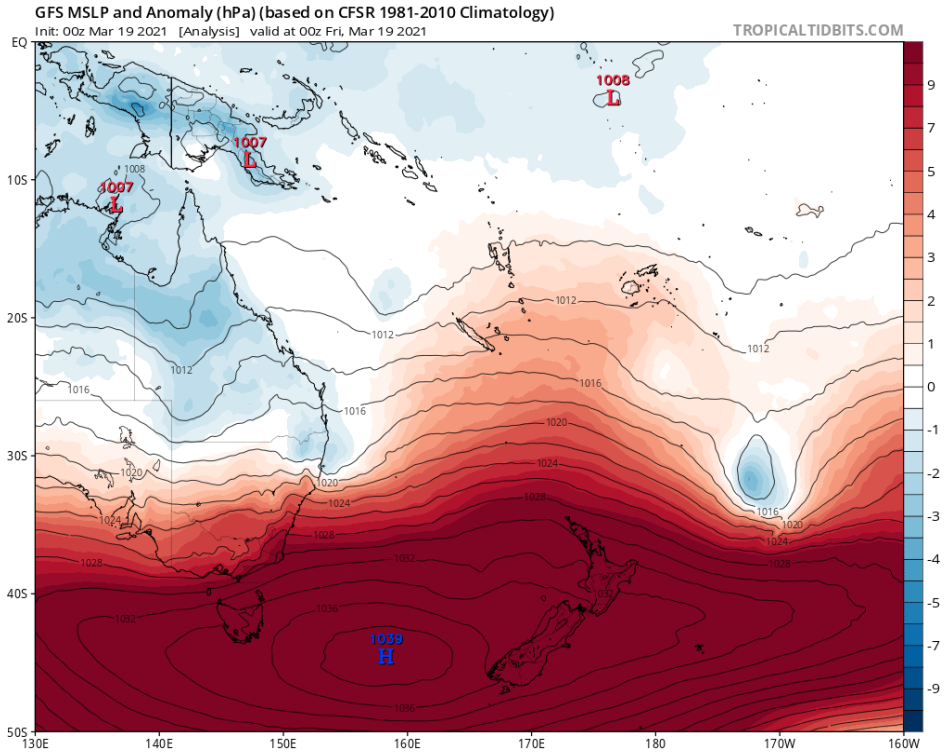
Greater Wellington
Te Pane Matua Taiao

Climate and Water Resources Summary for the Wellington Region

Warm Season (November to April) 2020-2021

Release date: 31 May 2021



Mean Sea Level Pressure (contours) and anomaly (in red and blue) for Friday 19th March 2021. The image shows the remarkable extent of the high pressure anomalies dominating the Southern Ocean around New Zealand. This has been a common feature towards the end of the warm season, causing dry weather and early frosts in the Wairarapa. Image Credits: tropicaltidbits.com

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

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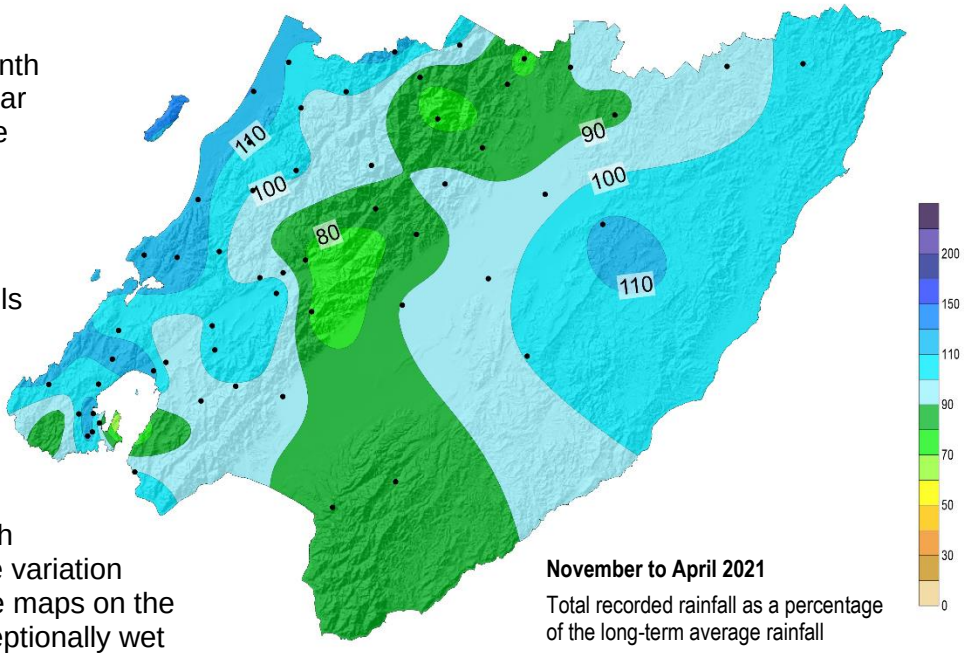
Report release date: May 2021

The warm season from November to April 2021 saw near average rainfall totals across the region (80 to 110% of normal) over the 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 between individual months with November being very wet compared to normal, and January and April being very dry.

Rainfall (November to April)

The map below shows rainfall recorded during the six month period from November to April 2021 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 despite significant differences in monthly distribution.



November to April 2021

Total recorded rainfall as a percentage of the long-term average rainfall

The eastern Wairarapa hills received 90 to 110% of normal rainfall totals while from the Tararua and Remutaka ranges westward totals were around 80 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: November and December, saw recorded rainfall totals up to 250% of normal. In stark contrast January and April 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 number of rain days was above normal in the lowland areas of Kāpiti, Porirua, Hutt valley and Wellington. Heavy rain days over the six month period were around normal.

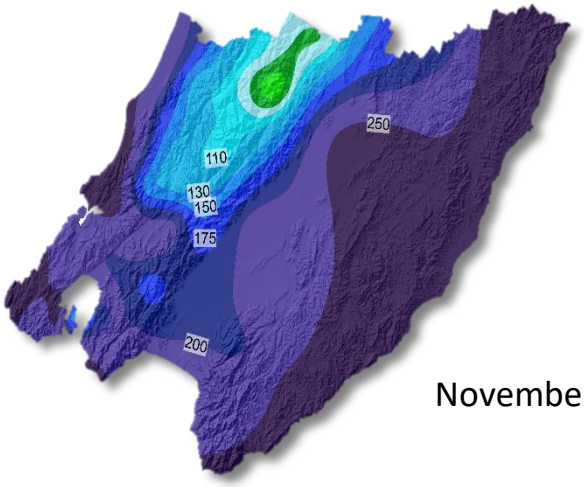
Number of Rain Days and Heavy Rain Days during November to April across the region (long-term average in brackets.)

	Kāpiti Coast		Porirua	Hutt Valley & Wellington		Ruamāhanga		Eastern Wairarapa	
	Lowland	Hills	Lowland	Lowland	Hills	Lowland	Hills	North	South
Rain Days (>1mm)	59 [52]	78 [77]	52 [44]	51 [46]	64 [67]	39 [42]	82 [82]	49 [47]	45 [52]
Heavy Rain Days(>25mm)	3 [4]	22 [21]	6 [4]	5 [4]	10 [10]	4 [3]	24 [24]	5 [4]	4 [4]

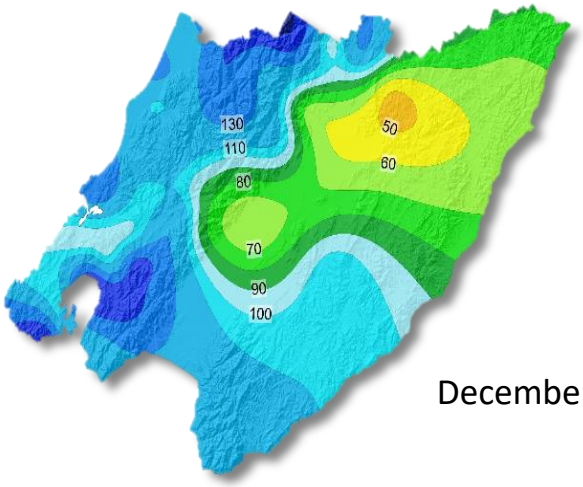
Rainfall by the month

January and April rainfall totals were well below average over all parts of the region, with November showing high rainfall in most areas.

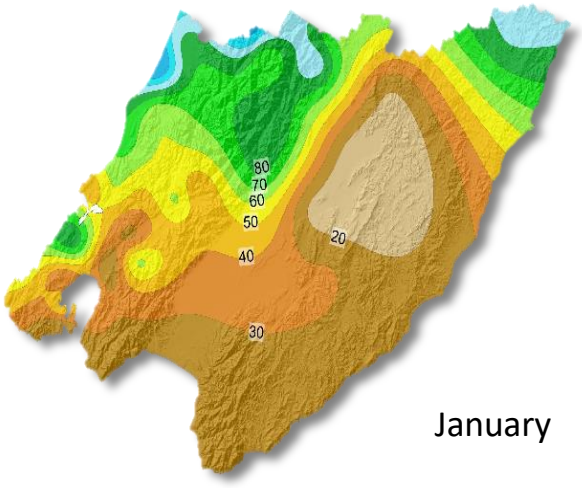
November was characterised by a number of heavy rain events with the first two weeks of the month experiencing an extended north-easterly airflow that brought record-high rainfall, particularly to the east coast area.



