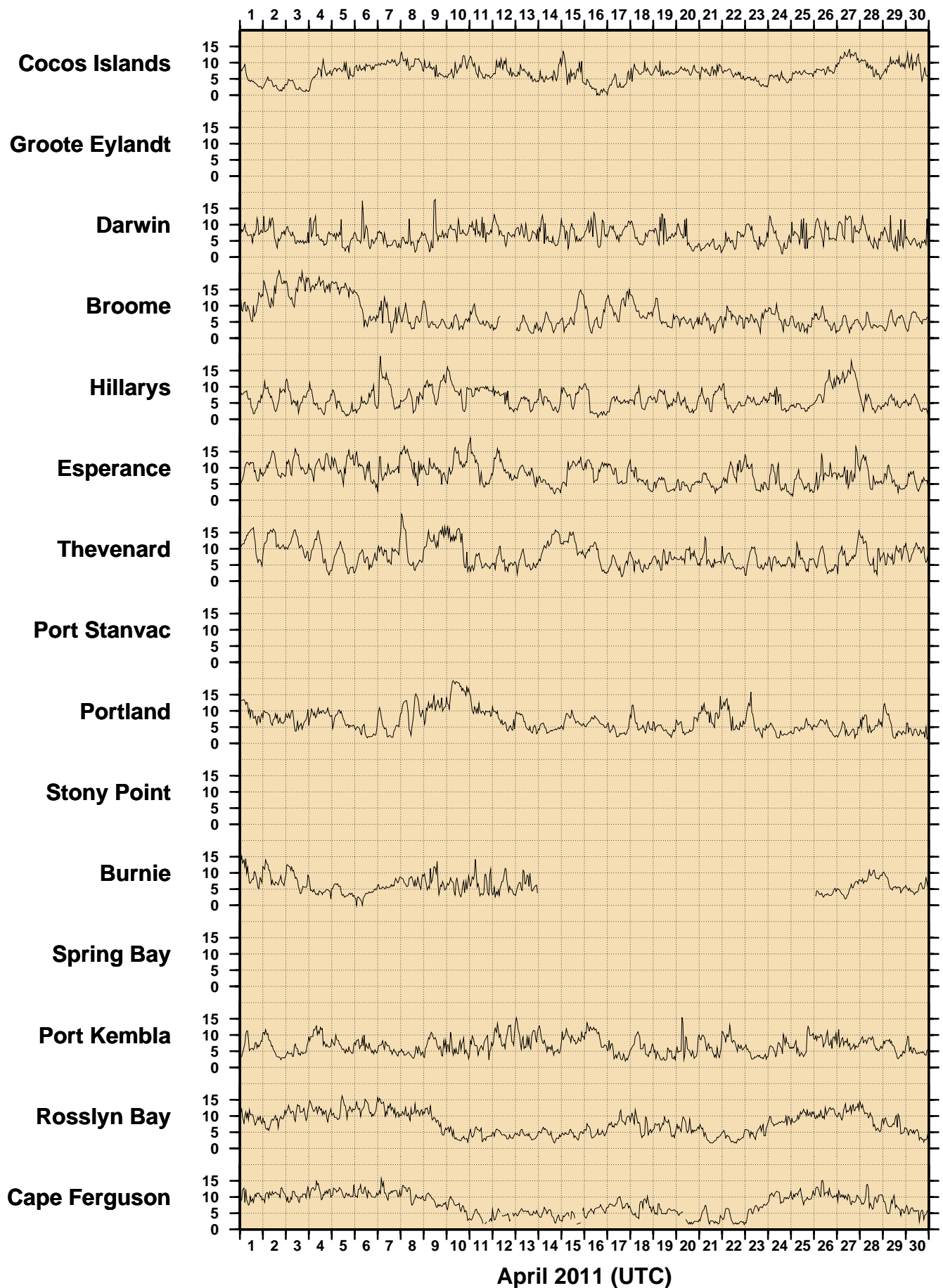




Figure 7

APRIL 2011  
HOURLY AIR TEMPERATURES (°C)

