greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

# Climate briefing

## Wellington region, May 2016

Alex Pezza and Mike Thompson
Environmental Science Department

For more information, contact the Greater Wellington Regional Council:

Wellington
PO Box 11646

T 04 560 4746
F 04 385 6960
www.gw.govt.nz

Masterton
PO Box 41

T 04 560 4746
F 06 378 2146
www.gw.govt.nz

April 2016

www.gw.govt.nz
info@gw.govt.nz

## Executive summary

This climate briefing is the final in a series of monthly reports that were initiated in November 2015 in response to the unusual climate conditions observed across the Wellington region and New Zealand as a whole. These climate anomalies (e.g., far below average wind and rainfall) were mainly due to the very strong El Niño and the unusual way it changed the atmospheric pressure and wind patterns around New Zealand. However, the El Niño has now almost completely dissipated, and the climate is slowly returning to a more normal regime as we head into the cold season. Future temperature and rainfall anomalies will be reported through our regular Seasonal Climate and Water Resource Summaries for the Wellington Region (http://www.gw.govt.nz/seasonal-climate-and-water-resource-summaries-2/).

The persistent action of blocking anticyclones around New Zealand over summer and autumn helped create the very prolonged hot and dry conditions noted for the Wairarapa in the last briefing issued in April (http://www.gw.govt.nz/assets/Our-Environment/Environmental-monitoring/Environmental-Reporting/Climate-briefing-April-2016.pdf). Since then, the vegetation health index monitored by satellite shows that the water stress (measured on surface vegetation) has been lessening, although the soil is still exceptionally dry for this late in the season. The extent of water stress in the Wairarapa next summer will depend to some degree on the level of soil water and shallow aquifer recovery that occurs over the next few months.

**Climate prediction for winter:** While the El Niño has dissipated, the sea surface temperatures are very warm around the western coast of New Zealand. With New Zealand being a small country with high topography surrounded by water, the sea surface temperatures play a significant role in modulating both the air temperatures and rainfall pattern. Although the water temperatures can change by the action of colder southerly winds and fronts (as happened at this time last year leading to a very cold winter season), most climate models predict the current oceanic warming to persist. An area of high pressure is also predicted to dominate to the north of New Zealand, enhancing the westerly winds and storms during winter. Hence, a warmer than average winter is expected across the Wellington region in terms of mean temperatures, but very cold episodes with frosts are likely in between the mild periods. Rainfall should be near or above average in the west, with increased chance of severe flooding and storms, and near average rainfall in the Wairarapa. A seasonal outlook for the regional Whaitua (catchments) will be released in mid-June.

**Summary of key findings:**

1. The drought stress over southern Wairarapa has slightly lessened on the surface (vegetation and top soil) since late March, mostly due to morning dew and reduced solar radiation;

2. Slightly greener pasture and slightly improved vegetation health indicators compared to late March are shown by satellite;

3. Regardless of the slight recovery the overall dryness in most of the Wairarapa is still extremely severe for this late in the season, highlighting an abnormal extension of the warm/dry season well into autumn;

4. The El Niño is rapidly dissipating, and the combined climate drivers are conducive for normal winter rainfall in the Wairarapa, with normal to above average rainfall in the western ranges.

# Contents

# 1. Climate drivers

## 1.1 El Niño – Southern Oscillation (ENSO)

The 2015/2016 El Niño has now dissipated. Because of the lag in the oceanic system the effects of the El Niño are still being seen in the atmosphere, but are rapidly subsiding. Figure 1.1 shows that the latest predictions suggest a rapid reversal into La Niña conditions in winter, followed by conditions bordering between neutral and La Niña during spring. These conditions favour a rapid return to normal rainfall and possible soil water recovery during winter, depending on the behaviour of other (less predictable) climate drivers such as the Southern Annular Mode.

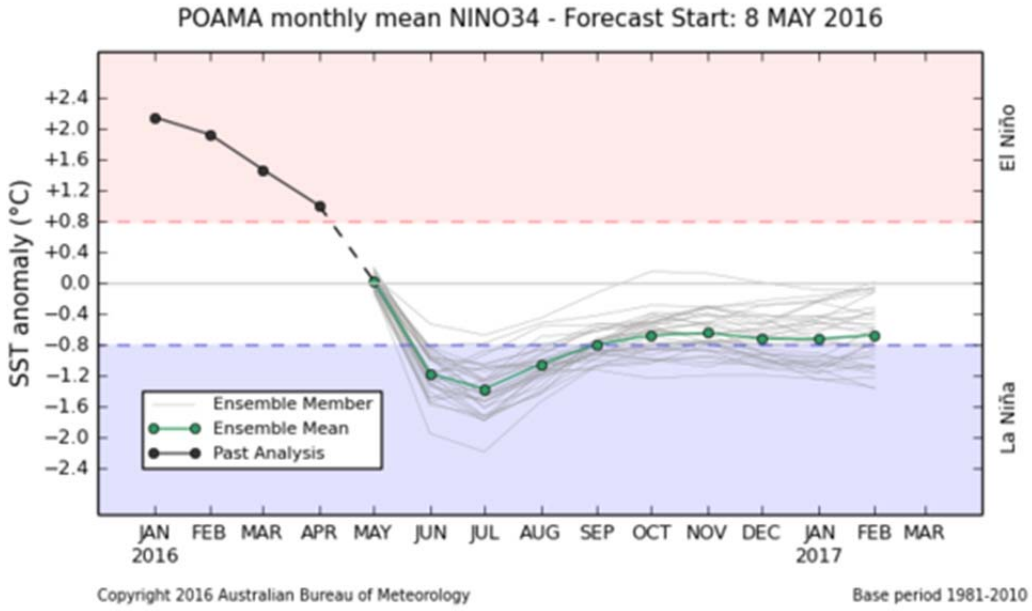



Figure 1.1: Latest ENSO projections until February 2017. The figure shows that conditions are predicted to be on the border between neutral and La Niña conditions for the remaining of the year. Source: Australian Bureau of Meteorology.