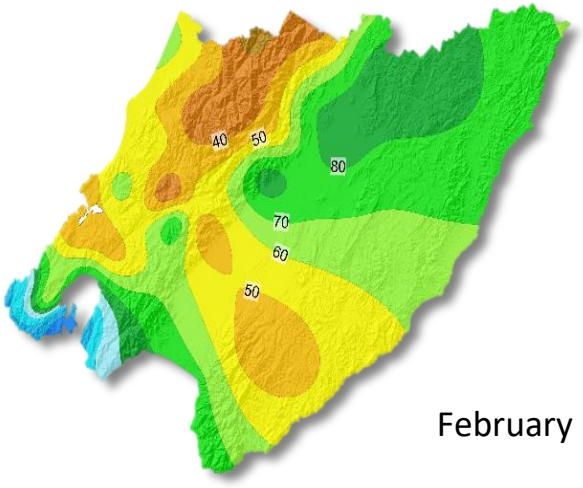
November



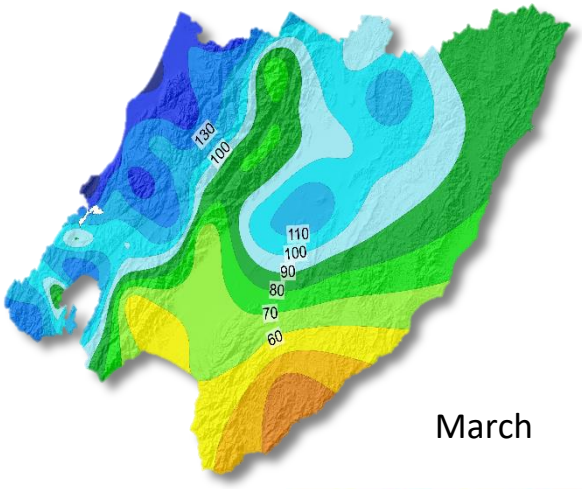
December



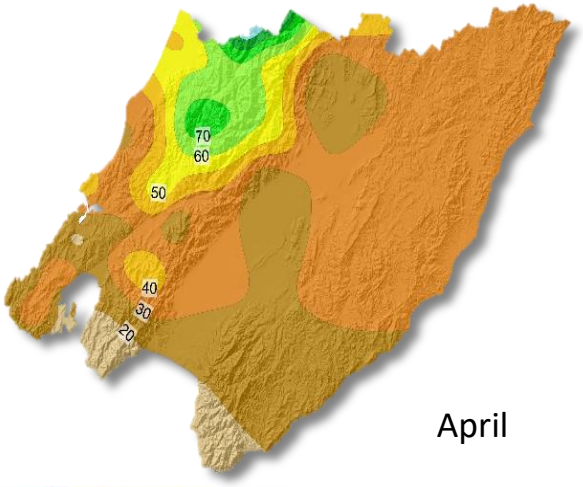
January



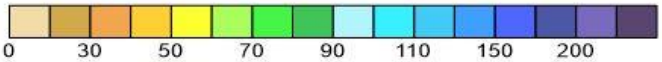
February



March

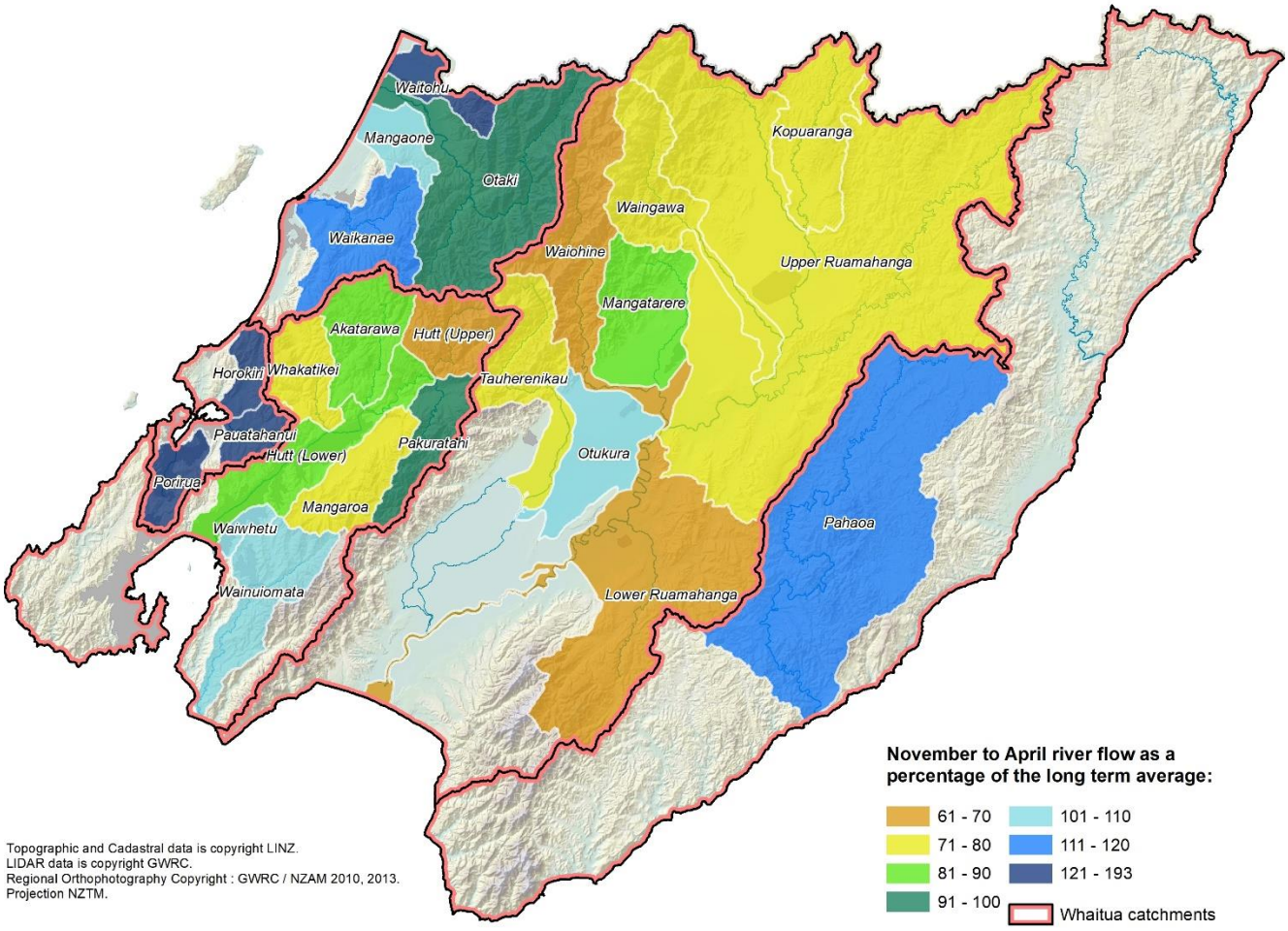


April



River flow

The map below shows mean river and stream flow conditions recorded over the November to April 2021 period, for various monitored catchments, as a percentage of the long-term average flow for the same period.



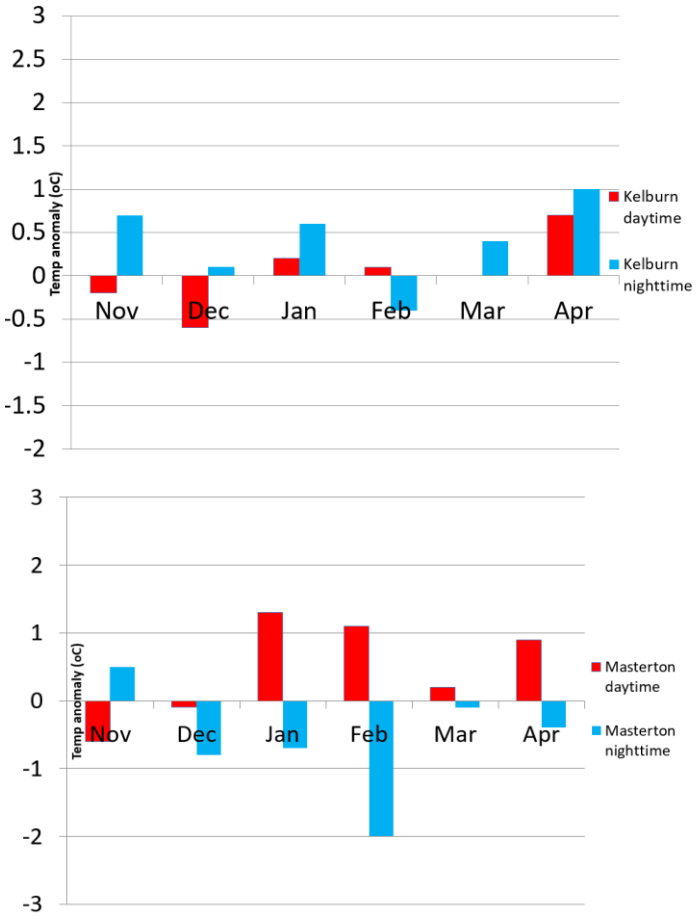
The majority of the region's streams and rivers experienced below average to average flows during the six month period except for catchments draining to the Porirua Harbour.

