

**THE AUSTRALIAN BASELINE SEA LEVEL
MONITORING PROJECT**

MONTHLY DATA REPORT

OCTOBER 2009



Australian Government

Bureau of Meteorology

This report was prepared under the Australian Greenhouse Science Program for the Australian Greenhouse Office, supported by the National Tidal Centre, Bureau of Meteorology.



Australian Government

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 October 2009 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

OCTOBER 2009

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. Movement of each station relative to the International Terrestrial Reference Frame is not monitored.

NOTES ON THE DATA FOR OCTOBER 2009

Sea level data return (Figures 1 and 17) in October 2009 was good for most stations. Data losses were experienced at some stations as a consequence of upgrading their data loggers as part of the network modernisation project. New Telmet 320 loggers were installed at Groote Eylandt (5 hours of data lost), Thevenard (2 hours), Spring Bay (2 hours) and Port Kembla (20 hours). The policy of switching off the power when fuel ships are in dock in Broome resulted in the loss of 56 hours of data. Continuity of the data streams from the old and new data logging systems is being maintained, with the wind data the only meteorological parameter still requiring verification.

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. Evidence of a tsunami signal (20cm) can be seen in the Rosslyn Bay residuals for the 8th of October following a magnitude Mw7.6 earthquake that occurred at 22:03 UTC on the 7th of October around 600km north-northwest of Port Vila, Vanuatu. 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 October 2009 with the long-term values. Note that the long-term ranges are calculated using the previous sets of October data for each station **excluding** the current month of data.

A record maximum air temperature for October was set for Hillarys (35.1°C) this month. The water temperatures for October 2009 fell within the long-term minimums and maximums for all stations whilst a record October minimum barometric pressure was recorded at Portland (988.8hPa) and maximum air pressures were recorded at Burnie (1033.8hPa) and Spring Bay (1035.0hPa).

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.

The sea level anomalies (Figure 12) in October 2009 were greater than 5cm at Cocos Islands, Rosslyn Bay and Cape Ferguson and negative at all other locations - lower than 5cm along Australia's western and southern coasts from Broome to Spring Bay.

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.

The barometric pressure anomalies (Figure 14) for October 2009 were positive (or close to zero) for all locations this month. From Esperance to Spring Bay significant positive barometric pressure anomalies close to or exceeding 3 hPa were observed. 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.

The number of hits to the Australian Baseline Sea Level Monitoring project web pages from January 2006 to October 2009 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 October 2009.

| Recent short-term sea level trends in the project area based upon SEAFRAME data through October, 2009 | | | | |
|--|------------------------------|-------------------|---------------|----------------------------|
| Location | Lat / Long | Installation Date | Trend (mm/yr) | Change from previous month |
| Cocos Islands | 12°07'07.1"S / 96°53'30.9"E | Sep1992 | +8.5 | +0.1 |
| Groote Eylandt | 13°51'36.2"S / 136°24'56.1"E | Sep 1993 | +7.6 | -0.1 |
| Darwin | 12°28'18.4"S / 130°50'45.1"E | May 1990 | +7.6 | -0.1 |
| Broome | 18°00'03.0"S / 122°13'07.1"E | Nov 1991 | +8.6 | -0.1 |
| Hillarys | 31°49'32.0"S / 115°44'18.9"E | Nov 1991 | +8.6 | -0.1 |
| Esperance | 33°52'15.2"S / 121°53'43.3"E | Mar 1992 | +6.0 | -0.2 |
| Thevenard | 32°08'56.2"S / 133°38'28.8"E | Mar 1992 | +4.8 | -0.1 |
| Port Stanvac | 35°06'31.0"S / 138°28'1.3"E | Jun 1992 | +5.7 | -0.3 |
| Portland | 38°20'36.4"S / 141°36'47.4"E | Jul 1991 | +3.3 | -0.1 |
| Lorne | 38°32'49.4"S / 143°59'19.8"E | Jan 1993 | +1.8 | -0.2 |
| Stony Point | 38°22'19.7"S / 145°13'28.9"E | Jan 1993 | +1.9 | -0.2 |
| Burnie | 41°03'0.3"S / 145°54'54.0"E | Sep 1992 | +3.0 | -0.1 |
| Spring Bay | 42°32'45.1"S / 147°55'57.8"E | May 1991 | +3.5 | -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 | +1.9 | +0.1 |
| Cape Ferguson | 19°16'38.4"S / 147°03'30.4"E | Sep 1991 | +3.1 | +0.1 |

Figure A: Number of hits on the Australian Baseline Sea Level Monitoring Project web pages from 2006 to October 2009.

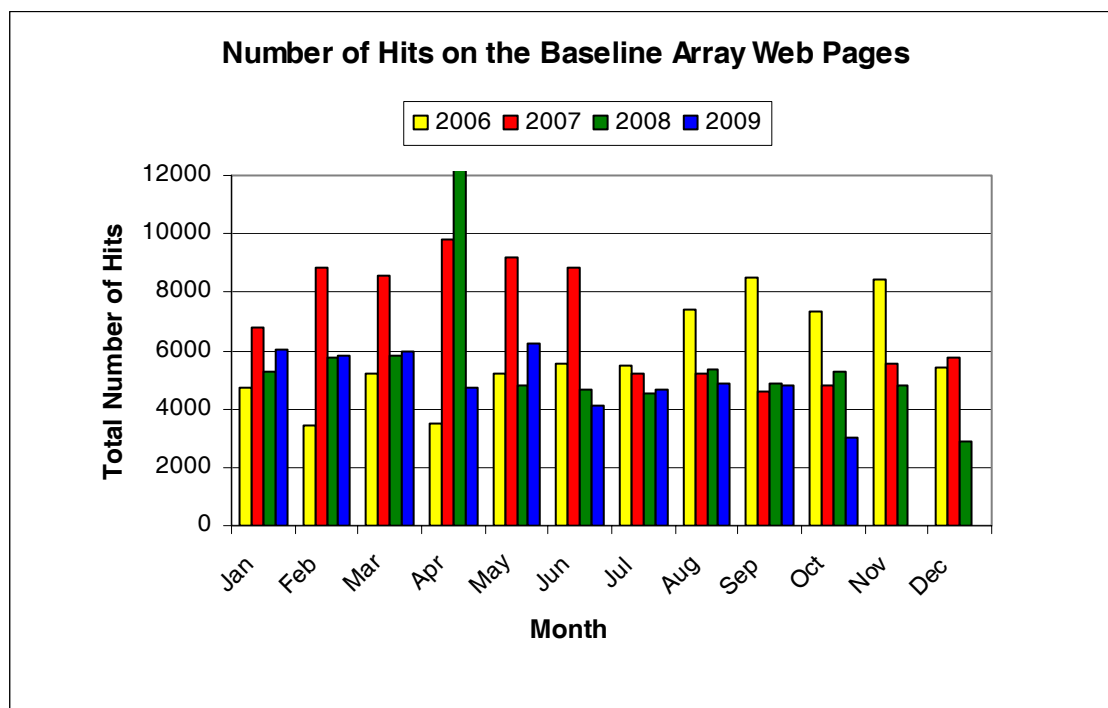
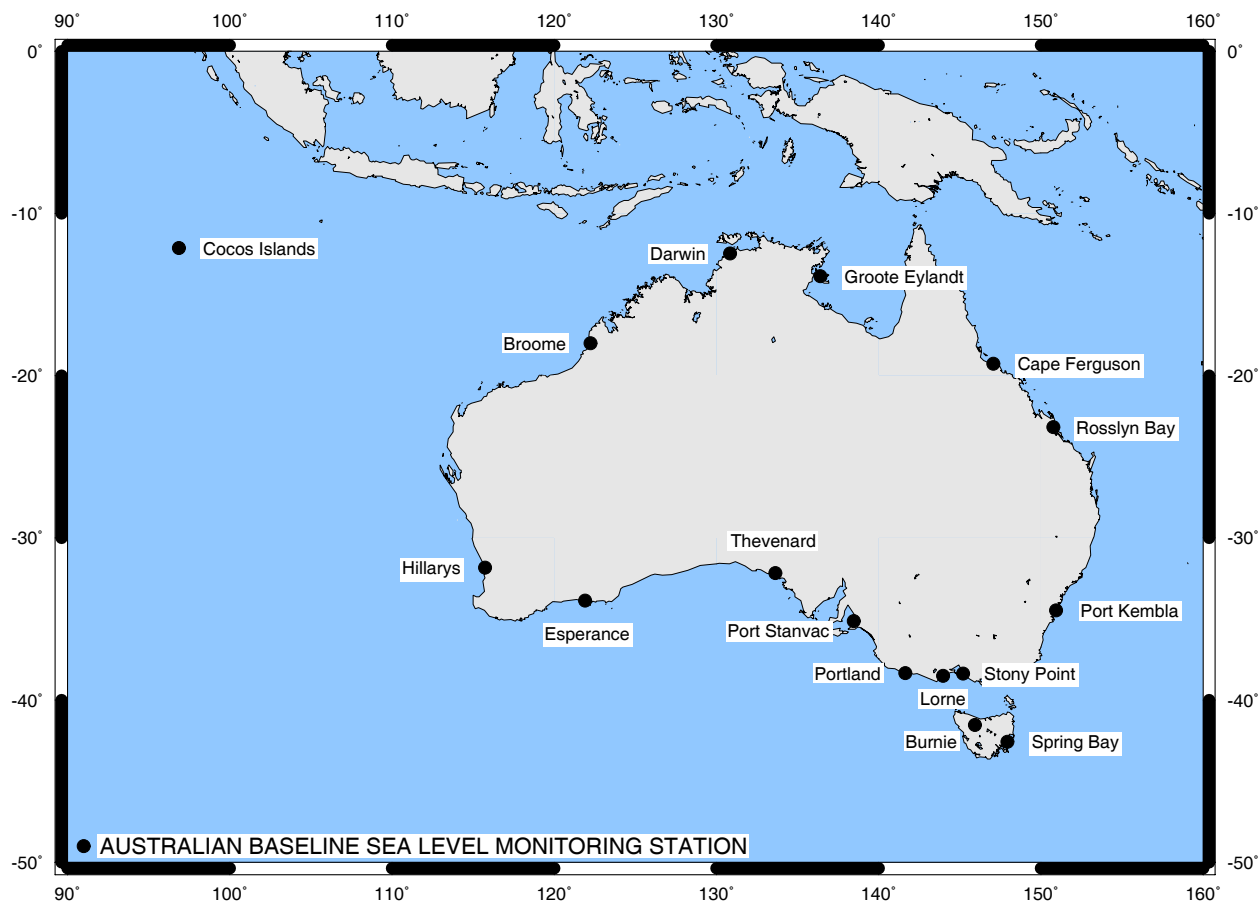


Figure B: Australian Baseline Sea Level Monitoring Project sites.