## 1.2 Sea ice extent

Sea ice extent is very important to New Zealand because of our relative proximity to Antarctica. The ice strengthens the cold fronts that affect New Zealand during winter. The Antarctic sea ice extent is currently close to average, compared to last year when it was significantly greater than average. This development suggests that the coming winter is unlikely to be as cold as last year. The evolution of the sea surface temperatures (Section 1.3) leads to a similar conclusion.

## 1.3 Sea surface temperatures

The latest sea surface temperature for April 2016 shows that the oceanic waters to the west of New Zealand have been the warmest on record for the second consecutive month (i.e., both March and April) since satellite records began in 1979. Additionally, about 12% of the world has had the warmest water temperature on record, reflecting the strong global warming signal. As we head into winter, the warm waters increase the probability of severe storms and

floods on the western coast, as more evaporation and heat/energy is transferred into the atmosphere.

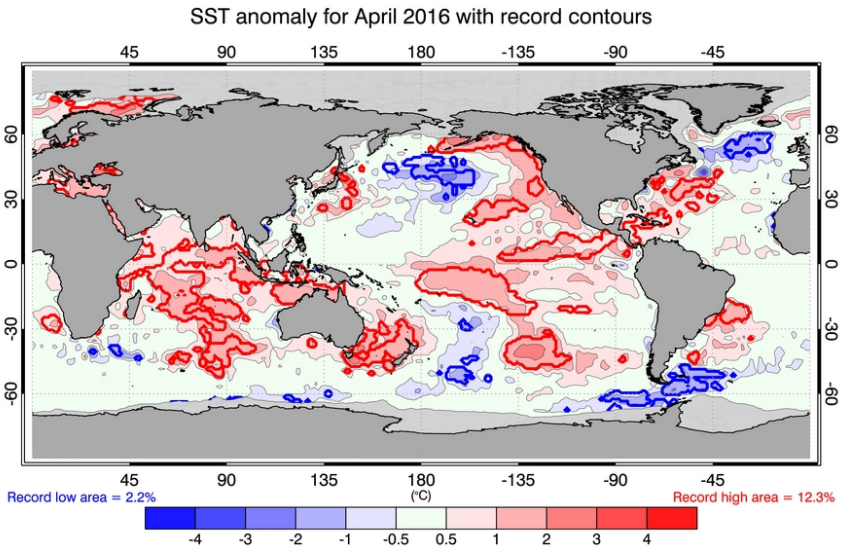



Figure 1.2: Sea surface temperature anomalies for April 2016. Areas of record warm or record cold temperatures since 1979 are shown by the contour lines. Source: Australian Bureau of Meteorology.

# 2. Wairarapa dry conditions update

## 2.1 Satellite-derived vegetation health and drought stress indices

Figure 2.1 shows the satellite-derived drought-stress index for the week ending 12th May 2016. The drought index is still high in north-eastern Wairarapa, but has slightly lowered in south Wairarapa relative to mid-April when this area was under exceptional stress. Overall, the water stress is still significantly worse than observed at the same time last year, reflecting an exceptionally warm and dry autumn with very little recovery.

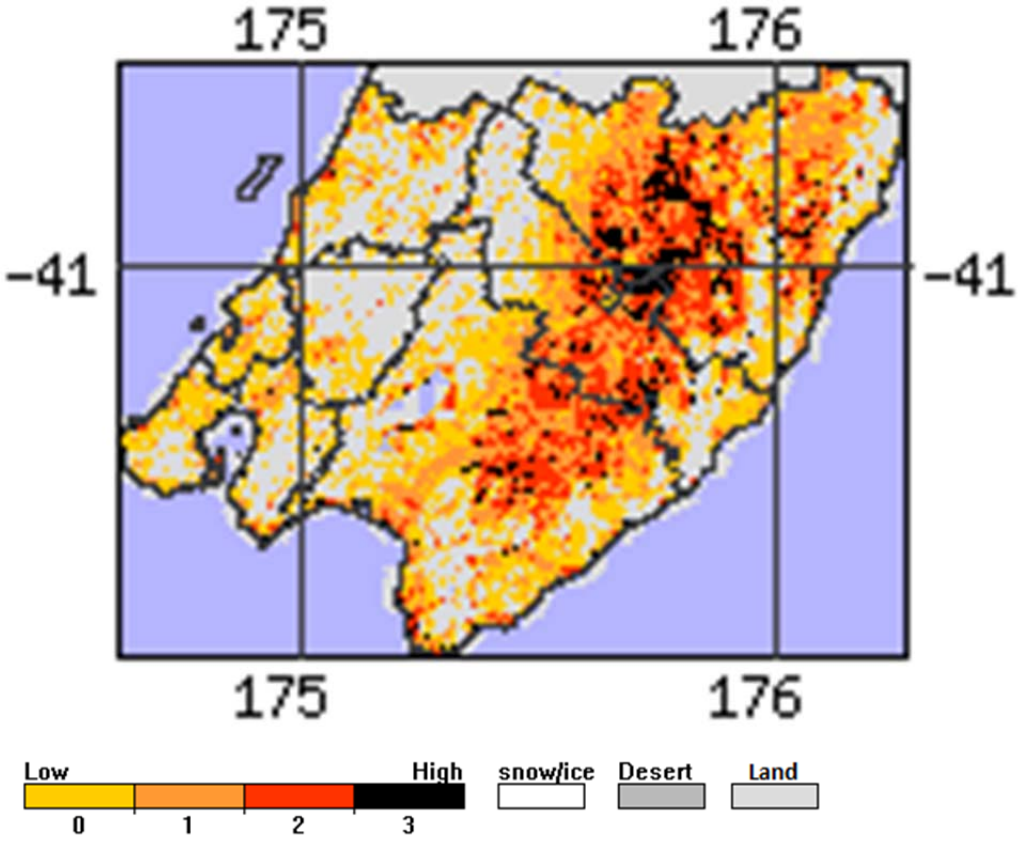



Figure 2.1: Satellite-derived Drought-stress Index for the week ending 12 May 2016. Drought index scale (right): 0 (moderate or no stress), 1 (severe stress), 2 (extreme stress), 3 (exceptional stress). The index is relative to a 25 year period base climatology. Source: NOAA/US, resolution 4km.

