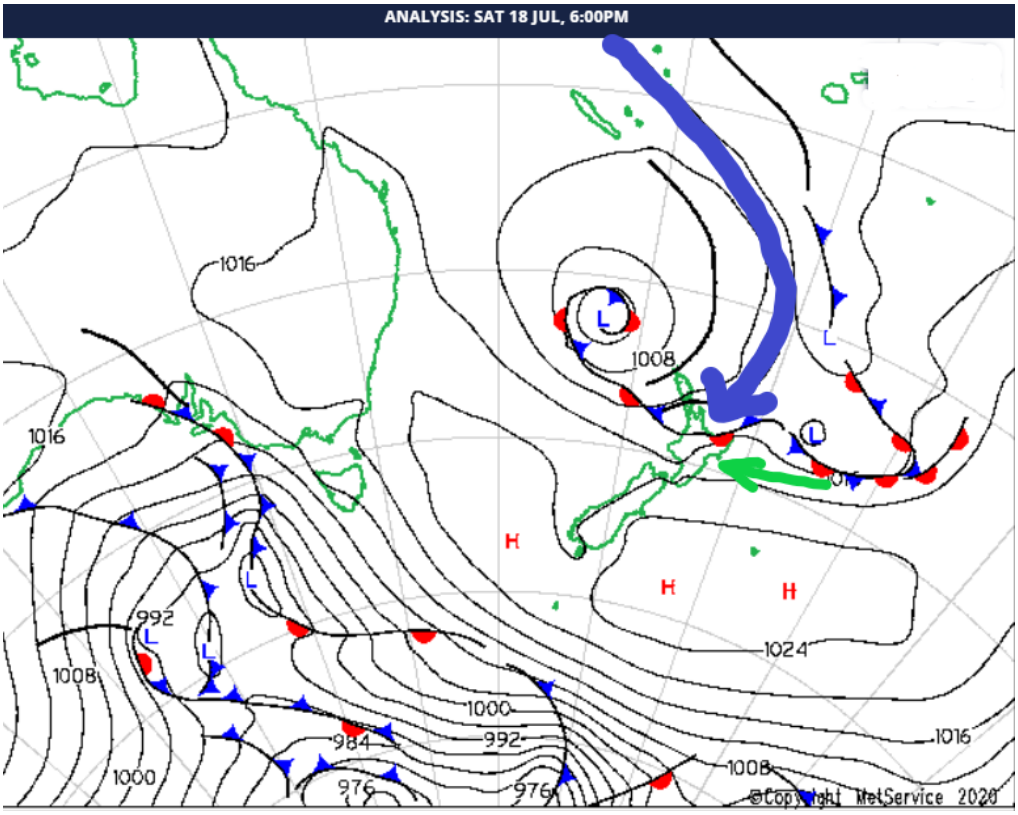
greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Climate and Water Resources Summary for the Wellington Region

Cold Season (May to October) 2020

Release date: 30 November 2020

Regional overview



Synoptic chart of Saturday 18 July 2020 at 6pm, depicting the onshore moist flow of subtropical air that fed the necessary humidity for the Northland Floods. Over 200 mm of rain fell in a very short time period, causing severe flooding which was regarded as a one in a 500 year event. Gisborne, Hawkes Bay and the Coromandel Peninsula were also affected. With climate change, more severe weather events like this are expected, with greater on-flow of subtropical humid air being channelled into New Zealand. Image Credits: MetService.

In this report you will find:

More information

For more information on monitoring sites and up-to-date data please visit http://www.gw.govt.nz/environmental-science/. Several climate sites are operated by NIWA and/or MetService, and GWRC is grateful for permission to present the data in this report.

Disclaimer

Report release date: November 2020

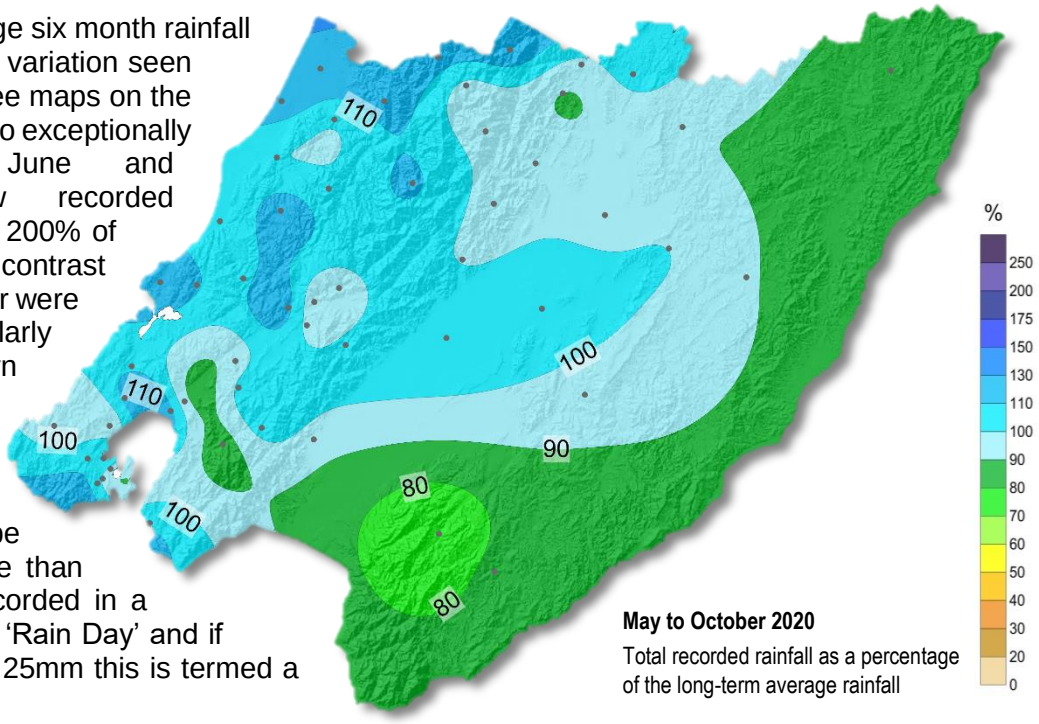
The cold season from May to October 2020 saw near average rainfall totals across the region (80 to 110% of normal) over the entire six month period. However, a closer look into the rainfall patterns on a monthly basis shows that there was large variation in the rainfall anomaly in individual months with August and October being very dry compared to normal, and June and September being very wet.

Rainfall (May to October)

The map below shows rainfall recorded during the entire six month period from May to October 2020 as a percentage of the long term average.

The pattern for the six month period is one of largely near average rainfall across the region. The eastern Wairarapa hills received 80 to 90% of normal rainfall totals while from the Tararua and Remutaka ranges westward totals were around 100 to 110%.

The close to average six month rainfall anomaly belies the variation seen month to month (see maps on the following page). Two exceptionally wet months, June and September, saw recorded rainfall totals up to 200% of normal. In stark contrast August and October were very dry, particularly through eastern areas.



Analysis of the number of days that it rained can be informative. If more than 1mm of rain is recorded in a day this is called a 'Rain Day' and if there is more than 25mm this is termed a 'Heavy Rain Day'.

The total number of Rain Days was below normal for most of the region. Conversely, many areas saw more Heavy Rain Days than normal - indicating that the near-average six month rainfall totals was brought about by fewer but larger rain events.

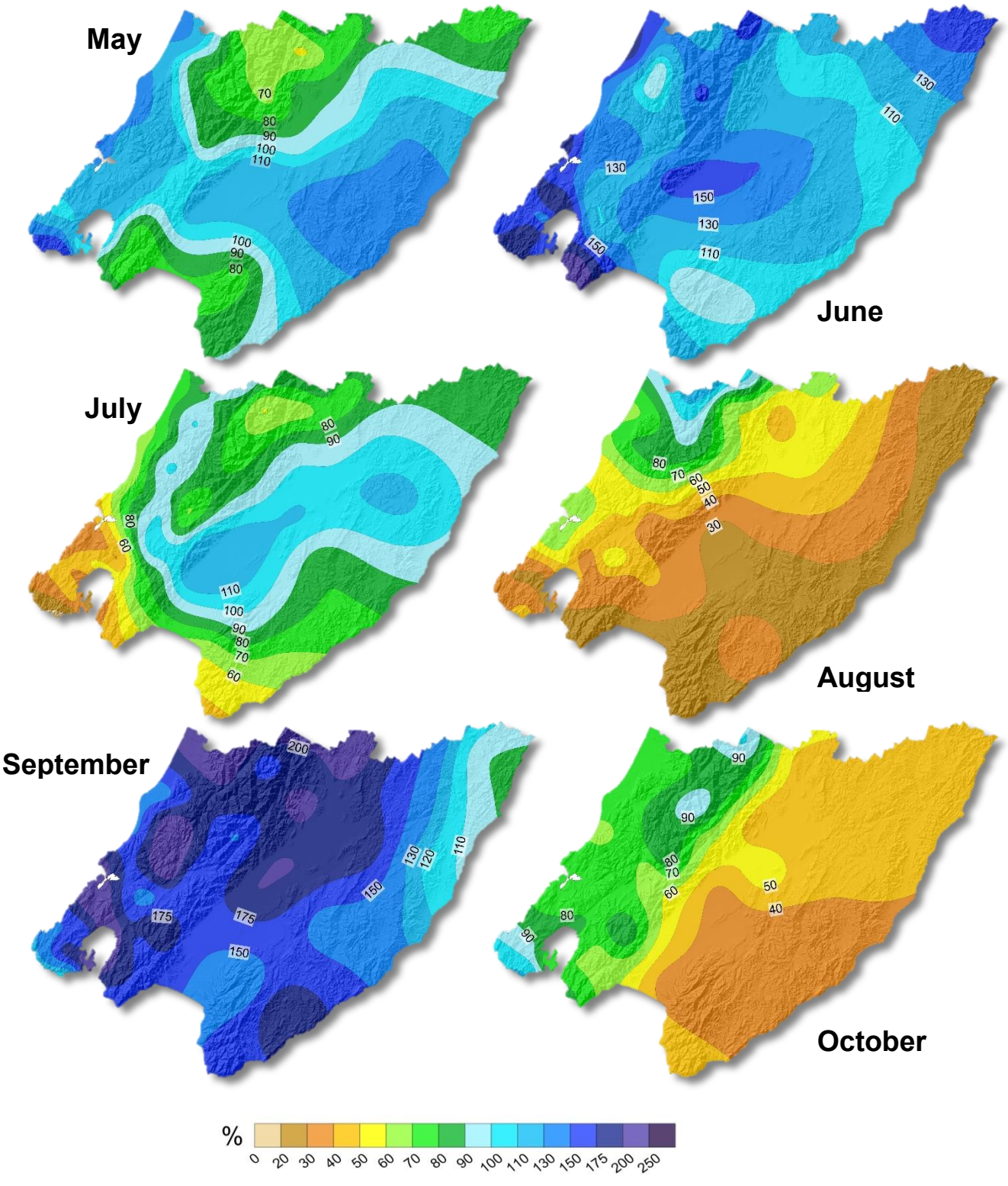
Number of Rain Days and Heavy Rain Days during May to October across the region (long-term average in brackets.)