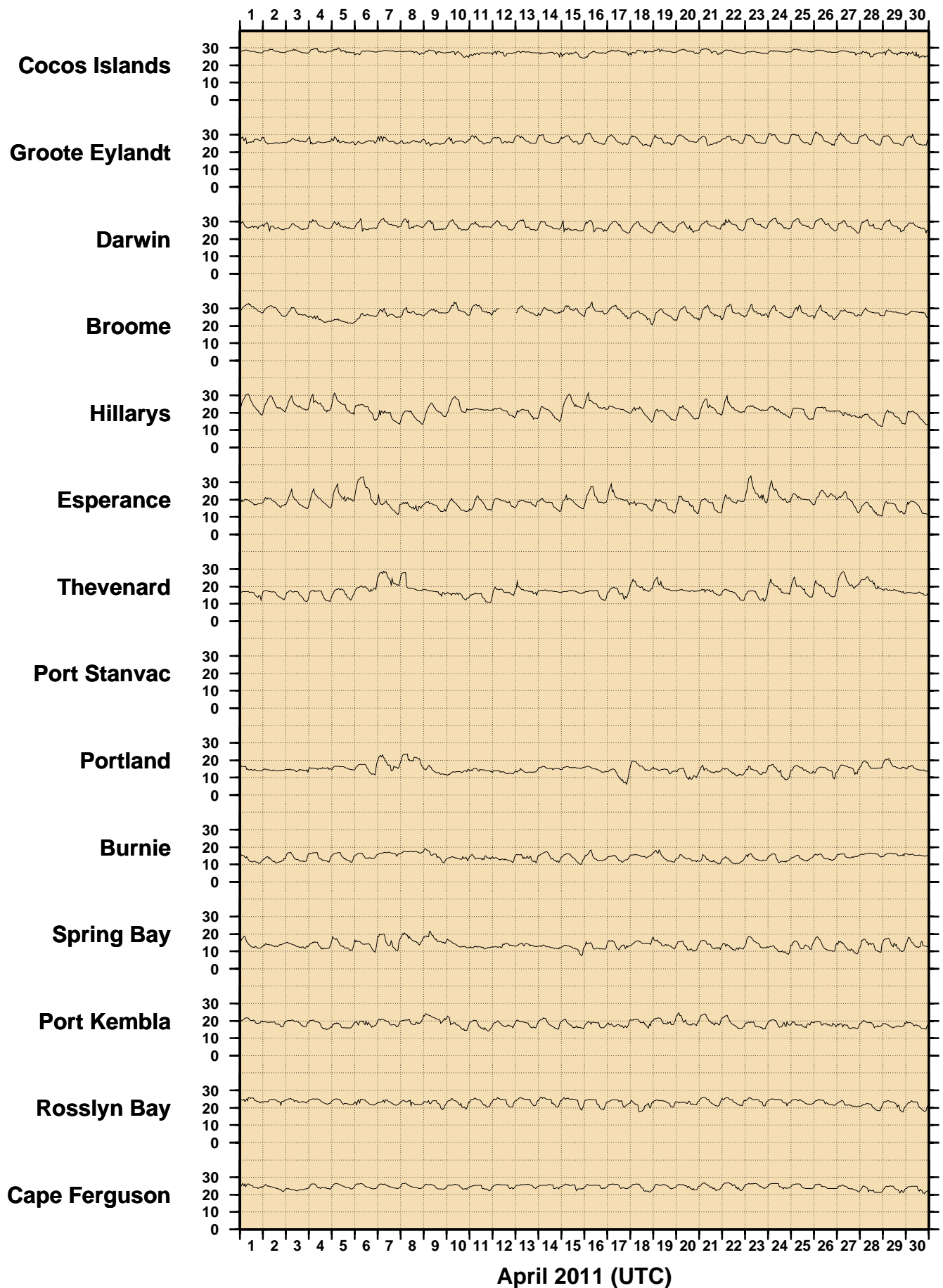


Figure 8

APRIL 2011  
HOURLY WATER TEMPERATURES (°C)