The *Monthly Data Report* is prepared by the NTC, Bureau of Meteorology for the Australian Greenhouse Office. 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/>

Please note the following:

While all care has been taken in the collection, analysis and compilation of the data, it is supplied on the condition that neither the *Commonwealth of Australia* nor the NTC, Bureau of Meteorology shall be liable for any loss or injury whatsoever arising from the use of the data. The Commonwealth of Australia holds copyright for material contained in this document.

Individuals and organisations are advised that quality controlled six-minute or hourly data from these stations are available on request from the NTC, Bureau of Meteorology. Some handling fees may be charged. For commercial agencies requesting data, some additional costs may be levied.

Figure 1

OCTOBER 2009
SIX MINUTE SEA LEVEL OBSERVATIONS (m)

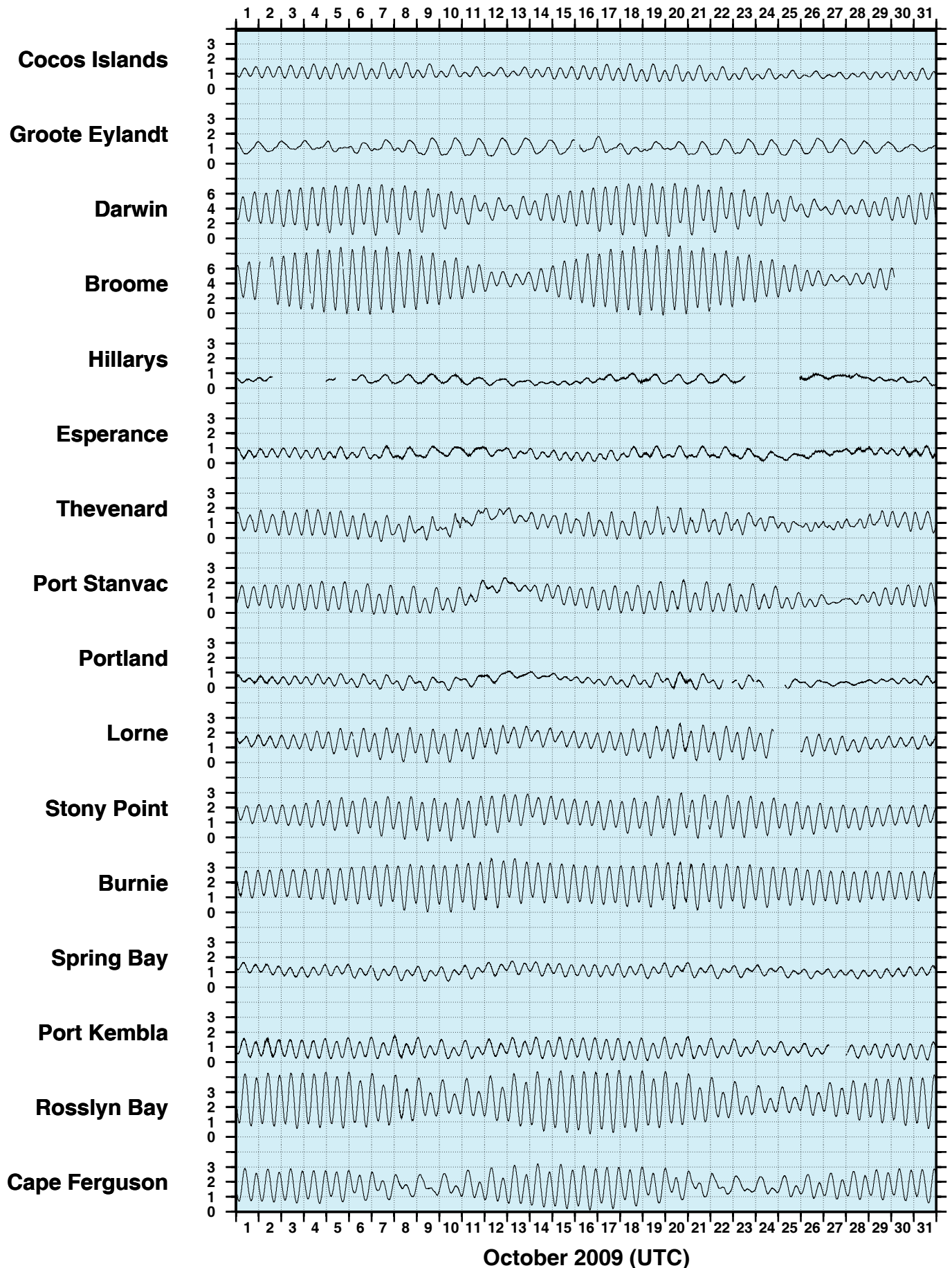


Figure 2
OCTOBER 2009
SIX MINUTE RESIDUAL WATER LEVELS (m)

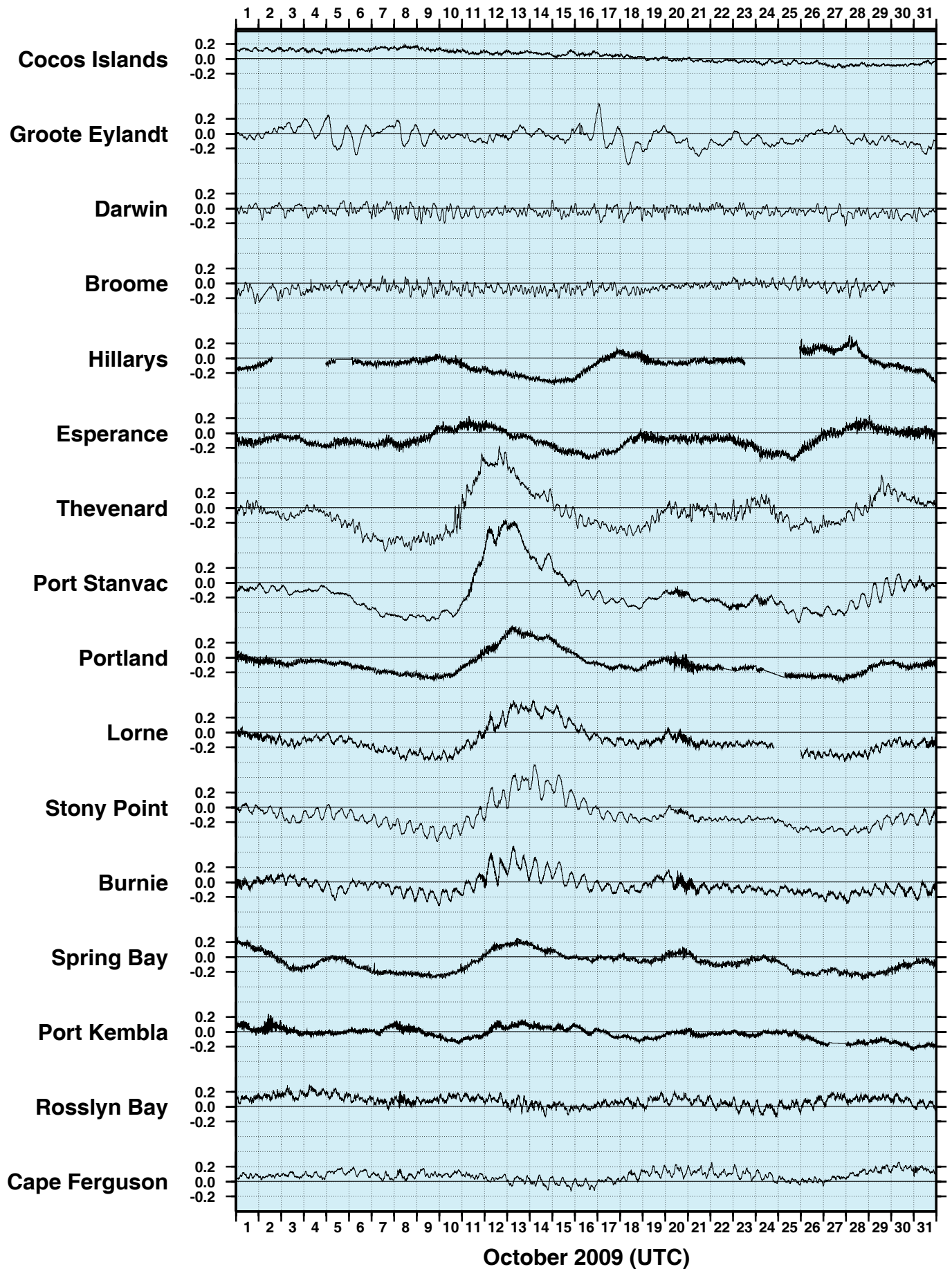


Figure 3
OCTOBER 2009
SIX MINUTE RESIDUALS
ADJUSTED FOR ATMOSPHERIC PRESSURE (m)

