greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Climate briefing

Wellington region, February 2016

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1. Highlights

Rainfall has been persistently below average in parts of the Wellington region, especially the south and east coasts, since the end of 2014. In January 2016 some significant recovery occurred, with widespread rainfall in the region surpassing twice the monthly average in some areas. This was associated with tropical moisture originating from ex-tropical cyclones passing to the north of New Zealand, and a blocking anticyclone to the east. However, from late January the pattern reversed again into a dry spell.

This exceptionally high variability is not the standard pattern normally associated with El Niño years. Another climate driver that influences New Zealand's climate, the Southern Annular Mode (SAM), has been in a strong positive phase since the end of last year. This is uncommon during strong El Niños, and has contributed towards the establishment of blocking anticyclones to the east, with a drastic reduction of the westerly winds compared to the start of the season. This pattern has increased the displacement of warm and humid tropical air masses with relatively drier conditions on the west coast, meaning that the period from January to mid-February was more like a La Niña rather than an El Niño year. Therefore, the combination of different climate drivers helps explain the mixed atmospheric response during the season.

The El Niño is still strong but is slowly declining as predicted, and its influence should disappear towards the beginning of winter. The weather behaviour for the remaining of the summer season, including early autumn, will largely depend on the interaction between the remaining influences of El Niño – Southern Oscillation (ENSO) as well as the other climate drivers such as the SAM. NIWA is still predicting a 40% probability of a dry remaining of summer and early autumn in the Wairarapa. In the absence of any forecast guidance there would be an equal likelihood (33% chance) of either dry, normal or wet conditions.

In summary, the remaining summer is expected to have irregular and alternating of bursts of wet and longer dry periods, with overall increased statistical odds favouring drier than average conditions when the season is taken as a whole.

Water conservation strategies for summer: In light of current El Niño conditions and the climate predictions, Wellington Water has already highlighted the need to enhance water conservation strategies this summer. For more information please refer to their website: http://wellingtonwater.co.nz/media-releases/get-set-for-a-dry-summer/

Seasonal Climate and Water Resources: The extended seasonal climate reports for the Wellington region produced by the Environmental Science Department can be found here: http://www.gw.govt.nz/seasonal-climate-and-water-resource-summaries-2/

2. El Niño – Southern Oscillation (ENSO)

2.1 Current status

The latest state as of 6 February 2016 of the current El Niño is shown in Figure 2.1 (upper panel), with fairly warm waters in the central Equatorial Pacific Ocean extending all the way to South America. The peak strength of the current event is comparable to the strongest El Niño events on record (Figure 2.1 (lower panel).

The waters are cool on the far eastern side of New Zealand, which is a normal response of the oceanic circulation to El Niño events. However, the waters immediately around New Zealand are now warm, which is partially a response to a persistently positive Southern Annular Mode (Figure 2.2), with frequent blocking anticyclones to the east bringing warm and humid tropical air masses into the northern parts of New Zealand, and a reduction of the westerly winds compared to the start of the season.

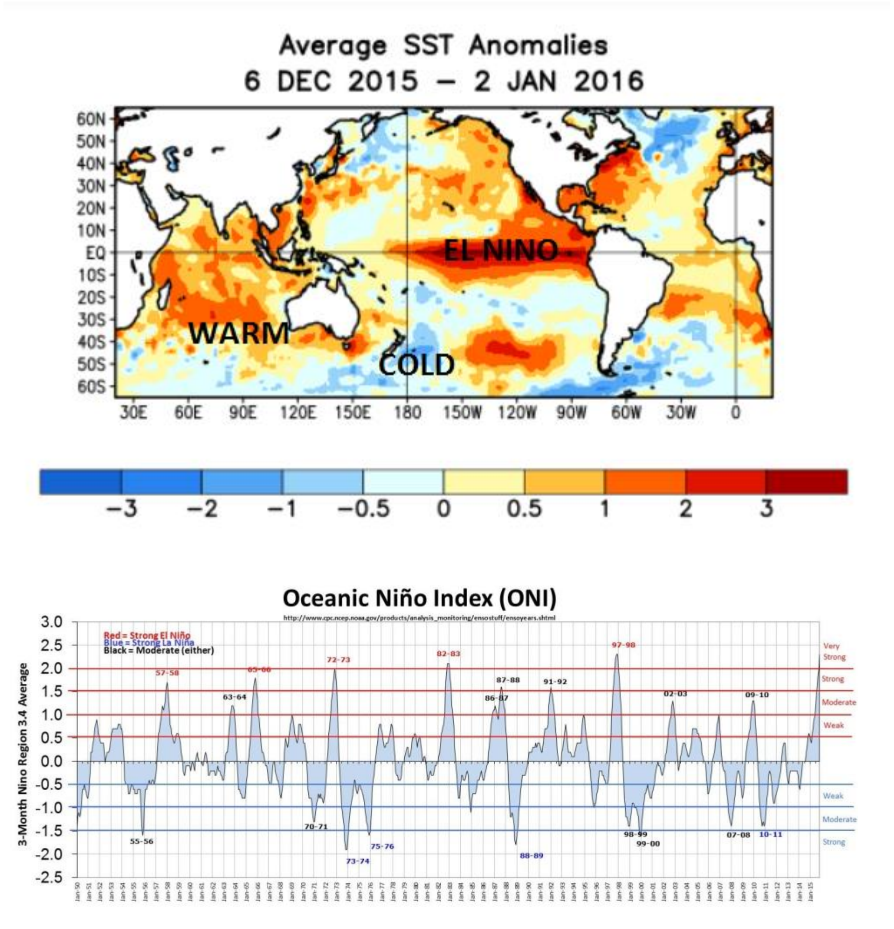


Figure 2.1: Latest water temperature anomalies (upper panel) and how the current El Niño sits in relation to past events (lower panel). Source: NOAA/USA

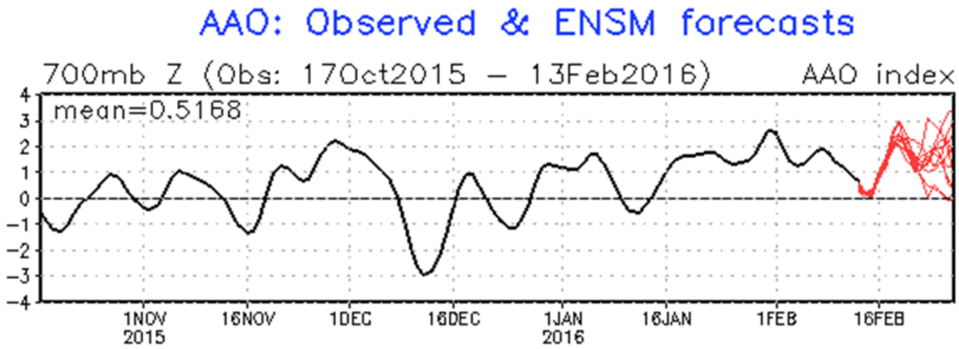


Figure 2.2: Evolution of the Southern Annular Mode, as measured by the Antarctic Oscillation Index (AAO). A persistence of positive values is seen for much of 2016, with forecasts for the remaining of February (in red) continuing within positive values. The persistence of the positive phase of this index tends to be associated with blocking anticyclones to the east of New Zealand and a reduction of the westerly winds, which is unusual during strong El Niño years. Source: NOAA/USA