	Kāpiti Coast		Porirua	Hutt Valley & Wellington		Ruamāhanga		Eastern Wairarapa	
	Lowland	Hills	Lowland	Lowland	Hills	Lowland	Hills	North	South
Rain Days (>1mm)	57 [70]	97 [104]	63 [66]	58 [69]	79 [95]	58 [66]	102 [114]	71 [70]	63 [80]
Heavy Rain Days(>25mm)	6 [4]	28 [25]	11 [5]	9 [5]	18 [13]	7 [3]	34 [34]	4 [6]	8 [7]

Rainfall by the month

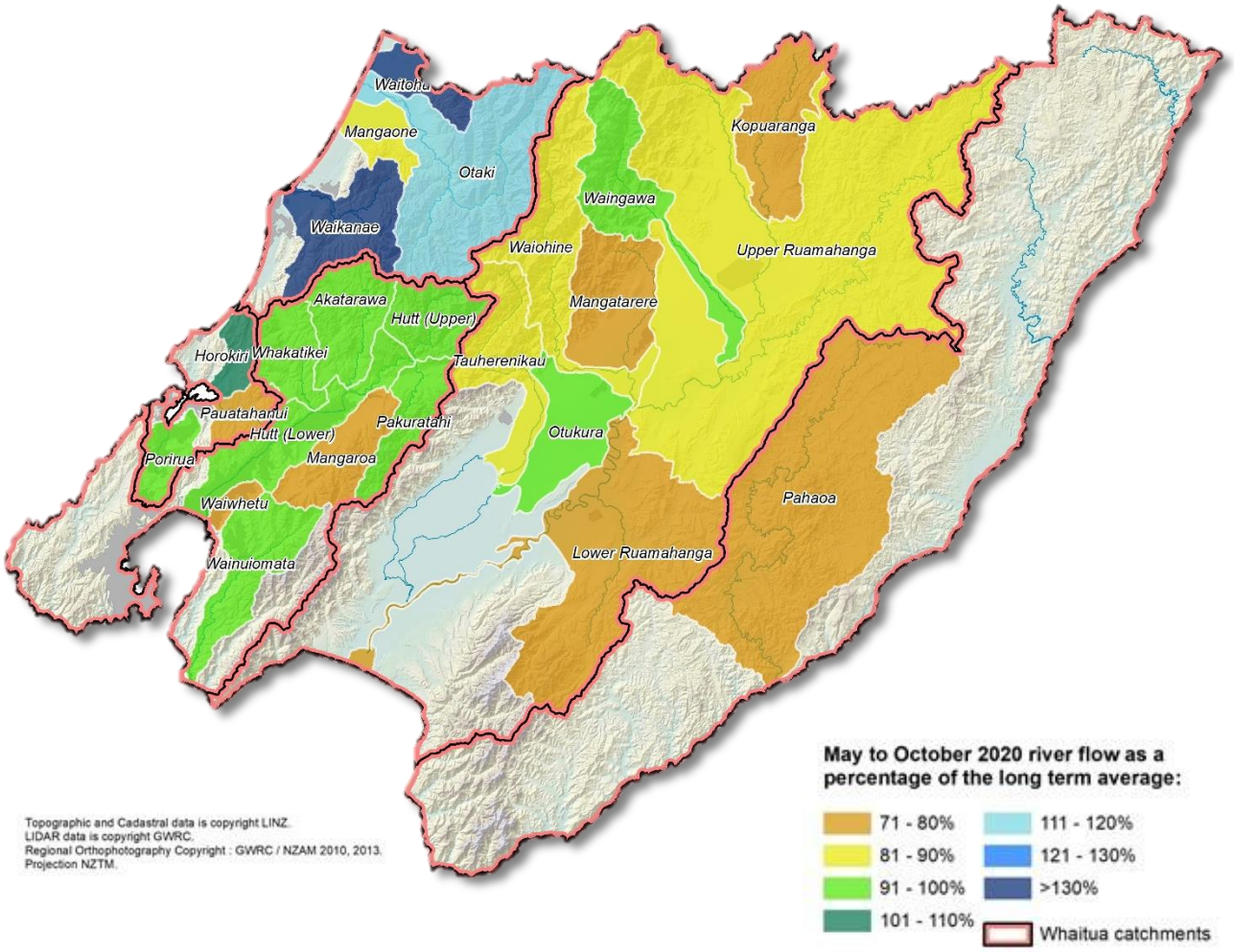
August and October rainfall totals were well below average over all parts of the region, with July showing low rainfall in southern areas.

June and September had well above average rainfall. September was characterised by a number of heavy rain events with the last week of the month experiencing an extended warm northerly airflow that brought high rainfall and warm temperatures which was sharply followed by a bitterly, cold southerly



River flow

The map below shows mean river and stream flow conditions recorded over the May to October 2020 period, for various monitored catchments, as a percentage of the long-term average flow for the same period.



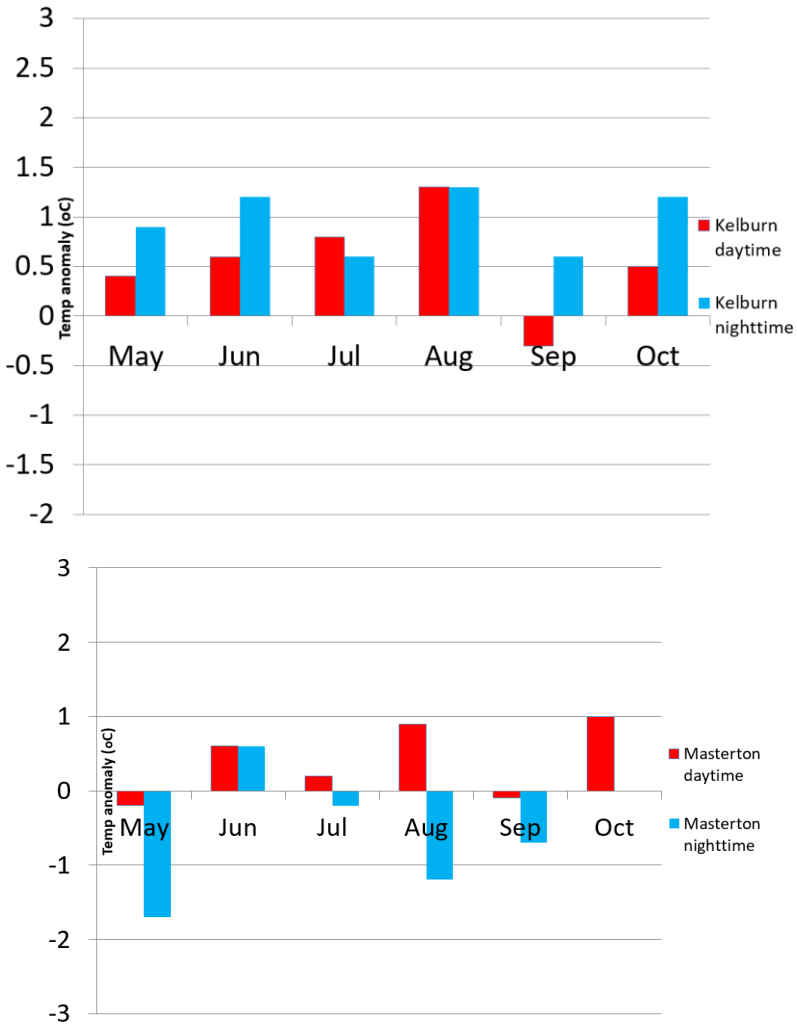
The majority of the region's stream and rivers experienced below average to average flows during the six month period with the exception of catchments draining from the Kāpiti Coast side of the Tararua Range.

Rivers and streams east of the Tararua divide had relatively lower flow conditions than those to the west.

Air temperatures

Air temperature is measured at a number of meteorological monitoring sites across the region. It is useful to look at the anomalies (i.e., departures from normal) in average temperatures month by month, in order to understand the climate variability.

The graphs below show the monthly average daytime maximum and average nighttime minimum temperature anomalies (i.e., based on every day of the month) for Kelburn (upper panel) and Masterton (lower panel). We can see that the warm season was mostly warmer than normal for Wellington, reflecting the background warming under maritime influence for our region, with the moderating effects of a warmer ocean. For Masterton, cold nights were observed as a reflection of the local topography and clear skies at night.



Average daytime and nighttime temperature anomalies for Kelburn (top) and Masterton (bottom) for the cold season period. The cold season was almost constantly warm in Wellington (compared to the climatological average). For Masterton, dry air kept the nights very cold especially in May, August and September.