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 night-time 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 quite variable. For Wellington, there was a predominance of warmer than average nights, and April was the month with the warmest temperature anomaly. For Masterton, there was a predominance of hotter than average days and colder than average nights.



Average daytime and night-time temperature anomalies for Kelburn (top) and Masterton (bottom) for the warm season period. The season was variable, with colder and warmer than normal months alternating within the period. There was a predominance of hot days and cold nights in Masterton, and overall warmer nights in Wellington.

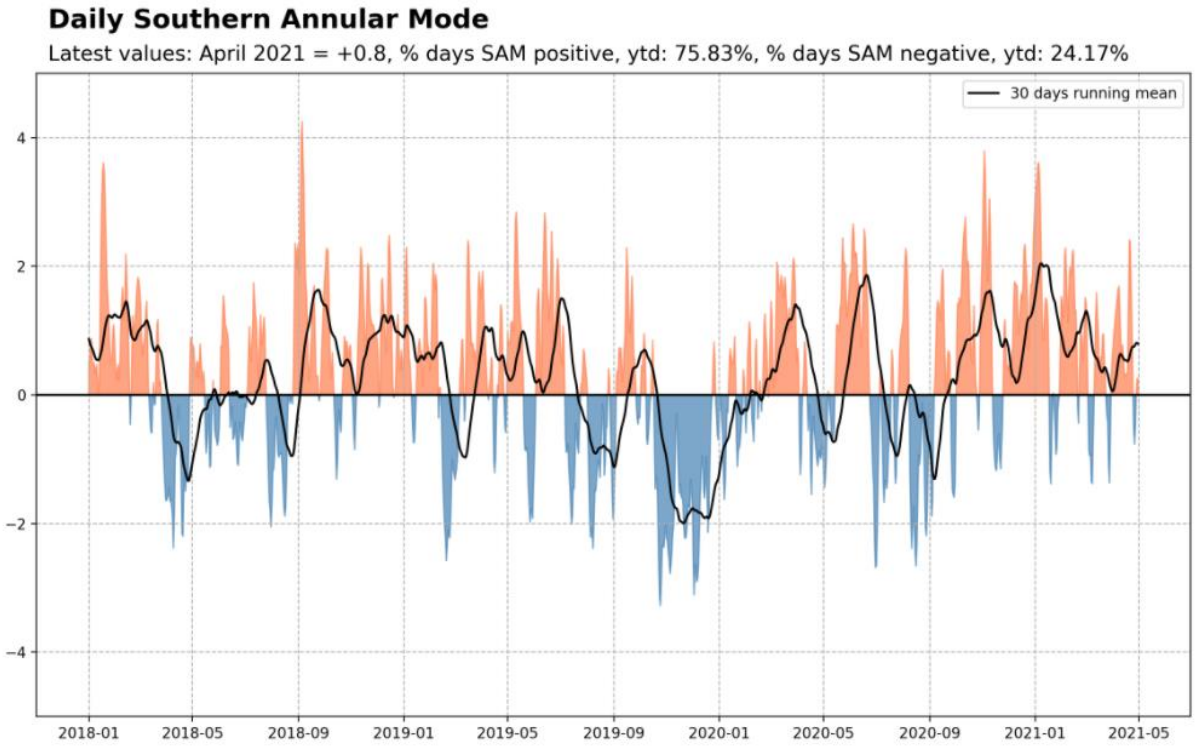
Global climate drivers

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 November 2020 to April 2021 are:

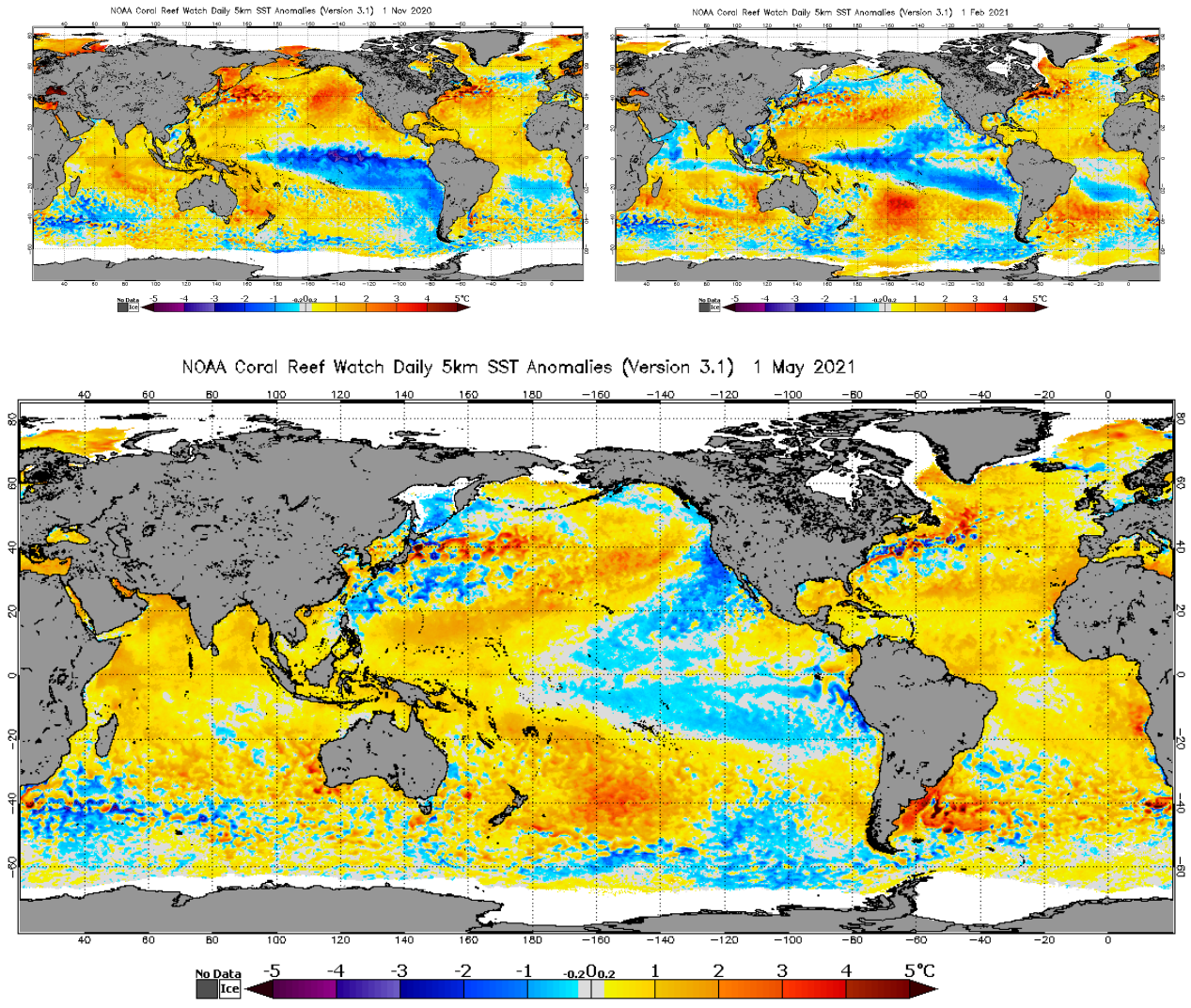
- The six-month period was rather variable, oscillating between warmer than normal and colder than normal. Masterton had particularly dry weather, with cold nights and hot days;
- The sea surface temperatures (following page) had warmed considerably around and east of New Zealand, as La Niña reached its peak and started to disappear from the Equatorial Pacific;
- The Southern Annular Mode (graph below) was predominantly positive for most of the period;
- Slight low pressure anomalies dominated the oceanic areas around New Zealand (page 7), with a quite variable circulation regime oscillating between westerlies and easterly flow.



The Southern annular mode (SAM) was mostly positive since spring 2020. Source: https://niwa.co.nz/climate/information-and-resources/southern-annular-mode

Global climate drivers and extreme weather events

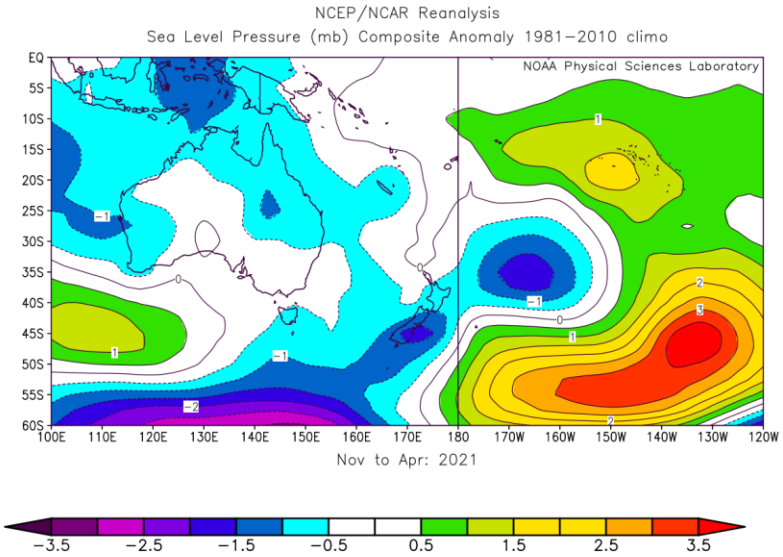
Climate drivers are global mechanisms that can influence the weather in our region. The El Niño/Southern Oscillation[1] (ENSO) phenomenon reached a mature La Niña phase in November (cold anomalies in blue, upper left panel), and is now dissipating back into a neutral phase (bottom panel). The sea surface temperature around New Zealand was variable throughout the warm season, leading to an overall fairly average beach experience for the Wellington region. However, as we head into winter, the waters have shifted towards a quite mild state, with a significantly warmer than average blob to the east of the country. The Indian Ocean is also largely warmer than average, but the Indian Ocean Dipole is predicted to remain borderline between neutral and positive. The sea ice extent around Antarctica grew significantly in late February and early March, and is now sitting above average for this time of the year (full extension seen in white).



