

SOUTHERN MIDLANDS COUNCIL



Climate Change Information for Decision Making

T.A. Remenyi, N. Earl, P.T. Love, D.A. Rollins, R.M.B. Harris
*Climate Futures Programme, Discipline of Geography & Spatial Sciences,
University of Tasmania*

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.

BACKGROUND

The Climate Change Information for Decision Making - Southern Midlands 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.

This document expands these local profiles and has been developed to support decision making across Southern Midlands's strategic, operational, service, adaptation and emergency management planning functions.

This document is to be reviewed and updated when more up-to-date becomes available, or at 5-yearly intervals. It should be considered in conjunction with Southern Midlands's policies and strategies, alongside technical and industry standards.

All values are based on the projections generated by the Climate Futures Programme, using previously published results that can be found here: <http://climatefutures.org.au>.

Values given are the multi-model mean of the six downscaled global climate models. Averaging the six models smooths out the variability and shows the forced climate response independent of the model variability. For most variables, the range between climate models is not large relative to the percent change projected. In order to capture the regional variability, the data are separated into cool, average and warm values (where appropriate). For this, individual cells were identified that represented the 20th (cooler), 50th (average) or 80th (warmer) percentile of average surface temperature within a region. This provides councils with great utility when manganga a diverse landscape.

The material in this report is based on computer modelling for climate change scenarios and, as such, there are inherent uncertainties involved. While every effort has been made to ensure the material in this report is accurate, The University of Tasmania provides no warranty, guarantee or representation that the material is accurate, complete, up to date, non-infringing or fit for a particular purpose. The use of the material is entirely at the risk of the user. The user must independently verify the suitability of the material for its own use. To the maximum extent permitted by law, the University of Tasmania, its participating organisations and their officers, employees, contractors and agents, exclude liability for any loss, damage, costs or expenses whether direct, indirect, consequential including loss of profits, opportunity and third-party claims that may be caused through the use of, reliance upon, or interpretation of the material in this report.

CURRENT CLIMATE AND RECENT TRENDS

All Tasmanian Local Government Areas (LGA) 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 LGAs 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.

EXTREME EVENTS

The changes in climate that are most likely to impact upon the LGAs infrastructure, roads, and the local community and environment are a increase in intensity of extreme events. Potential impacts by 2100 are as follows (following a 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: **Southern Midlands local government area: Cool subregions**