## 2.2 Soil moisture assessment from the NIWA Drought Indicator maps

Figure 2.2 shows the soil moisture deficit from the NIWA national drought indicator maps zoomed in for the Wellington region for 7th April 2016 (left) and 17 May 2016 (right). Improvement is apparent since our last briefing in mid-April, particularly in the south Wairarapa, consistent with the reduction in drought index severity discussed in the previous section. However, the deficit is still extremely unusual for this time of the year, highlighting the very prolonged warm and dry season compared to normal. This extension of the dry season well into autumn is what is expected under climate change predictions for the Wellington region.

The partial improvement is more related to the formation of morning dew and reduced evaporation as a result of decreasing solar radiation rather than rainfall itself, as rainfall to date remains below average in the Wairarapa. The level of soil water recovery over the next few months will be an important determinant of how water stress develops next spring/summer as the solar radiation increases again.

As discussed in Section 1.1, the current climate prediction related to the development of the ENSO phenomenon is favourable for at least near-normal rainfall in the Wairarapa during the next three months.

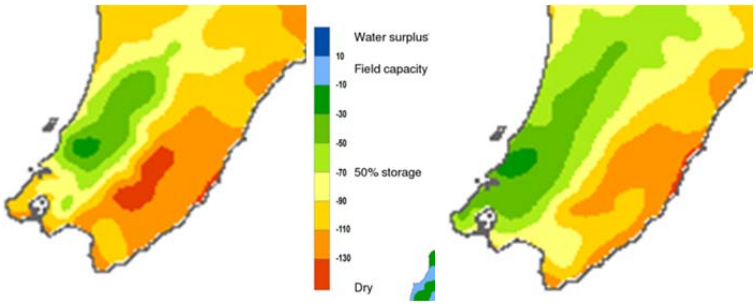



Figure 2.2: Soil moisture deficit for 7 April 2016 (left) and 17 May 2016 (right). Although improved over the last month, the soil moisture deficit as of 17 May is still notably worse than what would be expected for this late in the season, highlighting the unusual extension of the dry/warm season. This is consistent with climate change predictions. Source: NIWA drought monitor. https://www.niwa.co.nz/climate/nz-drought-monitor/droughtindicatormaps/Soil%20Moisture%20Deficit%20%28SMD%29

## 2.3 Observed rainfall and soil moisture conditions for selected sites

Figure 2.3 shows the location of selected GWRC rainfall and soil moisture monitoring sites. Plots of accumulated rainfall and soil moisture trends are provided in the following pages.

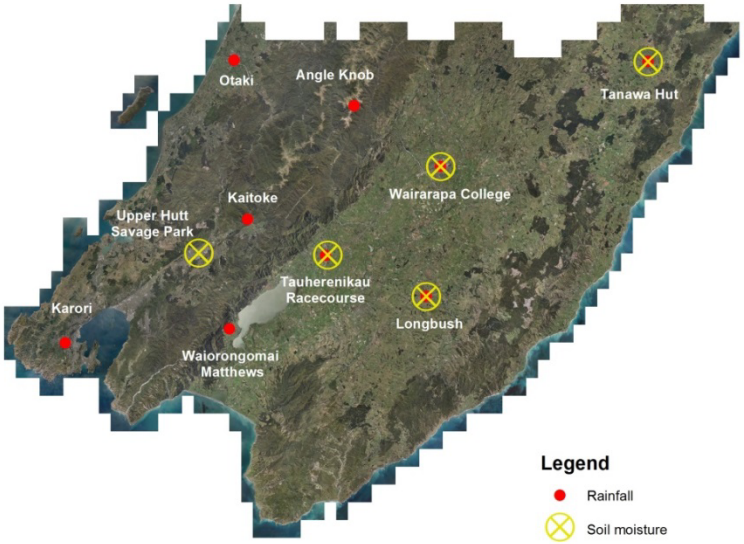
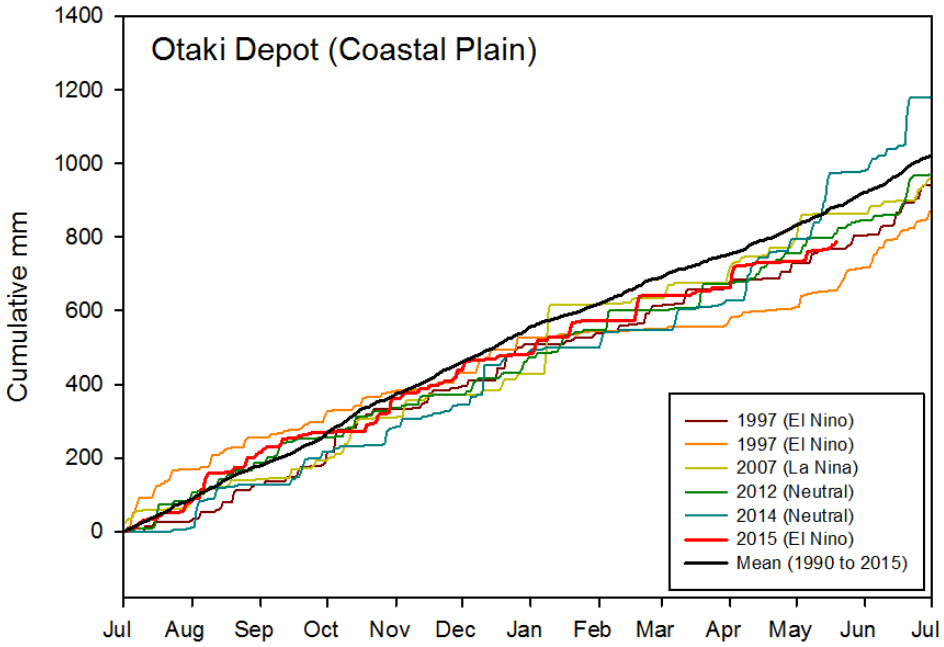



