15. Carpentaria Coast

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15.1 Introduction

This chapter examines water resources in the Carpentaria Coast region in 2009–10 and over recent decades. Seasonal variability and trends in modelled water flows, stores and levels are considered at the regional level.

Details for selected rivers, wetlands, groundwater, urban areas and agriculture are not addressed. At the time of writing, suitable quality controlled and assured surface water quality data from the Australian Water Resources Information System (Bureau of Meteorology 2011a) were not available.

The chapter begins with an overview of key data and information on water flows in the region in recent times followed by a description of the region.

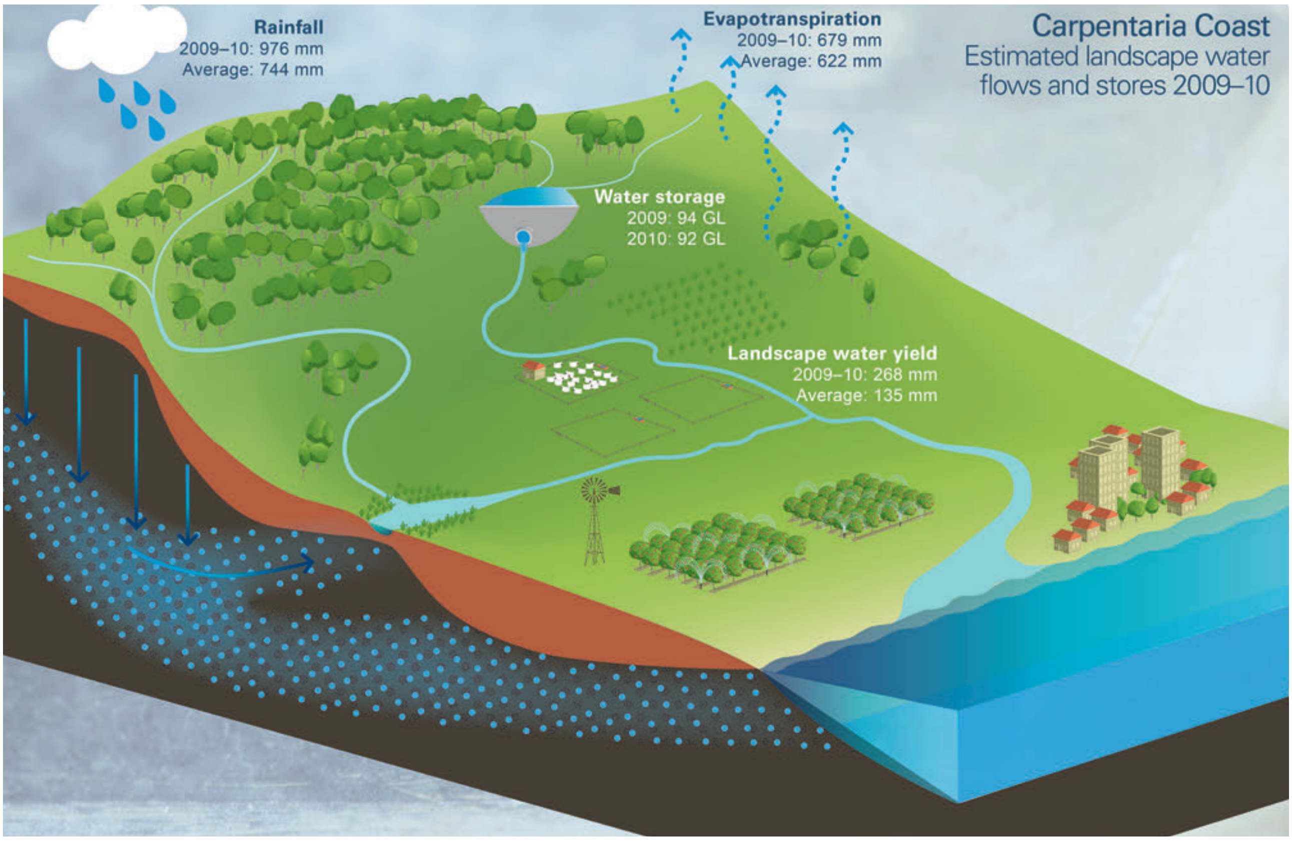


Figure 15-1. Overview of annual landscape water flow totals (mm) in 2009–10 compared to the long-term average (July 1911 to June 2010) and accessible surface water storage volumes (GL) for the 1st July 2009 and 30th June 2010 for the Carpentaria Coast region

15.2 Key data and information

Figure 15-1 presents the 2009–10 annual landscape water flows and the change in accessible surface water storage in the Carpentaria Coast region. The region experienced above average rainfall and evapotranspiration for 2009–10 and the high rainfall resulted in very much higher than average modelled landscape water yield[1] (see Table 15-1). The reported surface water storage in this region is Lake Julius (only 26 per cent of the total storage capacity in the region). Other main storages in the region that are not reported include Lake Mitchell and Lake Moondarra. The decrease in accessible volume, over the year given that this was a wetter than average year, was due to some deliberate releases from storage during May 2010.