Projected changes in selected climate variables for each 20-year time period from 2000 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	2000–2020			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)	9.6	10.1	0.6	6.1	10.8	1.2	13	11.5	2	20.7	12.4	2.8	29.7	13.1	3.5	37.1
Average daily maximum temperature (°C)	14.8	15.5	0.7	4.5	16.3	1.5	9.8	17.1	2.3	15.4	18.1	3.3	22	18.9	4	27.1
Average daily minimum temperature (°C)	4.3	4.8	0.5	11.5	5.3	1	23.9	5.9	1.7	39.1	6.7	2.4	56.4	7.3	3.1	71.8
Hottest daily temperature of the year (°C)	35.6	36.4	0.8	2.3	37.3	1.7	4.9	38.5	2.9	8.2	39	3.4	9.7	39.9	4.3	12.2
Temperature of warmest days [99 th percentile] (°C)	32.4	33.2	0.8	2.6	33.9	1.5	4.6	34.9	2.5	7.7	35.9	3.5	10.7	36.4	3.9	12.2
Temperature of warmest nights [99 th percentile] (°C)	15.7	16.4	0.6	3.9	17.1	1.4	8.8	17.9	2.2	13.7	18.9	3.2	20	19.4	3.6	23.2
Temperature of coldest nights [1 st percentile] (°C)	-2.2	-1.9	0.3	14.9	-1.6	0.6	28.4	-1.2	1	45.5	-0.7	1.5	69	-0.2	2	90.9
Average annual frost risk days (<2°C)	111.9	95.7	-16.2	-14.5	81	-30.8	-27.6	64.2	-47.7	-42.7	46.6	-65.3	-58.3	35	-76.9	-68.7
Average annual freeze risk days (<0°C)	44.3	35.6	-8.8	-19.8	27.5	-16.8	-37.9	19.1	-25.2	-56.9	11.5	-32.9	-74.1	6.6	-37.8	-85.2
Average annual summer days (>25°C)	27.5	30.2	2.7	9.9	34.3	6.8	24.6	40.1	12.5	45.6	45.5	17.9	65.2	50.2	22.7	82.4
Average annual hot days (>30°C)	10.3	12.9	2.6	25.4	16.1	5.8	56.8	21.2	10.9	105.8	25.7	15.4	150.1	31	20.8	202
Average annual extreme heat days (>40°C)	0	0.1	0.1	287.5	0.2	0.1	601.2	0.4	0.4	1782.1	0.7	0.7	3184.5	0.9	0.9	4060.5
Mean Minimum Asphalt Critical Viscosity	43598.8	53141.6	9542.7	21.9	65334.4	21735.5	49.9	83513.6	39914.7	91.5	111901.4	68302.6	156.7	143048.4	99449.6	228.1
Average annual evaporation (mm)	859.7	884.2	24.5	2.9	935.1	75.4	8.8	996	136.4	15.9	1060.1	200.4	23.3	1150.8	291.2	33.9
Average annual rainfall (mm)	568.6	544.4	-24.1	-4.2	519.8	-48.8	-8.6	517.9	-50.6	-8.9	504.9	-63.7	-11.2	525.8	-42.8	-7.5
Seasonal rainfall - Winter (mm)	174.9	162	-12.9	-7.4	151.7	-23.1	-13.2	157	-17.9	-10.2	157.2	-17.7	-10.1	166.3	-8.6	-4.9
Seasonal rainfall - Spring (mm)	138.1	132.1	-6	-4.3	123	-15.1	-10.9	120.3	-17.8	-12.9	121.1	-17	-12.3	106.6	-31.5	-22.8
Seasonal rainfall - Summer (mm)	120.4	119.4	-1	-0.8	130.4	10	8.3	121	0.6	0.5	118.5	-1.9	-1.6	126.7	6.3	5.3
Seasonal rainfall - Autumn (mm)	144.3	143.4	-0.9	-0.6	126.5	-17.8	-12.4	131.6	-12.7	-8.8	119.5	-24.8	-17.2	133.2	-11.1	-7.7
Annual maximum daily rainfall (mm)	80.4	82.7	2.3	2.9	96.8	16.4	20.5	87.8	7.4	9.3	86.9	6.6	8.2	101.6	21.3	26.5
Rainfall Extreme - 24hr 10% AEP (mm) ^a	119.8	123.4	3.6	3	127.4	7.7	6.4	132	12.2	10.2	137.3	17.5	14.6	141.6	21.8	18.2
Rainfall Extreme - 24hr 5% AEP (mm) ^a	137.5	141.6	4.1	3	146.2	8.8	6.4	151.5	14	10.2	157.5	20.1	14.6	162.5	25.1	18.2
Rainfall Extreme - 24hr 1% AEP (mm) ^a	175.7	181	5.3	3	187	11.2	6.4	193.7	17.9	10.2	201.4	25.7	14.6	207.8	32.1	18.2
Rainfall Extreme - 24hr 0.5% AEP (mm) ^a	193.7	199.5	5.8	3	206.1	12.4	6.4	213.5	19.8	10.2	222	28.3	14.6	229	35.3	18.2
Rainfall Extreme - 48hr 10% AEP (mm) ^a	155.8	160.4	4.7	3	165.7	10	6.4	171.6	15.9	10.2	178.5	22.8	14.6	184.2	28.4	18.2
Rainfall Extreme - 48hr 5% AEP (mm) ^a	177.9	183.3	5.3	3	189.3	11.4	6.4	196.1	18.1	10.2	203.9	26	14.6	210.4	32.5	18.2
Rainfall Extreme - 48hr 1% AEP (mm) ^a	228.6	235.4	6.9	3	243.2	14.6	6.4	251.9	23.3	10.2	262	33.4	14.6	270.3	41.7	18.2
Rainfall Extreme - 48hr 0.5% AEP (mm) ^a	252	259.6	7.6	3	268.1	16.1	6.4	277.7	25.7	10.2	288.8	36.8	14.6	298	46	18.2
Average annual cumulative Forest Fire Danger Index	1188.3	1249.3	61	5.1	1395	206.7	17.4	1501	312.7	26.3	1675.3	487	41	1845	656.7	55.3
Sea level - 1% AEP with Freeboard (m) ^b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

^aBased on recommendations from Australian Rainfall and Runoff, Book 1 Scope And Philosophy, Chapter 6 Climate Change Considerations, version last updated 14th May 2019.

^bBased on recommendations from Tasmanian Government Department of Premier and Cabinet Coast Hazards Report, December 2015. For exact details reference Sea Level Rise Planning Allowances or Coastal Risk Hazard Bands (from theList).