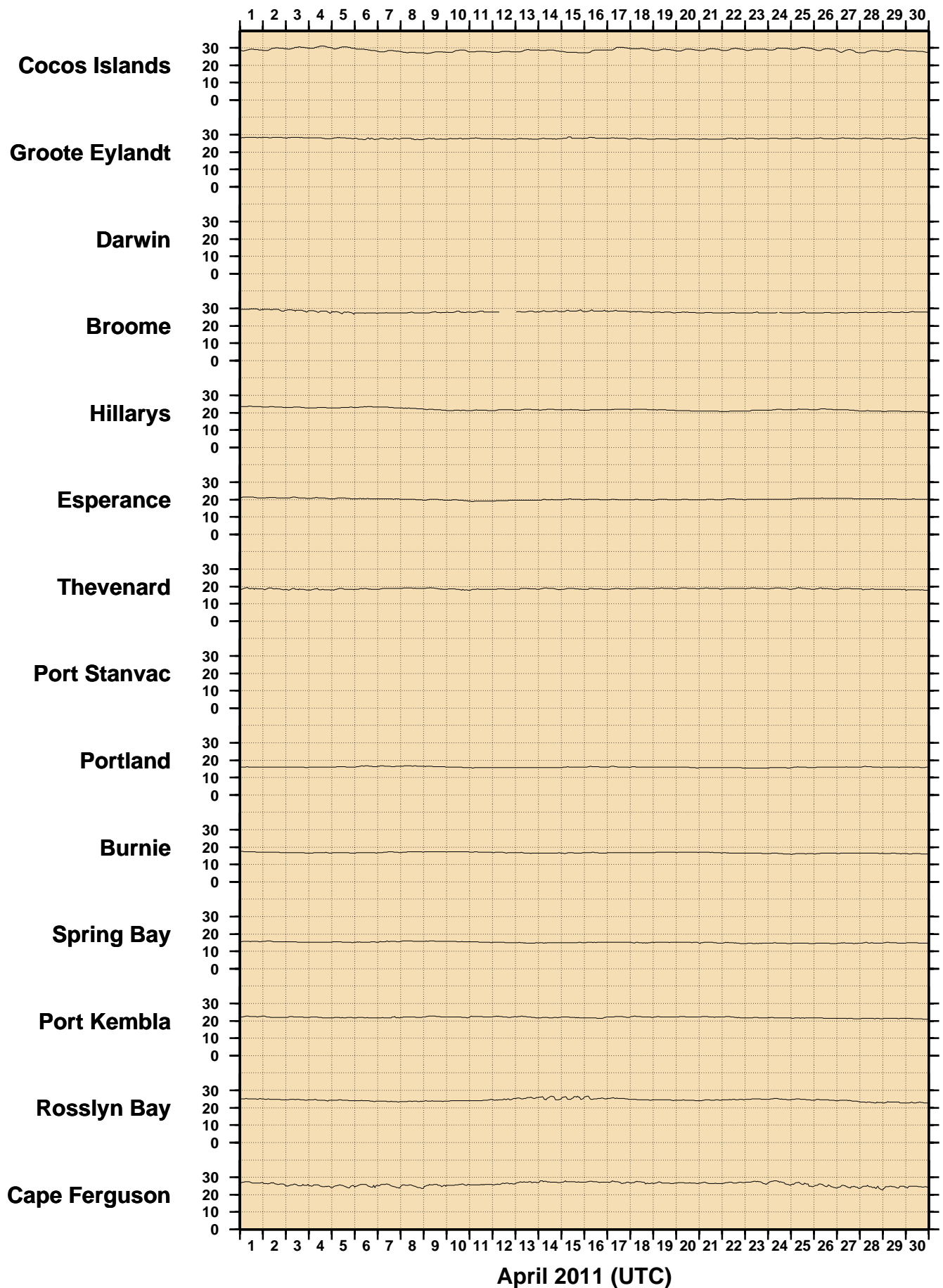
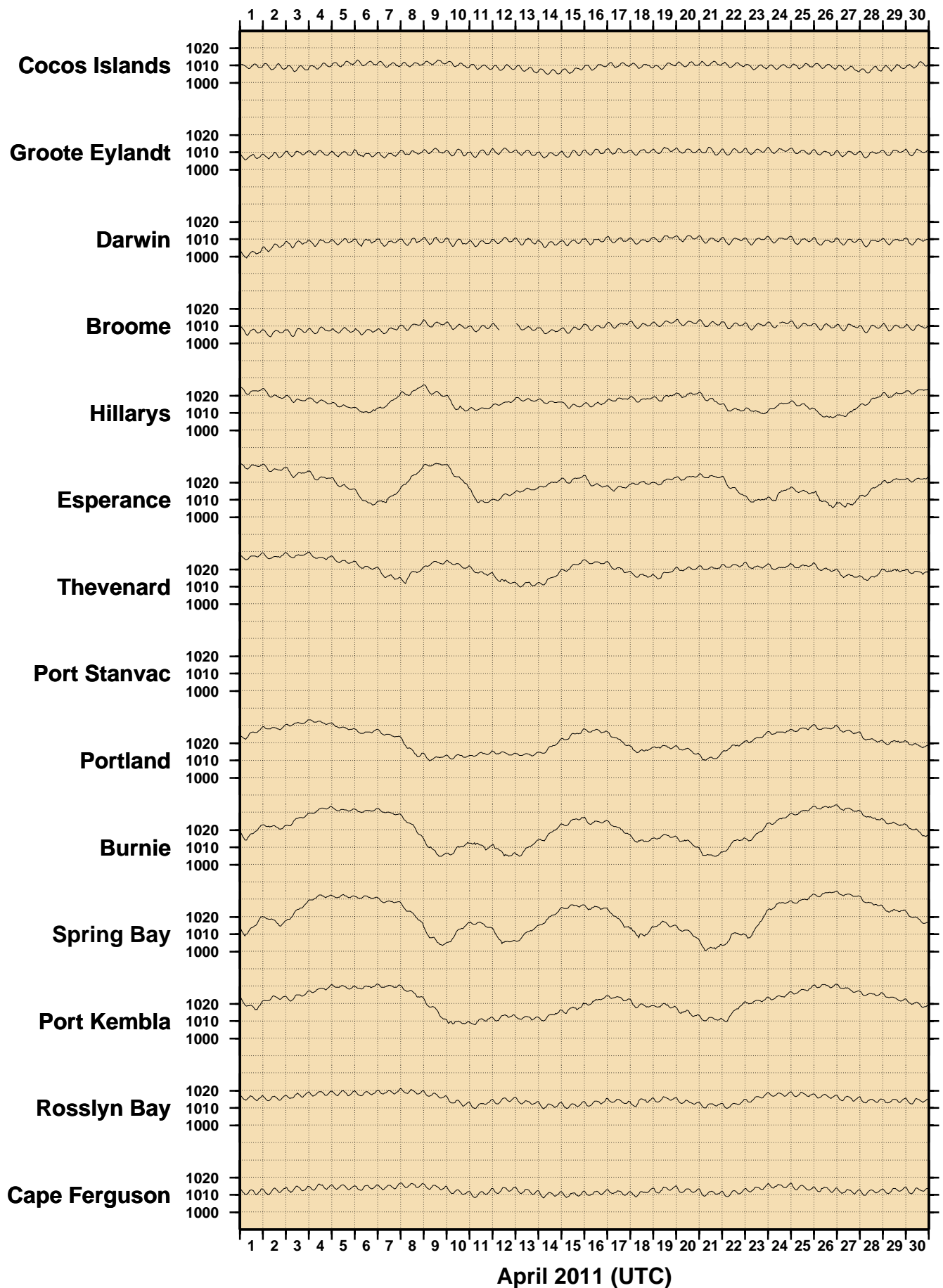