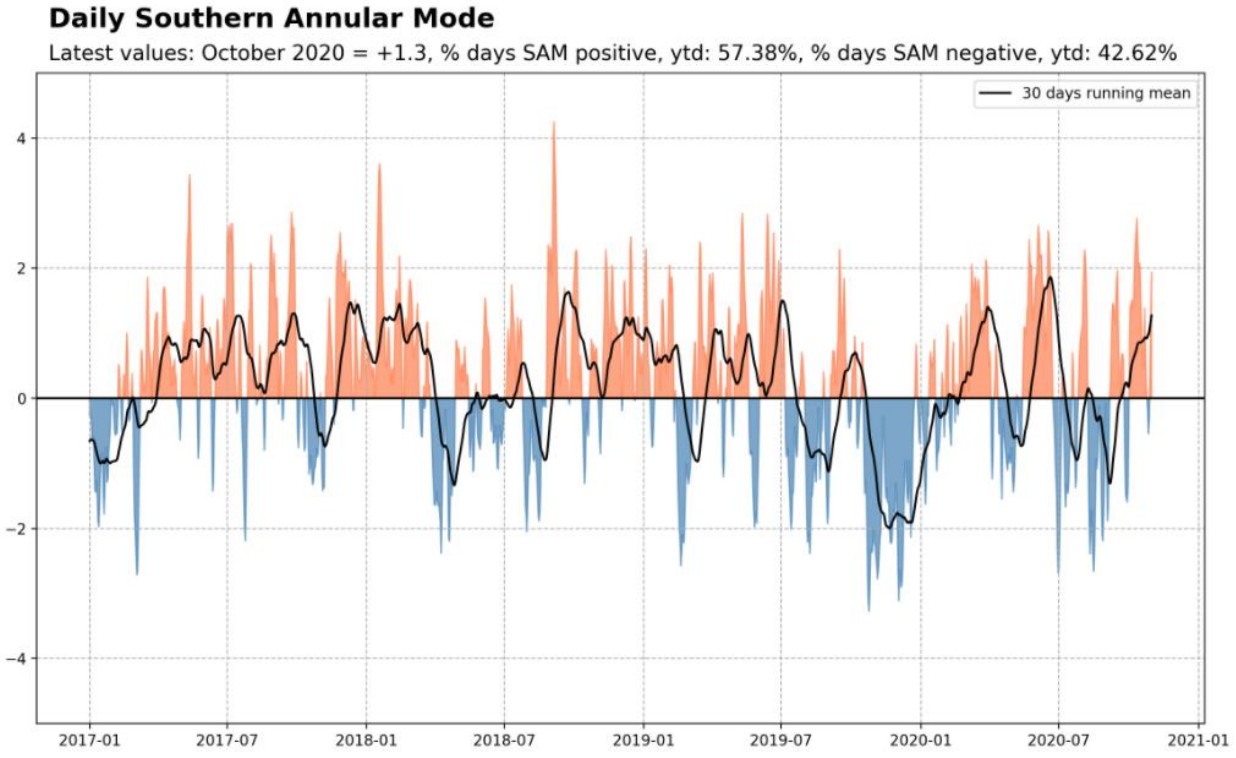
Global climate drivers

Climate variability and climate change

People often ask if the variable weather patterns in our region are a result of climate change. While natural climate variability has always been quite pronounced in our region, weather extremes are expected to get worse as a result of human-induced climate change and global warming caused by greenhouse gas emissions (https://www.gw.govt.nz/climate-change/).

Some key observations about climate variability and change in our region during the period May to October 2020 are:

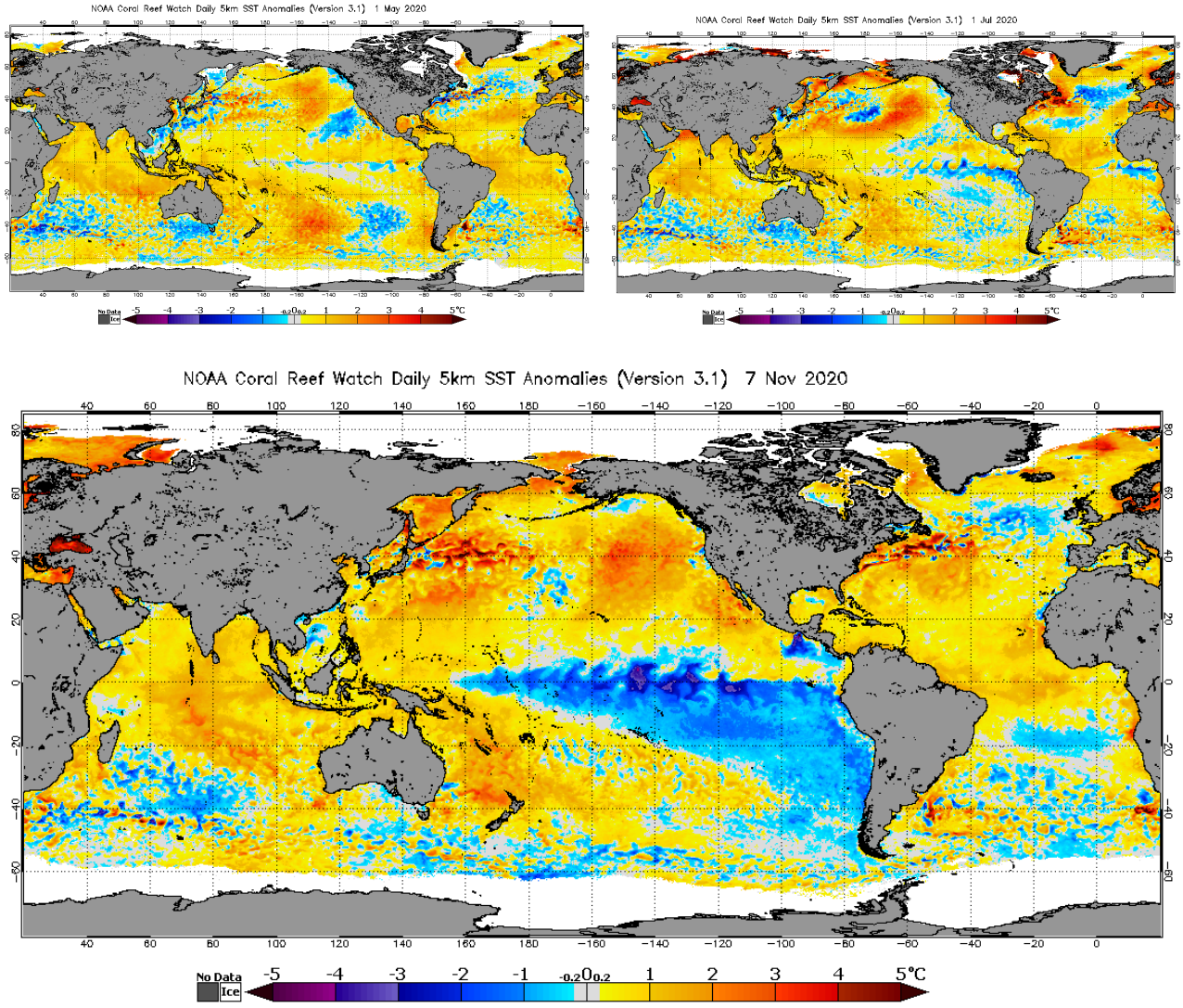
- The six-month period was consistently warmer than normal, especially in Wellington. Masterton had cold nights due to local topographic effects, and drier air with clear skies;
- The sea surface temperatures (following page) have warmed considerably around New Zealand, as a La Niña developed in the Equatorial Pacific;
- The Southern Annular Mode (graph below) started very positive in June, reverted to negative in July to September, and is now back to positive again;
- High pressure anomalies dominated the oceanic areas east of New Zealand (page 7), with easterly flow and heavy rainfall on the eastern hills at times, alternating with a strong westerly flow in between.



The Southern annular mode (SAM) has been oscillating between positive and negative for most of this year. Source: https://niwa.co.nz/climate/information-and-resources/southern-annular-mode

Global climate drivers and extreme weather events

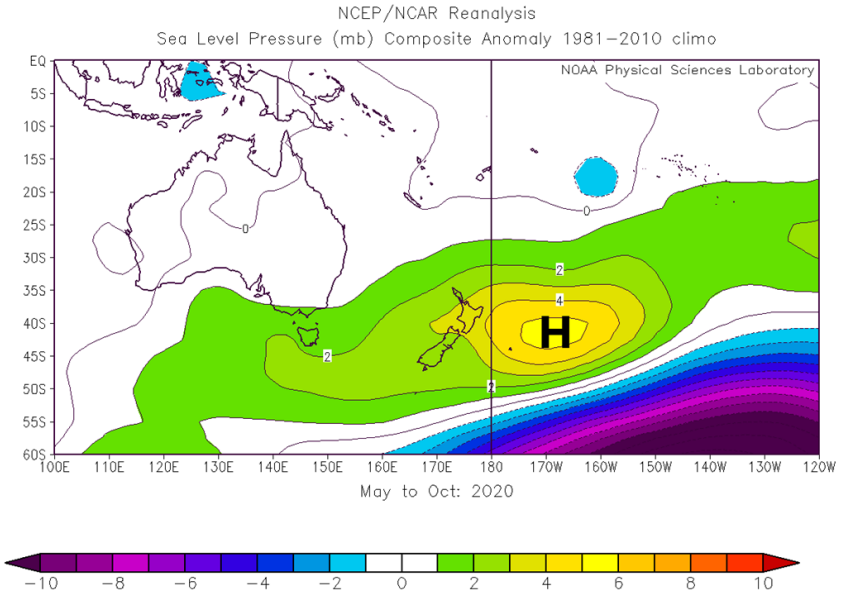
Climate drivers are global mechanisms that can influence the weather in our region. The El Niño/Southern Oscillation[1] (ENSO) phenomenon has now shifted towards a negative (La Niña) phase, and is expected to influence our weather patterns over the summer season. The sea surface temperature around New Zealand has substantially warmed over the last few months, in response to the maturing La Niña pattern. The Indian Ocean is also largely warmer than average, but the Indian Ocean Dipole is predicted to remain neutral. The sea ice extent around Antarctica has recovered in comparison to what was observed in 2019, and is now near normal (full extension seen in white).



Sea surface temperature anomalies on 1st May 2020 (left), 1th July 2020 (right) and 7th November 2020 (bottom). We can see the development of a mature La Niña condition in the Equatorial Pacific (cold blue tongue), with an intensification of the warming around New Zealand (bottom image). These conditions are creating the perfect combination for a hot and humid summer ahead. Source: NOAA/USA.

[1] https://www.niwa.co.nz/education-+-and-training/schools/students/enln

The pressure anomalies over the six month period show an anticyclone to the east of the country (marked as H). This pattern contributed to the establishment of moist north-easterly flows, which is expected during La Niñas. This anticyclonic pattern was most pronounced in October and dominated the average, but the month to month variation was high. For example, in September the flow was in fact more El Niño-like, with an anticyclonic flow on the Tasman causing a very strong westerly flow for New Zealand. In practice, large swings in atmospheric flow have been the keynote of most of the weather patterns this year, helping explain why La Niña has been slow to take a firm grip and provide a more stable, gentle north-easterly flow, typical of previous negative ENSO events.



Mean sea level pressure anomaly for May to Oct 2020.

High pressure anomalies dominated the oceanic areas east of New Zealand, with an easterly flow and heavy rainfall on the eastern hills at times, alternating with a strong westerly flow in September. This figure only reflects the average flow, while the month-to-month variation had large swings between easterly and westerly flow.