Table 2: Southern Midlands local government area: Average subregions

Projected changes in selected climate variables for each 20-year time period from 2000 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	2000–2020			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)	10.6	11.2	0.5	5	11.7	1.1	10.3	12.5	1.8	17.2	13.3	2.7	25.2	14	3.4	31.8
Average daily maximum temperature (°C)	15.8	16.3	0.6	3.6	17	1.2	7.6	17.8	2	12.9	18.7	3	18.8	19.5	3.7	23.6
Average daily minimum temperature (°C)	5.5	6	0.5	8.9	6.5	1	17.9	7.1	1.6	29.8	7.9	2.4	43.3	8.5	3	55.1
Hottest daily temperature of the year (°C)	36.4	37.3	0.9	2.5	38	1.6	4.5	39.1	2.7	7.4	39.6	3.3	9	40.6	4.2	11.6
Temperature of warmest days [99 th percentile] (°C)	32.6	33.2	0.6	1.8	33.7	1.2	3.6	34.8	2.2	6.8	35.9	3.3	10.1	36.1	3.5	10.9
Temperature of warmest nights [99 th percentile] (°C)	15.9	16.7	0.8	4.9	17.3	1.4	8.9	18.1	2.2	13.6	19.1	3.2	20.3	19.6	3.7	23.2
Temperature of coldest nights [1 st percentile] (°C)	-1.8	-1.5	0.3	14.8	-1.2	0.6	32.2	-0.8	1	55.9	-0.2	1.5	86.3	0.3	2.1	119
Average annual frost risk days (<2°C)	74.6	62.8	-11.9	-15.9	52	-22.7	-30.3	39.4	-35.3	-47.2	27	-47.6	-63.8	18.8	-55.9	-74.9
Average annual freeze risk days (<0°C)	25.8	19.8	-6	-23.1	15.6	-10.2	-39.5	9.8	-16	-62.1	5.7	-20.1	-77.8	3.3	-22.5	-87
Average annual summer days (>25°C)	25.9	28.1	2.2	8.4	32	6.2	23.8	37	11.1	43	43.4	17.5	67.7	48.4	22.5	86.9
Average annual hot days (>30°C)	9.4	11.2	1.8	19.6	13.6	4.2	45.2	17.9	8.5	90.7	22.3	12.9	137.6	27.5	18.1	192.8
Average annual extreme heat days (>40°C)	0.1	0.2	0.1	153.6	0.3	0.2	264.1	0.6	0.5	588.9	0.9	0.8	1021.9	1.1	1.1	1314
Mean Minimum Asphalt Critical Viscosity	69344.6	84198	14853.4	21.4	102517.9	33173.3	47.8	131373.8	62029.1	89.5	176076.2	106731.6	153.9	225397.1	156052.4	225
Average annual evaporation (mm)	1001.7	1023.8	22.1	2.2	1071.2	69.5	6.9	1142.4	140.7	14	1220.3	218.5	21.8	1328.7	327	32.6
Average annual rainfall (mm)	597.9	576.9	-21	-3.5	576.9	-21	-3.5	567.8	-30.1	-5	545	-52.9	-8.8	562.3	-35.6	-5.9
Seasonal rainfall - Winter (mm)	160.9	148.6	-12.3	-7.7	144.9	-16	-9.9	150.2	-10.8	-6.7	145.7	-15.2	-9.5	156	-4.9	-3
Seasonal rainfall - Spring (mm)	146.8	139.5	-7.4	-5	133.9	-12.9	-8.8	127.5	-19.4	-13.2	128.7	-18.1	-12.3	107	-39.8	-27.1
Seasonal rainfall - Summer (mm)	149.3	149.4	0.1	0	164.2	14.9	10	157.8	8.5	5.7	148.6	-0.7	-0.5	161.3	12	8.1
Seasonal rainfall - Autumn (mm)	150.4	152.8	2.3	1.6	147.2	-3.2	-2.1	145.4	-5.1	-3.4	134.6	-15.9	-10.6	145.7	-4.8	-3.2
Annual maximum daily rainfall (mm)	80.4	82.7	2.3	2.9	96.8	16.4	20.5	87.8	7.4	9.3	86.9	6.6	8.2	101.6	21.3	26.5
Rainfall Extreme - 24hr 10% AEP (mm) ^a	120.1	123.4	3.3	2.7	126.8	6.7	5.6	131.4	11.3	9.4	136.6	16.5	13.7	140.9	20.8	17.3
Rainfall Extreme - 24hr 5% AEP (mm) ^a	137.8	141.6	3.7	2.7	145.6	7.7	5.6	150.8	13	9.4	156.8	18.9	13.7	161.7	23.9	17.3
Rainfall Extreme - 24hr 1% AEP (mm) ^a	176.2	181	4.8	2.7	186.1	9.9	5.6	192.8	16.6	9.4	200.4	24.2	13.7	206.8	30.6	17.3
Rainfall Extreme - 24hr 0.5% AEP (mm) ^a	194.3	199.5	5.3	2.7	205.1	10.9	5.6	212.5	18.3	9.4	220.9	26.7	13.7	227.9	33.7	17.3
Rainfall Extreme - 48hr 10% AEP (mm) ^a	156.2	160.4	4.2	2.7	164.9	8.8	5.6	170.9	14.7	9.4	177.6	21.5	13.7	183.3	27.1	17.3
Rainfall Extreme - 48hr 5% AEP (mm) ^a	178.4	183.3	4.8	2.7	188.4	10	5.6	195.2	16.8	9.4	203	24.5	13.7	209.4	30.9	17.3
Rainfall Extreme - 48hr 1% AEP (mm) ^a	229.2	235.4	6.2	2.7	242.1	12.8	5.6	250.8	21.6	9.4	260.7	31.5	13.7	269	39.7	17.3
Rainfall Extreme - 48hr 0.5% AEP (mm) ^a	252.7	259.6	6.9	2.7	266.9	14.2	5.6	276.5	23.8	9.4	287.4	34.7	13.7	296.5	43.8	17.3
Average annual cumulative Forest Fire Danger Index	1774.2	1814.9	40.7	2.3	1935.3	161.1	9.1	2094.3	320	18	2326	551.8	31.1	2546.9	772.6	43.5
Sea level - 1% AEP with Freeboard (m) ^b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