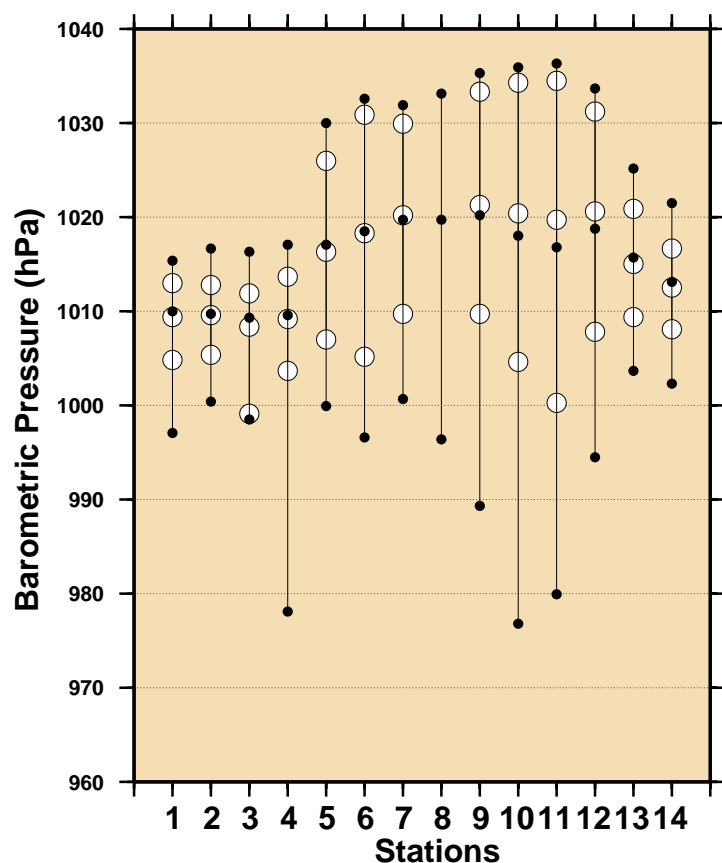
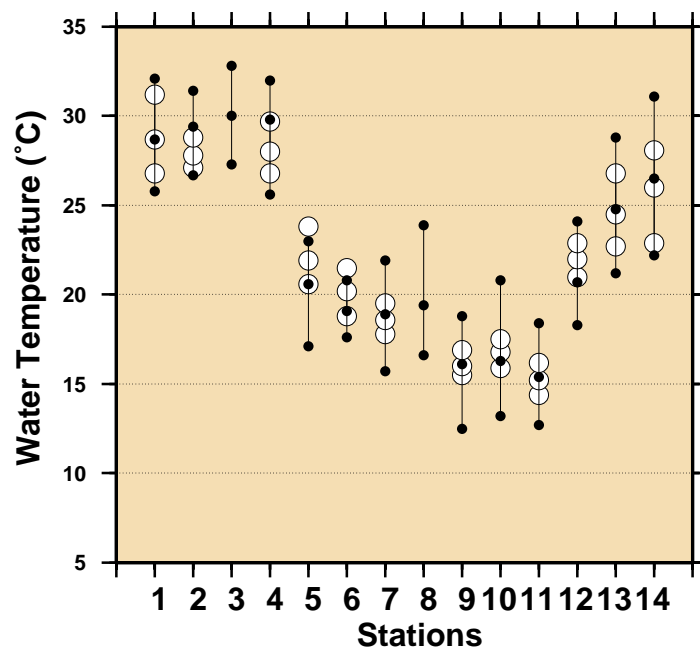
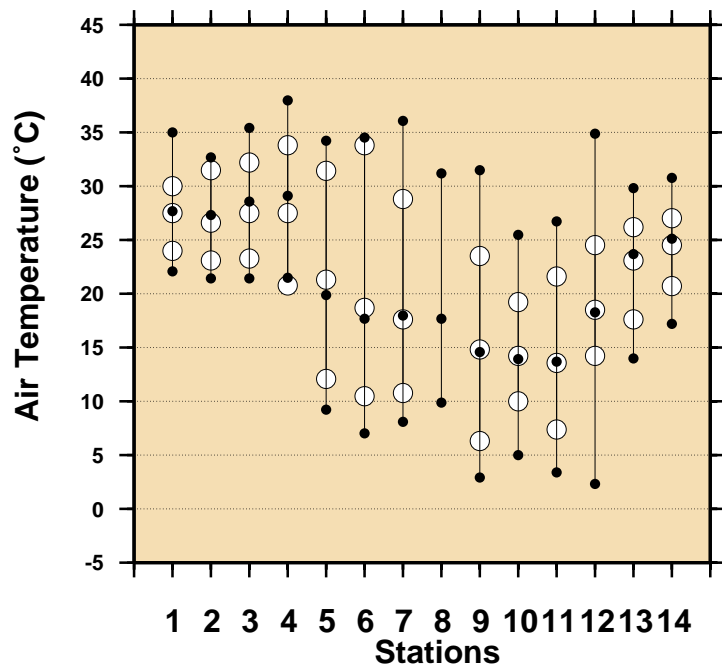
Figure 9

APRIL 2011  
HOURLY ATMOSPHERIC PRESSURE (hPa)





**Figure 10**  
**Comparison of April 2011 Max, Min & Mean with**  
**Long Term April 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