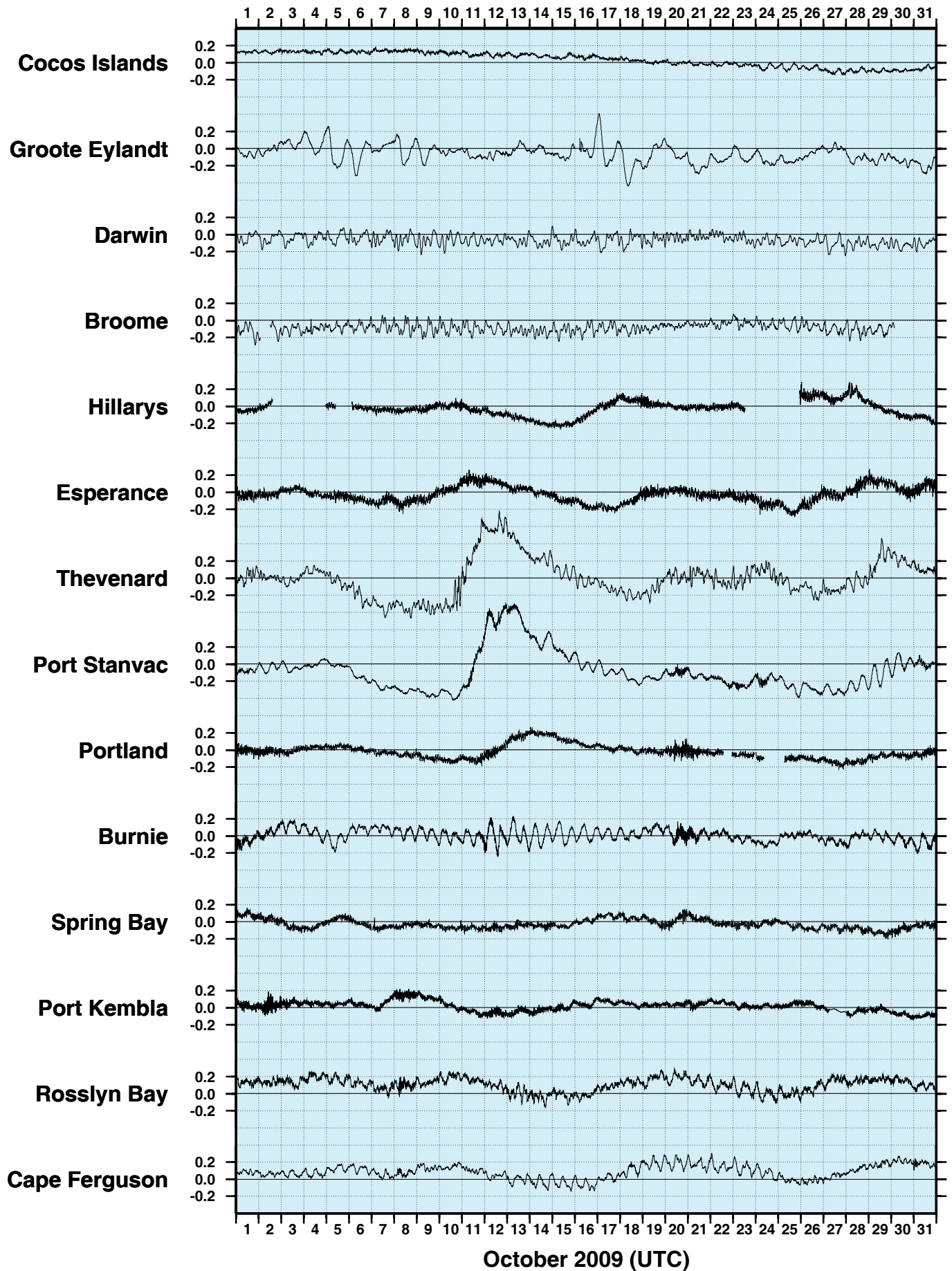


Figure 4

OCTOBER 2009
HOURLY WIND SPEEDS (m/s)

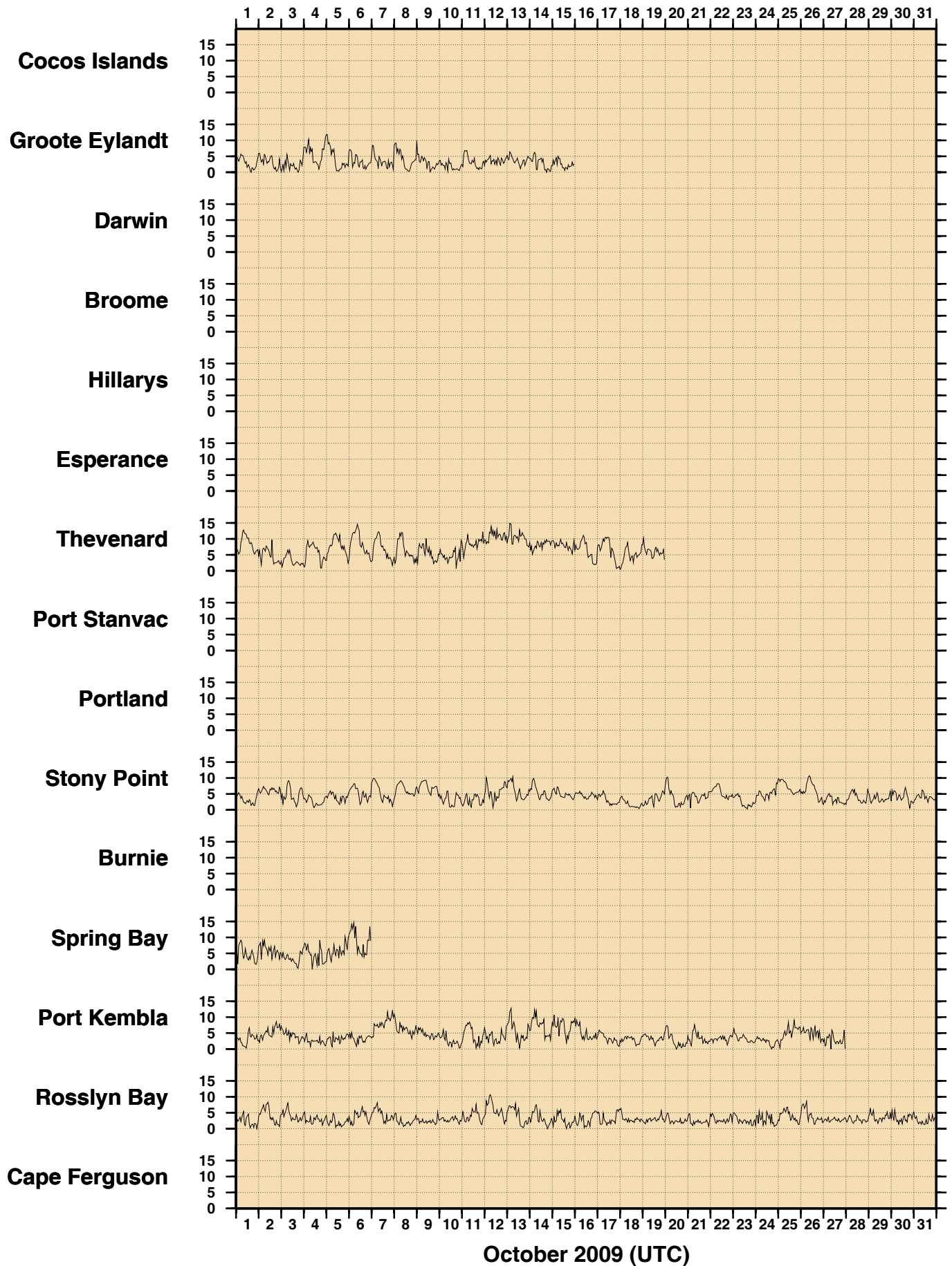


Figure 5

OCTOBER 2009
HOURLY INCIDENT WINDS (m/s, deg True)