Figure 2.3 (upper panel) shows what has happened during past historical El Niño summers (nine events since the record 1983 El Niño) compared to what is actually happening this year in terms of mean sea level pressure anomalies. Atmospheric pressure is an important parameter because it explains the wind anomalies and the resulting distribution of topographic rainfall.

During El Niños a high pressure anomaly sits to the south of New Caledonia (northwest of New Zealand, in red) and a low pressure anomaly forms to the south-east of New Zealand. This pressure differential is quite strong, increasing the westerlies and contributing towards droughts on the eastern part of New Zealand.

Figure 2.3 (lower panel) shows that the actual observed pattern from the beginning of 2016 is almost the symetrical opposite to what would be expected during a strong El Niño, with a blocking anticyclone to the east and a reduction of the westerly winds. This was not the case until the end of December, marking a profound change in the intra-seasonal atmospheric circulation from January onwards.

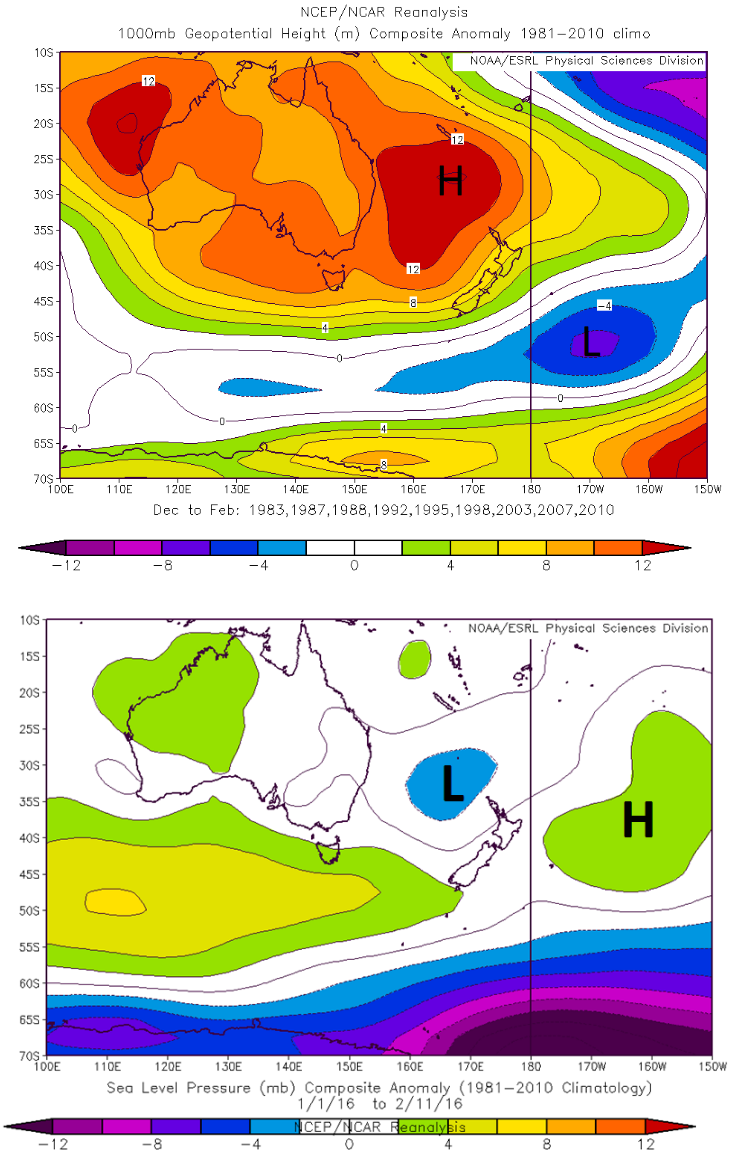


Figure 2.3: Pressure anomalies during typical El Niño summers (upper panel) and from 1 January 2016 to 11 February 2016 (lower panel). New Zealand is under the influence of high pressures (in red), which helps increase the westerly winds and reduce the normal rainfall pattern in traditional El Niños. However, an almost opposite pattern has been observed since the beginning of January 2016, resembling more La Niña rather than El Niño conditions. Source: NCEP Reanalysis/USA.

3. Broad-scale drought indicators

The broad scale indicators show that the soil moisture deficit as of 14th February 2016 for the Wellington region is virtually identical to what was observed at this time last year, while overall, the remaining areas of the country are less dry. The soil moisture anomalies (lower left) and the 60 day Standardised Precipitation Index (SPI, lower right) shows that the western portion of the Wellington region is relatively drier than the Wairarapa. This is the opposite of what would be expected in a normal El Niño, resulting from the combined influence of different climate drivers discussed previously.

