



TASMAN COUNCIL



*Southern Tasmanian*  
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## Climate Change Information for Decision Making

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## THE PURPOSE OF THIS DOCUMENT

This document summarises key climate indices useful to operational council staff. The climate indices were selected in direct consultation with council personnel and reflect the operational, tactical and strategic climate information needs for decision makers within all of the local councils of southern Tasmania.

This document expands upon previously produced *local profiles* and has been developed to support decision making across Tasman's strategic, operational, service, adaptation and emergency management planning functions.

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## BACKGROUND

The Climate Change Information for Decision Making - Tasman has been developed using outputs from the *Climate Futures for Tasmania Project* and the *Climate Futures Australasian Projections 2019 data archive*, developed by the University of Tasmania's Climate Futures Programme.

All values are based on the projections generated by the Climate Futures Programme, using previously published results. Descriptive documentation and supporting reports can be found here: <http://climatefutures.org.au>. This document is to be reviewed and updated when more up-to-date information becomes available, or at 5-yearly intervals. It should be considered in conjunction with Tasman's policies and strategies, alongside technical and industry standards.

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Values given are the multi-model mean from an ensemble of six downscaled global climate models based on the *business as usual* high emissions scenario RCP8.5 (the scenario human society is currently most closely following). Averaging across the ensemble smooths out the inter-annual variability, revealing the forced climate response. For most variables, the range between climate models is

not large relative to the percent change projected into the future.

In order to capture the regional variability, the data were separated into *cool* (< 25<sup>th</sup> percentile), *average* (between the 25<sup>th</sup> and 75<sup>th</sup> percentile) or *warm* (> 75<sup>th</sup> percentile) grid cells, based on average temperature during the baseline period, 1961–1990. These three groups of values were then analysed and presented separately. This provides councils with greater utility when managing a diverse landscape (NB: municipalities with small spatial extents have limited differences captured across the municipality at 10km<sup>2</sup> resolution). It is the responsibility of the user to determine which values may be most appropriate for a given application. For example, if building a road over Vines Saddle, it would be more useful to apply values from the cooler table, whereas for estimating future high-intensity rainfall within Kingston CBD, values from the warmer table would be more appropriate.

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## CURRENT CLIMATE AND RECENT TRENDS

All Tasmanian municipalities have a temperate, maritime climate with relatively mild winters at low elevations, transitioning towards warm alpine winters at higher elevations. Long-term average temperatures have risen in the decades since the 1950s at a rate of up to 0.1 °C per decade, with this rate expected to increase from 2020 onwards.

Despite covering small geographic areas all municipalities experience marked rainfall gradients, with average annual rainfall from about 600 mm per year at lower elevations and about 1500 mm per year at higher elevations. There has been a decline in average annual rainfall since the mid 1970s, and this decline has been strongest in autumn and enhanced over higher elevation regions.

## EXTREME EVENTS

The changes in climate that are most likely to impact upon the each municipality's infrastructure, roads, the local community and the environment are an increase in intensity of extreme events. Potential impacts by 2100 are as follows (following the *business as usual* high emissions scenario RCP8.5):

- Increased evaporation and longer dry periods coupled with more extreme temperatures are likely to enhance the occurrence and intensity of bushfires.
  - The frequency of extremely hot days (> 40°C) is projected to increase. Heat wave frequency is projected to remain stable, but will increase in intensity (warmer days and nights).
  - The Annual Exceedance Probability (AEP) is a measure of the rarity of an event. Rainfall AEPs are expressed as the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year. Heavier rainfall events are expected within a warmer climate. High daily runoff events are likely to increase, including those that may lead to erosion or flooding.
  - Inundation along all coastal frontage will increase due to sea level rise. This means the coastal inundation AEP values for all probability events will increase in intensity. The current 100-year coastal inundation event may become a 50-year event by 2030, and a 5-year event by 2090.
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Table 1: **Tasman local government area: Cool subregions**

Projected changes in selected climate variables for each 20-year time period from 2001 to 2100 relative to the baseline period 1961–1990. All values are reported following the RCP8.5 emissions scenario. Changes reported relative to the 1961-1990 baseline period.