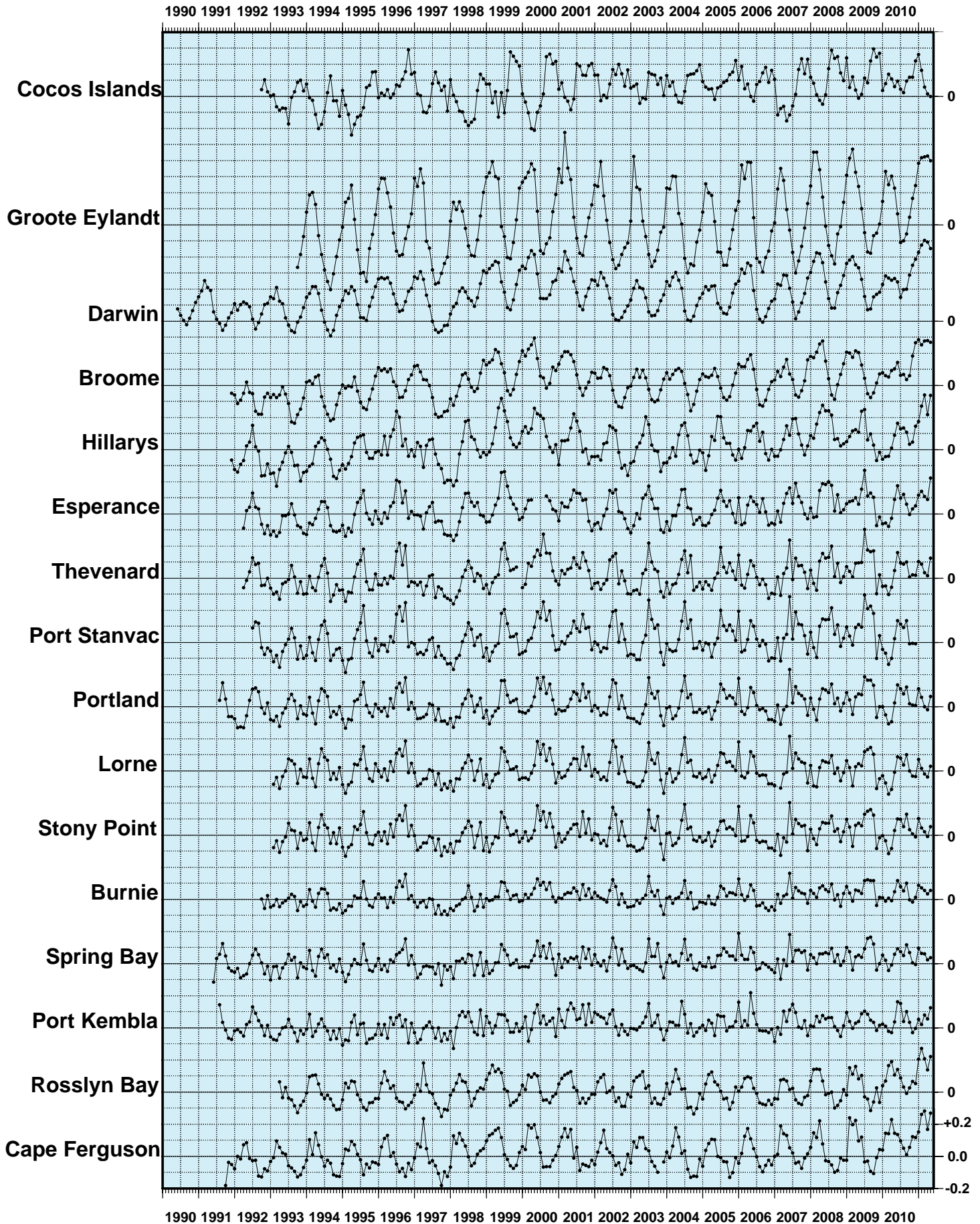
- April 2011 Maximum
- April 2011 Mean
- April 2011 Minimum