Sea surface temperature anomalies on 1st Nov 2020 (left), 1st Feb 2021 (right) and 1st May 2021 (bottom). We can see the slow demise of La Niña in the Equatorial Pacific (cold blue tongue), with an intensification of the warming around and east of New Zealand during the six-month period (bottom image). Source: NOAA/USA.

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

The Mean Sea Level Pressure (MSLP) anomaly for the six month period shows that New Zealand was surrounded by a low pressure area (blue areas on the map). This was responsible for a quite variable circulation pattern, oscillating between cooler westerly bursts and easterly flow. We note that these pressure anomalies were only small, and that the Southern Annular Mode remained positive during the season, as discussed earlier. As such, the negative pressure anomalies were not strong enough to induce significant rain over the season, and a mostly dry pattern was still seen for most of the region.



Mean Sea Level Pressure anomaly for Nov 2020 to April 2021.

Below average pressure dominated the oceanic areas around New Zealand, creating an unsettled warm season largely alternating between westerly and easterly winds.

Source: NOAA (USA).

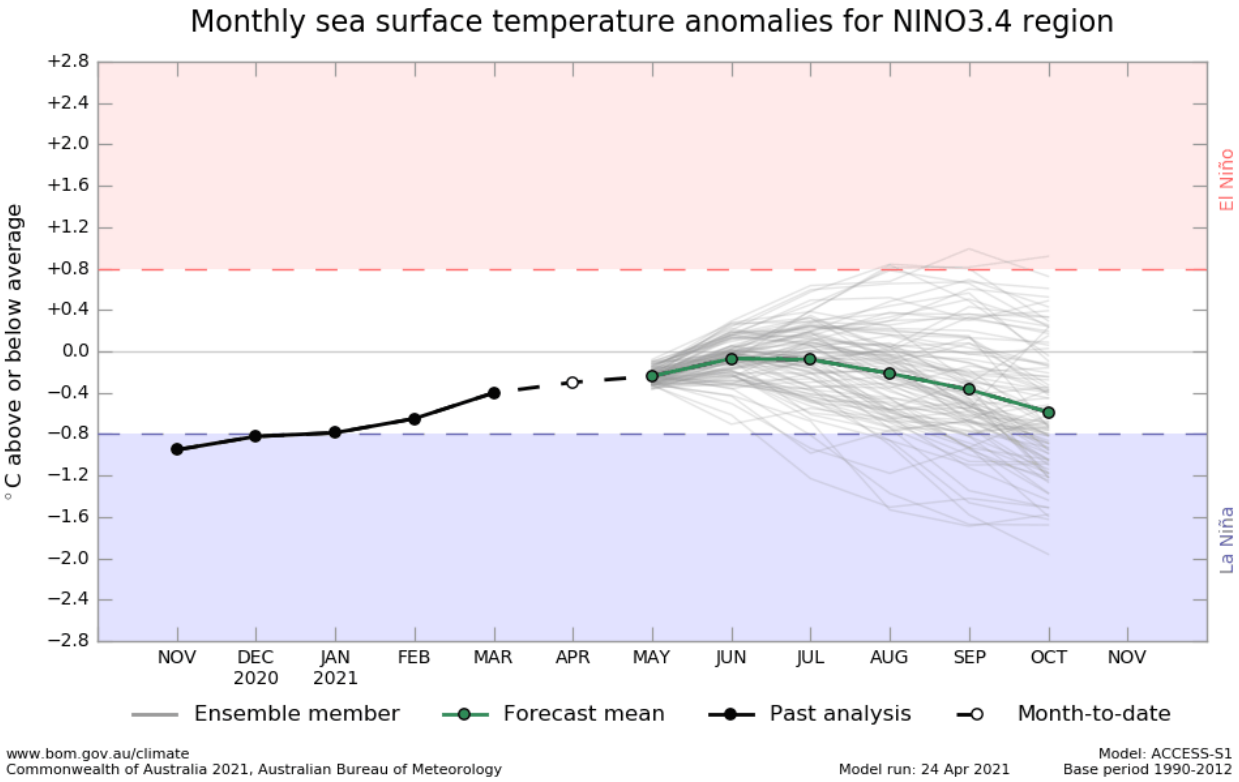
Both ENSO and the Indian Ocean Dipole (IOD) are expected to remain neutral over the winter season (as noted above), while the Southern Annular Mode (SAM) will likely remain mostly positive. This suggests that the predominant climate factor for our region could be the warmer than average oceanic waters around New Zealand. These warmer waters have the potential to increase evaporation and the chances of heavy rainfall events. This is amplified in a background of mostly warmer than average SSTs extending all the way to the subtropics, which could create humid corridors of tropical moisture transport such as the exceptional Canterbury event seen in late May.

Seasonal climate outlook update

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

- Neutral ENSO and Indian Ocean Dipole most likely;
- Warmer oceanic waters around and east of New Zealand;
- Above normal air temperatures with high variability. Short cold bursts in between longer mild spells;
- Early frosts inland, due to sporadic anticyclonic influence;
- Mixed rainfall anomalies, starting drier than average. High chances of extreme rainfall events, which could bring the total accumulation closer to average later in the season.

The full climate outlook for winter will be released by the end of June.



ENSO predictions as of 24 April 2021, showing that the phenomenon is expected to remain neutral over the next few months. *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:

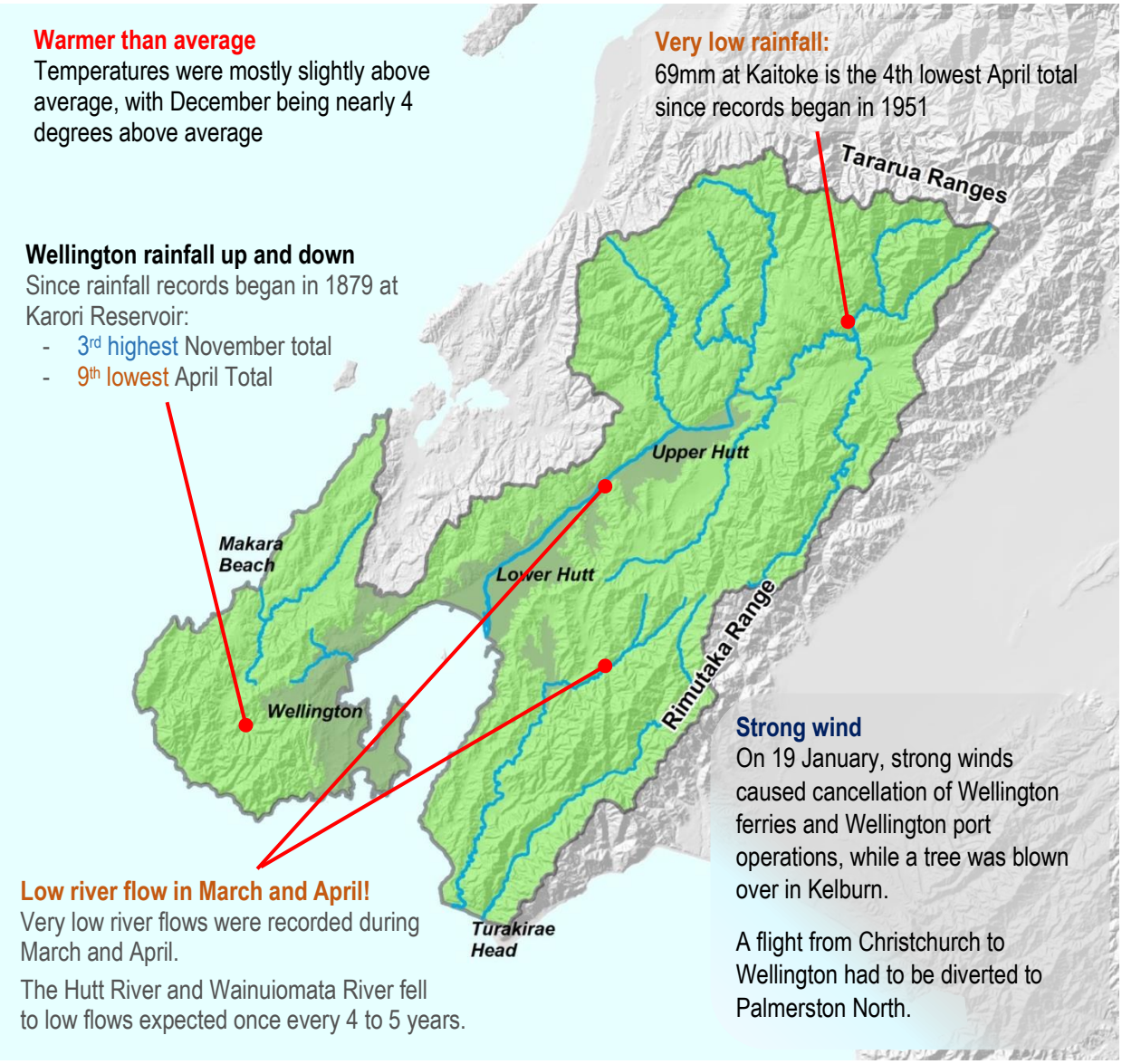
- Wellington Harbour and Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga Valley
- Wairarapa Coast

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 the region.