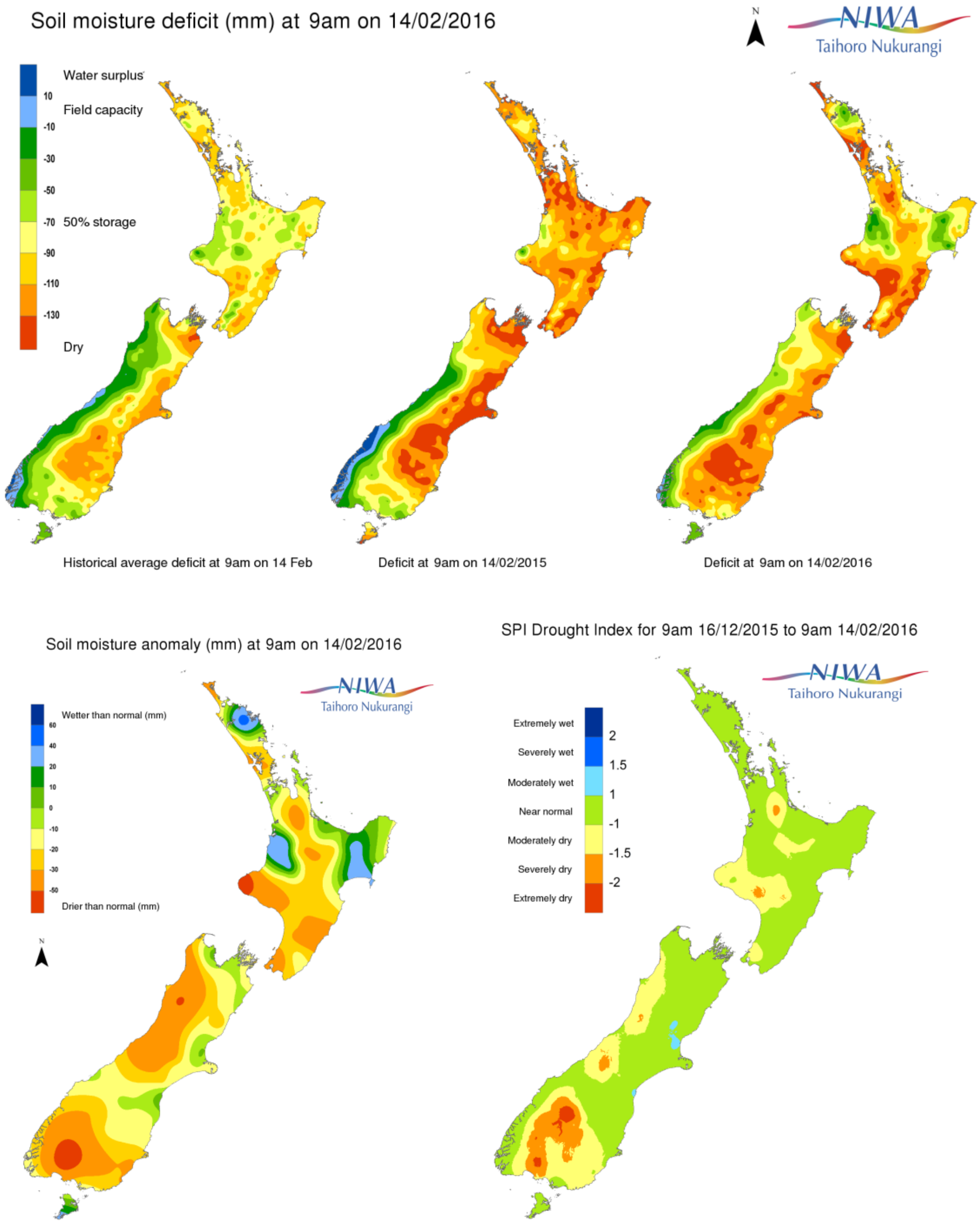


Figure 3.1: Soil moisture deficit (compared to historical average and same time last year) and soil moisture anomalies as of 14th Feb 2016 (upper panels and lower left), and Standardised Precipitation Index for the last 60 days (bottom right). Source: NIWA Drought Monitor.

4. Observed rainfall and soil moisture conditions

4.1 Accumulated rainfall and soil moisture at selected sites

Figure 4.1 shows the location of a selection of representative GWRC rainfall and soil moisture monitoring sites. Plots of accumulated rainfall and soil moisture trends are provided in the following pages.

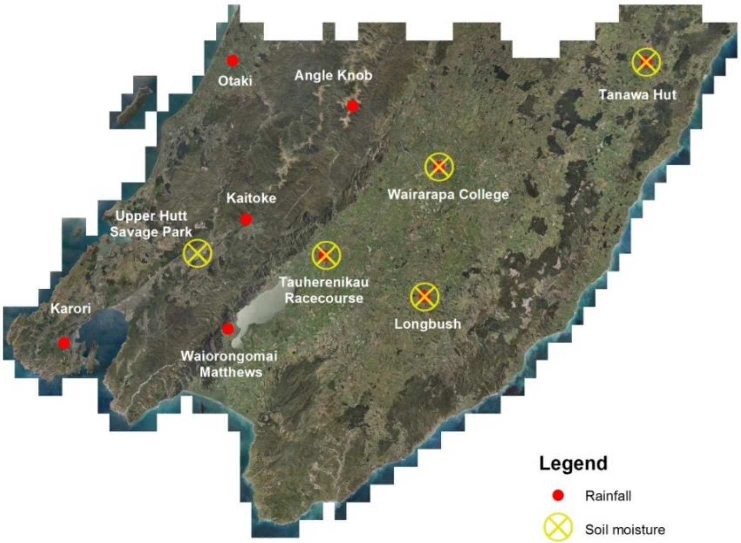


Figure 4.1: Map of rainfall and soil moisture monitoring locations

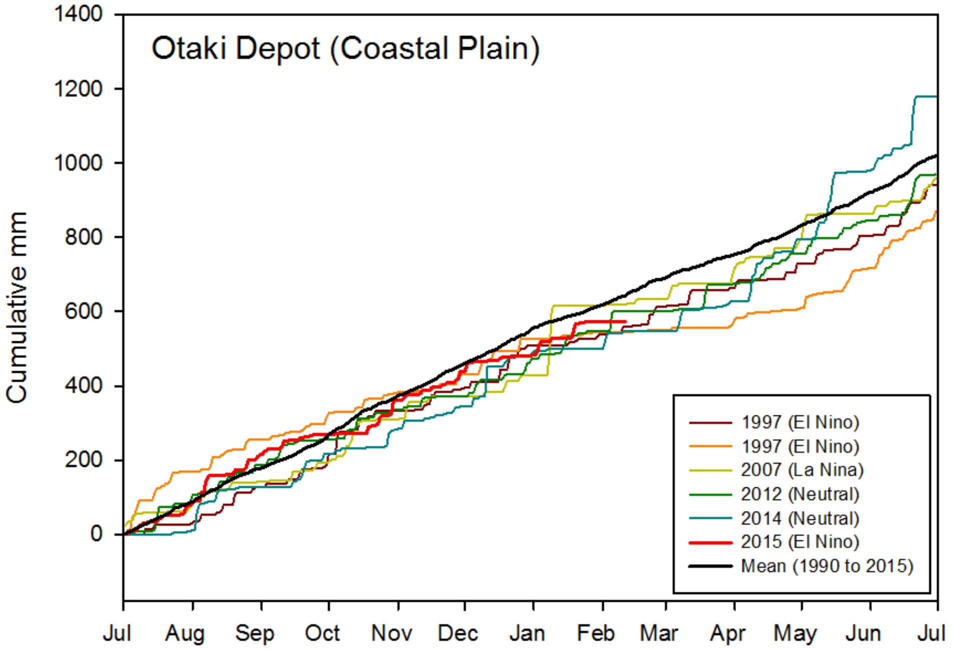
4.1.1 Rainfall – since 1 July 2015

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 (ie, 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.