Climate Variable	1961–1990	2001–2020			2021–2040			2041–2060			2061–2080			2081–2100		
	value	value	change	% change	value	change	% change	value	change	% change	value	change	% change	value	change	% change
Average annual daily mean (°C)	11.3	12	0.7	6.4	12.7	1.4	12	13.7	2.4	21.3	14.8	3.5	30.8	15.8	4.5	39.6
Average daily maximum temperature (°C)	14.8	15.5	0.8	5.3	16.2	1.5	10	17.4	2.6	17.8	18.6	3.8	25.8	19.7	4.9	33.3
Average daily minimum temperature (°C)	7.9	8.6	0.7	8.4	9.1	1.2	15.7	10.1	2.2	27.9	11.1	3.2	40.1	11.9	4	51.2
Hottest daily temperature of the year (°C)	32	33.1	1.1	3.5	33.8	1.9	5.8	34.9	2.9	9	36.3	4.3	13.6	37.1	5.1	15.9
Temperature of warmest days [99 <sup>th</sup> percentile] (°C)	26.7	27.8	1.2	4.3	28.6	1.9	7.2	30.2	3.5	13	31.9	5.2	19.4	32.9	6.2	23.4
Temperature of warmest nights [99 <sup>th</sup> percentile] (°C)	15.3	16.1	0.8	5.1	16.7	1.5	9.5	18.1	2.9	18.7	19.9	4.6	30.3	21.1	5.9	38.3
Temperature of coldest nights [1 <sup>st</sup> percentile] (°C)	1	1.6	0.6	57.7	2.1	1.1	110	2.8	1.8	184.8	3.8	2.8	279.7	4.7	3.7	373.3
Average annual frost risk days (<2°C)	10	6	-4	-38	4	-6	-61.4	2	-8	-80	1	-9	-91.1	0	-10	-96.8
Average annual freeze risk days (<0°C)	1	1	-1	-50.5	0	-1	-73.8	0	-1	-85	0	-1	-94.5	0	-1	-97.4
Average annual summer days (>25°C)	5	7	2	30.8	9	3	63.3	13	8	139.6	20	14	267	27	21	396.1
Average annual hot days (>30°C)	1	2	1	55.5	3	1	129	4	3	286.9	8	7	584.7	12	11	975
Average annual extreme heat days (>40°C)	<1	<1	<1	NA	<1	<1	NA	<1	<1	NA	<1	<1	NA	<1	<1	NA
Mean Minimum Asphalt Critical Viscosity	174800	227700	52900	30.3	287500	112700	64.5	415300	240500	137.6	609700	434900	248.8	855000	680200	389.1
Average annual evaporation (mm)	922	985	64	6.9	1012	90	9.8	1157	235	25.5	1269	347	37.6	1436	514	55.8
Average annual rainfall (mm)	960	943	-17	-1.8	924	-37	-3.8	924	-36	-3.7	888	-72	-7.5	947	-13	-1.4
Seasonal rainfall - Winter (mm)	286	282	-4	-1.5	268	-18	-6.4	284	-2	-0.8	286	0	-0.1	307	21	7.4
Seasonal rainfall - Spring (mm)	232	228	-4	-1.9	215	-17	-7.3	208	-24	-10.2	212	-20	-8.4	198	-34	-14.9
Seasonal rainfall - Summer (mm)	211	199	-12	-5.6	216	5	2.2	207	-4	-1.8	183	-28	-13.5	210	-1	-0.7
Seasonal rainfall - Autumn (mm)	246	256	10	3.9	247	1	0.2	247	0	0.2	228	-18	-7.3	245	-1	-0.4
Annual maximum daily rainfall (mm)	74	77	3	3.6	88	13	18.1	85	11	14.6	80	6	8.5	92	18	24.7
Rainfall Extreme - 24hr 10% AEP (mm) <sup>a</sup>	158	164	6	3.7	170	11	7	178	20	12.5	187	29	18.1	195	37	23.2
Rainfall Extreme - 24hr 5% AEP (mm) <sup>a</sup>	183	189	7	3.7	195	13	7	205	23	12.5	216	33	18.1	225	42	23.2
Rainfall Extreme - 24hr 1% AEP (mm) <sup>a</sup>	233	242	9	3.7	250	16	7	262	29	12.5	275	42	18.1	287	54	23.2
Rainfall Extreme - 24hr 0.5% AEP (mm) <sup>a</sup>	257	266	10	3.7	275	18	7	289	32	12.5	303	46	18.1	316	60	23.2
Rainfall Extreme - 48hr 10% AEP (mm) <sup>a</sup>	208	216	8	3.7	223	15	7	235	26	12.5	246	38	18.1	257	48	23.2
Rainfall Extreme - 48hr 5% AEP (mm) <sup>a</sup>	236	245	9	3.7	252	17	7	265	30	12.5	278	43	18.1	291	55	23.2
Rainfall Extreme - 48hr 1% AEP (mm) <sup>a</sup>	301	312	11	3.7	322	21	7	338	38	12.5	355	54	18.1	371	70	23.2
Rainfall Extreme - 48hr 0.5% AEP (mm) <sup>a</sup>	330	343	12	3.7	354	23	7	372	41	12.5	390	60	18.1	407	77	23.2
Average annual cumulative Forest Fire Danger Index	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sea level - 1% AEP with Freeboard (m) <sup>b</sup>	2.16	2.24	0.08	3.7	2.32	0.16	7.4	2.4	0.24	11.1	2.64	0.48	22.2	3	0.84	38.9

<sup>a</sup>Based on recommendations from Australian Rainfall and Runoff, Book 1 Scope And Philosophy, Chapter 6 Climate Change Considerations, version last updated 14<sup>th</sup> May 2019.