Figure 2.3: Map of rainfall and soil moisture monitoring locations

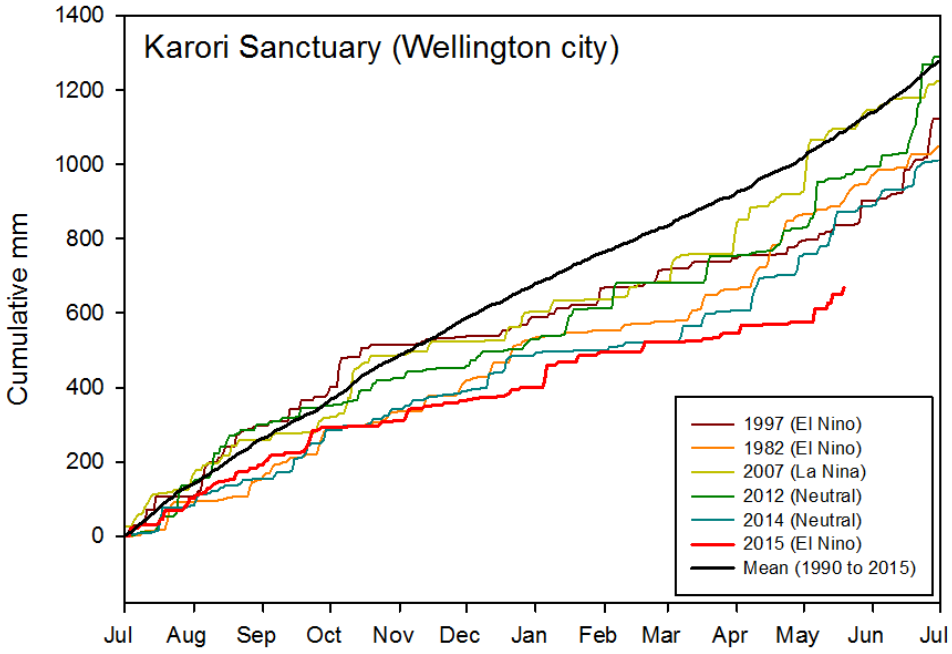
### 2.3.1 Rainfall accumulation – since 1 July 2015

The following rainfall plots show total rainfall accumulation (mm) since 1 July 2015. For comparative purposes, cumulative plots for selected historic years with notably dry summers in the Wairarapa have been included, as well as the site mean. Many of the GWRC telemetered rain gauge sites in the lower lying parts of the Wairarapa (i.e., not Tararua Range gauges installed for flood warning purposes) have only been operating since the late 1990s so the period of data presented is somewhat constrained to the past two decades. For each historical record plotted, an indication of ENSO climate state (El Niño, La Niña or neutral) at that time is also given. GWRC does not operate a rain gauge in the southern-most parts of the Wairarapa Valley that is suitable for presenting data in this report. This means that we cannot be confident that the rainfall patterns seen elsewhere extend to this part of the region other than the satellite and VCN data already presented.