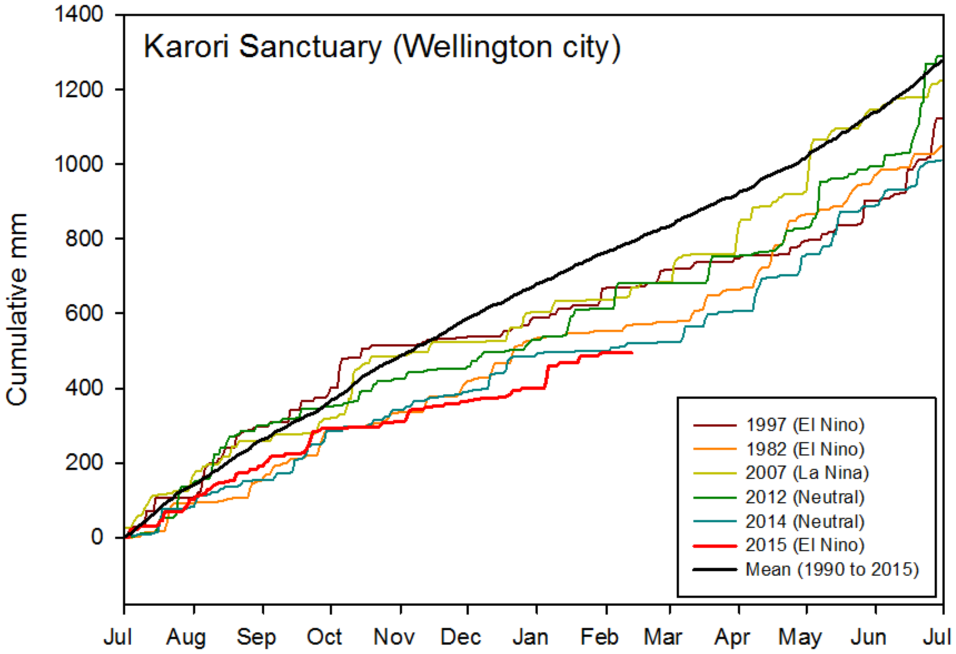
Generally speaking, rainfall accumulation since July 2015 has been below average across the region and significantly so in some areas (e.g., the southwestern part of the region around Wellington city and the mid to southern Wairarapa Valley). There has been no substantial rain since early January in most parts of the region, although the eastern Wairarapa in particular received some useful top-ups of around 20mm on 18/19 January and again a week later. Accumulated rainfall in the eastern hill country is now comparable with an average year and much higher than recent dry years (e.g., 2012/13 and 2014/15). Soil moisture levels across the region remain within the expected normal range for this time of year (mid-January), although are currently in a drying phase.

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.

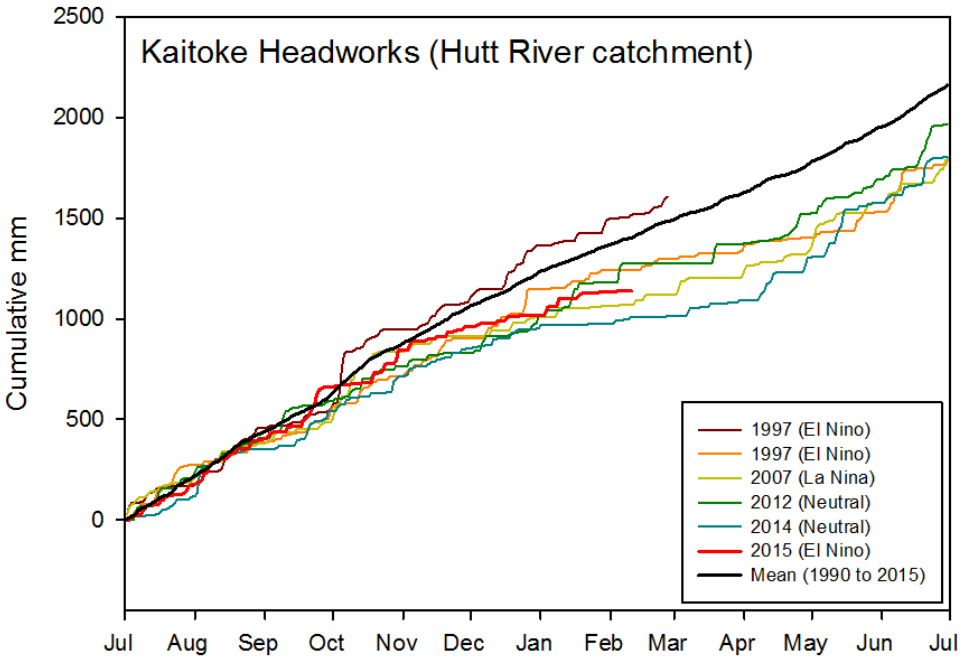
(a) Kapiti Coast

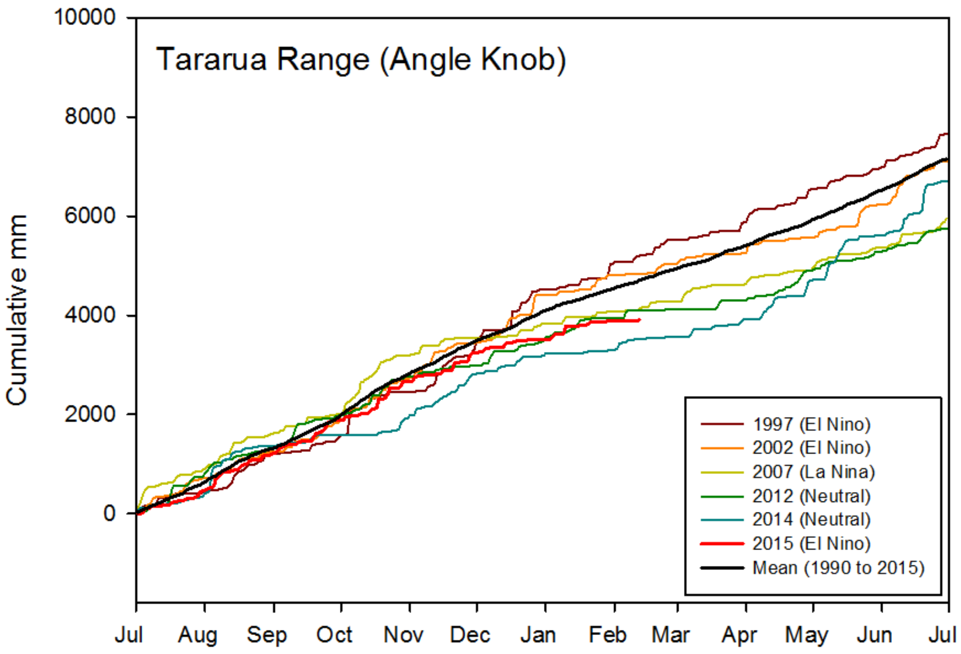


(b) Southwest (Wellington city)