<sup>b</sup>Based on recommendations from Tasmanian Government Department of Premier and Cabinet, Coast Hazards Report, December 2015.

For exact details reference (from theList): Sea Level Rise Planning Allowances; or Coastal Risk Hazard Bands.

Table 2: **Tasman local government area: Average subregions**

Projected changes in selected climate variables for each 20-year time period from 2001 to 2100 relative to the baseline period 1961–1990. All values are reported following the RCP8.5 emissions scenario. Changes reported relative to the 1961-1990 baseline period.

Climate Variable	1961–1990	2001–2020			2021–2040			2041–2060			2061–2080			2081–2100		
	value	value	change	% change	value	change	% change	value	change	% change	value	change	% change	value	change	% change
Average annual daily mean (°C)	11.7	12.4	0.7	5.6	13	1.2	10.6	13.9	2.2	18.8	14.9	3.2	27.1	15.8	4.1	34.7
Average daily maximum temperature (°C)	15.5	16.1	0.7	4.5	16.8	1.3	8.6	17.8	2.4	15.2	18.9	3.4	22	19.8	4.4	28.3
Average daily minimum temperature (°C)	8	8.6	0.6	7.8	9.1	1.2	14.6	10	2.1	25.8	10.9	2.9	37	11.7	3.7	47
Hottest daily temperature of the year (°C)	34	35	1	2.9	35.8	1.8	5.3	36.8	2.8	8.3	38.1	4.1	12.2	39.1	5.1	14.9
Temperature of warmest days [99 <sup>th</sup> percentile] (°C)	27.7	28.7	1.1	3.8	29.4	1.7	6.2	30.8	3.2	11.4	32.5	4.8	17.4	33.5	5.8	21
Temperature of warmest nights [99 <sup>th</sup> percentile] (°C)	15.7	16.4	0.7	4.6	17	1.3	8.3	18.1	2.4	15.2	19.4	3.7	23.5	20.3	4.7	29.8
Temperature of coldest nights [1 <sup>st</sup> percentile] (°C)	1	1.5	0.5	49.4	1.9	0.9	92.4	2.6	1.6	159.3	3.5	2.5	246.6	4.3	3.3	328.3
Average annual frost risk days (<2°C)	10	6	-4	-37.9	4	-6	-58.2	2	-8	-78.6	1	-10	-91.6	0	-10	-96.8
Average annual freeze risk days (<0°C)	1	1	-1	-51	0	-1	-73.3	0	-1	-87.5	0	-1	-96.8	0	-1	-98.3
Average annual summer days (>25°C)	7	9	2	23.7	11	4	49.4	15	7	105.6	21	14	193	27	20	286.1
Average annual hot days (>30°C)	2	2	1	43.8	3	2	93.5	5	3	202.2	8	6	386.4	12	10	612.1
Average annual extreme heat days (>40°C)	<1	<1	<1	NA	<1	<1	NA	<1	<1	NA	<1	<1	NA	<1	<1	NA
Mean Minimum Asphalt Critical Viscosity	179500	229600	50100	27.9	285800	106300	59.2	400700	221200	123.2	570600	391100	217.9	778300	598800	333.6
Average annual evaporation (mm)	964	1018	54	5.6	1048	83	8.6	1181	216	22.4	1286	322	33.3	1441	477	49.5
Average annual rainfall (mm)	811	792	-19	-2.4	781	-31	-3.8	780	-31	-3.9	749	-62	-7.7	801	-10	-1.2
Seasonal rainfall - Winter (mm)	238	231	-6	-2.7	222	-16	-6.9	235	-3	-1.2	237	-1	-0.5	253	16	6.5
Seasonal rainfall - Spring (mm)	195	190	-5	-2.3	181	-13	-6.8	175	-20	-10	177	-18	-9.1	164	-31	-15.7
Seasonal rainfall - Summer (mm)	181	172	-10	-5.4	188	7	3.6	181	0	-0.1	160	-21	-11.7	184	3	1.4
Seasonal rainfall - Autumn (mm)	211	218	7	3.3	209	-2	-0.9	207	-3	-1.6	193	-18	-8.5	211	1	0.3
Annual maximum daily rainfall (mm)	74	77	3	3.6	88	13	18.1	85	11	14.6	80	6	8.5	92	18	24.7
Rainfall Extreme - 24hr 10% AEP (mm) <sup>a</sup>	159	164	5	3.4	169	10	6.4	177	18	11.4	185	26	16.4	192	33	21
Rainfall Extreme - 24hr 5% AEP (mm) <sup>a</sup>	183	189	6	3.4	195	12	6.4	204	21	11.4	213	30	16.4	222	39	21
Rainfall Extreme - 24hr 1% AEP (mm) <sup>a</sup>	234	242	8	3.4	249	15	6.4	261	27	11.4	273	38	16.4	283	49	21
Rainfall Extreme - 24hr 0.5% AEP (mm) <sup>a</sup>	258	266	9	3.4	274	17	6.4	287	29	11.4	300	42	16.4	312	54	21
Rainfall Extreme - 48hr 10% AEP (mm) <sup>a</sup>	209	216	7	3.4	223	13	6.4	233	24	11.4	244	34	16.4	253	44	21
Rainfall Extreme - 48hr 5% AEP (mm) <sup>a</sup>	237	245	8	3.4	252	15	6.4	264	27	11.4	276	39	16.4	286	50	21
Rainfall Extreme - 48hr 1% AEP (mm) <sup>a</sup>	302	312	10	3.4	321	19	6.4	336	34	11.4	351	50	16.4	365	63	21
Rainfall Extreme - 48hr 0.5% AEP (mm) <sup>a</sup>	332	343	11	3.4	353	21	6.4	369	38	11.4	386	54	16.4	401	70	21
Average annual cumulative Forest Fire Danger Index	876	908	33	3.7	947	71	8.1	1020	145	16.5	1135	259	29.5	1217	342	39
Sea level - 1% AEP with Freeboard (m) <sup>b</sup>	2.16	2.24	0.08	3.7	2.32	0.16	7.4	2.4	0.24	11.1	2.64	0.48	22.2	3	0.84	38.9