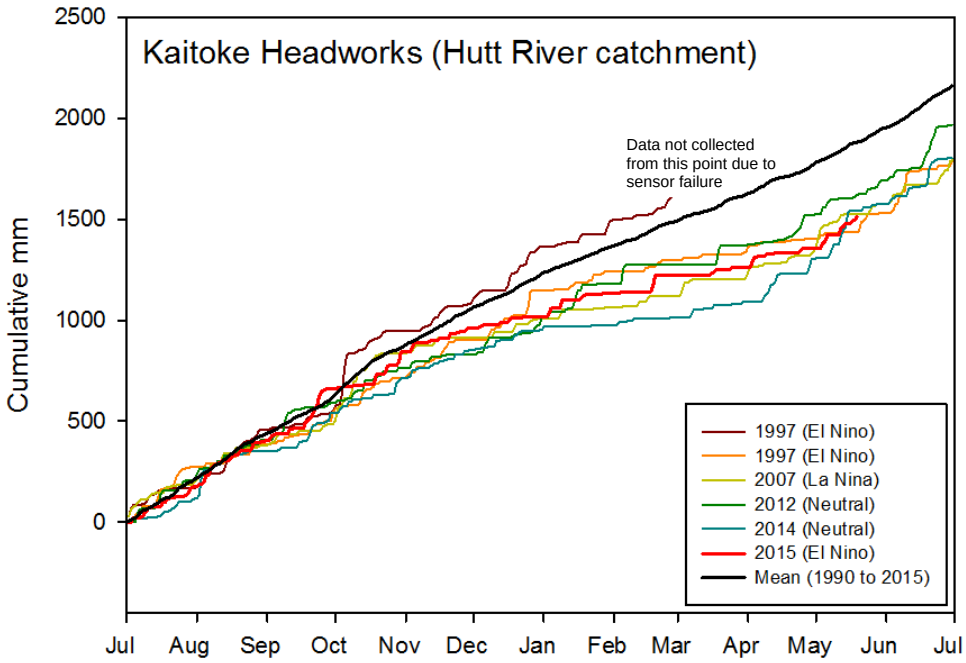
## Kapiti Coast

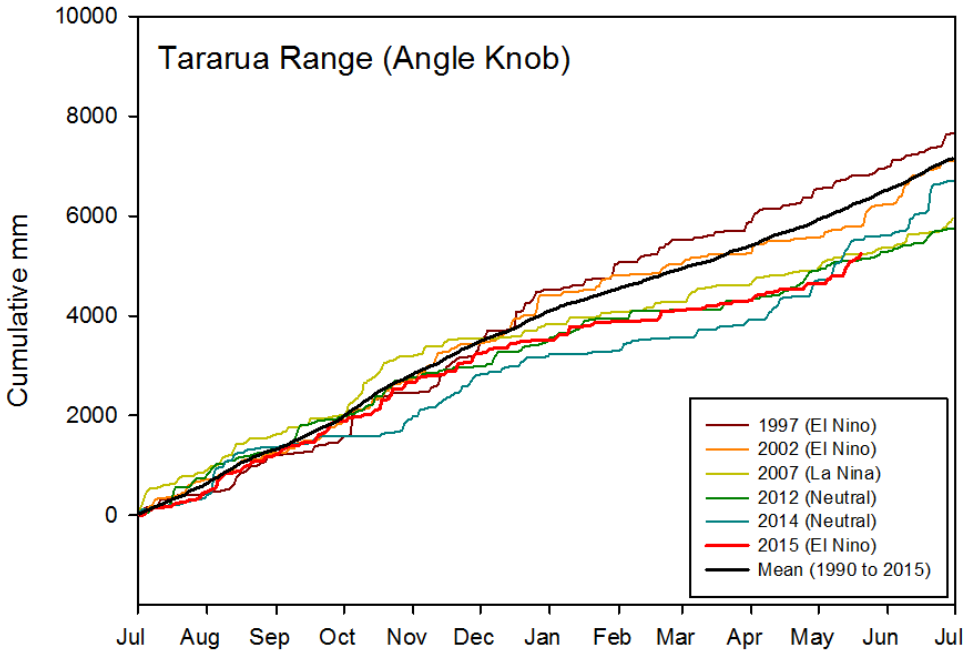



## Southwest (Wellington city)

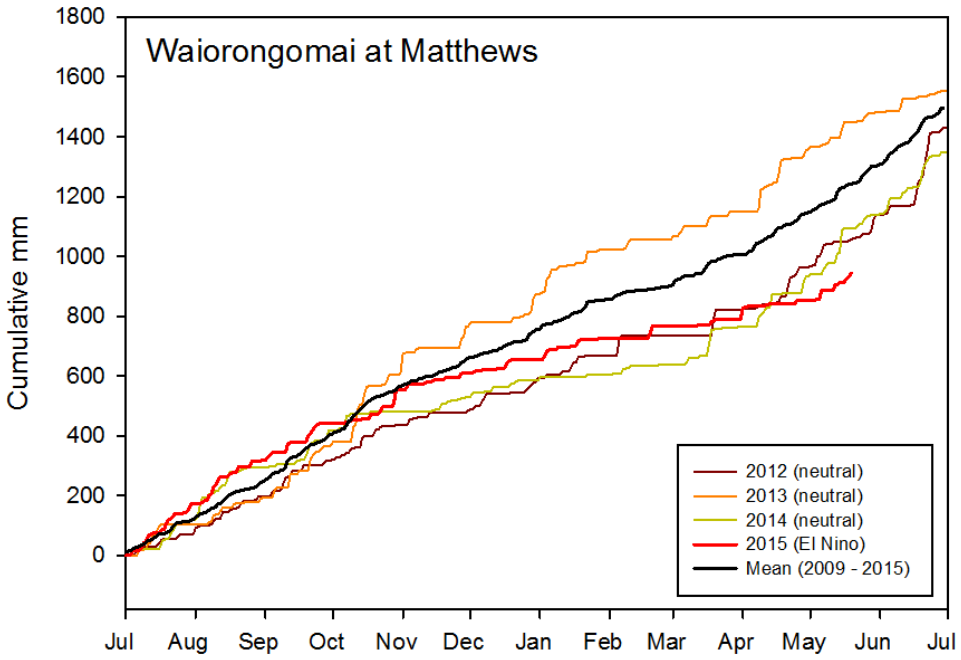


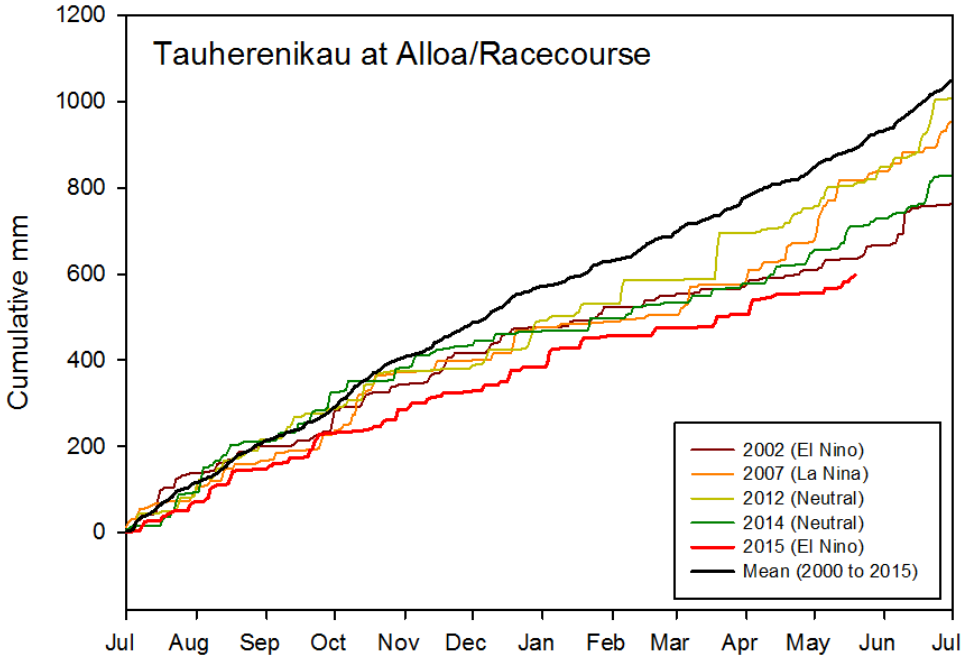
## Hutt Valley and Tararua Range

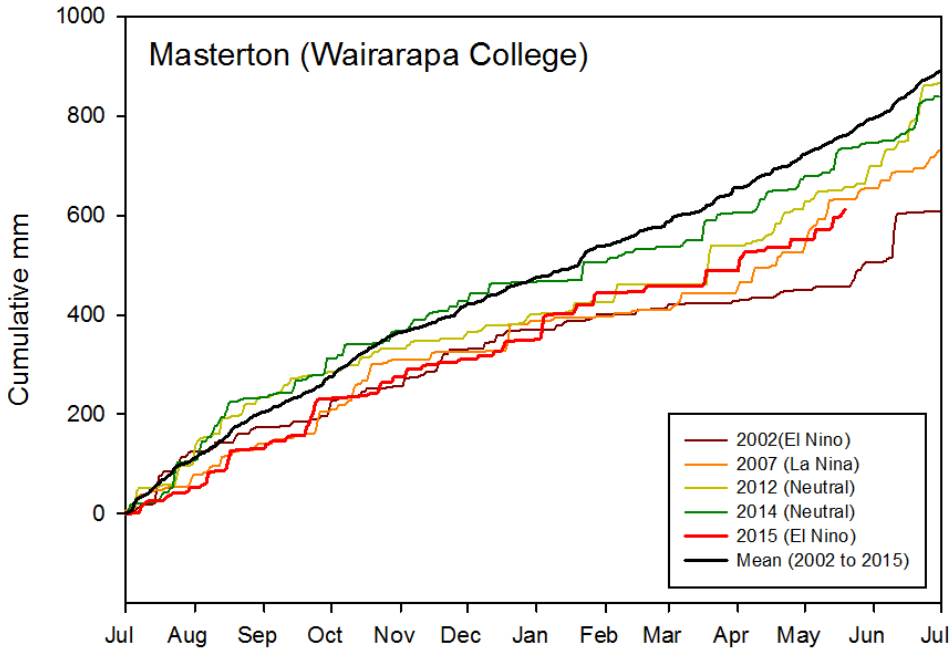


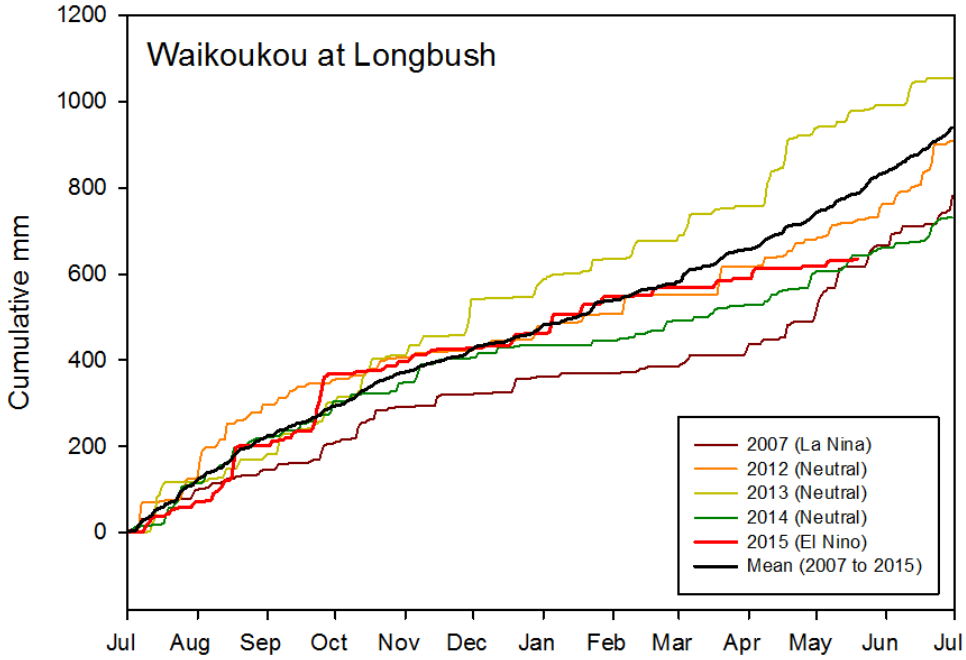



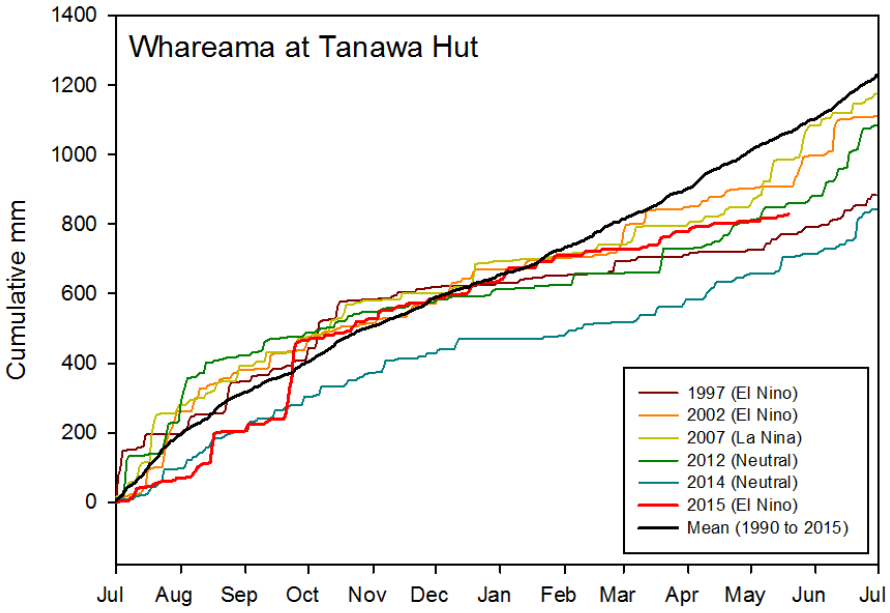
## Wairarapa


Waiorongomai at Matthews
Cumulative mm
1800
1600
1400
1200
1000
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2012 (neutral)
2013 (neutral)
2014 (neutral)
2015 (El Nino)
Mean (2009 - 2015)


Tauherenikau at Alloa/Racecourse
Cumulative mm
1200
1000
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2002 (El Nino)
2007 (La Nina)
2012 (Neutral)
2014 (Neutral)
2015 (El Nino)
Mean (2000 to 2015)


Masterton (Wairarapa College)
Cumulative mm
1000
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2002(El Nino)
2007 (La Nina)
2012 (Neutral)
2014 (Neutral)
2015 (El Nino)
Mean (2002 to 2015)