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

Wellington Harbour and Hutt Valley climate summary

- **Warmer than average**
- **Large rainfall variation from record high to record low**

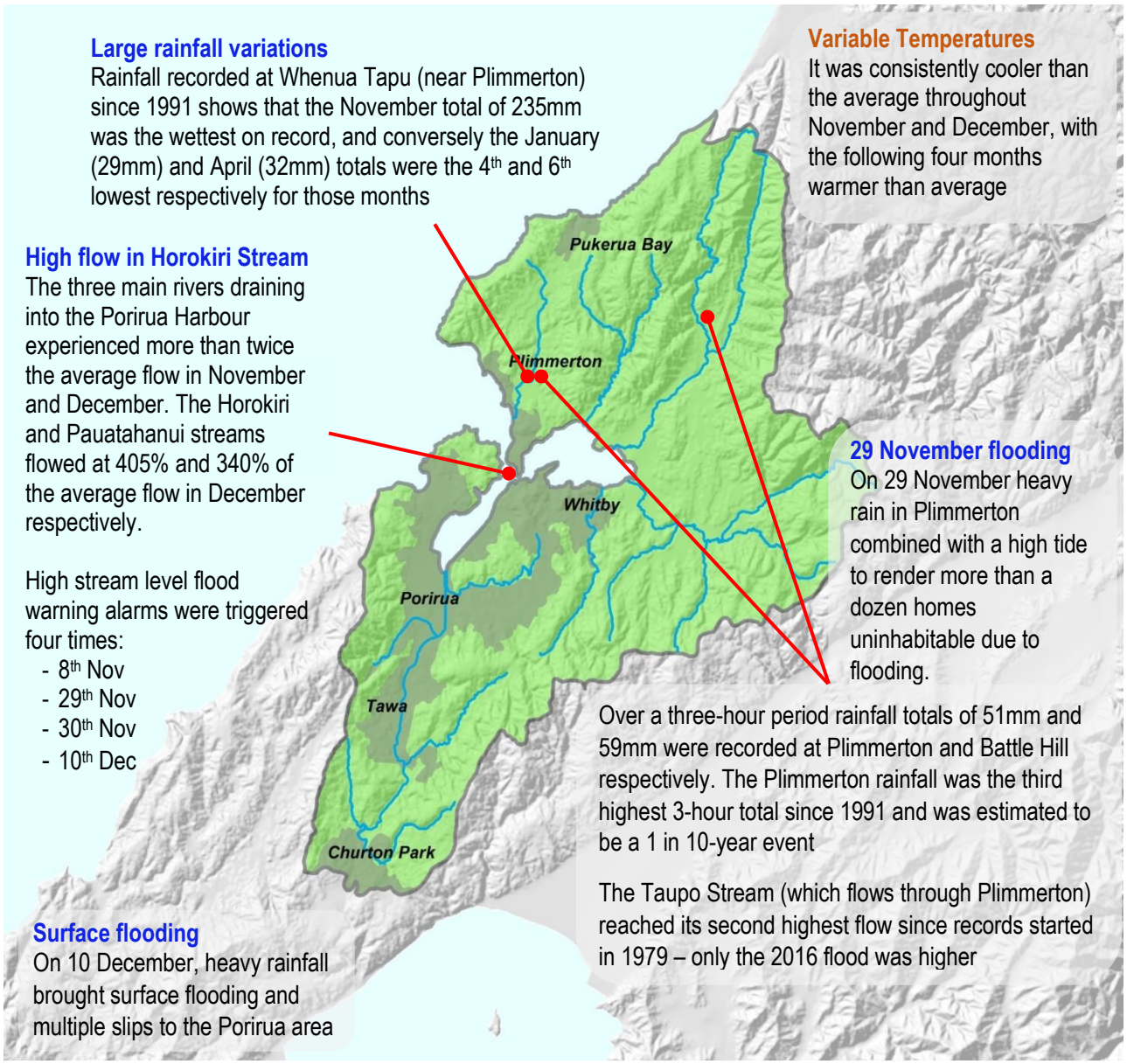


Want to look at the summary tables and graphs?

- Rainfall
- River flows

Te Awarua-o-Porirua climate summary

- **Near-average Temperatures**
- **Large rainfall variation from record high to record low**

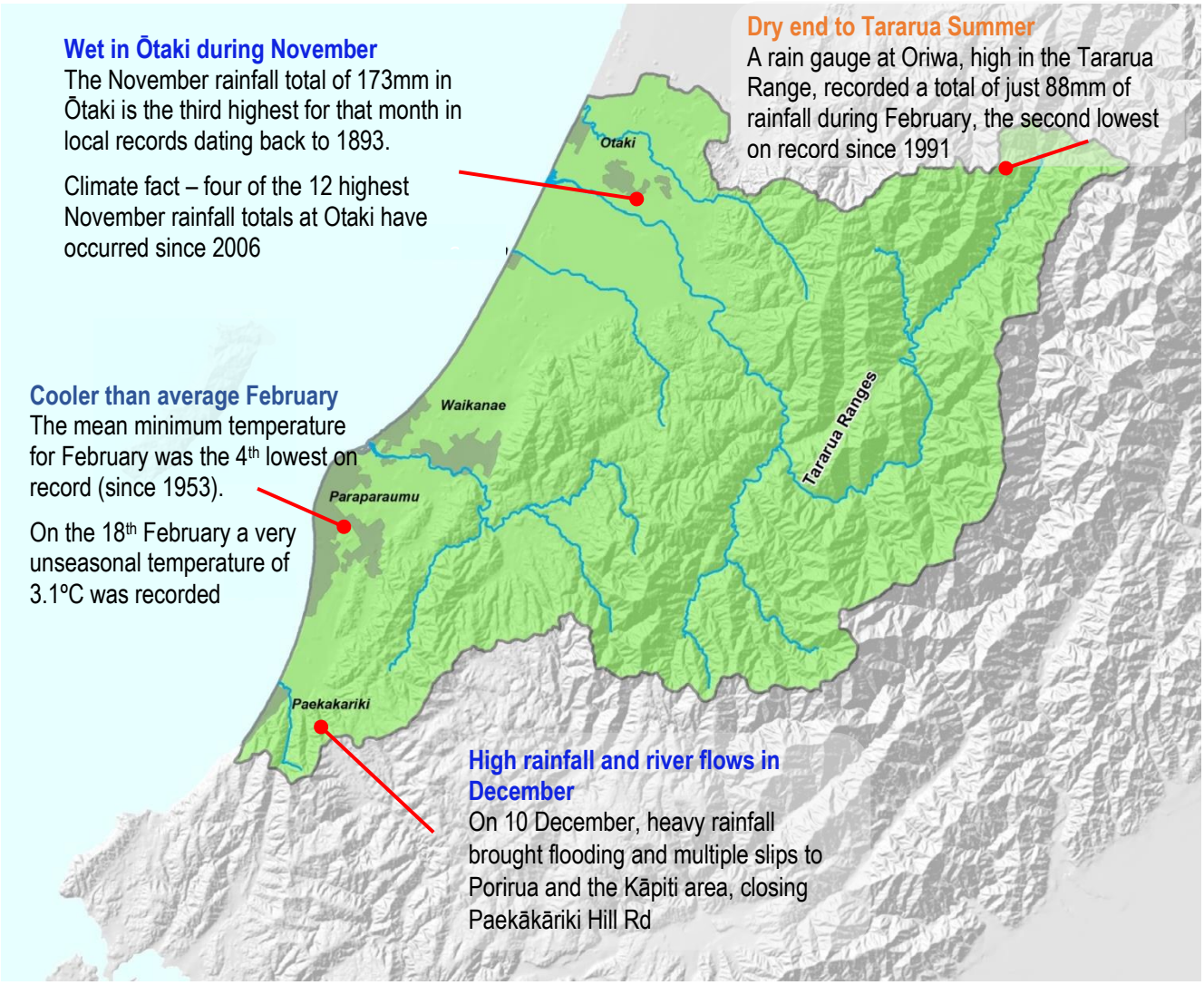


Want to look at the summary tables and graphs?