<sup>a</sup>Based on recommendations from Australian Rainfall and Runoff, Book 1 Scope And Philosophy, Chapter 6 Climate Change Considerations, version last updated 14<sup>th</sup> May 2019.

<sup>b</sup>Based on recommendations from Tasmanian Government Department of Premier and Cabinet, Coast Hazards Report, December 2015.

For exact details reference (from theList): Sea Level Rise Planning Allowances; or Coastal Risk Hazard Bands.

Table 3: **Tasman local government area: Warm subregions**

Projected changes in selected climate variables for each 20-year time period from 2001 to 2100 relative to the baseline period 1961–1990. All values are reported following the RCP8.5 emissions scenario. Changes reported relative to the 1961-1990 baseline period.

Climate Variable	1961–1990	2001–2020			2021–2040			2041–2060			2061–2080			2081–2100		
	value	value	change	% change	value	change	% change	value	change	% change	value	change	% change	value	change	% change
Average annual daily mean (°C)	12.2	12.9	0.7	5.6	13.5	1.3	10.6	14.5	2.3	18.8	15.5	3.3	27.1	16.5	4.2	34.6
Average daily maximum temperature (°C)	16.3	17	0.7	4.5	17.7	1.4	8.5	18.8	2.5	15.2	19.9	3.6	21.9	20.9	4.6	28
Average daily minimum temperature (°C)	8.2	8.8	0.6	7.9	9.4	1.2	14.8	10.3	2.1	26.2	11.2	3.1	37.5	12.1	3.9	47.7
Hottest daily temperature of the year (°C)	34.4	35.3	0.9	2.7	36.2	1.8	5.3	37.1	2.7	7.9	38.3	3.9	11.4	39.1	4.8	14
Temperature of warmest days [99 <sup>th</sup> percentile] (°C)	28.8	29.9	1.2	4.1	30.7	1.9	6.7	32.3	3.5	12.2	33.9	5.1	17.7	34.8	6	21
Temperature of warmest nights [99 <sup>th</sup> percentile] (°C)	16.1	16.8	0.7	4.3	17.4	1.3	8	18.4	2.3	14.6	19.7	3.6	22.2	20.6	4.5	27.9
Temperature of coldest nights [1 <sup>st</sup> percentile] (°C)	1.2	1.7	0.5	37.6	2.1	0.9	72.3	2.7	1.5	127.7	3.6	2.4	198.2	4.4	3.2	268.5
Average annual frost risk days (<2°C)	9	6	-3	-37.7	4	-5	-58.4	2	-7	-80	1	-9	-92.4	0	-9	-97.7
Average annual freeze risk days (<0°C)	1	1	0	-43.4	0	-1	-71	0	-1	-90.3	0	-1	-98	0	-1	-99.4
Average annual summer days (>25°C)	10	12	2	25.5	15	5	50.2	20	10	100.9	27	17	175.1	34	25	251.9
Average annual hot days (>30°C)	3	4	1	44.8	5	2	87.1	8	5	202.2	12	9	365	17	14	571.6
Average annual extreme heat days (>40°C)	<1	<1	<1	NA	<1	<1	NA	<1	<1	NA	<1	<1	NA	<1	<1	NA
Mean Minimum Asphalt Critical Viscosity	193500	249600	56100	29	313800	120300	62.2	446600	253100	130.8	643500	450000	232.6	889500	696000	359.7