Other than ENSO, the Indian Ocean Dipole (IOD) is expected to remain neutral, as noted above, while the Southern Annular Mode (SAM) has been oscillating between positive and negative, without a very clear preference. This suggests that the atmospheric flow over the next few months may be primarily driven by La Niña itself, with the warm oceanic waters around the country responding to both La Niña and background global warming.

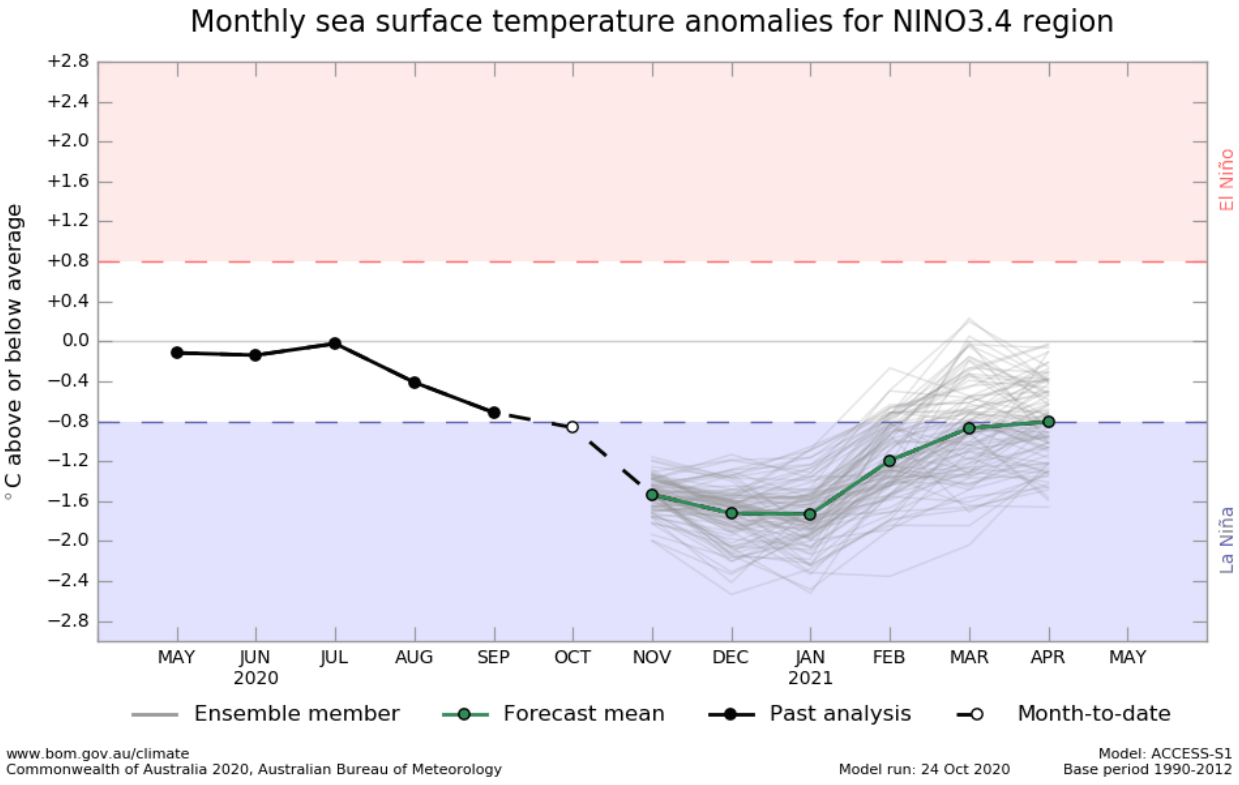
Seasonal climate outlook update

The ENSO phenomenon is expected to remain in the La Niña phase at least until the end of summer, while the other climate drivers are predicted to be mostly neutral or oscillating between positive and negative, as noted above. The waters around New Zealand have been warmer than normal as expected during La Niñas, with significant easterly flow and floods in November. La Niña tends to bring increased easterly or north-easterly flows, more humid and hot weather in summer, with thunderstorms inland in the Wairarapa.

The following points summarise the expected pattern over the next three months:

- La Niña pattern dominating the summer season;
- Mixed rainfall anomalies, possibly drier than average but high chances of easterly rain in the Wairarapa and eastern hills, with occasional extreme rainfall events and thunderstorms (low confidence for rainfall totals);
- Higher than normal risk of the region being affected by an ex Tropical Cyclone, with potential flooding and damaging winds;
- Warmer than average oceanic temperatures;
- Above average temperatures, with large swings between hot and colder;
- Predominance of north-easterly flow, but alternating with westerly bursts.

The full climate outlook for summer will be released with our next seasonal briefing before Christmas.



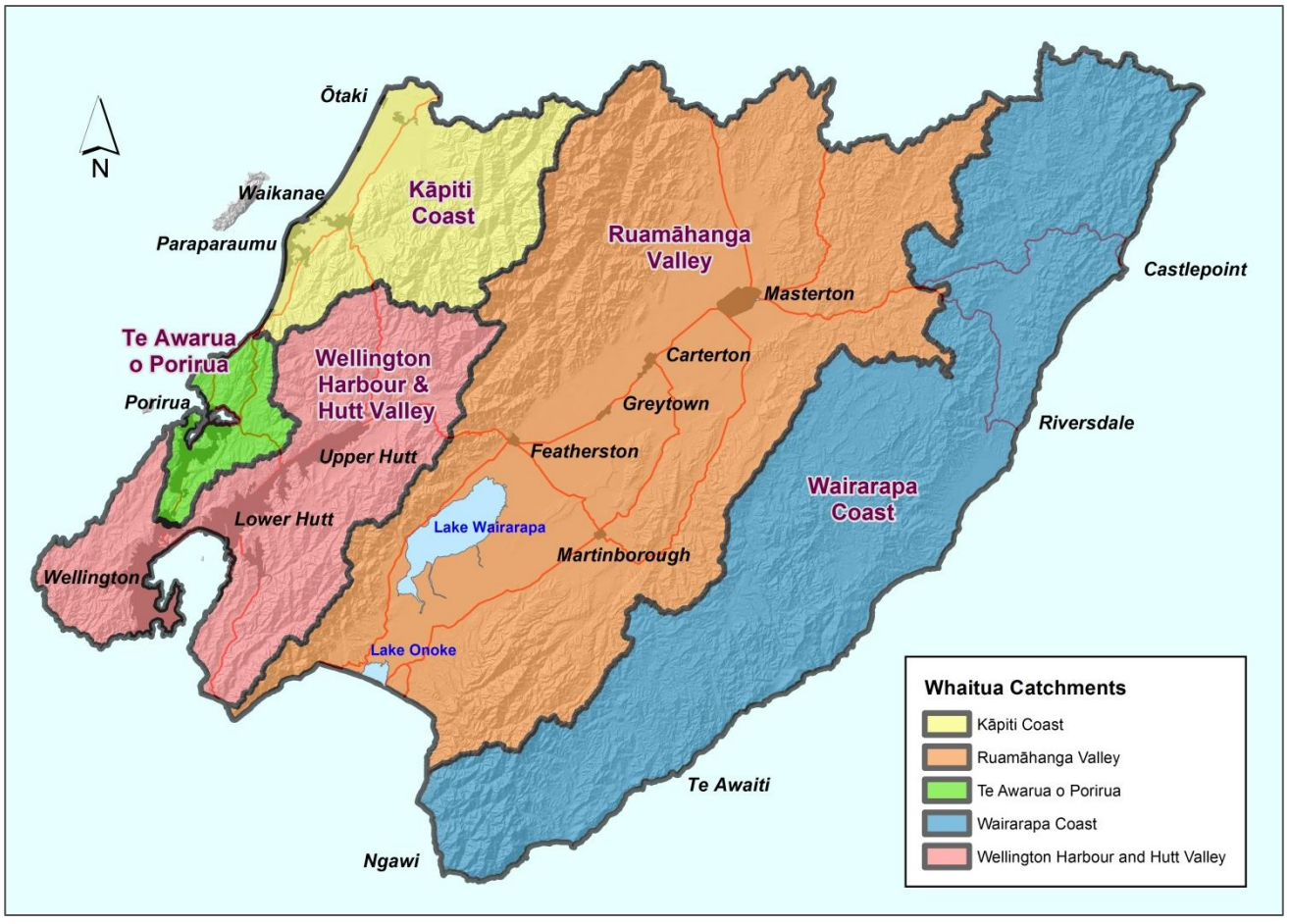
ENSO predictions as of 24 Oct 2020, showing that the phenomenon is expected to remain in the La Niña phase at least until the end of summer. *Source: BOM (Australia)*

What happened in each whaitua catchment?

Climate and water resource summaries are provided in the following sections for each of the five Wellington region whaitua catchment areas (as shown below). The whaitua catchments provide an important sub-regional basis for environmental management in the Wellington region[2], and roughly coincide with the different climate and water resource zones.