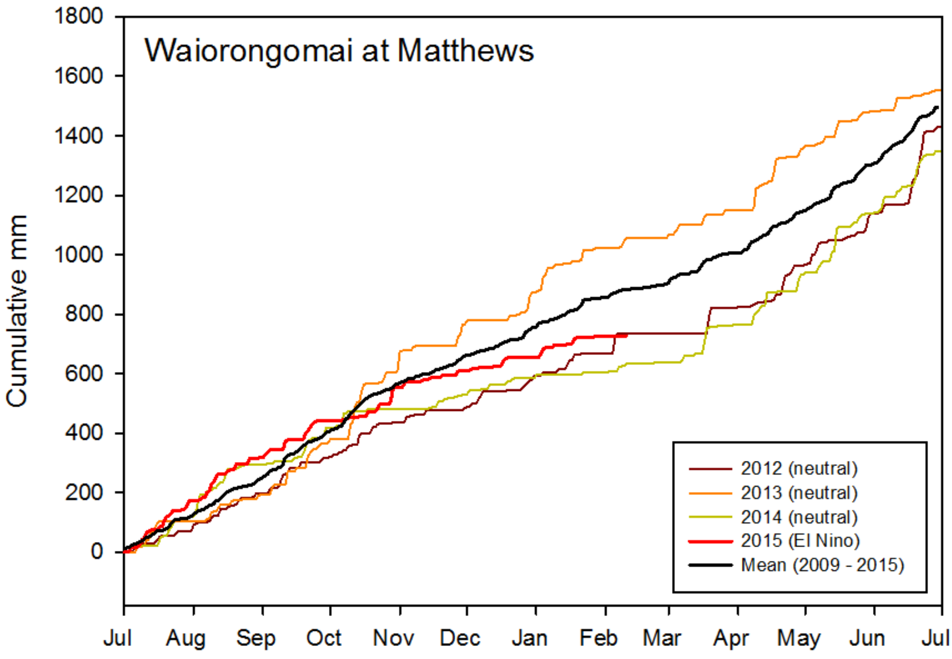


(c) Hutt and Tararua Range

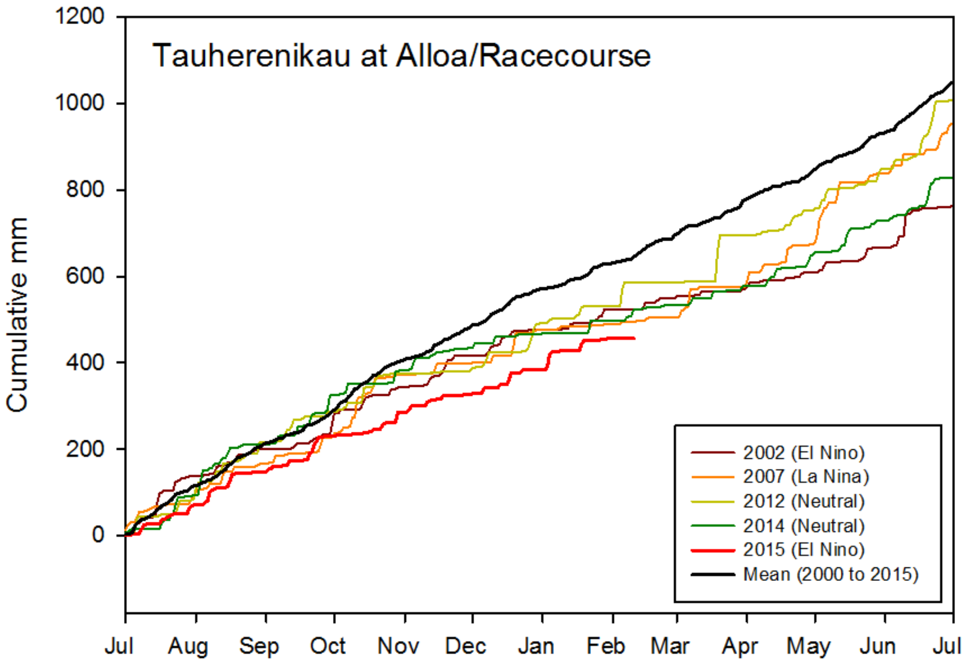




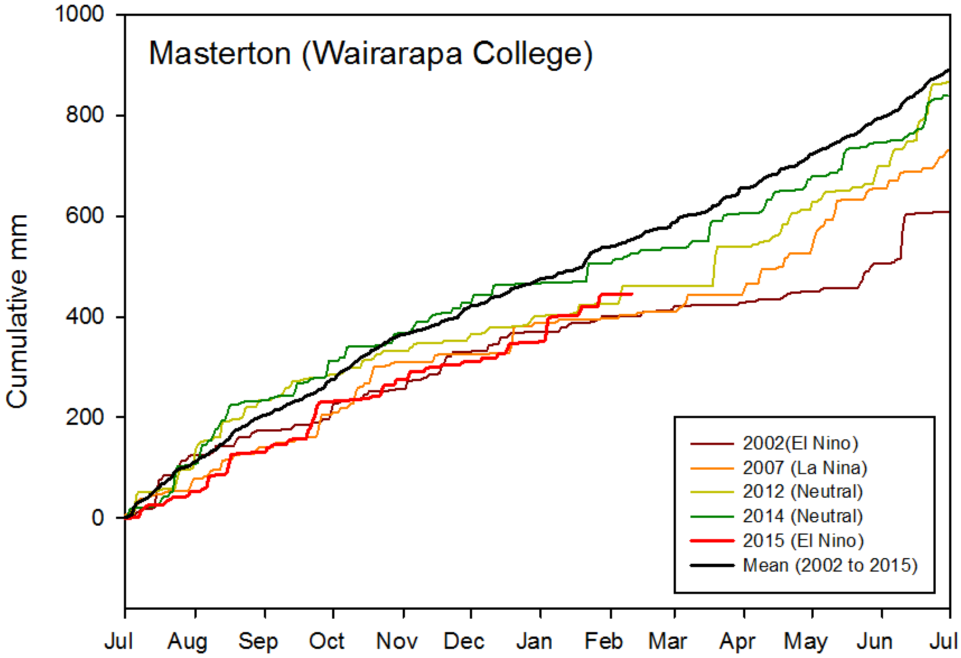
(d) Wairarapa

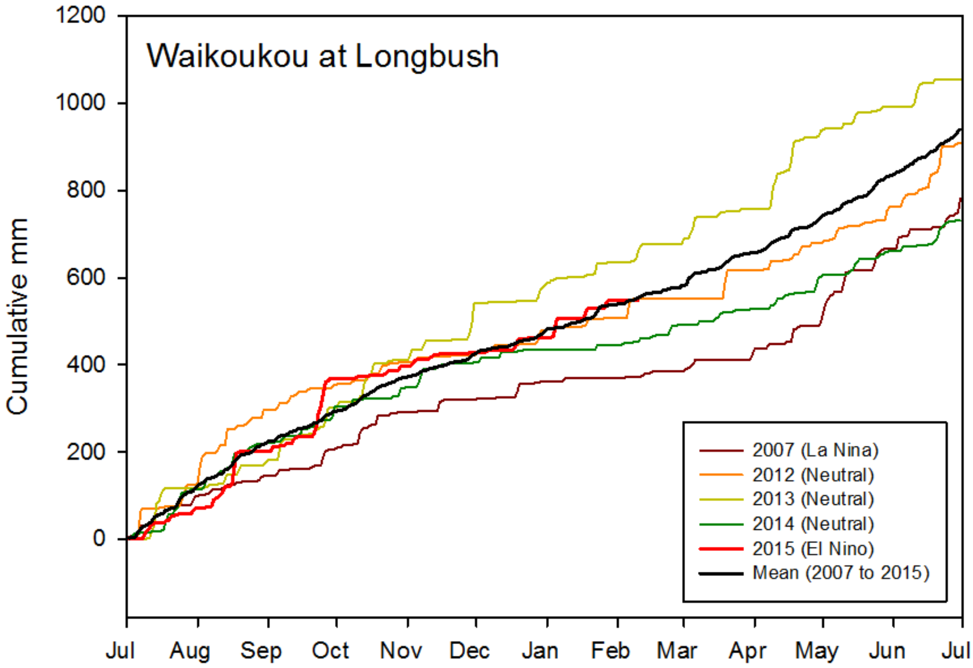


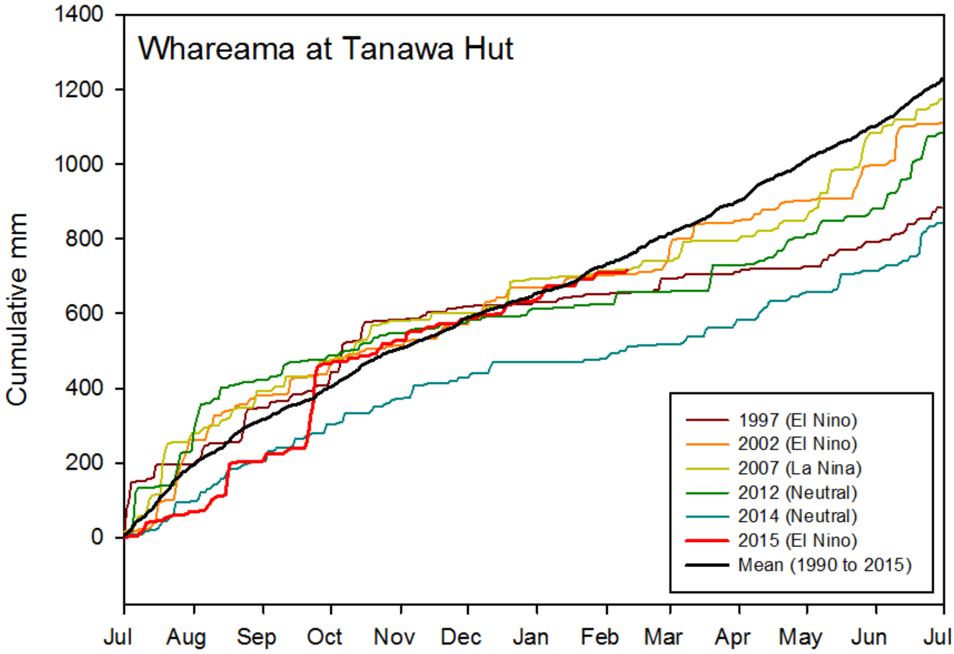
Waiorongomai at Matthews
Cumulative mm
1800
1600
1400
1200
1000
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2012 (neutral)