Average annual evaporation (mm)	1015	1069	54	5.3	1096	82	8	1233	218	21.5	1339	324	31.9	1497	483	47.6
Average annual rainfall (mm)	647	635	-12	-1.9	626	-21	-3.2	621	-26	-4	600	-48	-7.4	639	-9	-1.3
Seasonal rainfall - Winter (mm)	186	180	-6	-3	174	-12	-6.2	183	-2	-1.3	185	-1	-0.7	195	9	4.8
Seasonal rainfall - Spring (mm)	157	154	-3	-1.8	149	-8	-5.2	141	-16	-10.2	143	-14	-8.8	131	-26	-16.6
Seasonal rainfall - Summer (mm)	147	141	-7	-4.5	152	5	3.4	146	-1	-0.8	132	-16	-10.6	153	5	3.7
Seasonal rainfall - Autumn (mm)	168	175	7	4.4	166	-2	-1	165	-2	-1.4	155	-13	-7.9	169	2	0.9
Annual maximum daily rainfall (mm)	74	77	3	3.6	88	13	18.1	85	11	14.6	80	6	8.5	92	18	24.7
Rainfall Extreme - 24hr 10% AEP (mm) <sup>a</sup>	159	164	6	3.6	169	11	6.7	178	19	11.9	186	27	17.2	193	35	21.9
Rainfall Extreme - 24hr 5% AEP (mm) <sup>a</sup>	183	189	6	3.6	195	12	6.7	205	22	11.9	214	31	17.2	223	40	21.9
Rainfall Extreme - 24hr 1% AEP (mm) <sup>a</sup>	234	242	8	3.6	249	16	6.7	262	28	11.9	274	40	17.2	285	51	21.9
Rainfall Extreme - 24hr 0.5% AEP (mm) <sup>a</sup>	257	266	9	3.6	275	17	6.7	288	31	11.9	301	44	17.2	314	56	21.9
Rainfall Extreme - 48hr 10% AEP (mm) <sup>a</sup>	209	216	7	3.6	223	14	6.7	234	25	11.9	245	36	17.2	255	46	21.9
Rainfall Extreme - 48hr 5% AEP (mm) <sup>a</sup>	236	245	8	3.6	252	16	6.7	264	28	11.9	277	41	17.2	288	52	21.9
Rainfall Extreme - 48hr 1% AEP (mm) <sup>a</sup>	301	312	11	3.6	322	20	6.7	337	36	11.9	353	52	17.2	367	66	21.9
Rainfall Extreme - 48hr 0.5% AEP (mm) <sup>a</sup>	331	343	12	3.6	353	22	6.7	371	39	11.9	388	57	17.2	404	73	21.9
Average annual cumulative Forest Fire Danger Index	1485	1538	53	3.6	1608	123	8.3	1740	255	17.2	1923	438	29.5	2057	573	38.6
Sea level - 1% AEP with Freeboard (m) <sup>b</sup>	2.16	2.24	0.08	3.7	2.32	0.16	7.4	2.4	0.24	11.1	2.64	0.48	22.2	3	0.84	38.9

<sup>a</sup>Based on recommendations from Australian Rainfall and Runoff, Book 1 Scope And Philosophy, Chapter 6 Climate Change Considerations, version last updated 14<sup>th</sup> May 2019.

<sup>b</sup>Based on recommendations from Tasmanian Government Department of Premier and Cabinet, Coast Hazards Report, December 2015.

For exact details reference (from theList): Sea Level Rise Planning Allowances; or Coastal Risk Hazard Bands.

## **Climate Change Information for Decision Making - Tasman**

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