- **Rainfall**
- **River flows**

Kāpiti Coast climate summary

- **Warmer than average**
- **Very wet start to warm season but a very dry end**

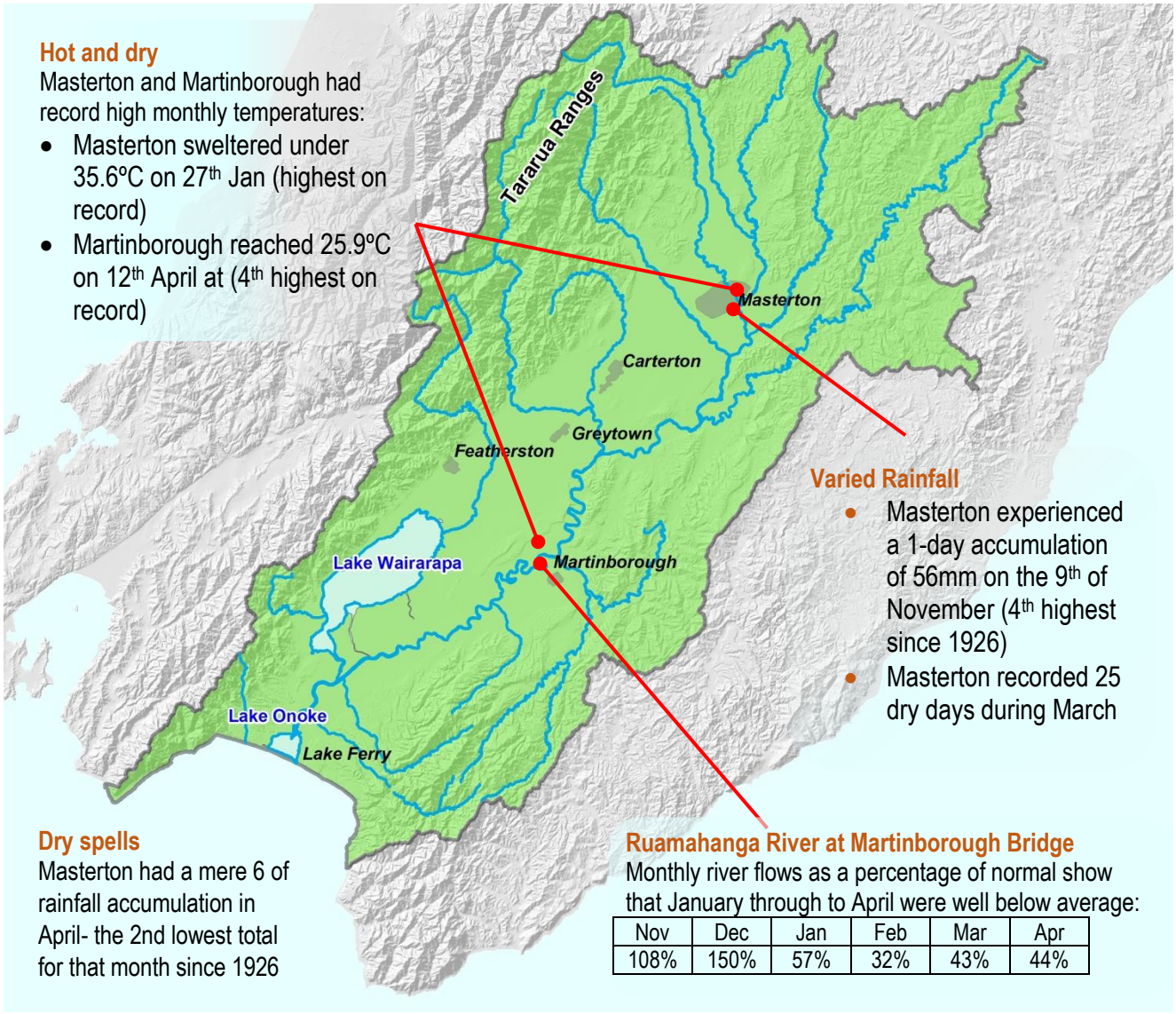


Want to look at the summary tables and graphs?

- Rainfall
- River flows

Ruamāhanga Valley climate summary

- **Warmer than average**
- **Large variations in rainfall**



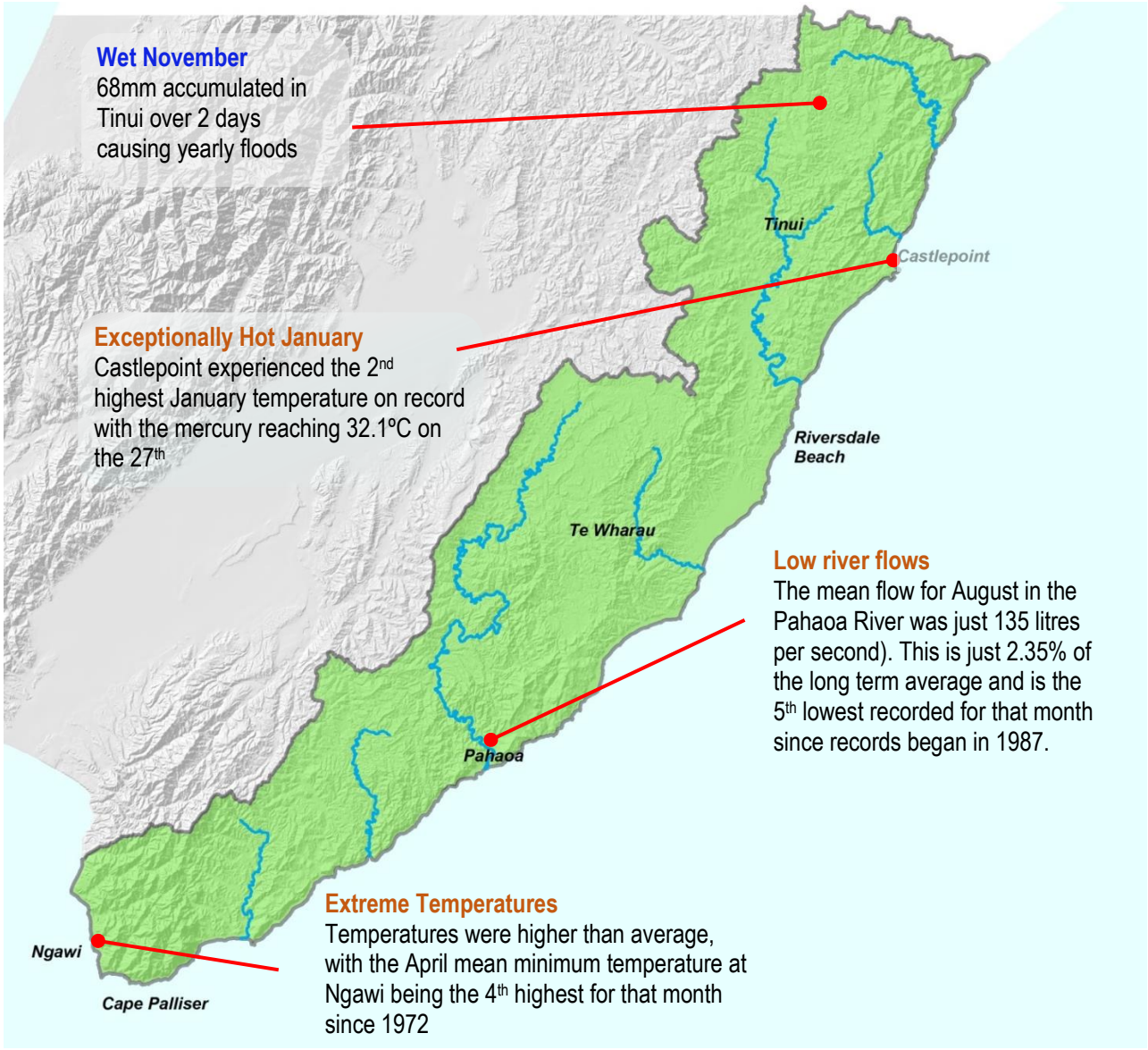
Nov	Dec	Jan	Feb	Mar	Apr
108%	150%	57%	32%	43%	44%

Want to look at the summary tables and graphs?

- Rainfall
- River flows

Wairarapa Coast climate summary

- **Record temperatures recorded**
- **Large variations in rainfall**



Want to look at the summary tables and graphs?

- Rainfall
- Soil moisture

Rainfall statistics

Rainfall was quite variable between individual months in the November to April period, but ended near average in a number of areas.