Table 15-1 gives an overview of the key findings extracted from the detailed assessments performed in this chapter.

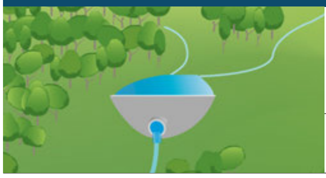
1. See Section 1.4.3 of Chapter 1–Introduction for the definition of this term.

Table 15-1. Key information on water flows and stores in the Carpentaria Coast region[2]

Landscape water balance

	During 2009–10			During the past 30 years	
	Region average	**Difference from long-term mean**	**Rank (out of 99)***	**Highest value (year)**	**Lowest value (year)**
Rainfall	976 mm	+31%	89	1,181 mm (2000–01)	496 mm (1987–88)
Evapotranspiration	679 mm	+9%	82	805 mm (2000–01)	549 mm (1987–88)
Landscape water yield	268 mm	+99%	94	358 mm (2008–09)	47 mm (1987–88)

Surface water storage (comprising approximately 26% of the region's total surface water storage)



	July 2009		June 2010		
Total accessible capacity	**Accessible volume**	**% of accessible capacity**	**Accessible volume**	**% of accessible capacity**	**% Change**
99 GL	94 GL	94.9%	92 GL	92.9%	-2.0%

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

2. See Section 1.4.3 of Chapter 1–Introduction for the definition of these terms.

15.3 Description of region

The Carpentaria Coast region covers approximately 647,000 km^2. The landscape is generally flat and low-lying. To the west is Arnhem Land and Groote Eylandt, the largest island in the Gulf. To the east is the Cape York Peninsula.

The climate is hot and humid with two distinct seasons per year. The dry season runs from about May to October and the monsoonal wet season from November to April. Almost all rainfall is compressed into two or three months.

Much of the region drains into the Gulf and comprises floodplains. The rivers, though mostly rather short, are very large by Australian standards and carry approximately a quarter of the continent's total yearly streamflow. Most rivers, however, flow only during the short wet season. Therefore, all perennial rivers and perennial springs are important sources of water. The main rivers flowing north to the Gulf of Carpentaria are the Mitchell, Flinders, Gilbert and Leichhardt rivers. The region includes no Ramsar wetland sites.

The region is sparsely populated, with about 56,000 people overall; approximately 23,000 of those are in the mining town of Mount Isa. The indigenous population is a significant component (more than 25 per cent) of the population.

The main urban centres (with more than 1,000 people) are Mount Isa, Cloncurry, Normanton, Doomadgee and Kowanyama. Mount Isa is the largest centre in this region. The Julius Dam and Moondarra Dam Water Supply Schemes, extracting water from Lake Julius and Lake Moondarra, are the major water supply sources for the Mount Isa area. Other centres source water supply predominantly from groundwater.

Pasture is the dominant land use (Figure 15-2). There are significant areas of nature conservation, Indigenous land use and some forestry. Irrigated agriculture only exists on a very local scale, supported by water from the two storages.

The hydrogeology of the region is dominated by the sediments of the Great Artesian Basin, fractured and karstic rock in some areas and some outcropping basement rock.

The Great Artesian Basin is one of Australia's largest and most significant groundwater basins with porous sandstone aquifers from the Triassic, Jurassic and Cretaceous periods. There is significant extraction of groundwater from this large resource for stock and domestic purposes. Fractured and karstic rock occurs in the Daly–Roper groundwater management unit (in the region's west) and Mount Isa groundwater management unit (in the south). In the hard rock of the basement, significant groundwater flow only occurs in rock fractures and this type of groundwater system typically offers restricted low volume groundwater resources.

The major watertable aquifers present in the region are given in Figure 15-3 (extracted from the Bureau of Meteorology's Interim Groundwater Geodatabase). Groundwater systems that provide more potential for extraction are labelled as:

- fractured and karstic rock
- Mesozoic (porous media – consolidated)
- Mesozoic sediment aquifer (porous media – consolidated)
- Surficial sediment aquifer (porous media – unconsolidated).