^aBased on recommendations from Australian Rainfall and Runoff, Book 1 Scope And Philosophy, Chapter 6 Climate Change Considerations, version last updated 14th May 2019.

^bBased on recommendations from Tasmanian Government Department of Premier and Cabinet Coast Hazards Report, December 2015. For exact details reference Sea Level Rise Planning Allowances or Coastal Risk Hazard Bands (from theList).

Table 3: Southern Midlands local government area: Warm subregions

Projected changes in selected climate variables for each 20-year time period from 2000 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	2000–2020			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)	11.8	12.3	0.5	4.5	12.9	1.1	9.3	13.6	1.8	15.6	14.5	2.7	23	15.2	3.4	28.9
Average daily maximum temperature (°C)	17.3	17.9	0.6	3.2	18.5	1.2	6.9	19.3	2	11.6	20.3	3	17.3	21	3.7	21.5
Average daily minimum temperature (°C)	6.3	6.8	0.5	8	7.3	1	16	7.9	1.7	26.6	8.7	2.4	38.7	9.3	3.1	49.2
Hottest daily temperature of the year (°C)	38.8	39.7	0.9	2.2	40.4	1.6	4.1	41.5	2.7	6.9	42	3.2	8.1	42.7	3.8	9.9
Temperature of warmest days [99 th percentile] (°C)	34.8	35.5	0.6	1.8	36	1.2	3.4	37	2.2	6.2	38	3.1	9	38.2	3.4	9.7
Temperature of warmest nights [99 th percentile] (°C)	16.8	17.5	0.8	4.5	18.1	1.3	7.9	18.9	2.1	12.6	20	3.2	19	20.4	3.6	21.7
Temperature of coldest nights [1 st percentile] (°C)	-1.1	-0.8	0.3	29.6	-0.4	0.7	61.9	0.1	1.2	109.8	0.7	1.8	167.4	1.4	2.5	229.1
Average annual frost risk days (<2°C)	51	40.9	-10.1	-19.8	32.4	-18.6	-36.5	22.4	-28.7	-56.1	13.9	-37.2	-72.8	8.4	-42.6	-83.5
Average annual freeze risk days (<0°C)	13.5	9.5	-4	-29.5	6.8	-6.7	-49.4	4	-9.6	-70.7	2.1	-11.4	-84.6	1.2	-12.3	-91.1
Average annual summer days (>25°C)	33.3	35.5	2.2	6.6	39.3	6	18.1	44	10.6	32	50.8	17.5	52.6	56.4	23.1	69.4
Average annual hot days (>30°C)	16.2	18.6	2.5	15.2	21.3	5.1	31.7	26.6	10.4	64.4	32.4	16.2	100.1	38.5	22.3	138
Average annual extreme heat days (>40°C)	0.5	0.7	0.1	27.1	1	0.5	88.1	1.6	1	189.4	2.1	1.5	282.1	2.6	2	365.5
Mean Minimum Asphalt Critical Viscosity	92935.8	113276.5	20340.7	21.9	138308.9	45373	48.8	177845	84909.2	91.4	239910.2	146974.4	158.1	308350	215414.1	231.8
Average annual evaporation (mm)	944.9	961.2	16.3	1.7	1004	59.1	6.3	1067.3	122.4	12.9	1139	194.1	20.5	1236.6	291.7	30.9
Average annual rainfall (mm)	553.5	536	-17.4	-3.2	532.6	-20.8	-3.8	523.6	-29.9	-5.4	489.2	-64.3	-11.6	507.2	-46.3	-8.4
Seasonal rainfall - Winter (mm)	139.4	126	-13.4	-9.6	120	-19.5	-14	124.4	-15	-10.8	122.5	-16.9	-12.1	127.7	-11.7	-8.4