Click the following links for:

- Wellington Harbour and Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga Valley
- Wairarapa Coast

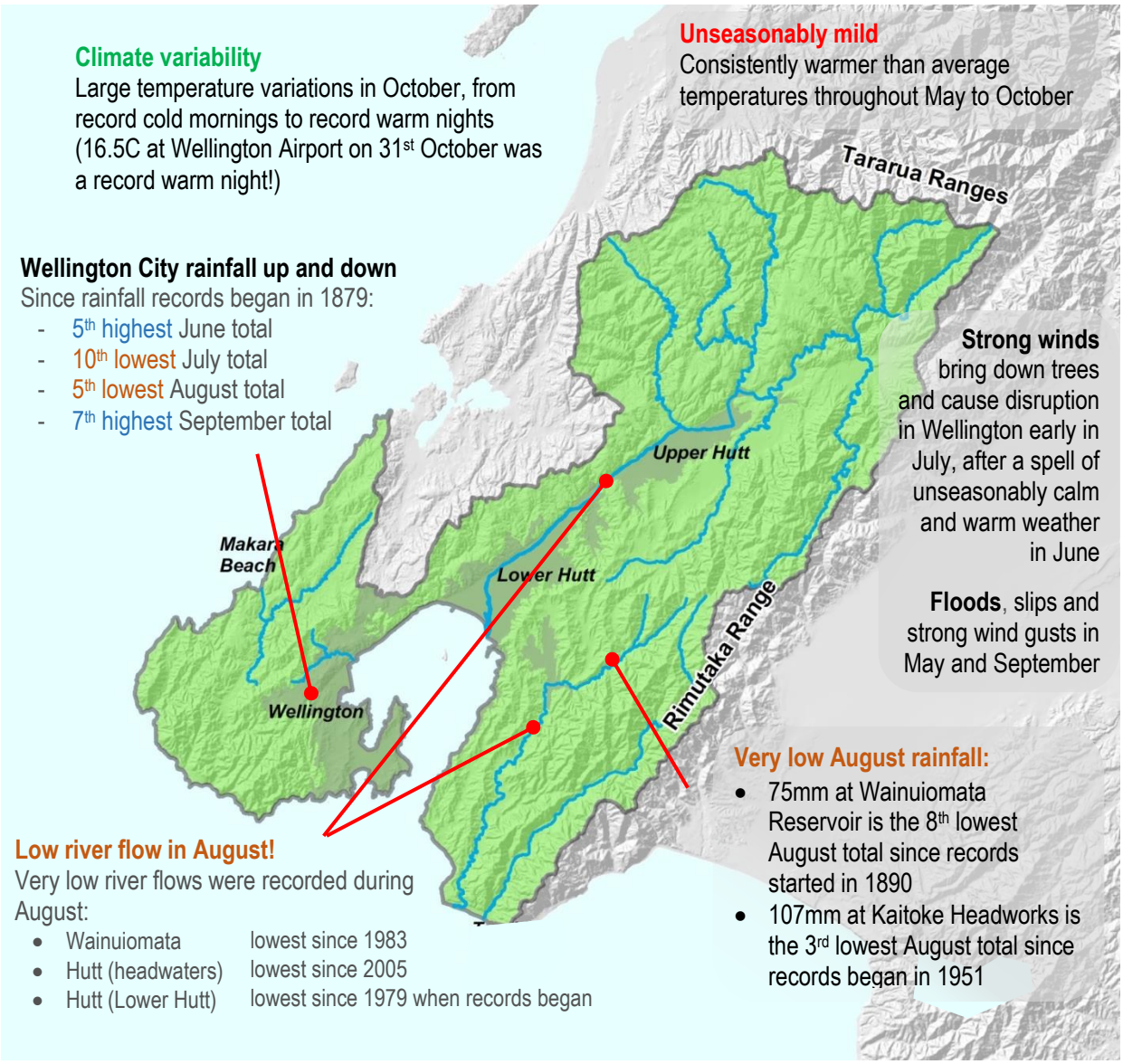


Map of the five whaitua catchment areas in the Wellington region. Each whaitua roughly coincides with a climatic zone, expressing the marked east-to-west contrast that we experience in our region.

[2] http://www.gw.govt.nz/whaitua-committees/

Wellington Harbour and Hutt Valley climate summary

- **Warmer than average**
- **Large swings in flow from westerlies to easterlies**
- **Large rainfall variation from record high to record low**

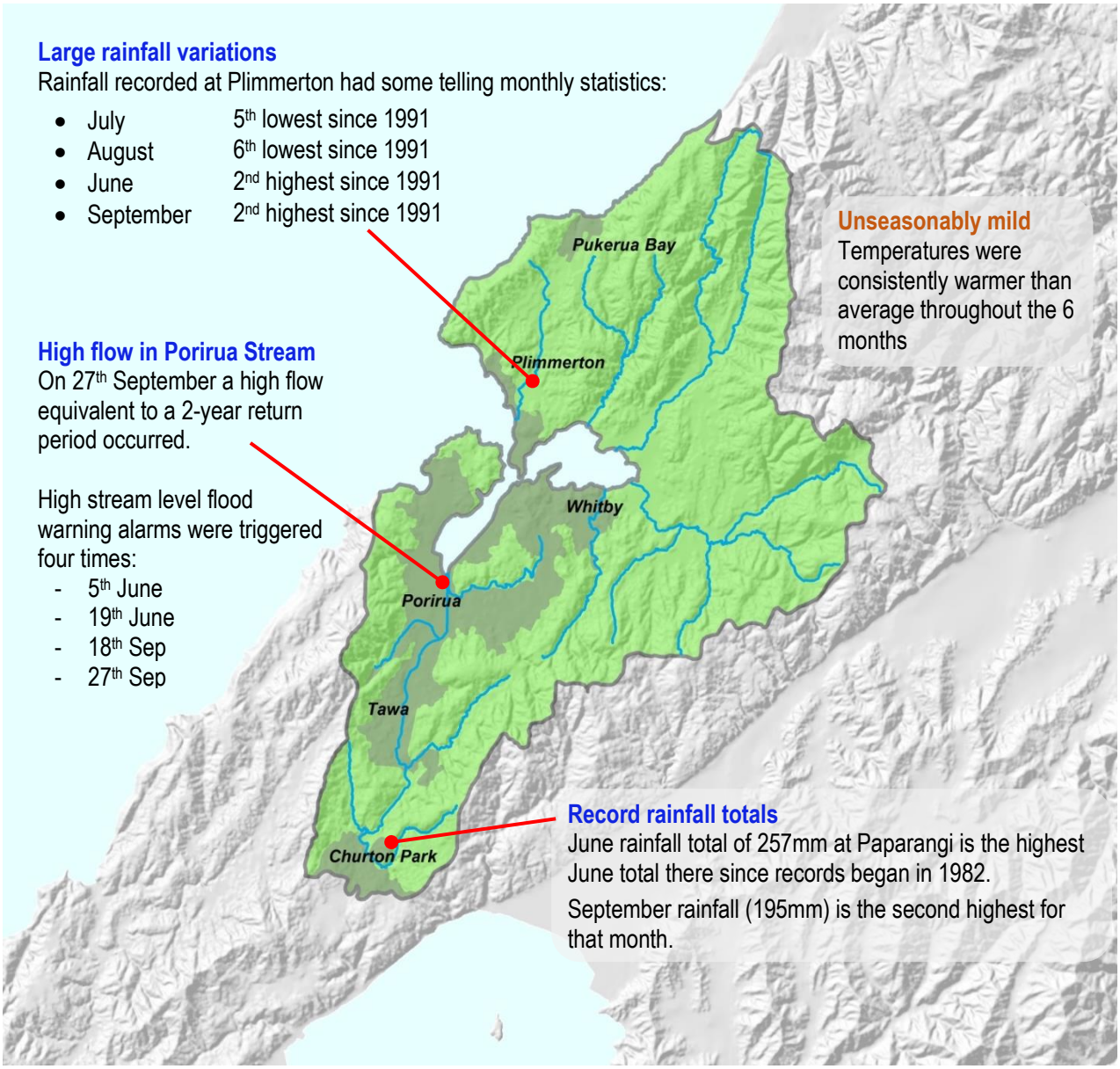


Want to look at the summary tables and graphs?

- Rainfall
- River flows

Te Awarua-o-Porirua climate summary

- **Warmer than average**
- **Large swings in flow from westerlies to easterlies**
- **Large rainfall variation from record high to record low**

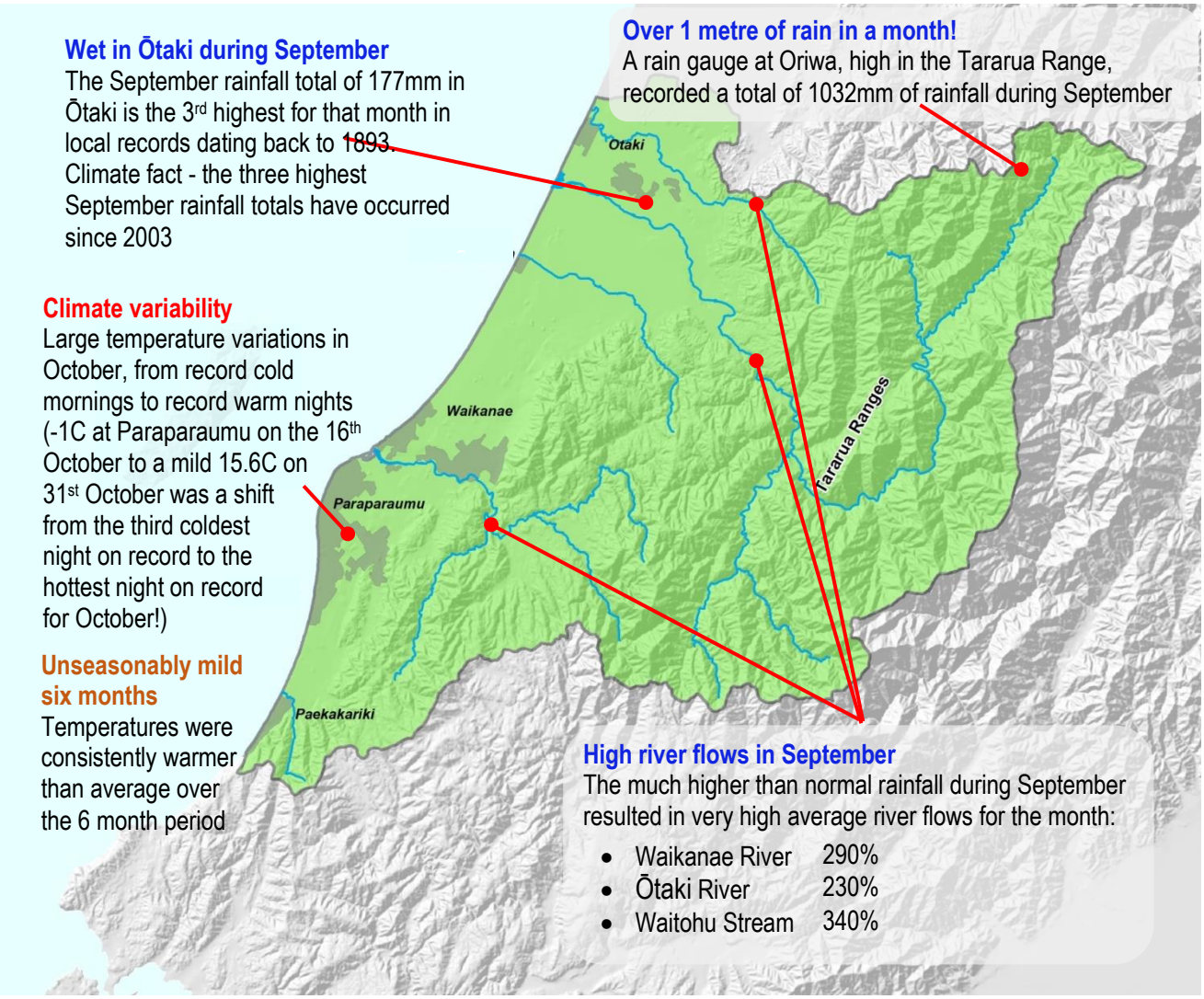


Want to look at the summary tables and graphs?