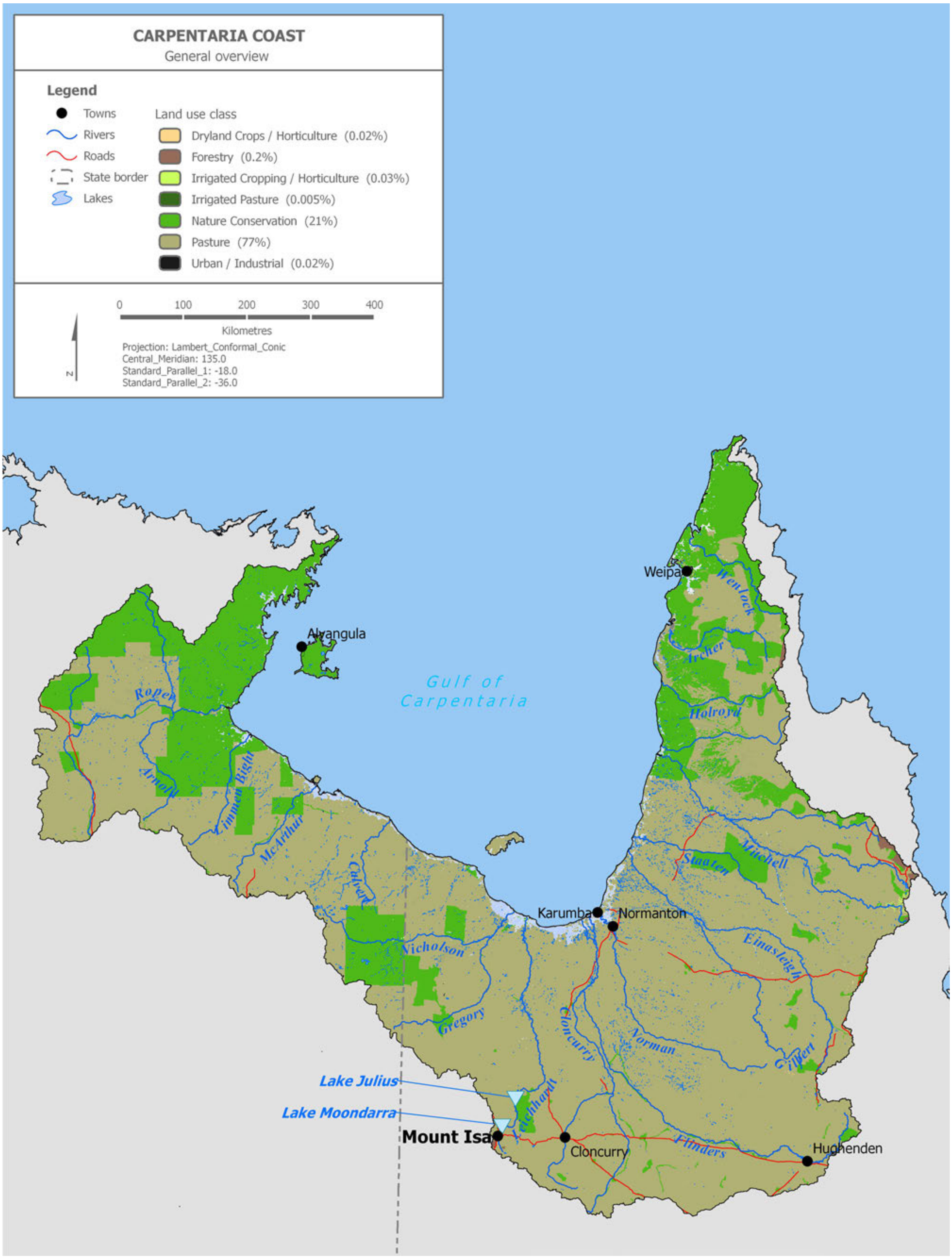


Figure 15-2. Key landscape and hydrological features of the Carpentaria Coast region (land use classes based on Bureau of Rural Sciences 2006)