- Long Term April Maximum
- Long Term April Mean
- Long Term April Minimum

# Figure 11

## MONTHLY MEAN SEA LEVELS TO APRIL 2011 (m)

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



**Figure 12**  
**SEA LEVEL ANOMALIES THROUGH APRIL 2011 (m)**

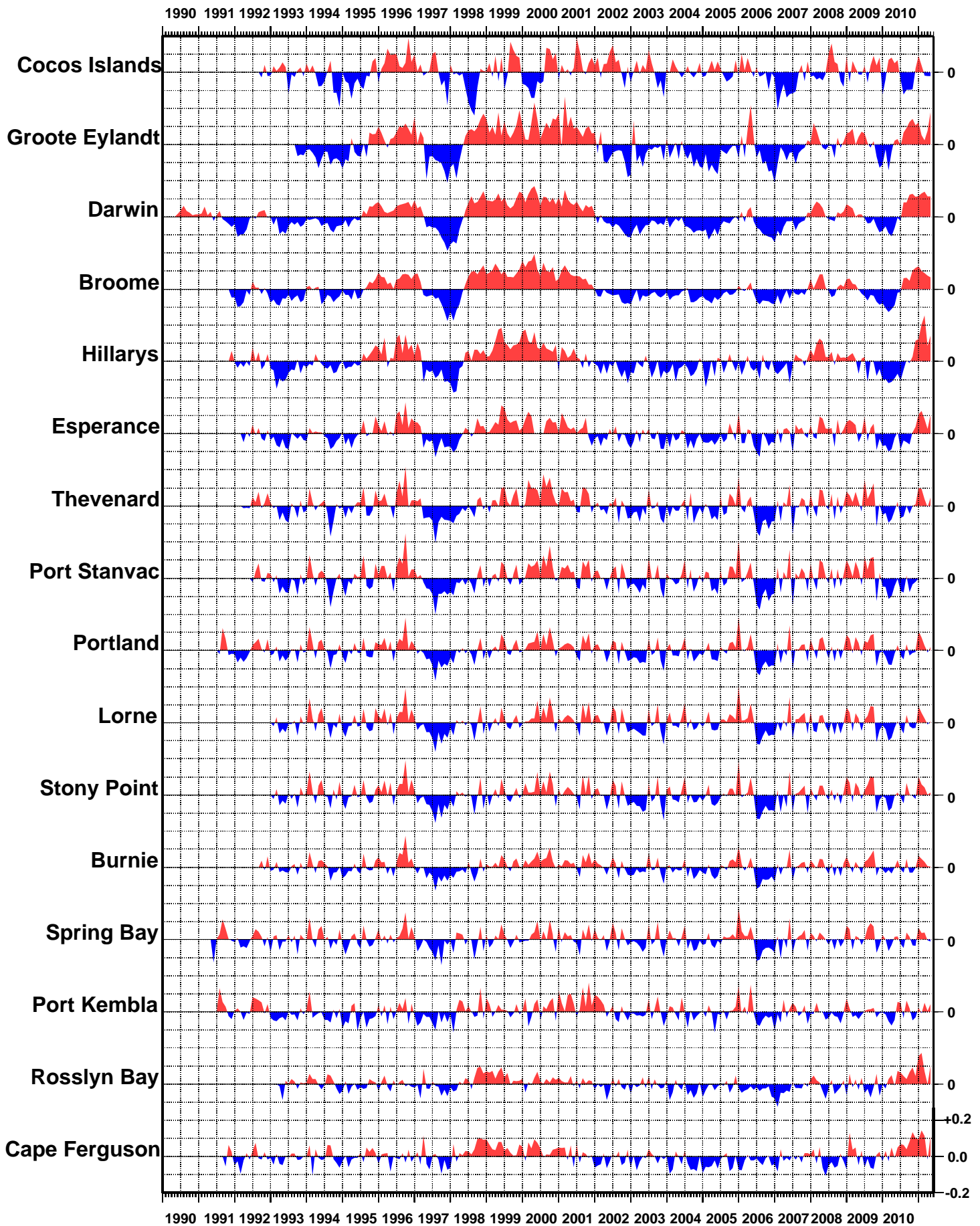