- Rainfall
- River flows

Kāpiti Coast climate summary

- **Warmer than average**
- **Large swings in flow from westerlies to easterlies**
- **Large rainfall variation from record high to record low**

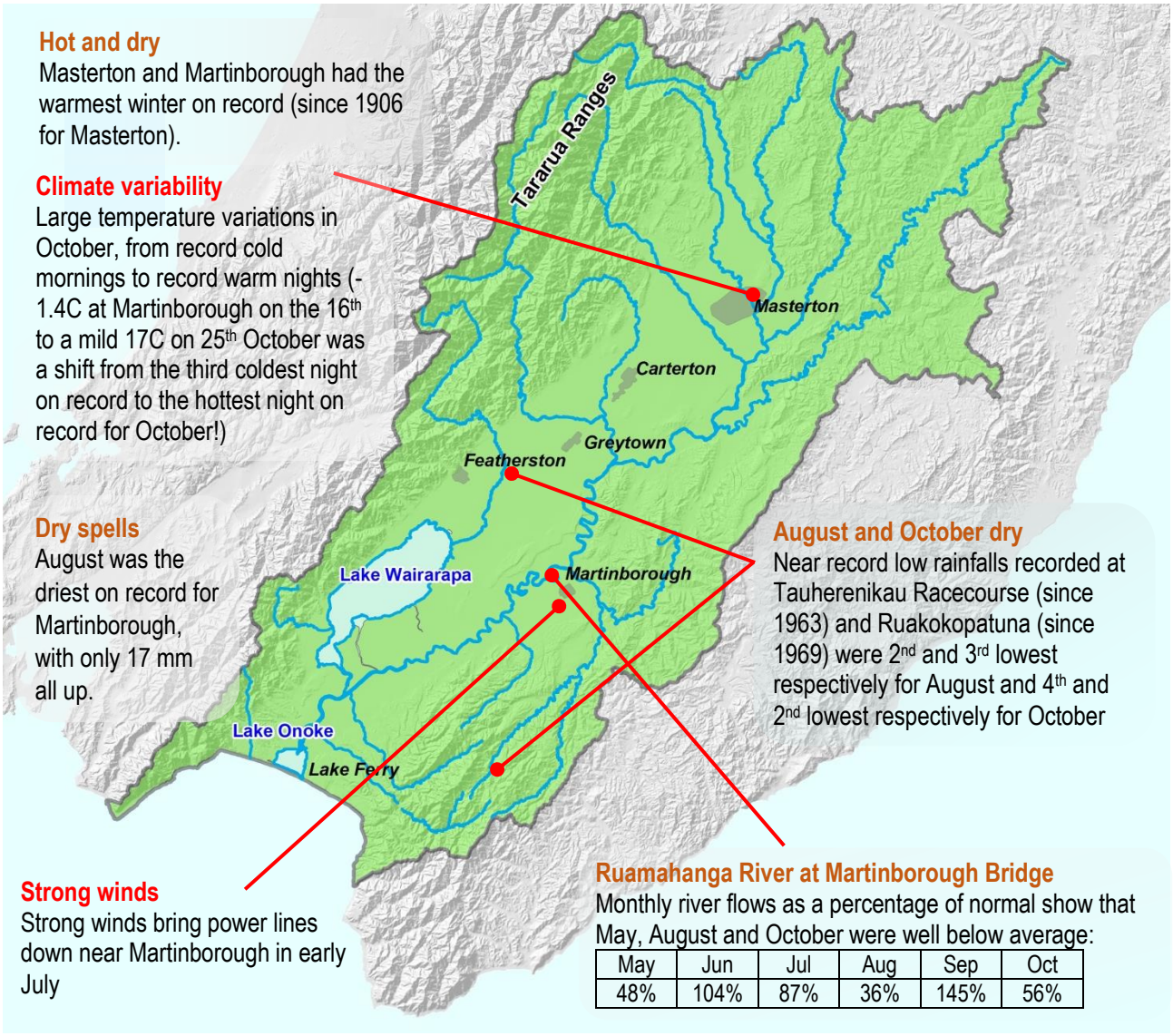


Want to look at the summary tables and graphs?

- Rainfall
- River flows

Ruamāhanga Valley climate summary

- **Warmest on record winter**
- **Large variations in rainfall**



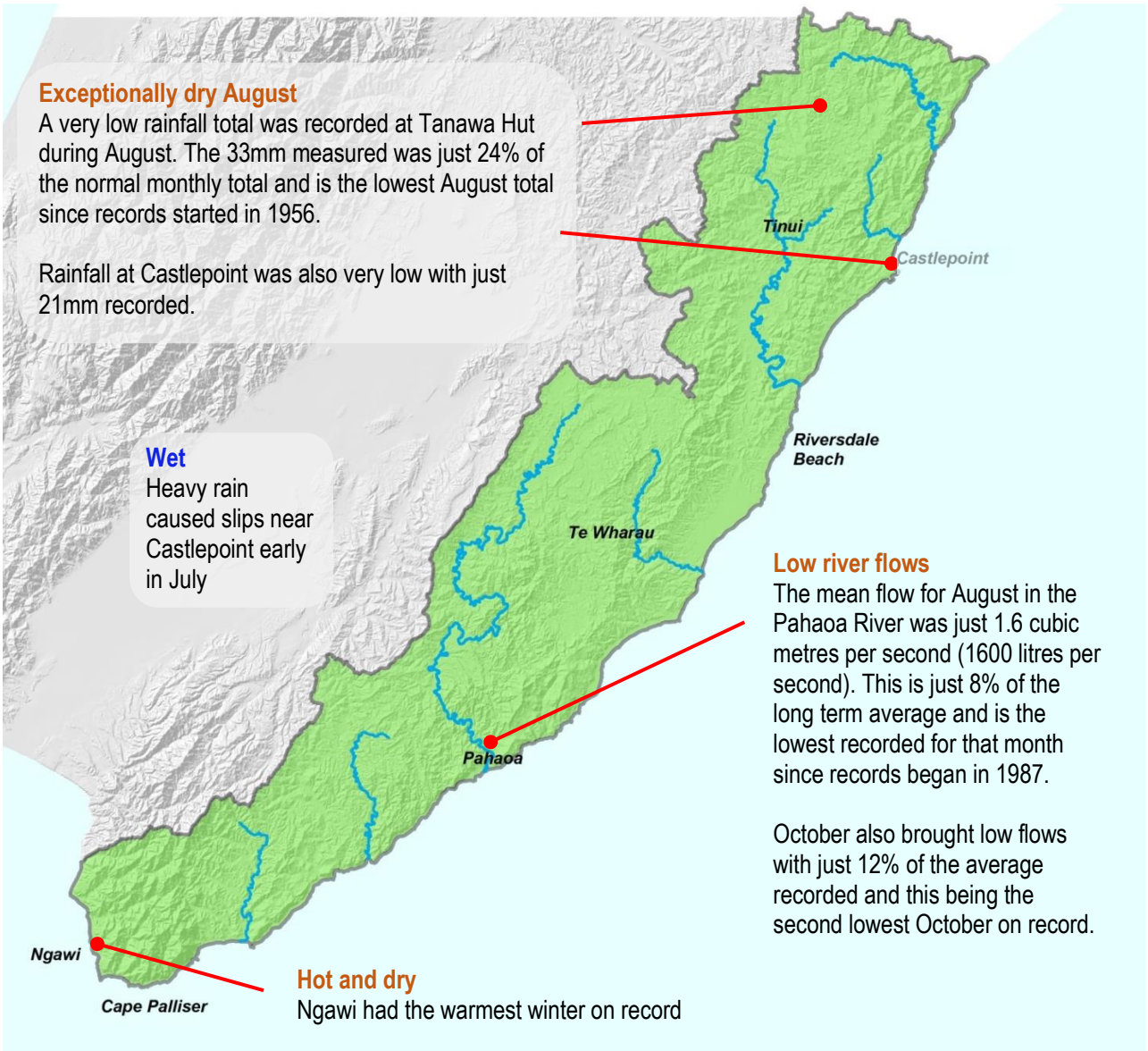
May	Jun	Jul	Aug	Sep	Oct
48%	104%	87%	36%	145%	56%

Want to look at the summary tables and graphs?

- Rainfall
- River flows

Wairarapa Coast climate summary

- **Warmest on record winter**
- **Large variations in rainfall**



Want to look at the summary tables and graphs?

- Rainfall
- Soil moisture

Rainfall statistics

Rainfall was quite variable over individual months in the May to October period, but ended near average in a number of areas.