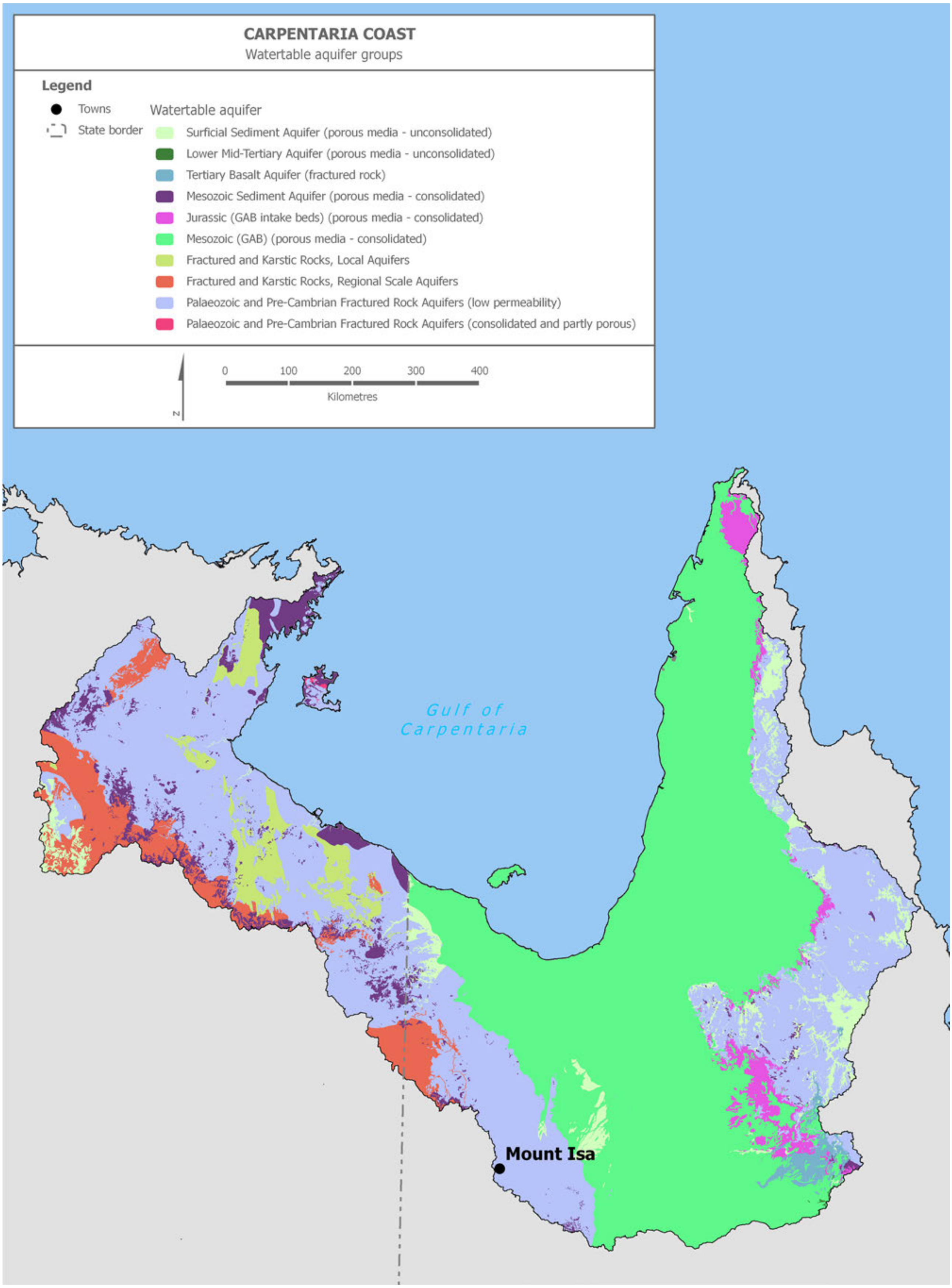


Figure 15-3. Watertable aquifer groups in the Carpentaria Coast region (Bureau of Meteorology 2011e)

15.4 Recent patterns in landscape water flows

The landscape water flows analyses presented in this section were derived from water balance models and are estimates of the real world situation. Some areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data for these areas. The models used and the associated output uncertainties are discussed in Chapters 1 and 2, with more details presented in the Technical supplement.

Figure 15-4 shows that historically the Carpentaria Coast region experiences extremely seasonal rainfall with a dominant wet summer period and a dry winter. The seasonal distribution of rainfall was particularly marked for 2009–10. Monthly rainfall was extremely low from July to November 2009 and was followed by very high rainfall during the wet season between December 2009 and April 2010. Total rainfall for January and April 2010, in particular, was very much higher than normal and the region experienced its second wettest April of the long-term record (July 1911 to June 2010).

Evapotranspiration in northern Australia exhibits a seasonal pattern closely linked to rainfall and water availability. Regional evapotranspiration was higher than normal during the high rainfall months of January to April 2010. Monthly totals remained relatively high through to the end of the year as a result of the high soil moisture availability generated by high April 2010 rainfall that extended the wet season.