Figure 13

# SEA LEVEL TRENDS THROUGH APRIL 2011 (mm/year)

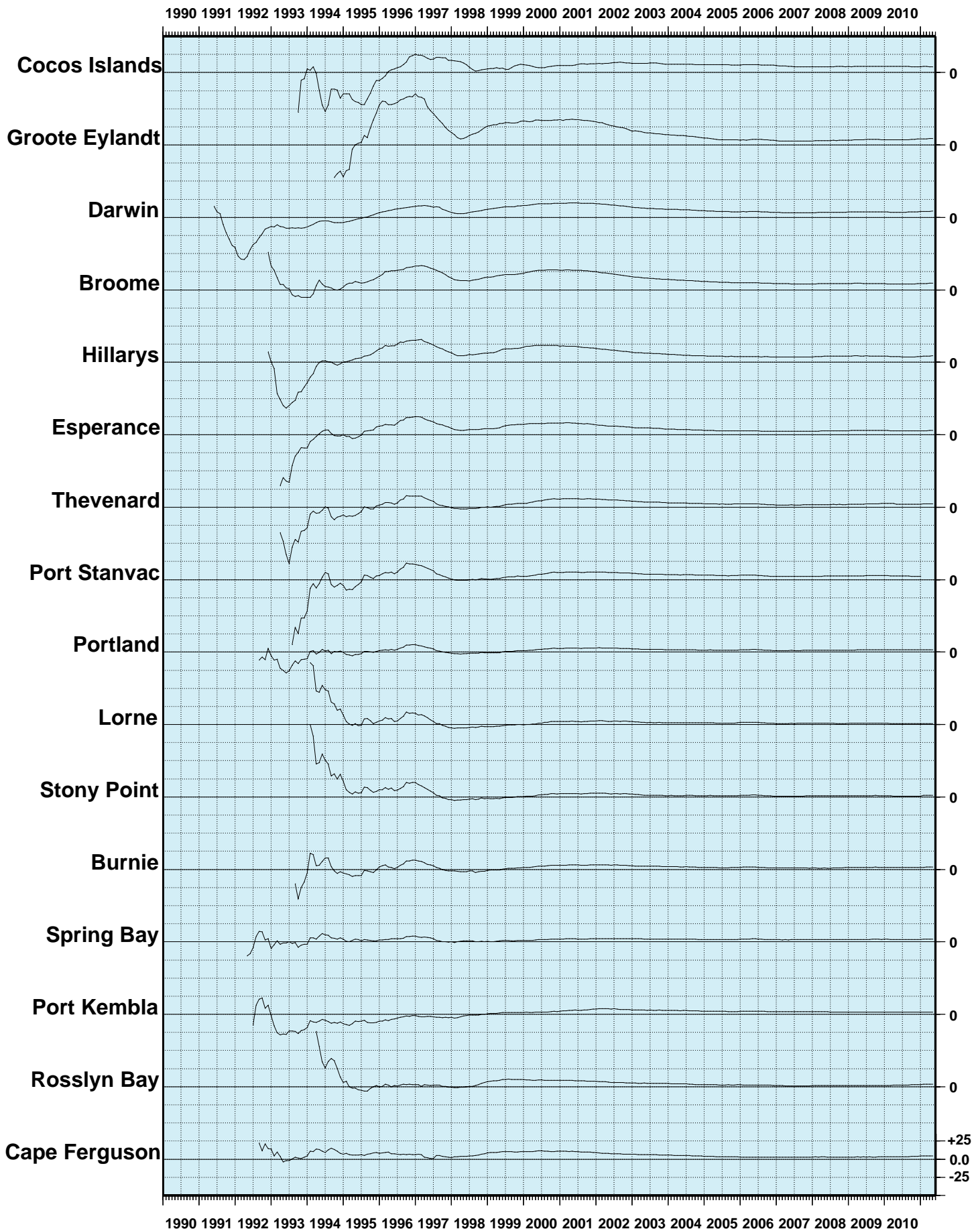


Figure 14

## BAROMETRIC PRESSURE ANOMALIES THROUGH APRIL 2011 (hPa)

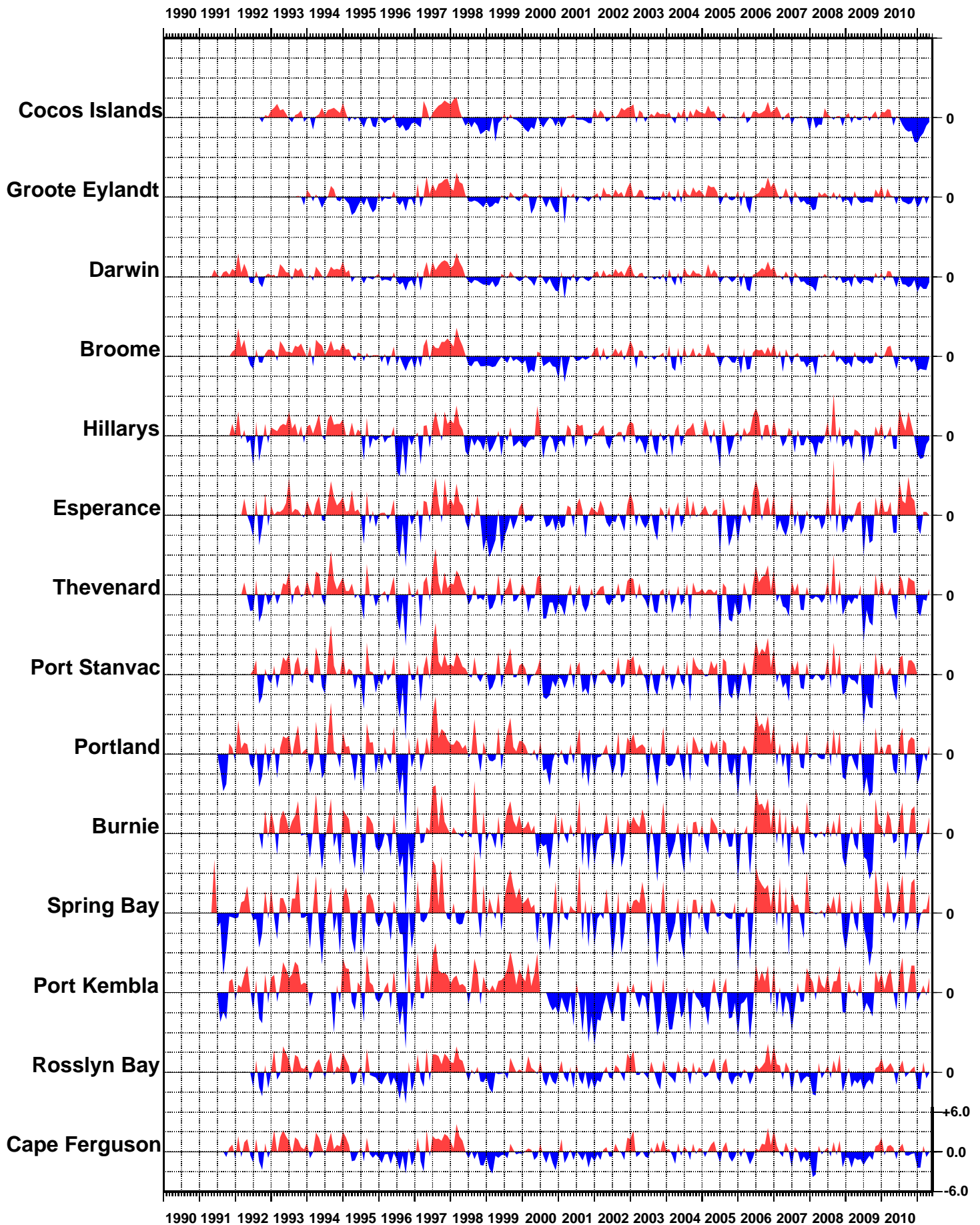


Figure 15