Seasonal rainfall - Spring (mm)	135	128.2	-6.8	-5	125.7	-9.3	-6.9	118.6	-16.3	-12.1	112.4	-22.6	-16.7	94.9	-40	-29.7
Seasonal rainfall - Summer (mm)	144.6	145.9	1.4	0.9	161.9	17.4	12	153.3	8.8	6.1	142.7	-1.8	-1.3	156.2	11.6	8
Seasonal rainfall - Autumn (mm)	143.5	148.5	5	3.5	137.6	-5.9	-4.1	139.5	-4	-2.8	122.7	-20.8	-14.5	135.4	-8.1	-5.6
Annual maximum daily rainfall (mm)	80.4	82.7	2.3	2.9	96.8	16.4	20.5	87.8	7.4	9.3	86.9	6.6	8.2	101.6	21.3	26.5
Rainfall Extreme - 24hr 10% AEP (mm) ^a	120.1	123.4	3.2	2.7	126.9	6.8	5.6	131.5	11.3	9.4	136.8	16.7	13.9	141.1	21	17.5
Rainfall Extreme - 24hr 5% AEP (mm) ^a	137.8	141.6	3.7	2.7	145.6	7.8	5.6	150.9	13	9.4	157	19.2	13.9	161.9	24.1	17.5
Rainfall Extreme - 24hr 1% AEP (mm) ^a	176.3	181	4.8	2.7	186.2	9.9	5.6	192.9	16.6	9.4	200.8	24.5	13.9	207.1	30.8	17.5
Rainfall Extreme - 24hr 0.5% AEP (mm) ^a	194.3	199.5	5.2	2.7	205.2	10.9	5.6	212.6	18.3	9.4	221.3	27	13.9	228.2	33.9	17.5
Rainfall Extreme - 48hr 10% AEP (mm) ^a	156.2	160.4	4.2	2.7	165	8.8	5.6	170.9	14.7	9.4	177.9	21.7	13.9	183.5	27.3	17.5
Rainfall Extreme - 48hr 5% AEP (mm) ^a	178.5	183.3	4.8	2.7	188.5	10	5.6	195.3	16.8	9.4	203.3	24.8	13.9	209.6	31.2	17.5
Rainfall Extreme - 48hr 1% AEP (mm) ^a	229.2	235.4	6.2	2.7	242.1	12.9	5.6	250.9	21.6	9.4	261.1	31.9	13.9	269.3	40.1	17.5
Rainfall Extreme - 48hr 0.5% AEP (mm) ^a	252.7	259.6	6.8	2.7	266.9	14.2	5.6	276.6	23.9	9.4	287.9	35.1	13.9	296.9	44.2	17.5
Average annual cumulative Forest Fire Danger Index	1548.5	1572.5	24	1.5	1679.2	130.7	8.4	1797.8	249.3	16.1	2023.3	474.7	30.7	2187.6	639.1	41.3
Sea level - 1% AEP with Freeboard (m) ^b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

^aBased on recommendations from Australian Rainfall and Runoff, Book 1 Scope And Philosophy, Chapter 6 Climate Change Considerations, version last updated 14th May 2019.

^bBased on recommendations from Tasmanian Government Department of Premier and Cabinet Coast Hazards Report, December 2015. For exact details reference Sea Level Rise Planning Allowances or Coastal Risk Hazard Bands (from theList).

Climate Change Information for Decision Making - Southern Midlands

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Discipline of Geography & Spatial Sciences; School of Technology, Environment & Design; University of Tasmania
Private Bag 78
Hobart Tasmania 7001
Tel: +61 3 6226 1511
Email: ted-admin@utas.edu.au

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