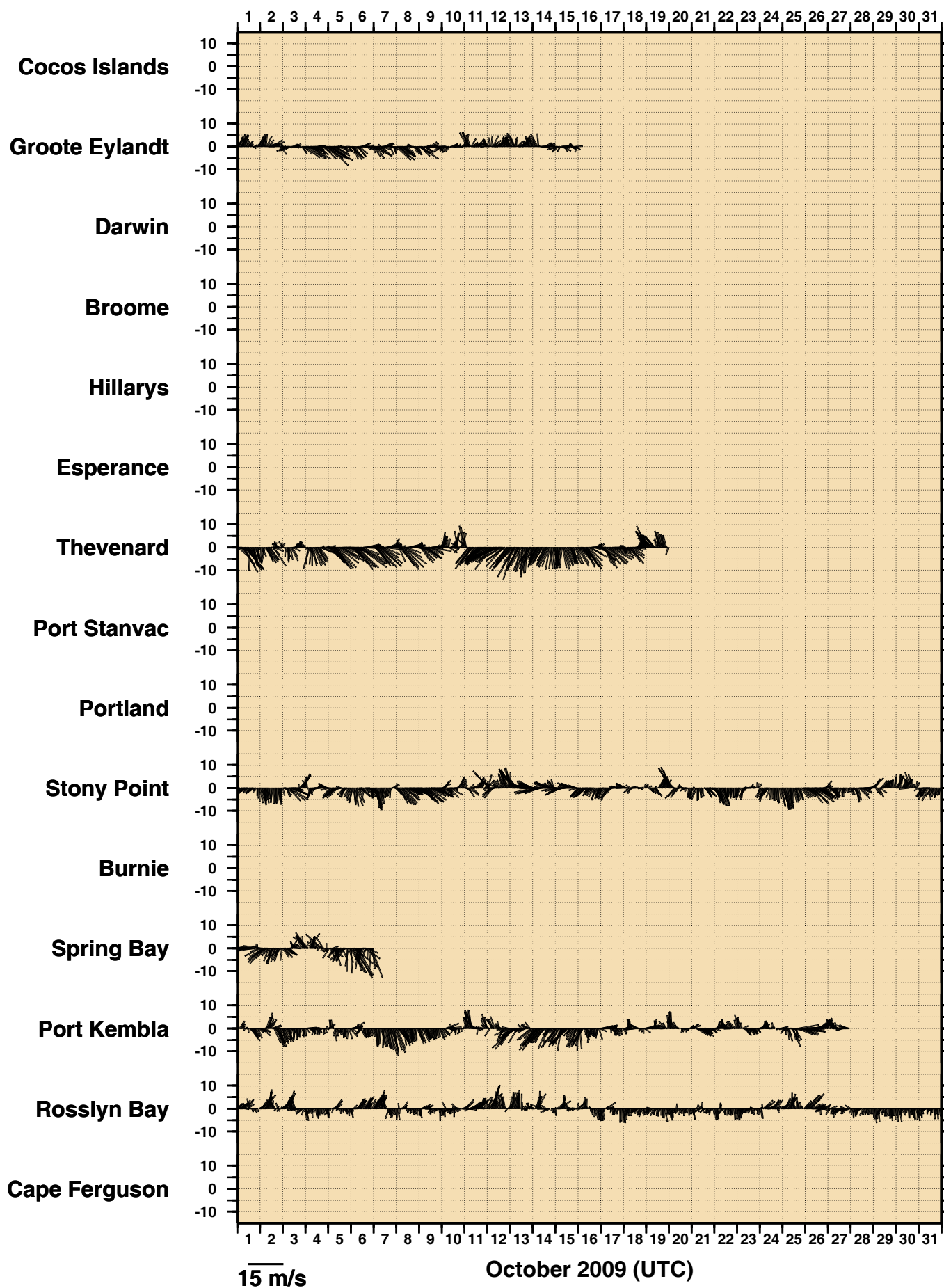


Figure 6

OCTOBER 2009
HOURLY MAXIMUM WIND GUSTS (m/s)

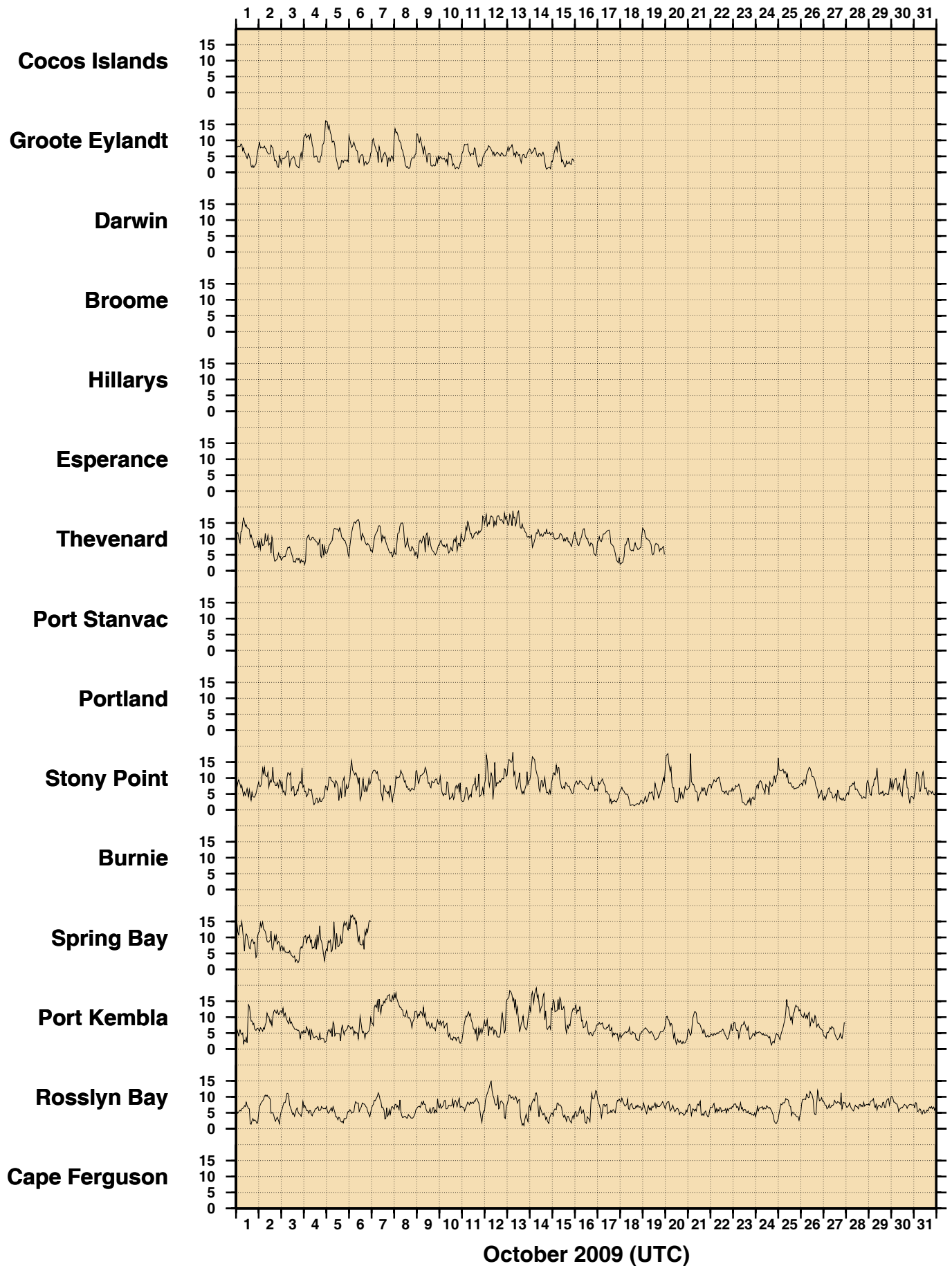


Figure 7

OCTOBER 2009
HOURLY AIR TEMPERATURES (°C)

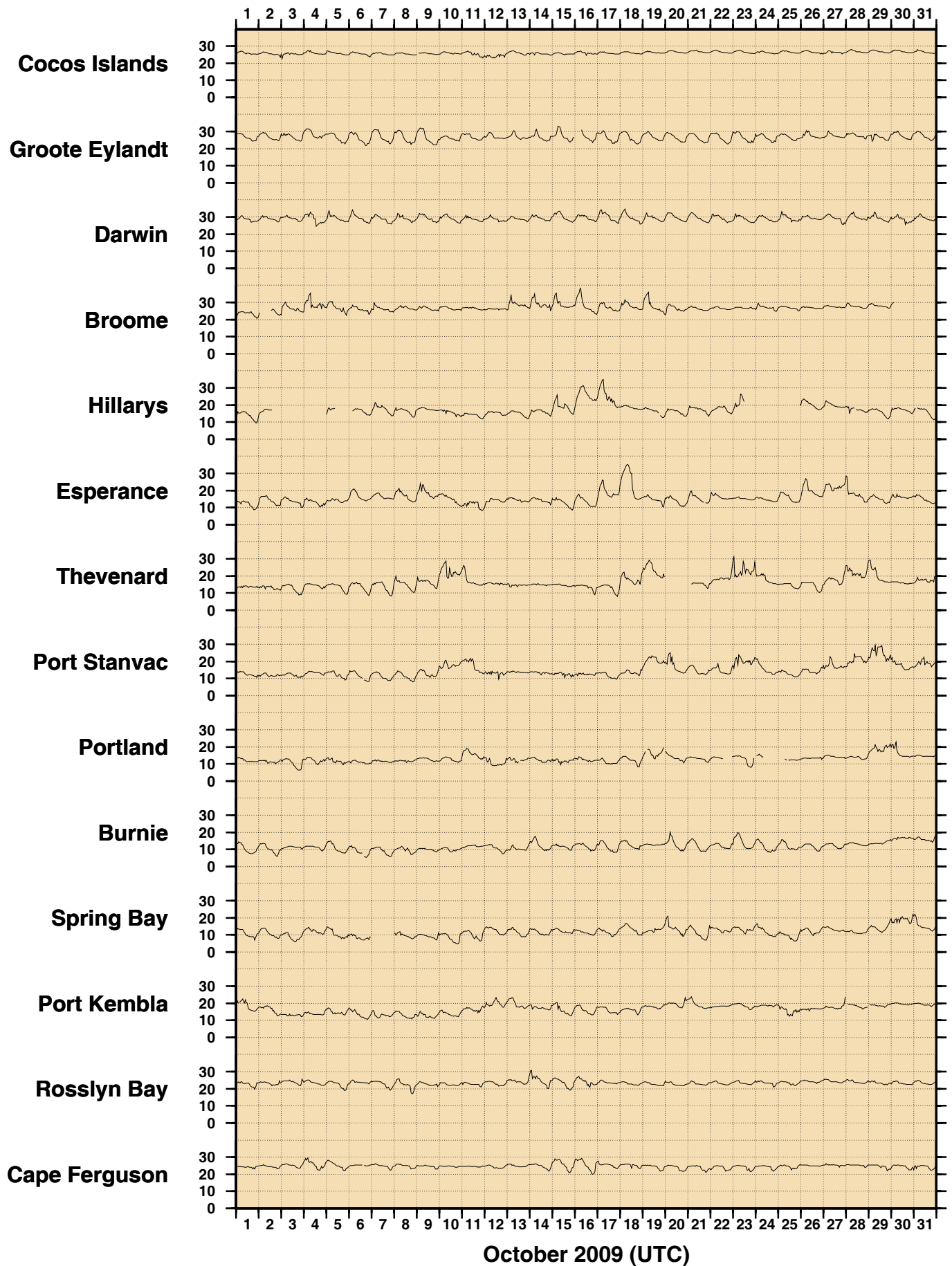


Figure 8

OCTOBER 2009
HOURLY WATER TEMPERATURES (°C)