## WATER TEMPERATURE ANOMALIES THROUGH APRIL 2011 (°C)

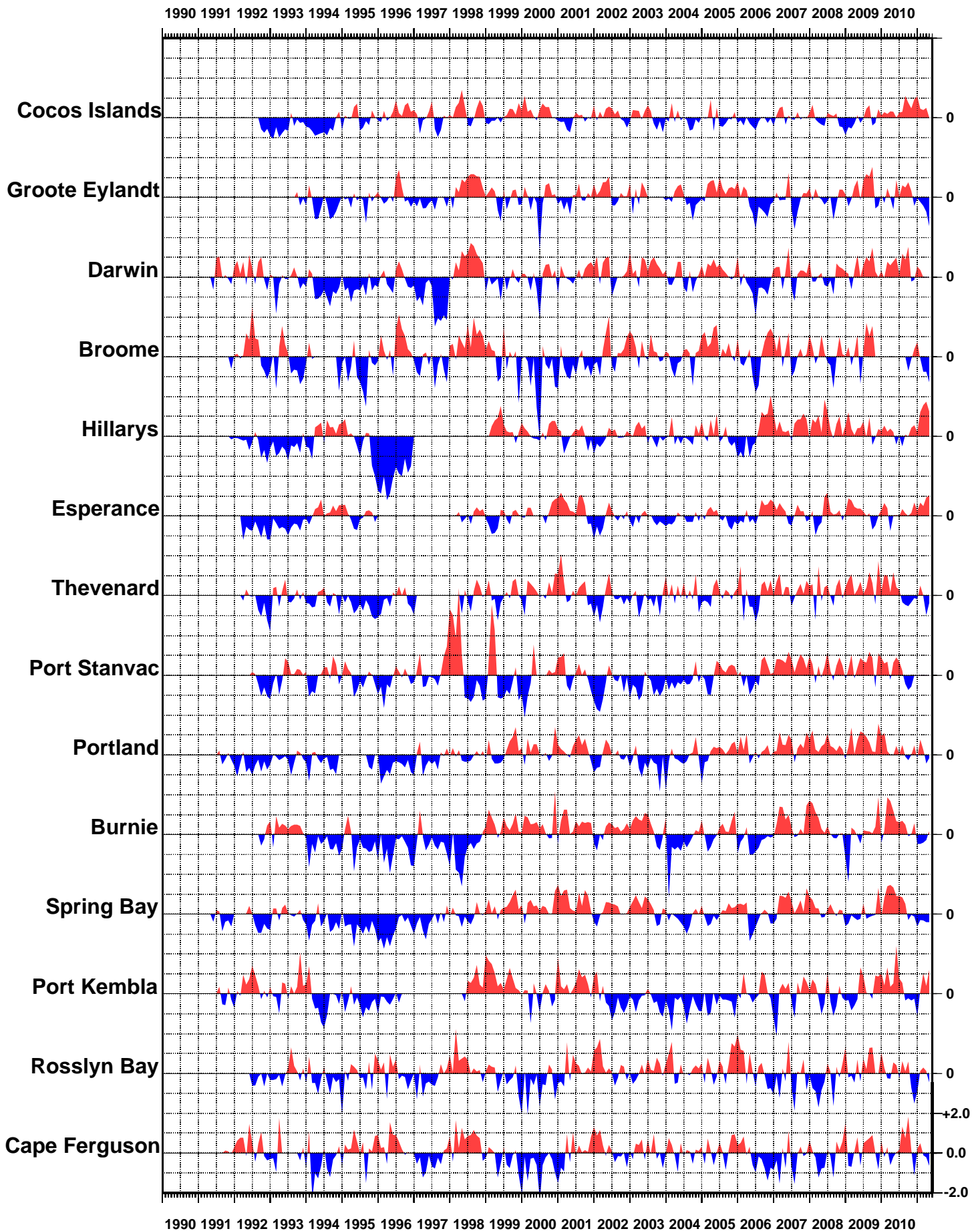
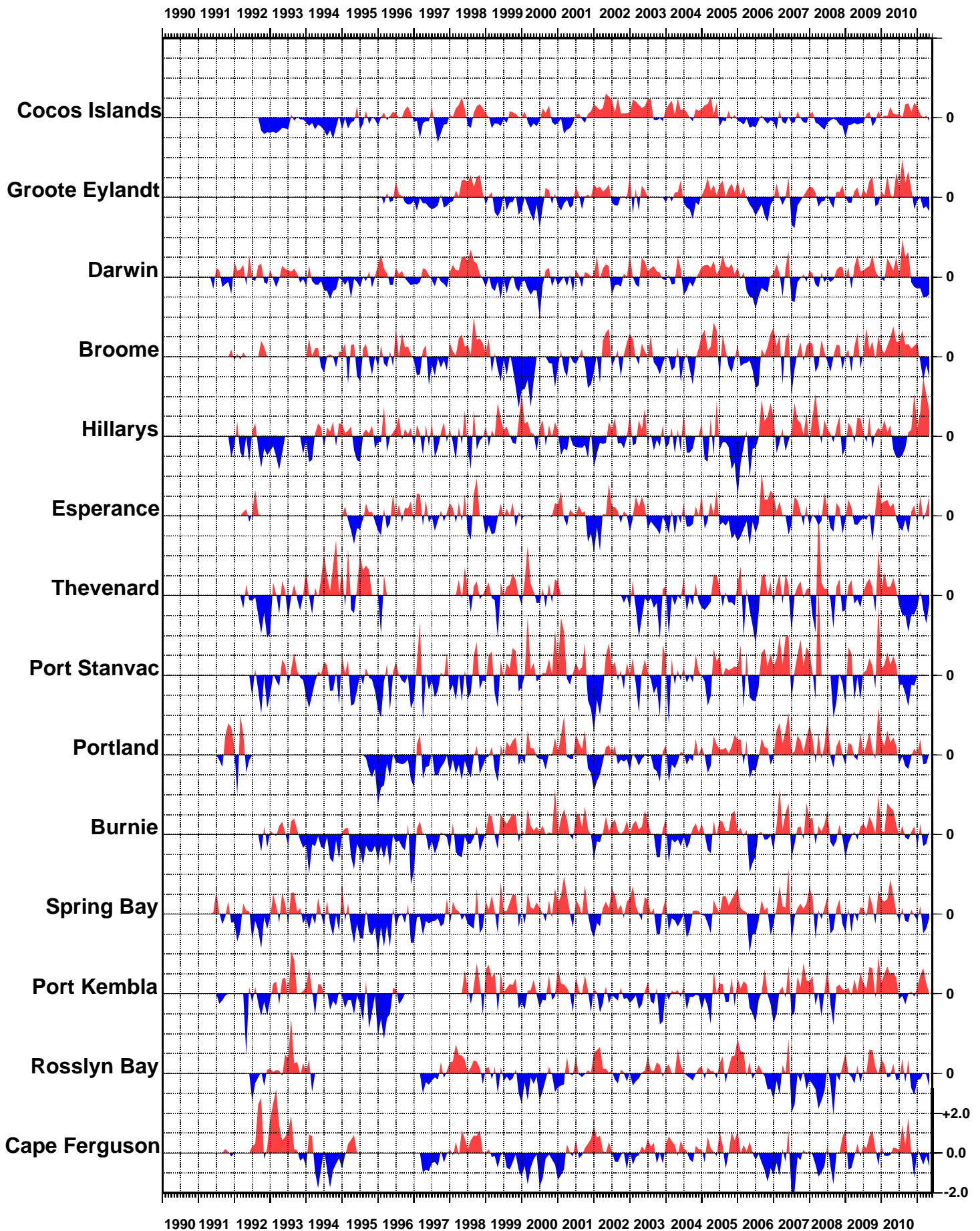




Figure 16

# AIR TEMPERATURE ANOMALIES THROUGH APRIL 2011 (°C)



## SEA LEVEL DATA RETURN

**\* Patchy record**