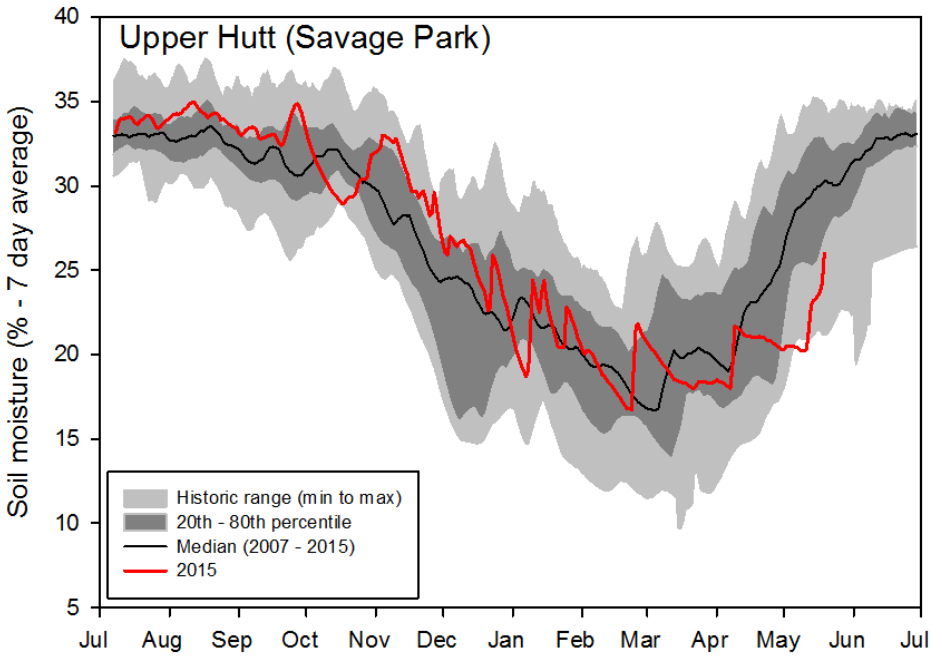

Waikoukou at Longbush
Cumulative mm
1200
1000
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2007 (La Nina)
2012 (Neutral)
2013 (Neutral)
2014 (Neutral)
2015 (El Nino)
Mean (2007 to 2015)



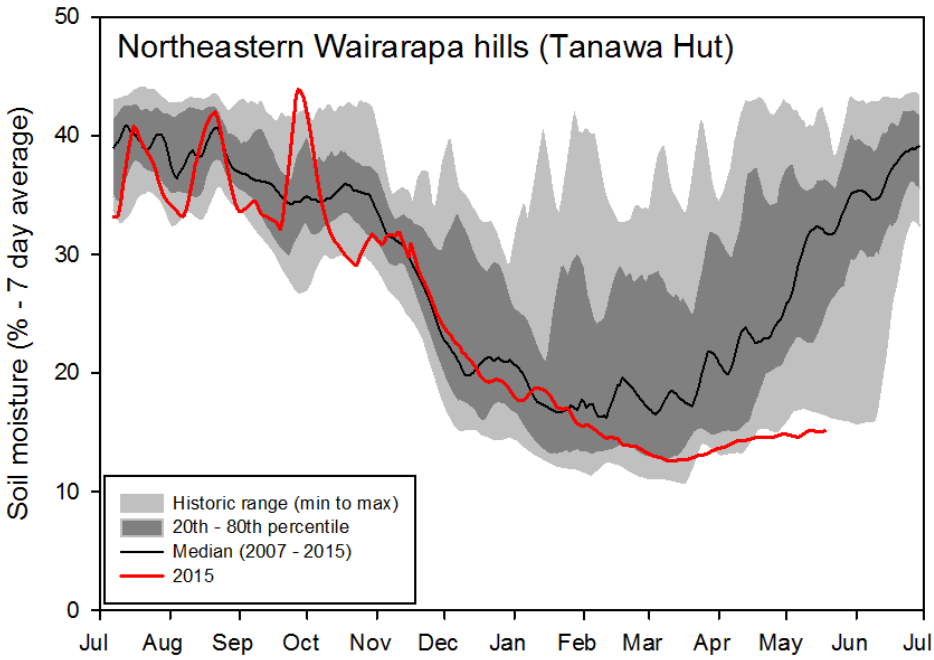

### 2.3.2 Soil moisture content – since 1 July 2015

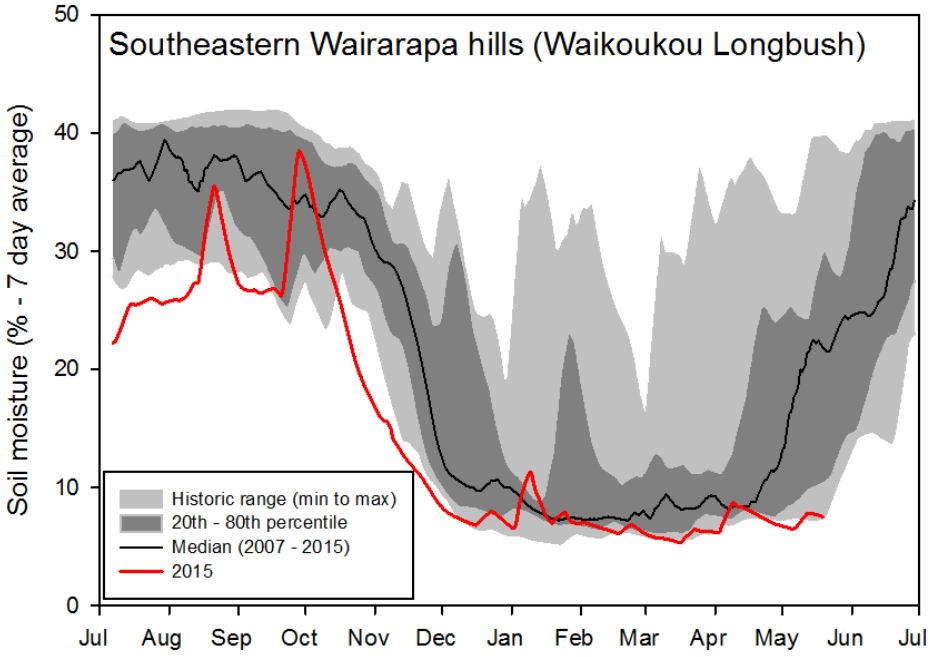
The soil moisture plots show seven day rolling average soil moisture (%) since 1 July 2015. An envelope plot of the historic range of data (and site mean) is also provided to give an indication of how the current soil moisture compares with that for a similar time of the season in past years. While the soil moisture plots are useful for tracking change within the current season and comparing relative differences between years, they do not provide the absolute moisture content (%) as many of the GWRC soil moisture sites have not yet been fully calibrated.