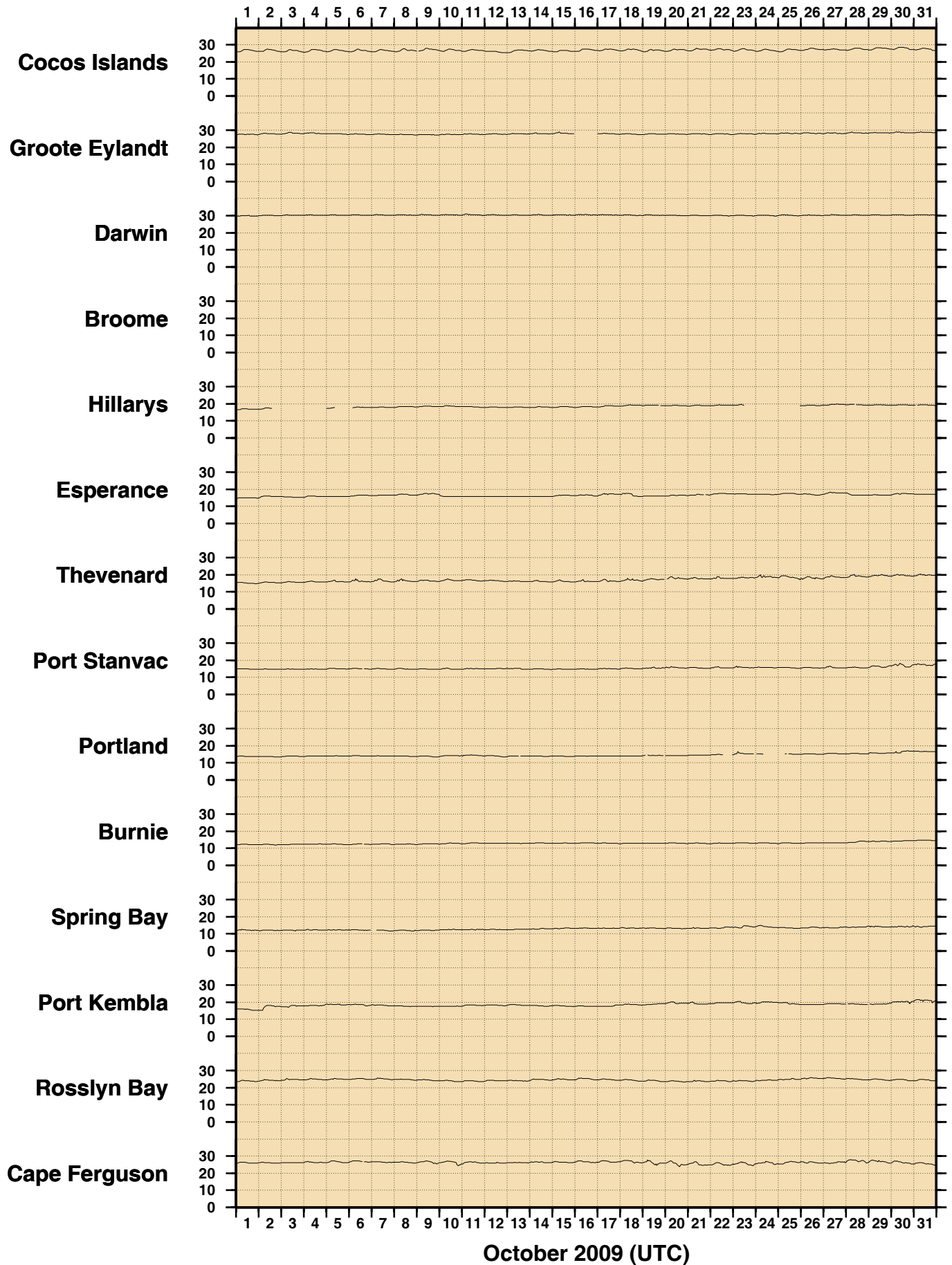


Figure 9

OCTOBER 2009
HOURLY ATMOSPHERIC PRESSURE (hPa)