Whaitua	Location	May %	Jun %	Jul %	Aug %	Sep %	Oct %	May-Oct (mm)	May-Oct %
Wellington Harbour & Hutt Valley Click to see cumulative rainfall plots	Kaitoke	95	122	71	49	166	81	1261	95
	Lower Hutt	130	136	43	36	194	64	687	95
	Wainuiomata	73	120	27	19	121	61	796	67
	Karori	122	194	45	32	192	94	796	110
	Wellington	138	216	49	34	224	88	703	122
Te Awarua-o-Porirua Click to see cumulative rainfall plots	Battle Hill	103	137	42	57	150	63	708	97
	Whenua Tapu	143	172	55	70	197	77	708	116
	Tawa	114	170	41	53	215	73	695	101
Kāpiti Coast Click to see cumulative rainfall plots	Otaki	132	163	79	90	221	78	685	126
	Waikanae	115	113	81	77	161	53	688	98
	Paekakariki	129	116	56	48	141	70	649	90
	Tararua (Otaki headwaters)	66	115	97	117	209	89	3054	118
Ruamāhanga Click to see cumulative rainfall plots	Masterton	90	116	100	53	183	72	518	99
	Featherston	122	146	96	27	183	39	610	102
	Longbush	132	130	75	29	161	38	523	93
	Tararua (Waiohine headwaters)	67	133	64	72	167	88	2659	98
Wairarapa Coast Click to see cumulative rainfall plots	Tanawa Hut	79	154	82	25	105	44	784	84
	Ngaumu	78		56	21	132	28	297	48

Click the following links to return to climate summaries for:

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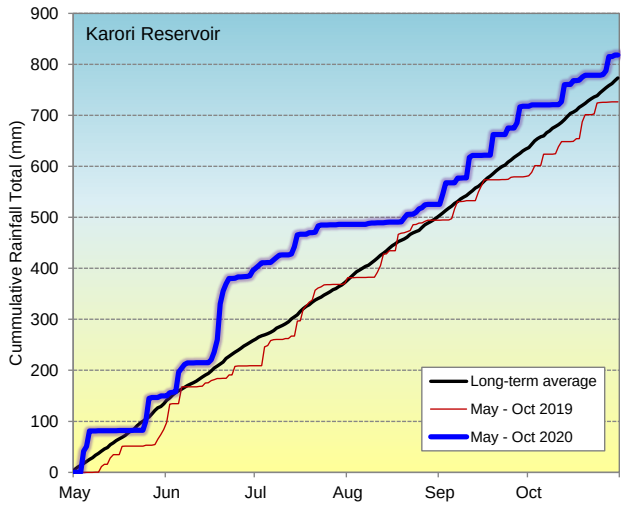
- Ruamāhanga
- Wairarapa Coast

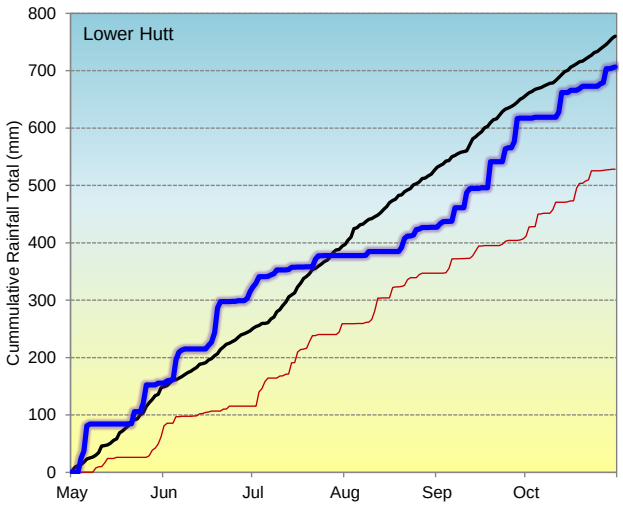
Cumulative rainfall plots

Cumulative rainfall totals for the May to October 2020 period are detailed for various rain gauges sites across the regional whaitua areas, as denoted by the blue trace on the following plots. The May to October for the previous year (2019) is denoted by the red trace and the black trace represents the long-term average rainfall accumulation.

Wellington and Hutt Valley

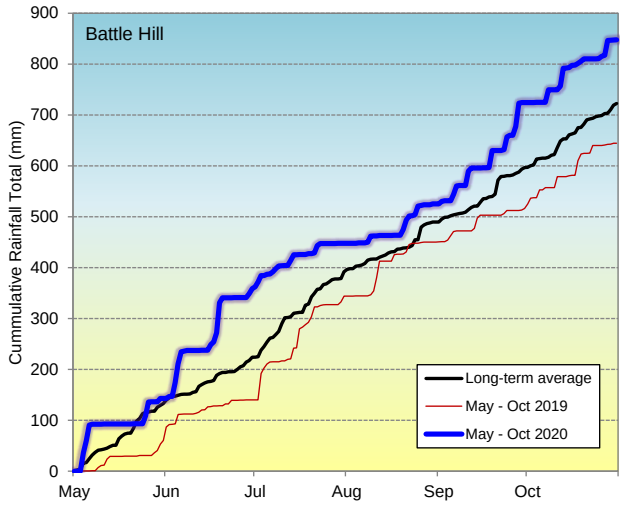
The plots highlight that the rainfall accumulation ended near the six month average but was punctuated by a very wet June and very dry July and August.

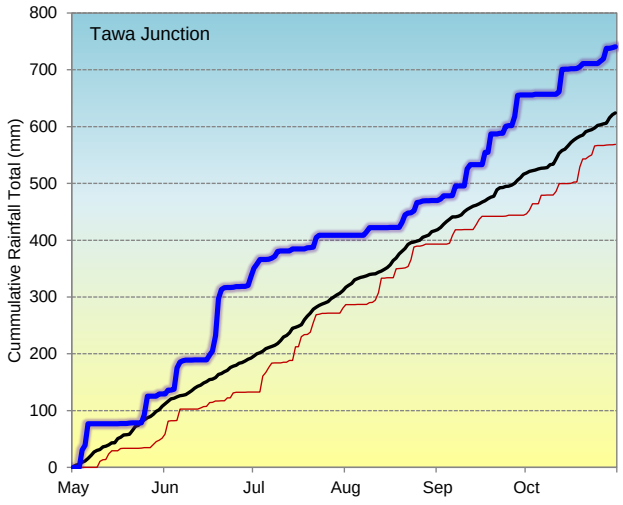




Porirua Harbour

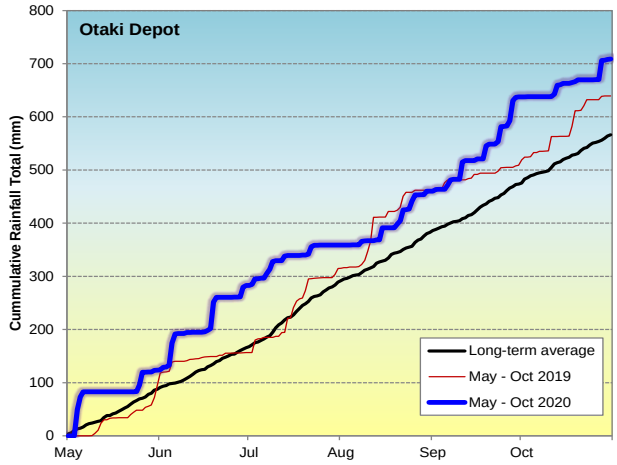
The plots shows the rainfall accumulation over the May to October period at two sites within the Te Awarua-o-Porirua whaitua area. Wet conditions in May, June and September contributed to the six month accumulation ending slightly above normal.

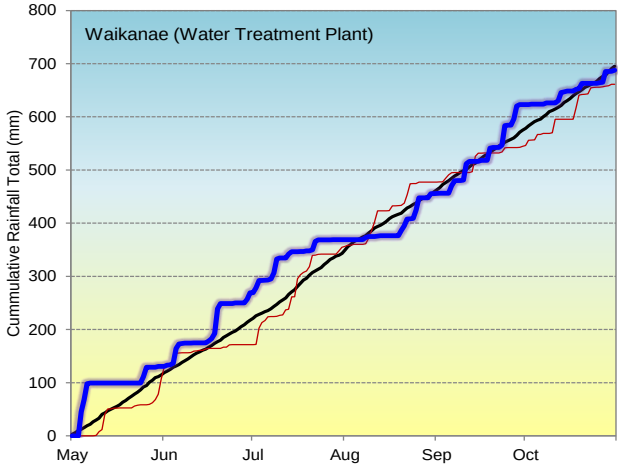




Kāpiti Coast

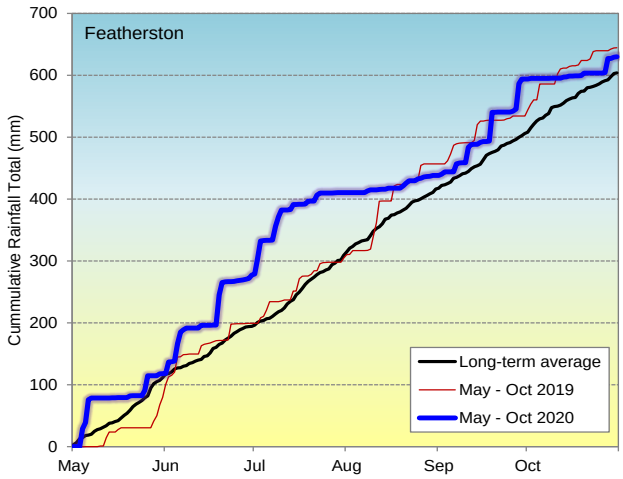
Rainfall recorded at Otaki tracked above average throughout the entire May to October period while Waikanae was closer to normal.

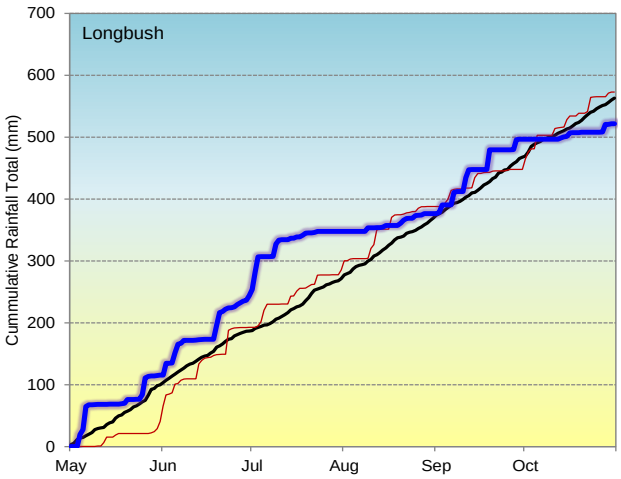




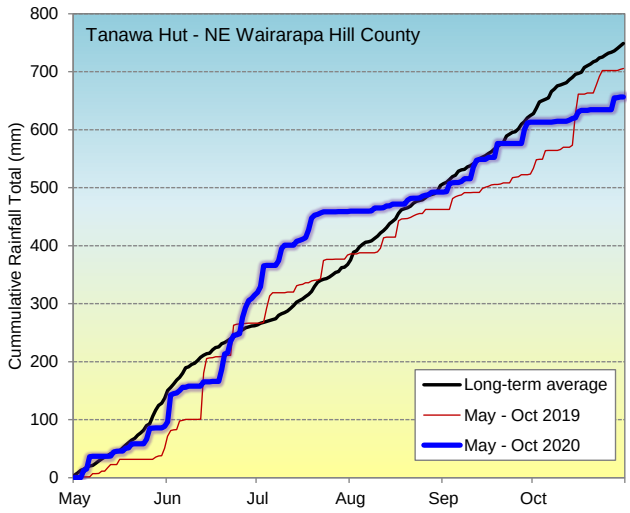
Ruamāhanga

Rainfall accumulation at these two locations clearly shows the wet July and dry August conditions.