2013 (neutral)
2014 (neutral)
2015 (El Nino)
Mean (2009 - 2015)



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)

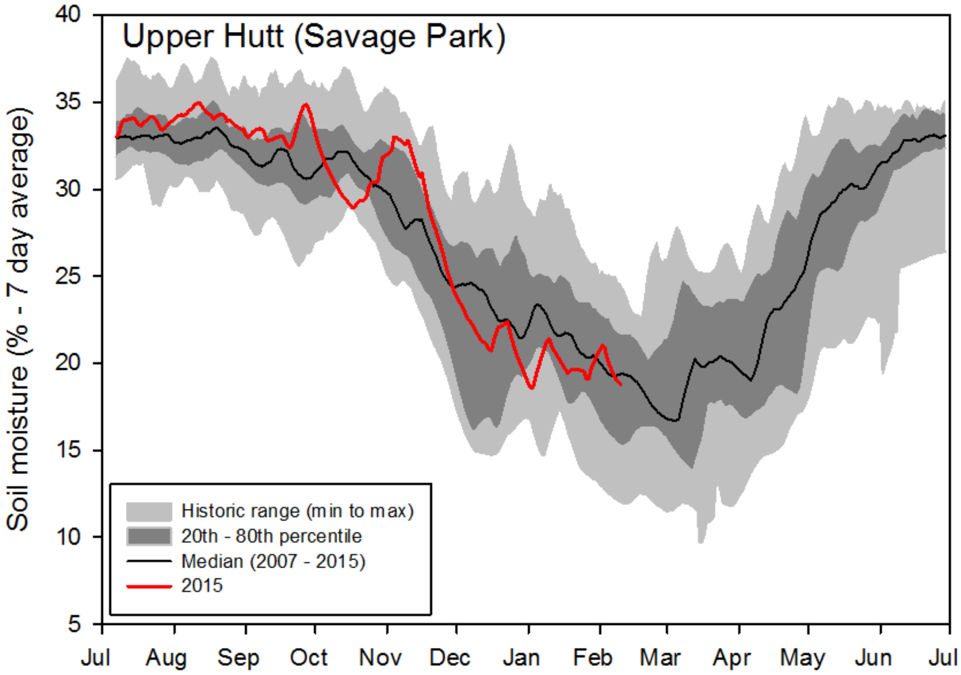

Whareama at Tanawa Hut
Cumulative mm
1400
1200
1000
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
1997 (El Nino)
2002 (El Nino)
2007 (La Nina)
2012 (Neutral)
2014 (Neutral)
2015 (El Nino)
Mean (1990 to 2015)