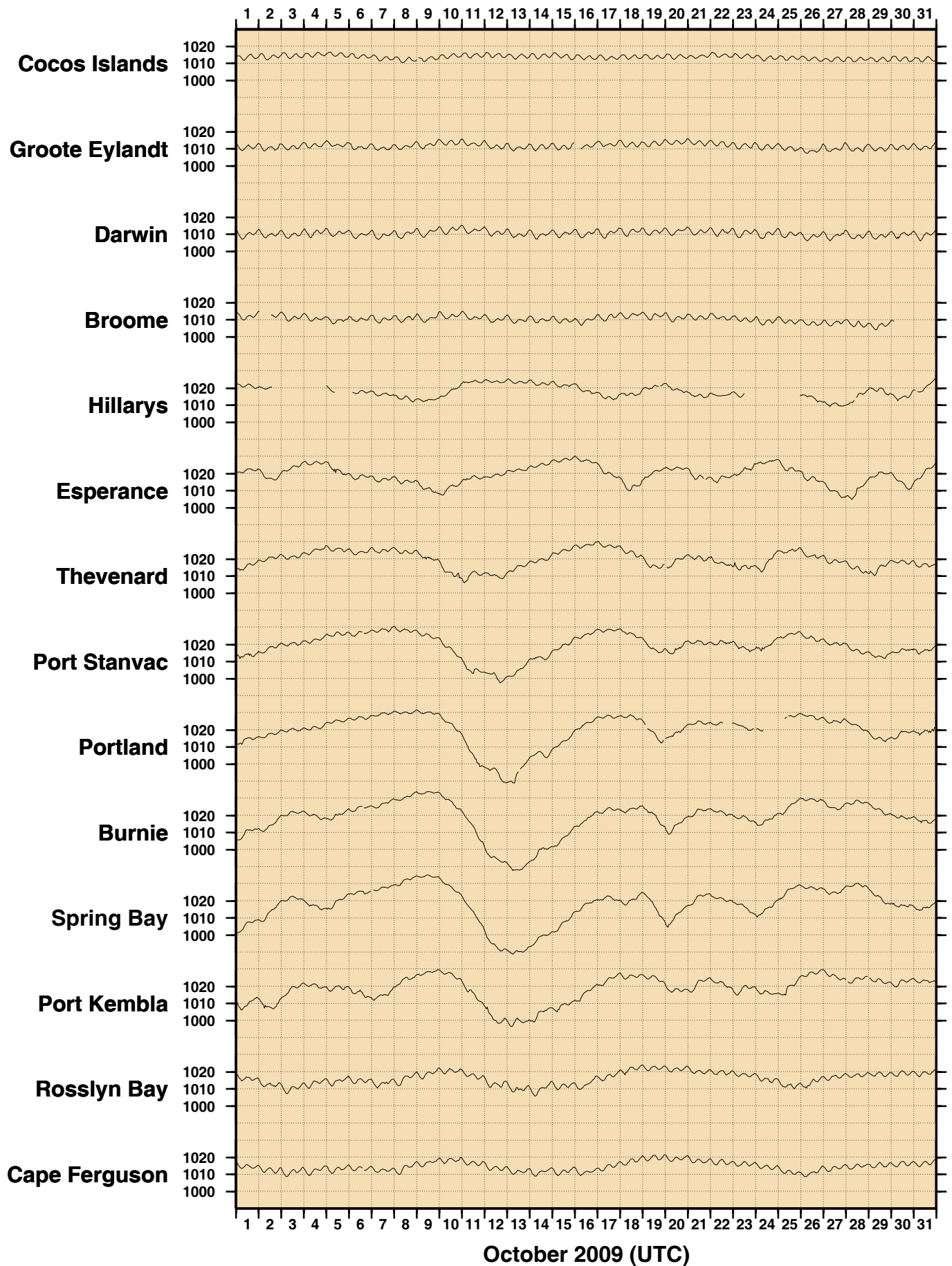
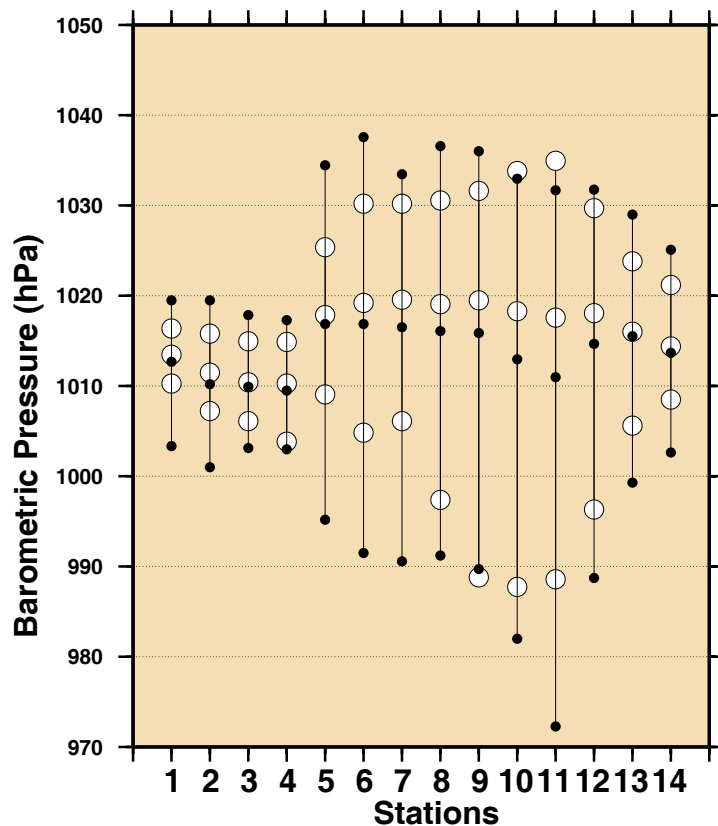
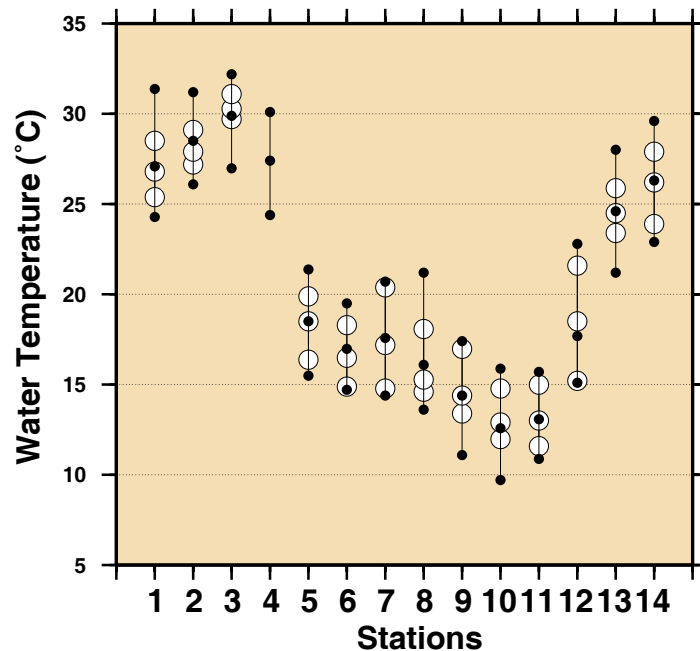
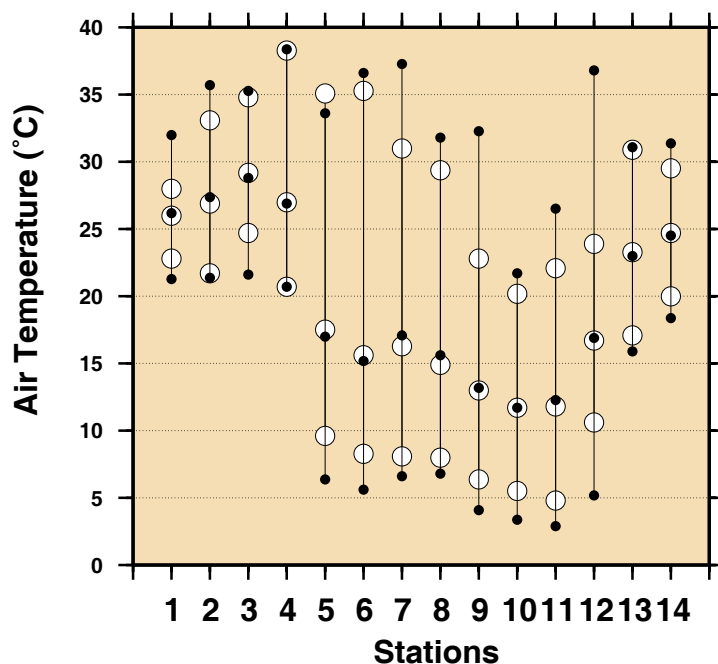


Figure 10
Comparison of October 2009 Max, Min & Mean with
Long Term October Values.



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

- October 2009 Maximum
- October 2009 Mean
- October 2009 Minimum
- Long Term October Maximum
- Long Term October Mean
- Long Term October Minimum

Figure 11

MONTHLY MEAN SEA LEVELS TO OCTOBER 2009 (m)

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

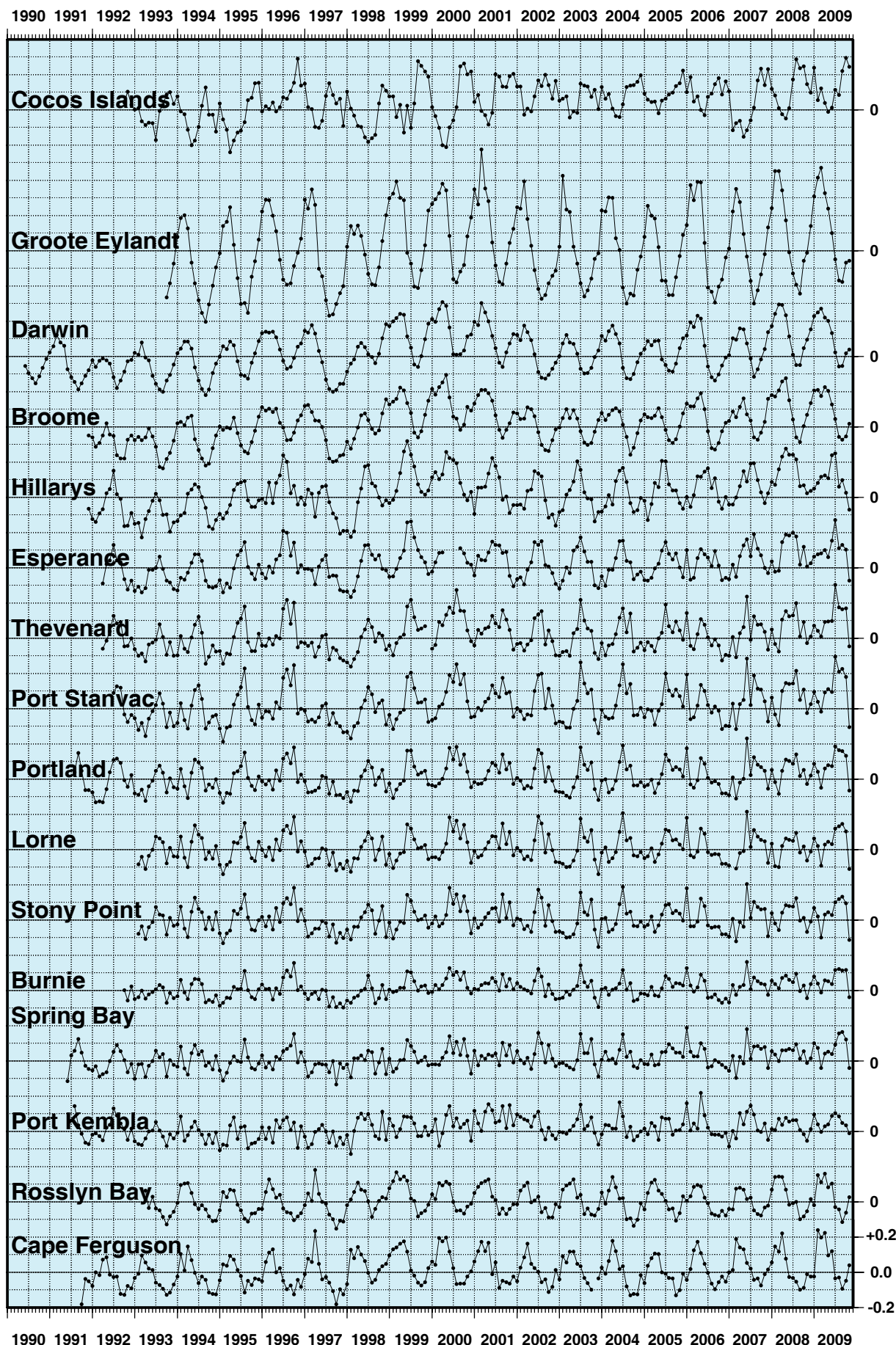


Figure 12
SEA LEVEL ANOMALIES THROUGH OCTOBER 2009 (m)