Wairarapa Coast



The Tanawa Hut rain gauge in the Wairarapa Coast area shows the steep rise due to very wet conditions during July before flattening off thanks to a dry August

River flows - averages

River flows over the entire May to October period ranged from 70 to 160 percent of average.

		Flow as a percentage of average						
Whaitua	**River**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**May-Oct**
Wellington Harbour & Hutt Valley	Hutt River - Kaitoke	84	121	91	43	173	65	95
	Hutt River - Taita Gorge	86	125	90	32	172	55	91
	Akatarawa River	93	114	95	38	176	55	92
	Mangaroa River	67	107	92	19	142	53	79
	Waiwhetu Stream	72	97	54	35	131	72	76
	Wainuiomata River	65	113	103	29	148	81	90
Te Awarua-o-Porirua	Porirua	88	199	59	38	150	78	99
	Pauatahanui	98	153	101	51	207	78	112
	Horokiri	90	183	70	35	174	85	102
Kāpiti Coast	Waitohu	128	138	100	72	342	133	156
	Otaki	88	108	102	62	229	97	115
	Mangaone	88	79	85	49	162	48	83
	Waikanae	144	126	119	47	294	90	131
Ruamāhanga	Kopuaranga	40	82	82	35	197	41	80
	Waingawa	52	124	81	53	165	67	91
	Waiohine	63	129	90	52	174	70	97
	Mangatarere	34	106	105	26	172	35	80
	Tauherenikau	83		98	39	150	60	86
	Otukura	97	171	133	43	105	47	98
	Ruamāhanga	48	104	87	36	145	56	80
Wairarapa Coast	Pahaoa	52	137	101	8	68	12	72

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- Ruamāhanga
- Wairarapa Coast

River flows – lowest

Minimum river and stream flows recorded during the May to October 2020 period.

Whaitua	River	Minimum Flow		
		Flow (m^3/s)	Date	Comment
Wellington Harbour & Hutt Valley	Hutt (Kaitoke)	1.480	16-Aug	
	Hutt (Taita Gorge)	5.430	16-Aug	
	Akatarawa	1.479	16-Aug	
	Mangaroa	0.526	21-May	
	Wainuiomata	0.241	21-May	
Te Awarua-o-Porirua	Porirua	0.195	21-May	
	Pauatahanui	0.280	21-May	
	Horokiri	0.149	21-May	
Kāpiti Coast	Waitohu	0.221	12-Aug	
	Otaki	5.595	16-Aug	
	Mangaone	0.127	21-May	
	Waikanae	1.740	16-Aug	
Ruamāhanga	Kopuaranga	0.317	1-May	
	Waingawa	1.594	21-May	
	Waiohine	4.297	16-Aug	
	Mangatarere	0.277	21-May	
	Tauherenikau	1.816	16-Aug	
	Otukura	0.195	21-May	
	Ruamāhanga (Upper)	-	-	
	Ruamāhanga (Lower)	13.319	21-May	
Wairarapa Coast	Pahaoa	0.298	1-May	

** Analyses have been completed on provisional data which may be subject to change once it is processed and archived.*

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- Wairarapa Coast

River flows – highest

Maximum river and stream flows recorded during the November to April 2020. The estimated return period is given for each event.

Whaitua	River	Maximum Flow		
		Flow (m^3/s)	Date	Return Period (years)
Wellington Harbour & Hutt Valley	Hutt (Kaitoke)	315	18-Sep	
	Hutt(Taita Gorge)	476	27-Sep	1
	Akatarawa	181	23-Sep	1
	Mangaroa	78	27-Sep	1
	Waiwhetu	11	27-Sep	
	Wainuiomata	28	27-Sep	1
Te Awarua-o-Porirua	Porirua	38	27-Sep	2
	Pauatahanui	31	27-Sep	1
	Horokiri	17	27-Sep	1
Kāpiti Coast	Waitohu	48	23-Sep	1
	Otaki	827	23-Sep	1
	Mangaone	7	23-Sep	1
	Waikanae	125	23-Sep	1
Ruamāhanga	Kopuaranga	47	27-Sep	1
	Waingawa	275	18-Sep	1
	Waiohine	601	18-Sep	1
	Mangatarere	45	27-Sep	1
	Tauherenikau	299	18-Sep	1
	Otukura	8	2-Jul	1
	Ruamāhanga (Upper)	379	27-Sep	1
	Ruamāhanga (Lower)	787	27-Sep	1
Wairarapa Coast	Pahaoa	265	2-Jul	1

** Analyses have been completed on provisional data which may be subject to change once it is processed and archived.*

Click the following links to return to climate summaries for:

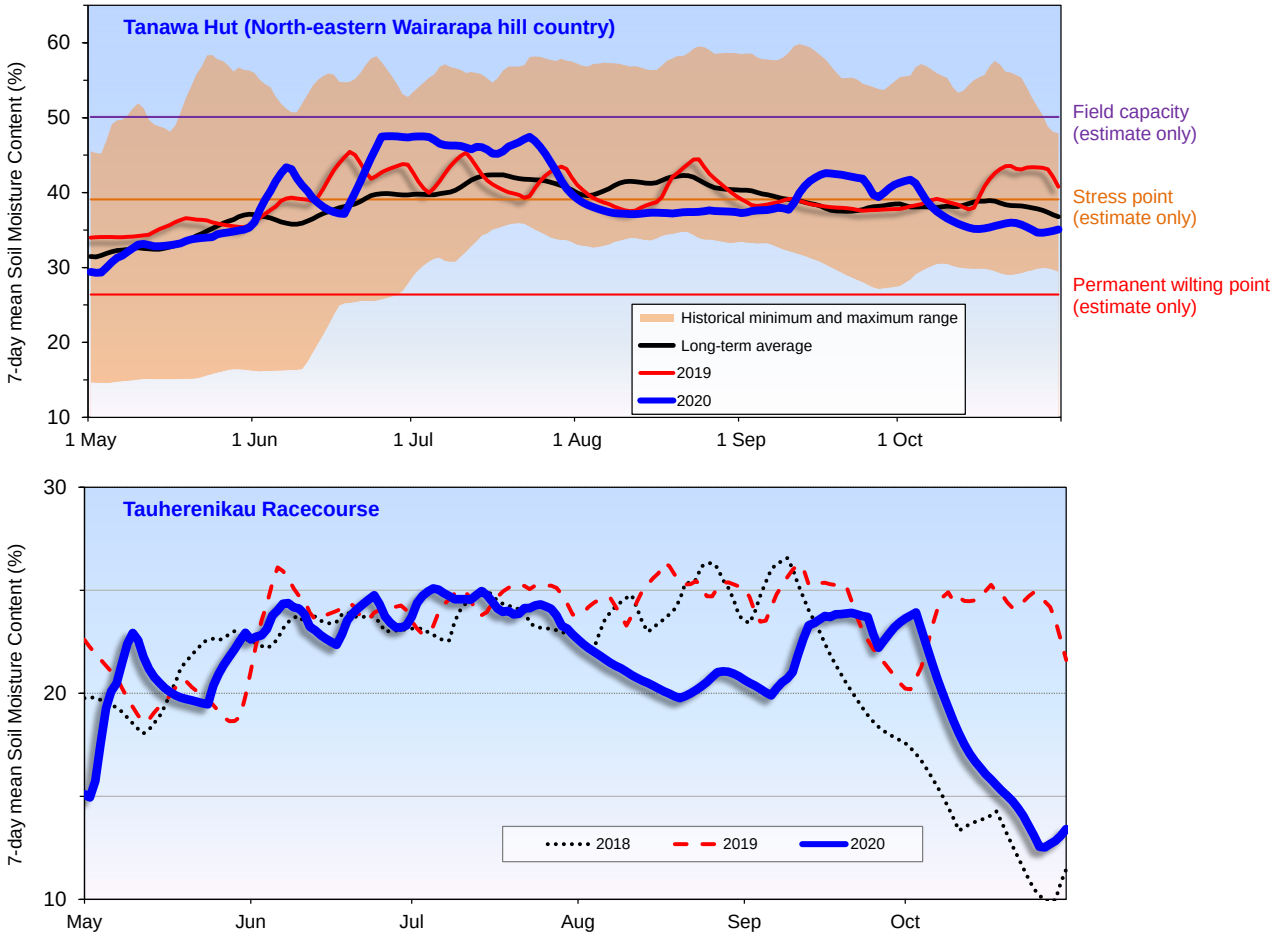
- Wellington Harbour & Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga
- Wairarapa Coast

Soil moisture content

Wairarapa Coast

May to October 2020 moisture content at monitoring sites at Tanawa Hut in north-east Wairarapa (Wairarapa Coast whaitua) and Tauherenikau racecourse (Ruamāhanga whaitua) are plotted below.

Soil moisture at Tanawa Hut has tracked near to average over the period whereas at Tauherenikau Racecourse there have been two periods of well below soil moisture in response to very low rainfall conditions during August and October.



Drought monitoring

GWRC maintains a drought check webpage with regional anomaly maps and links to live data across the region:

http://www.gwrc.govt.nz/drought-check/

Climate Briefings

In addition to the extended water resources reports, the Environmental Science department, GWRC, also produces seasonal updates specifically for the farming community. These can be accessed from the main Climate and Water Resource webpage:

http://www.gw.govt.nz/seasonal-climate-and-water-resource-summaries-2/

Environmental data

GWRC maintains a comprehensive online environmental data server providing real time data across the region for several climatic and hydrological variables

http://graphs.gw.govt.nz

Interactive Climate Change Mapping

The Environmental Science department at GWRC has produced one of the first comprehensive climate change mapping tools publicly available in New Zealand. The online mapping tool is fully interactive and easy to understand, allowing users to plot over twenty different variables, projected over every available IPCC scenario for both mid and late century

https://mapping1.gw.govt.nz/gw/ClimateChange/

Sea level Rise Mapper (New)

The Environmental Science department at GWRC is also making available a comprehensive sea level rise (SLR) mapper for the whole region. The tool allows users to have a view of sea level rise impacts, for values between zero and 5m SLR, including the effects of storm surge for selected heights. We encourage community and stakeholders to use this tool as a first screening of likely impacts that the region will be dealing with, as sea levels continue to rise.

https://mapping1.gw.govt.nz/GW/SLR/

The Greater Wellington Regional Council's purpose is to enrich life in the Wellington Region by building resilient, connected and prosperous communities, protecting and enhancing our natural assets, and inspiring pride in what makes us unique

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