4.1.2 Soil moisture content – since 1 July 2015

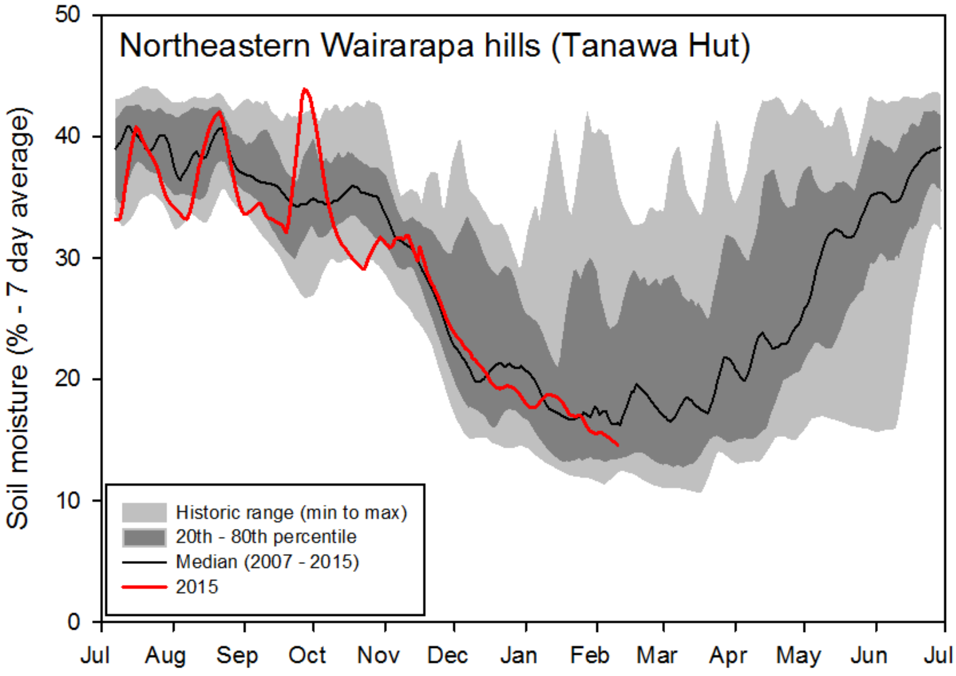
The soil moisture plots show seven day rolling average soil moisture (%) since 1 July 2015. An envelope plot of the historic range of data (and site mean) is also provided to give an indication of how the current soil moisture compares with that for a similar time of the season in past years. While the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

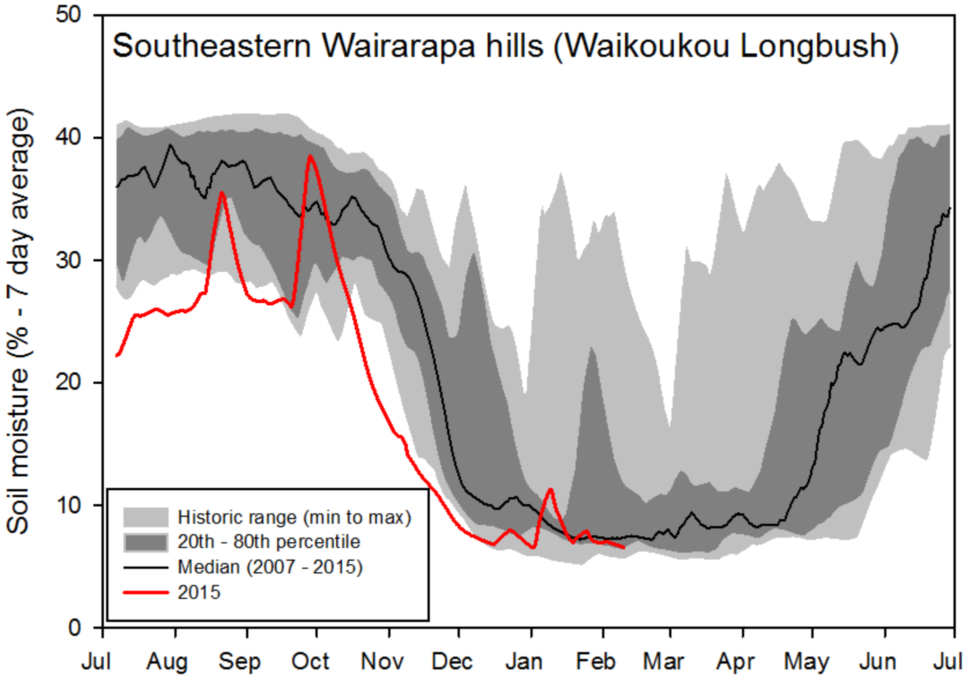
The soil moisture trends generally reflect the picture being generated by broad scale indicators (e.g., Figure 3.1); the severe deficits apparent in late December 2015 have been somewhat alleviated by the very useful rainfall in early January 2016 and the small top-ups since then.