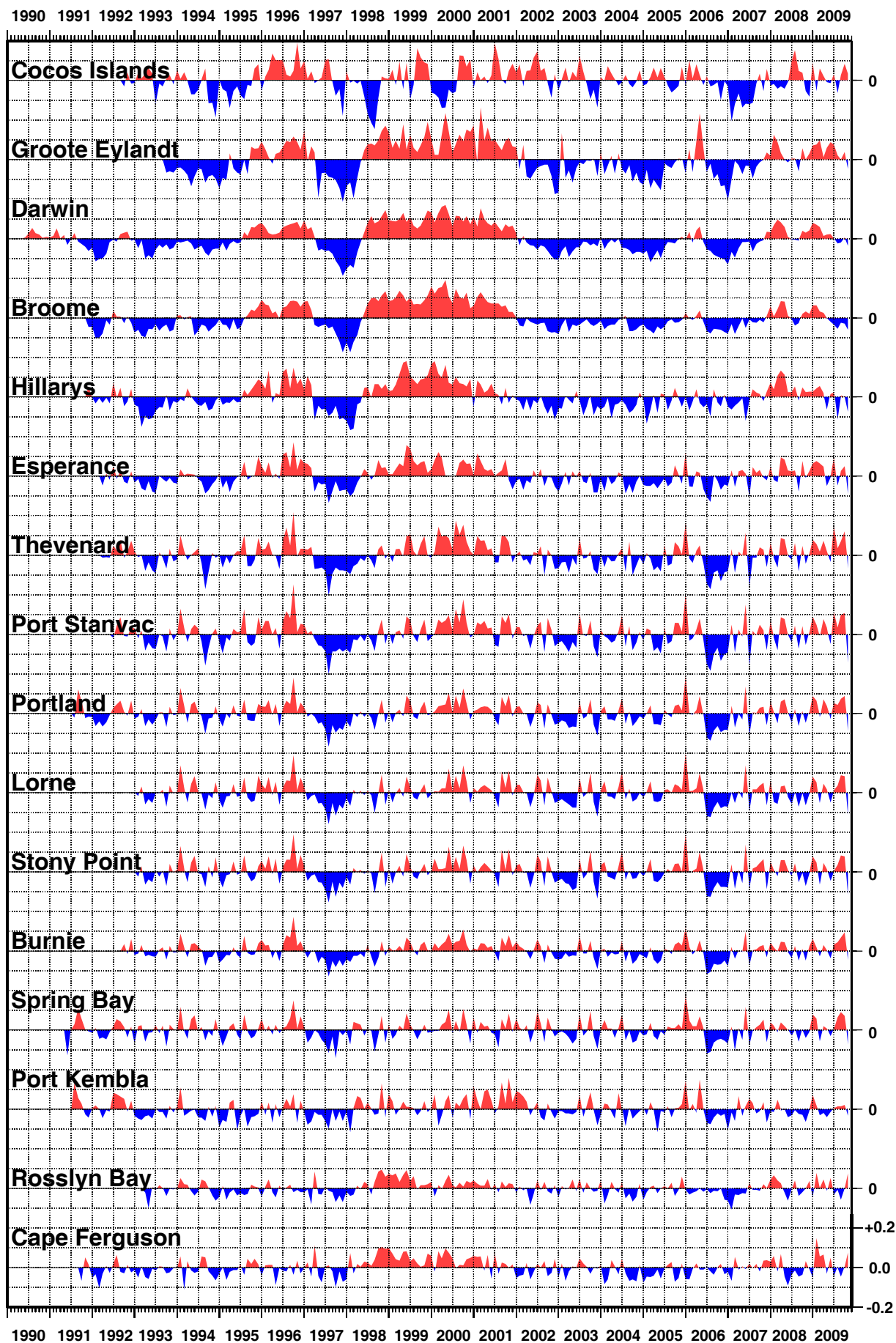


Figure 13

SEA LEVEL TRENDS THROUGH OCTOBER 2009 (mm/year)

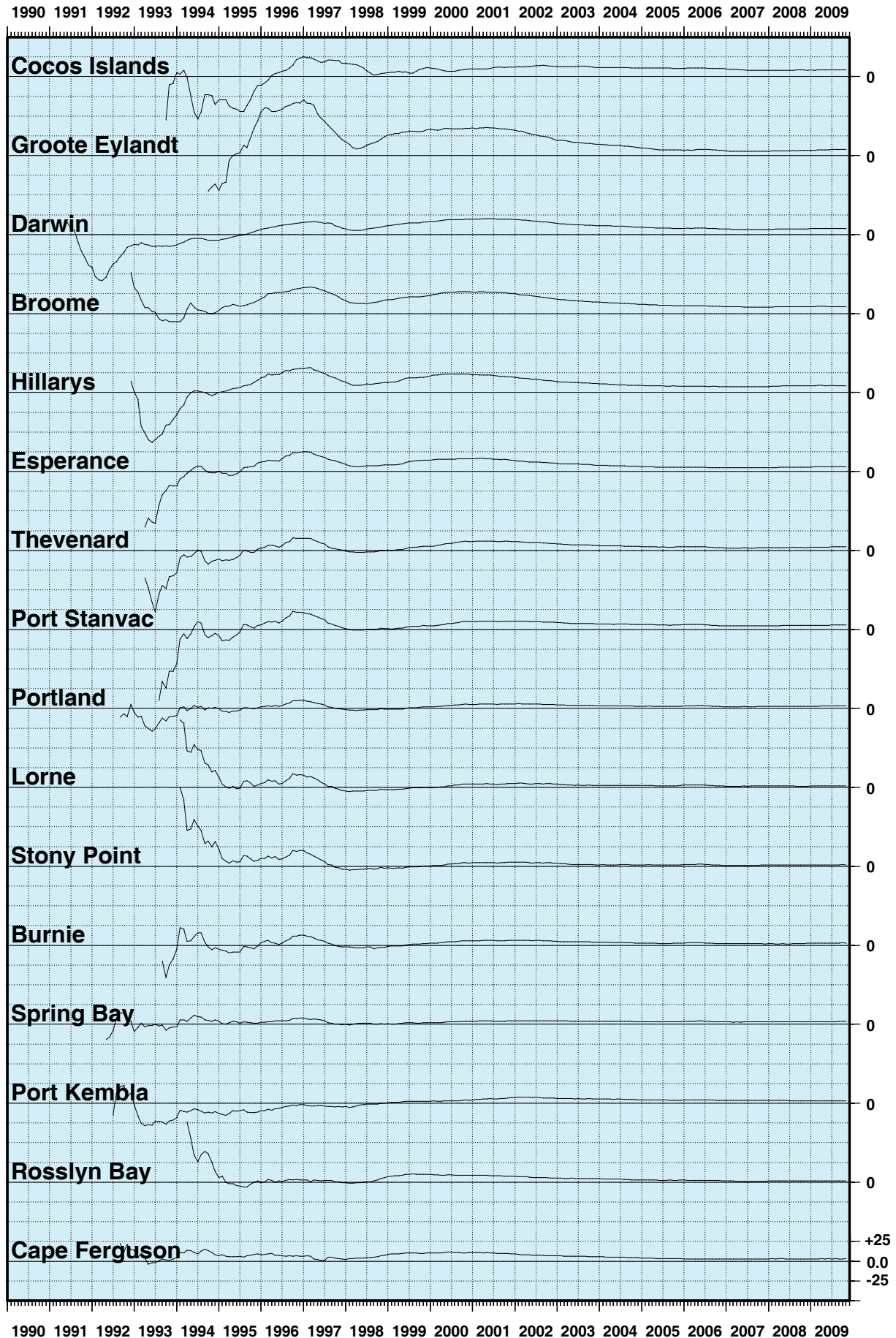


Figure 14

BAROMETRIC PRESSURE ANOMALIES THROUGH OCTOBER 2009 (hPa)