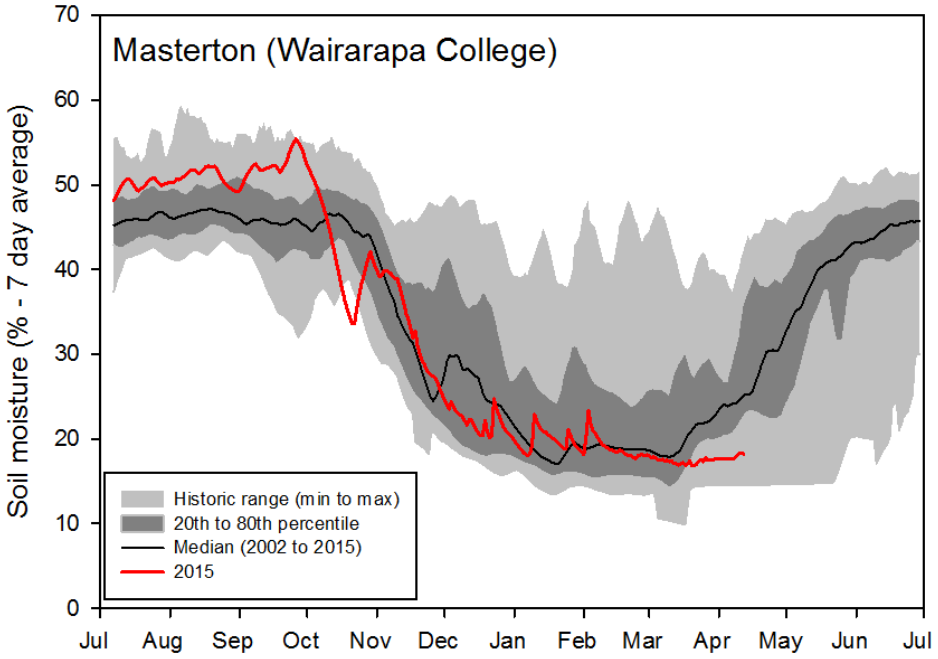
Hutt Valley

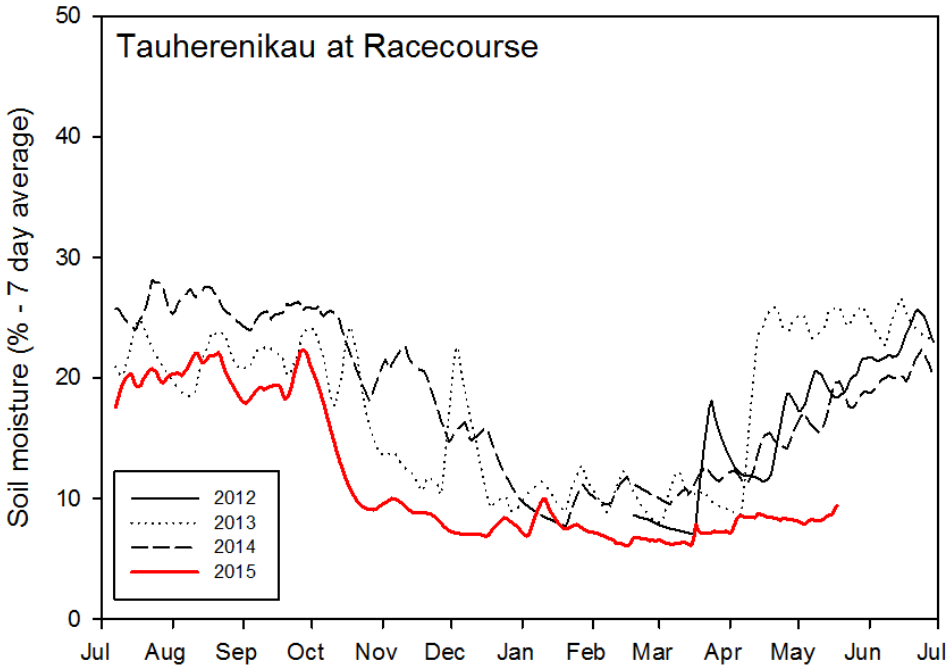


## Wairarapa


Northeastern Wairarapa hills (Tanawa Hut)
Soil moisture (% - 7 day average)
0
10
20
30
40
50
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Historic range (min to max)
20th - 80th percentile
Median (2007 - 2015)
2015


Southeastern Wairarapa hills (Waikoukou Longbush)
Soil moisture (% - 7 day average)
0
10
20
30
40
50
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Historic range (min to max)
20th - 80th percentile
Median (2007 - 2015)
2015




### 2.3.3 Overall assessment of rainfall accumulation and soil moisture

Accumulated rainfall since mid-winter 2015 remains very low across all sites compared with normal years. Furthermore, rainfall has been lower than the driest years in recent memory at most sites. The southernmost sites have recorded exceptionally low accumulations relative to other ‘drought’ years.

Soil moisture levels have recovered to an extent in the west but are still exceptionally low across all the Wairarapa sites for this time of year. There has been virtually no recovery in soil moisture in the Wairarapa, since mid-summer which is highly unusual and consistent with the observations from the satellite and NIWA drought indicator data discussed earlier.

## 3. Outlook for winter

While the El Niño has dissipated, the sea surface temperatures are very warm around the western coast of New Zealand as shown in Figure 1.2. With New Zealand being a small country with high topography surrounded by water, the sea surface temperatures play a significant role in modulating both the air temperatures and rainfall pattern. Although the water temperatures can change as a result of colder southerly winds and fronts (as happened at this time last year leading to a very cold winter season), most climate models predict the current oceanic warming to persist. An area of high pressure is also predicted to dominate north of New Zealand, enhancing the westerly winds and storms during winter.

Based on the pattern above a warmer than average winter is expected across the region in terms of mean temperatures, although very cold episodes with frosts are likely in between the mild periods. Rainfall should be near or above average on the western coast, with increased chance of severe flooding and storms. Near average rainfall is expected in the Wairarapa.

A climate outlook/predictions for the different Whaitua (catchments) in the region will be released in mid-June with the main seasonal report produced by Greater Wellington Regional Council (Seasonal Climate and Water Resource Summaries for the Wellington Region, available through http://www.gw.govt.nz/seasonal-climate-and-water-resource-summaries-2/).

## Acknowledgments

We would like to thank the National Oceanic and Atmospheric Administration (NOAA/US) for kindly providing us with satellite-derived drought indices.