Whaitua	Location	Nov %	Dec %	Jan %	Feb %	Mar %	Apr %	Nov-Apr (mm)	Nov-Apr %
Wellington Harbour & Hutt Valley Click to see cumulative rainfall plots	Kaitoke	127	97	46	50	103	41	782	81
	Lower Hutt	209	122	24	61	118	30	482	103
	Wainuiomata	195	169	36	62	59	32	678	95
	Karori	242	112	40	83	95	31	566	103
	Wellington	201	108	54	95	88	22	472	99
Te Awarua-o-Porirua Click to see cumulative rainfall plots	Battle Hill	252	135	61	62	128	36	708	121
	Whenua Tapu	283	145	45	45	183	43	581	129
	Tawa	247	127	61	53	130	28	503	112
Kāpiti Coast Click to see cumulative rainfall plots	Otaki	207	117	89	60	151	51	524	113
	Waikanae	184	108	70	49	161	44	590	104
	Paekakariki	275	125	75	56	143	31	555	150
	Tararua (Otaki headwaters)	121	148	81	44	139	60	1439	103
Ruamāhanga Click to see cumulative rainfall plots	Masterton	272	57	22	86	99	30	356	69
	Featherston	227	61	52	65	103	29	402	92
	Longbush	249	105	31	97	86	34	388	103
	Tararua (Waiohine headwaters)	97	135	73	33	87	64	1664	86
Wairarapa Coast Click to see cumulative rainfall plots	Tanawa Hut	301	72	90	74	85	35	527	104
	Ngaumu	223	55	21	72	116	20	350	99

Click the following links to return to climate summaries for:

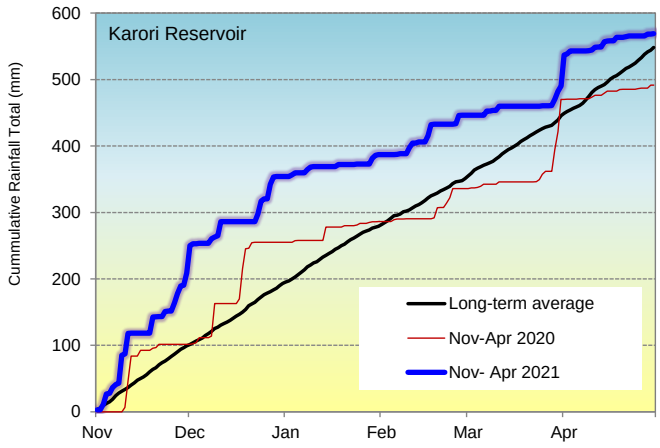
- Wellington Harbour & Hutt Valley
- Te Awarua-o-Porirua
- Kāpiti Coast
- Ruamāhanga
- Wairarapa Coast

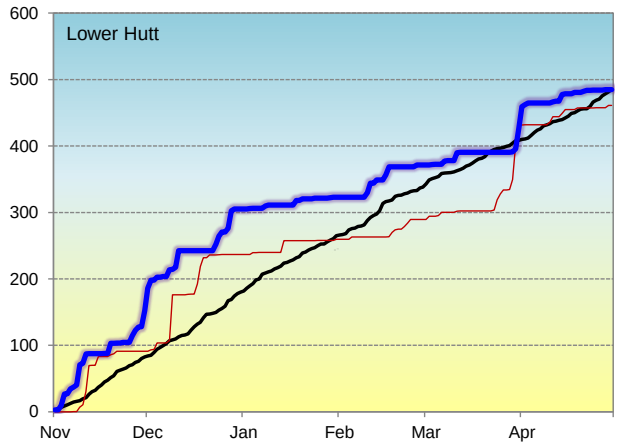
Cumulative rainfall plots

Cumulative rainfall totals for the November to April 2021 period are shown as a blue trace on the plots below for various rain gauges sites across the regional whaitua areasThe November to May period for the previous year (2020) is also shown (red trace) as well as the long-term average rainfall accumulation (black trace).

Wellington and Hutt Valley

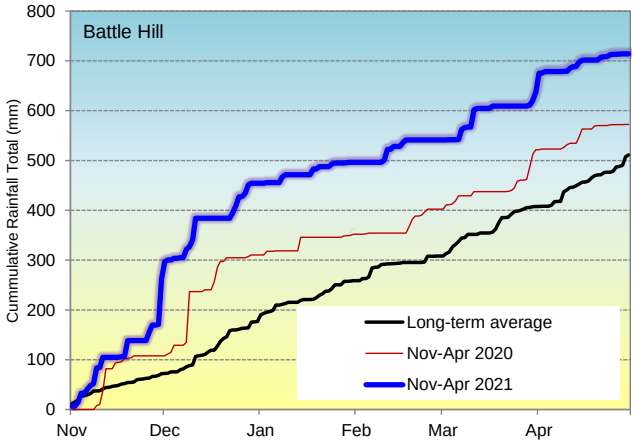
The plots highlight that the rainfall accumulation ended near the six month average but was punctuated by a very wet November and very dry January and February

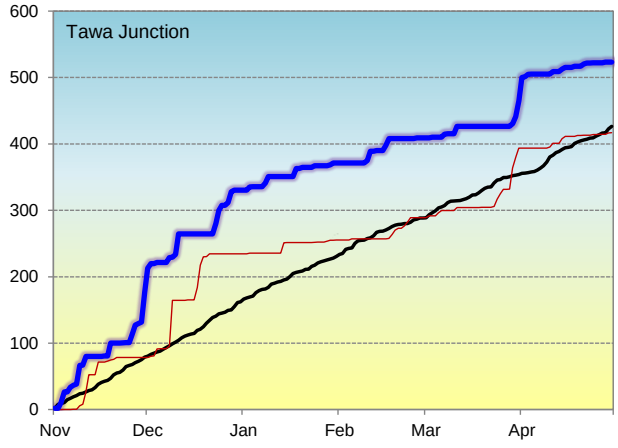




Porirua Harbour

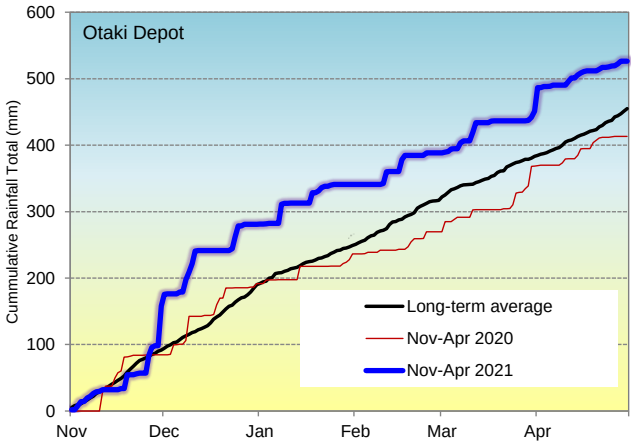
The plots show the rainfall accumulation over the November to April period at two sites within the Te Awarua-o-Porirua whaitua area. Wet conditions in November and December periods contributed to the higher than average six month accumulation.

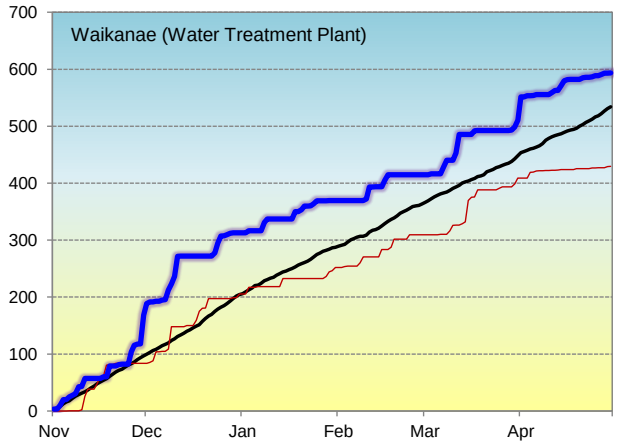




Kāpiti Coast

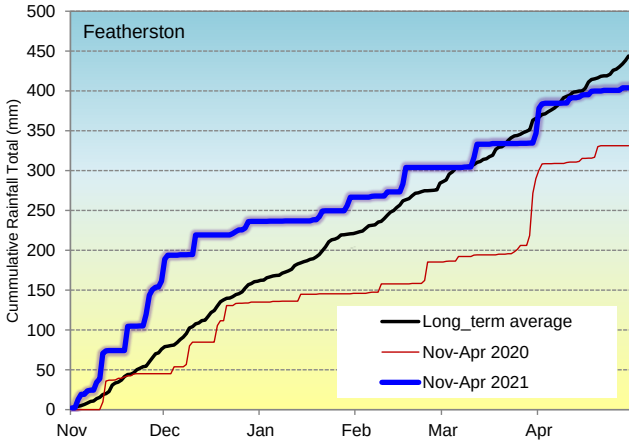
Rainfall recorded at Otaki tracked below average thanks to a dry November, yet above average throughout the entire December to April period.

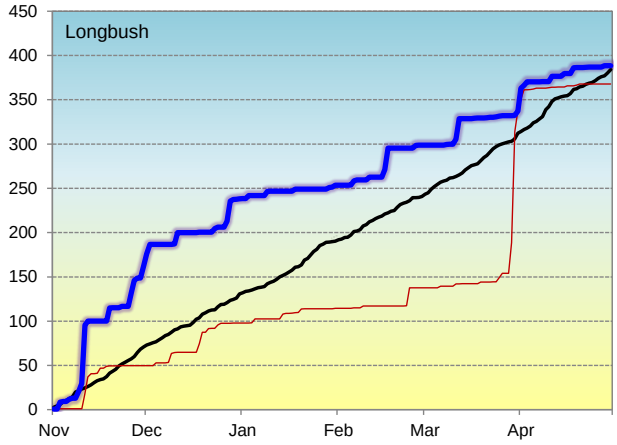




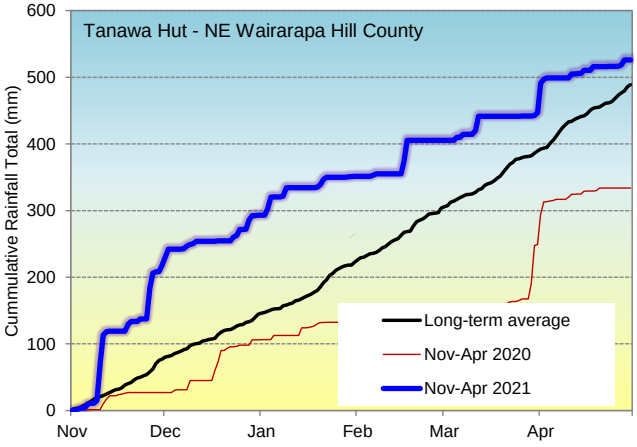
Ruamāhanga

Rainfall accumulation at these two locations clearly shows the wet December and dry March conditions.