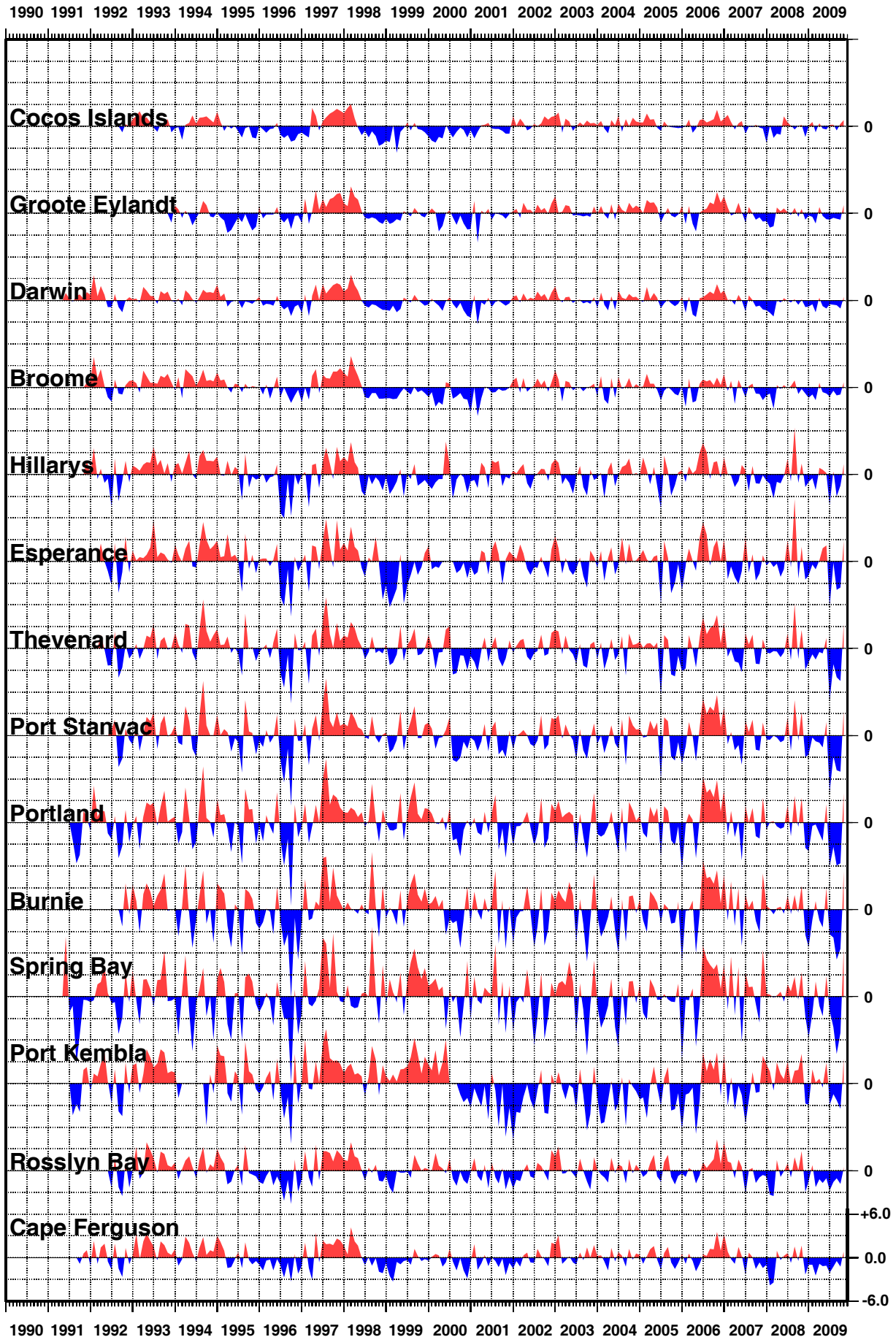


Figure 15

WATER TEMPERATURE ANOMALIES THROUGH OCTOBER 2009 (°C)

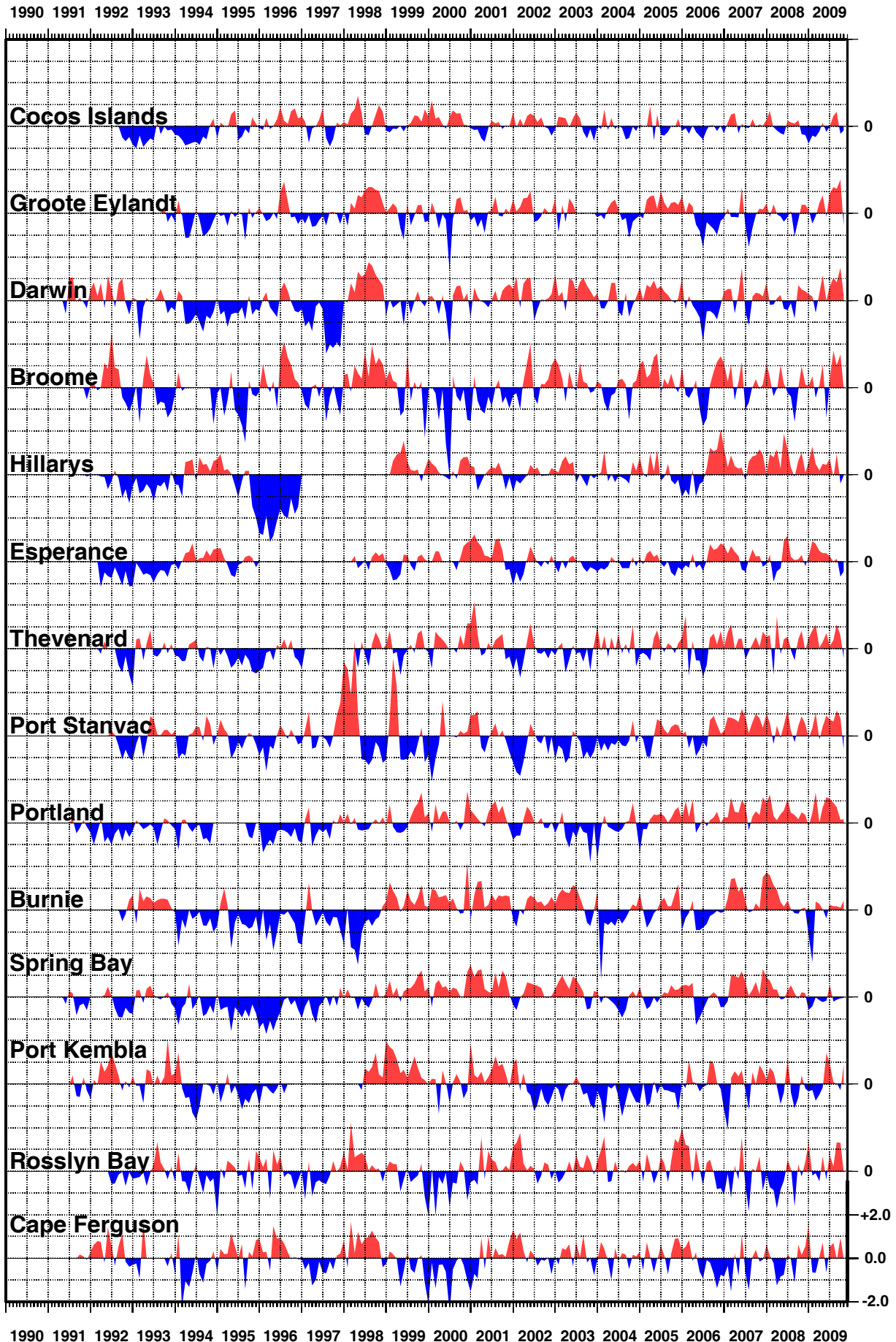


Figure 16
AIR TEMPERATURE ANOMALIES
THROUGH OCTOBER 2009 (°C)

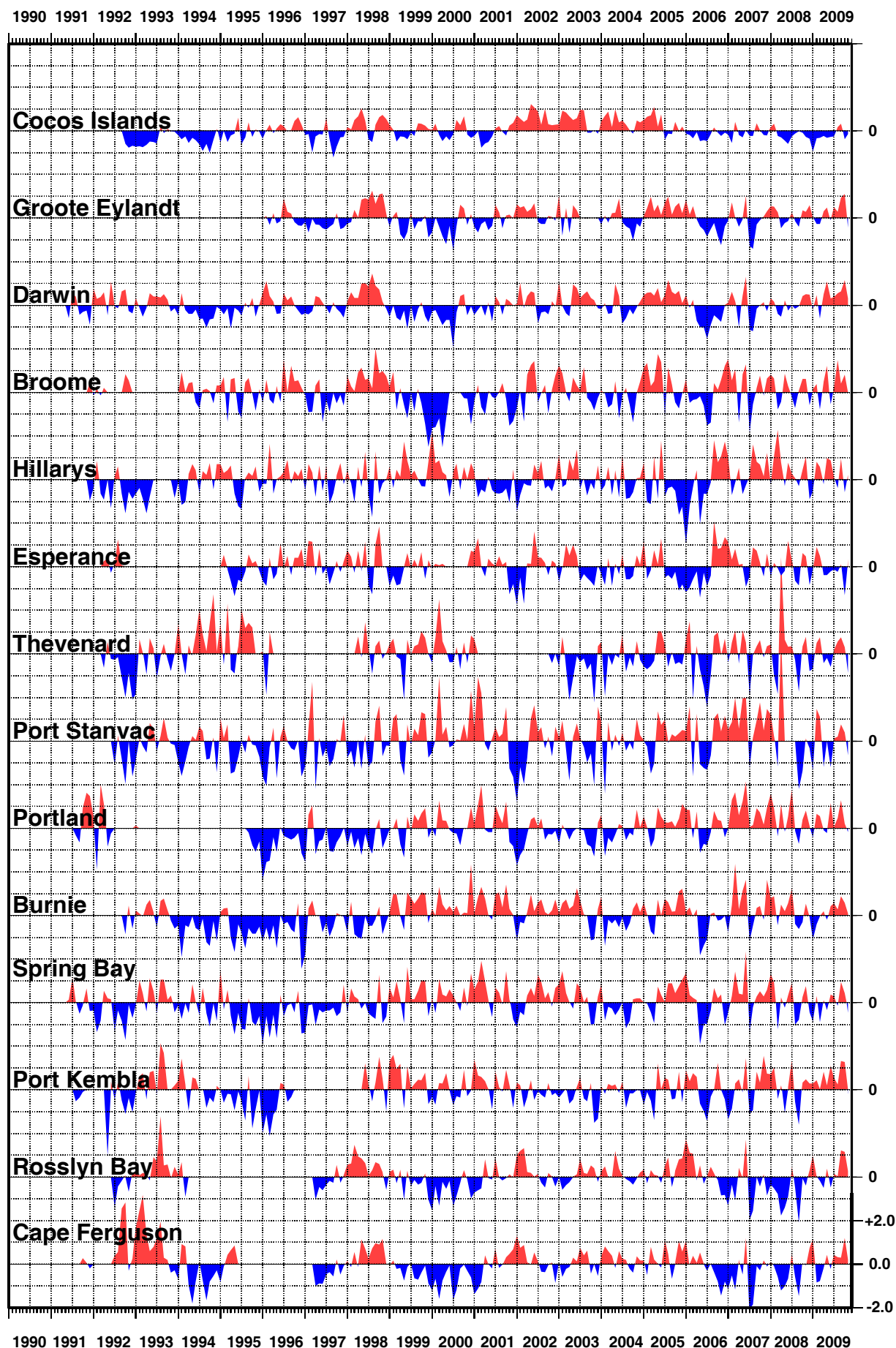


Figure 17 SEA LEVEL DATA RETURN

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

* Patchy record