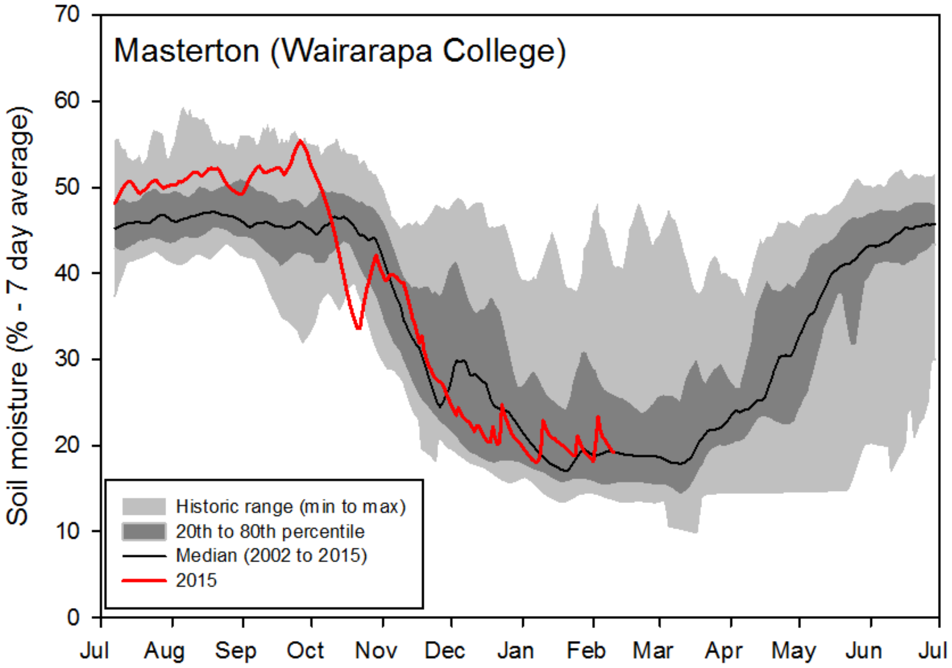
(a) Hutt Valley

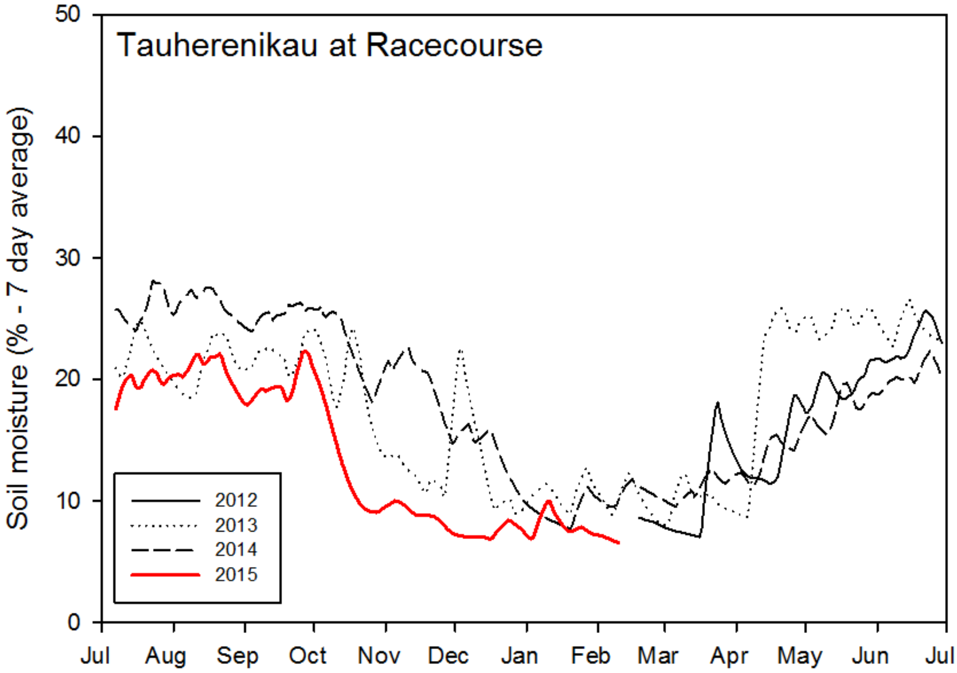


(b) Wairarapa


Northeastern Wairarapa hills (Tanawa Hut)
Soil moisture (% - 7 day average)
50
40
30
20
10
0
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)
50
40
30
20
10
0
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


Masterton (Wairarapa College)
Soil moisture (% - 7 day average)
70
60
50
40
30
20
10
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Historic range (min to max)
20th to 80th percentile
Median (2002 to 2015)
2015


Tauherenikau at Racecourse
Soil moisture (% - 7 day average)
50
40
30
20
10
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2012
2013
2014
2015

5. Climate predictions

5.1 El Niño strength and decay

As discussed in previous briefings, the current El Niño is expected to remain strong throughout the remaining summer period (albeit losing intensity), before steadily declining until reaching normal conditions in mid-winter 2016. Compared to the last briefing, the current projection is for a somewhat slower return to normal conditions, implying some possibly stronger residual influence of ENSO lasting until winter.

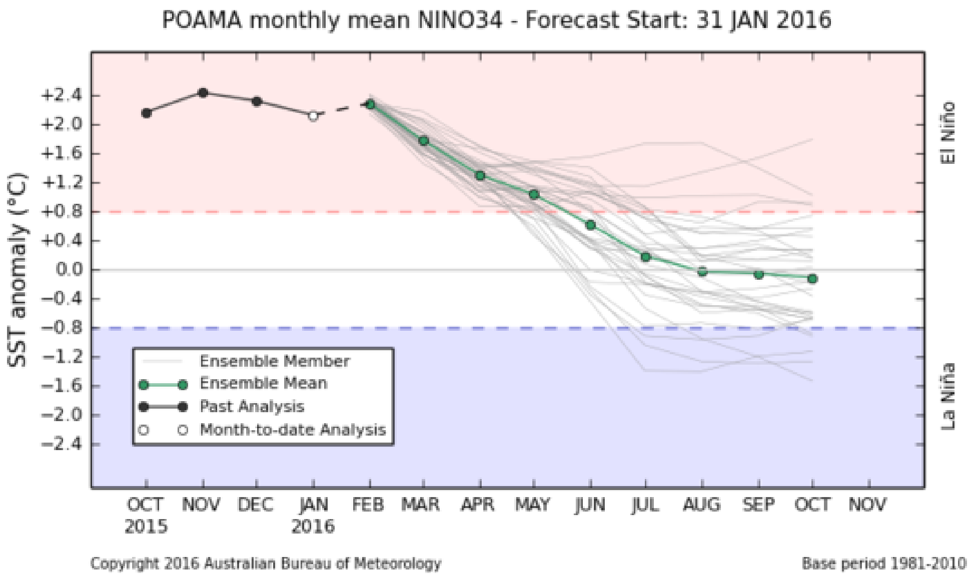


Figure 5.1: Climate projections for the evolution of the current El Niño. The projections show a progressive return to near normal conditions by winter 2016. Source: Bureau of Meteorology, Australia.

5.2 Summary outlook for the remaining summer season 2016

As mentioned at the start of this briefing, the atmospheric circulation in the period from January 2016 to mid-February has behaved more similarly to what would be expected in a La Niña year (instead of a strong El Niño), with a blocking anticyclone to the east reducing the westerly winds and pushing tropical air masses into the northern parts of New Zealand. This was associated with a persistently positive Southern Annular Mode, which is a key climate driver currently acting to oppose the expected El Niño contribution. The behaviour for the remaining summer depends on the interaction between SAM and ENSO, with likely short bursts of wet periods intermingled with longer dry and hot spells, and overall increased odds for drier than average conditions when the season is taken as a whole. A new climate outlook for autumn will be released with the Seasonal Climate Summary in mid-March 2016.