Wairarapa Coast



The Tanawa Hut rain gauge in the Wairarapa Coast area shows the steep rise due to very wet conditions during November and December before flattening off back towards the average accumulation thanks to a dry April.

River flows – averages

River flows over the November to April May to October period ranged from 60 to 190 percent of average.

		Flow as a percentage of average						
Whaitua	**River**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**Nov-Apr**
Wellington Harbour & Hutt Valley	Hutt River - Kaitoke	117		49	45	57	48	68
	Hutt River - Taita Gorge	120	150	40	33	47	38	83
	Akatarawa River	114	152	48	40	65	48	88
	Mangaroa River	137	155	42	18	16	16	80
	Waiwhetu Stream	171	183	76	59	83	37	109
	Wainuiomata River	150	207	73	47	42	41	109
Te Awarua-o-Porirua	Porirua	224	264	112	78	105	57	152
	Pauatahanui	214	343	97	60	76	63	169
	Horokiri		405	99	38	71	62	150
Kāpiti Coast	Waitohu	175	311	154	110	210	126	193
	Otaki	94	168	67	34	89	76	97
	Mangaone	79	145	101	93	143	114	110
	Waikanae	137	221	56	39	79	54	113
Ruamāhanga	Kopuaranga	100	168	40	28	28	30	71
	Waingawa	80	118	66	37	48	53	72
	Waiohine	73	112	49	28	39	42	61
	Mangatarere	138	139	55	41	27	29	81
	Tauherenikau	128	116	52	50	45	44	78
	Otukura	121	149	83	69	83	66	102
	Ruamāhanga	108	150	57	32	43	44	80
Wairarapa Coast	Pahaoa	404	278	21	5	2	10	119

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- Wairarapa Coast

River flows – lowest

Minimum river and stream flows recorded during the November to April 2021 period.

Whaitua	River	Minimum Flow		
		Flow (m^3/s)	Date	Comment
Wellington Harbour & Hutt Valley	Hutt (Kaitoke)	1.006	06-Mar	*17%*
	Hutt (Taita Gorge)	2.695	05-Mar	*15%*
	Akatarawa	0.970	05-Mar	*23%*
	Mangaroa	-	-	
	Wainuiomata	0.150	27-Mar	
Te Awarua-o-Porirua	Porirua	0.139	25-Mar	*29%*
	Pauatahanui	0.111	05-Mar	*26%*
	Horokiri	0.052	05-Mar	*14%*
Kāpiti Coast	Waitohu	-	-	
	Otaki	3.772	06-Mar	*15%*
	Mangaone	0.203	09-Mar	*73%*
	Waikanae	0.909	05-Mar	*22%*
Ruamāhanga	Kopuaranga	0.255	11-Feb	*18%*
	Waingawa	1.034	03-Mar	*13%*
	Waiohine	2.617	06-Mar	*11%*
	Mangatarere	0.126	10-Mar	*11%*
	Tauherenikau	0.955	06-Mar	*15%*
	Otukura	0.053	27-Jan	*20%*
	Ruamāhanga (Upper)	1.834	04-Mar	*13%*
	Ruamāhanga (Lower)	7.188	07-Mar	*18%*
Wairarapa Coast	Pahaoa	0.050	10-Mar	*1.25%*

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

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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)	134	11-Mar	1
	Hutt(Taita Gorge)	354	10-Dec	1
	Akatarawa	125	10-Dec	1
	Mangaroa	57	10-Nov	1
	Waiwhetu	10	08-Nov	1
	Wainuiomata	15	10-Nov	1
Te Awarua-o-Porirua	Porirua	37	10-Dec	2
	Pauatahanui	32	10-Dec	1
	Horokiri	42	29-Nov	4
Kāpiti Coast	Waitohu	44	11-Mar	1
	Otaki	633	08-Dec	1
	Mangaone	6	29-Nov	1
	Waikanae	120	10-Dec	1
Ruamāhanga	Kopuaranga	16	08-Dec	1
	Waingawa	156	08-Dec	1
	Waiohine	412	08-Dec	1
	Mangatarere	29	10-Nov	1
	Tauherenikau	99	10-Nov	1
	Otukura	3	01-Dec	1
	Ruamāhanga (Upper)	309	08-Dec	1
	Ruamāhanga (Lower)	605	08-Dec	1
Wairarapa Coast	Pahaoa	386	10-Nov	1

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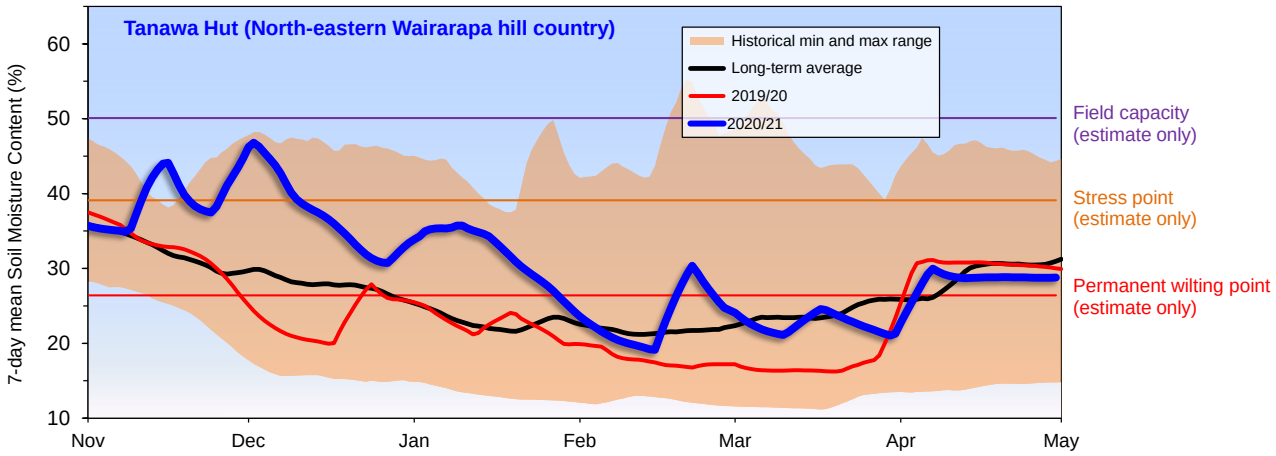
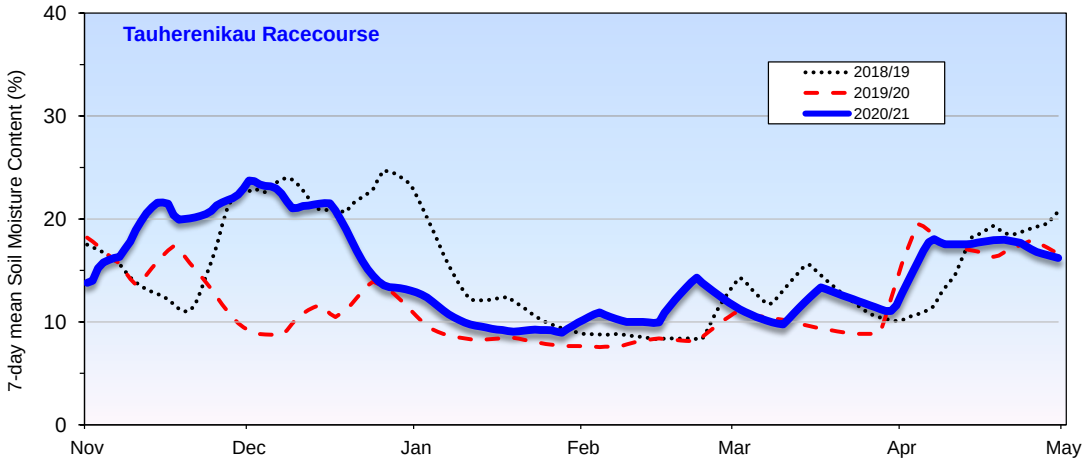
Soil moisture content

Wairarapa Coast

November to April 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 mostly tracked above average over the period whereas at Tauherenikau Racecourse there have been a period of low soil moisture in response to very low rainfall conditions from January to April.





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/

Greater Wellington Regional Council:

Wellington office
PO Box 11646
Manners Street
Wellington 6142

04 384 5708

Upper Hutt office
PO Box 40847
Upper Hutt 5018

04 526 4133

Masterton office
PO Box 41
Masterton 5840

06 378 2484

Follow the Wellington Regional Council

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