Modelled landscape water yield for the region shows clear responses to the high summer rainfall, particularly during January and April 2010. Landscape water yield for April was estimated to be the second highest April total in the long-term record (July 1911 to June 2010).

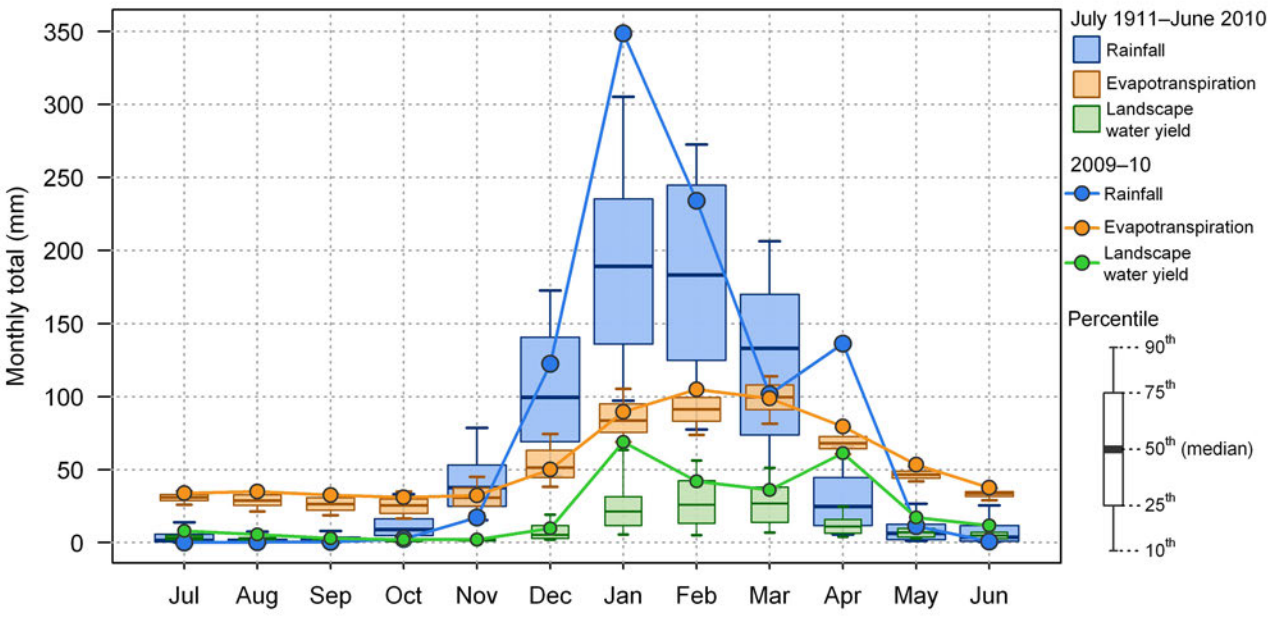


Figure 15-4. Monthly landscape water flows for the Carpentaria Coast region in 2009–10 compared with the long-term record (July 1911 to June 2010)

15.4.1 Rainfall

Rainfall for the Carpentaria Coast region for 2009–10 was estimated to be 976 mm, which is 31 per cent above the region's long-term (July 1911 to June 2010) average of 744 mm. Figure 15-5 (a)[3] shows that during 2009–10, the highest rainfall occurred along coastal areas in the north and northeast. Lowest rainfall totals were observed across the southern inland areas. Rainfall deciles for 2009–10, shown in Figure 15-5 (b), indicate rainfall was above average or very much above average across much of the region, particularly in the centre and west. Limited areas of below average rainfall are indicated along the western coast of the Cape York Peninsula.

Figure 15-6 (a) shows annual rainfall for the region over the past 30 years (July 1980 to June 2010). Over the 30-year period, rainfall ranged from 496 mm (1987–88) to 1,181 mm (2000–01). The annual average for the period was 801 mm. The data show that the region was noticeably wetter during the second half of the 30-year period. Total annual rainfall for the region was consistently at an average or above average level over the past four years.

An indication of patterns, trends and variability in the seasonal rainfall over the 30-year period summer (November–April) and winter (May–October) are presented using moving averages in Figure 15-6 (b). The data clearly show summer rainfall averages are very much higher than winter, reflecting the highly seasonal distribution of rainfall for the region. Summer period rainfall averages increased noticeably over the 30-year period, particularly from the lowest level reached at the end of the 1980s.

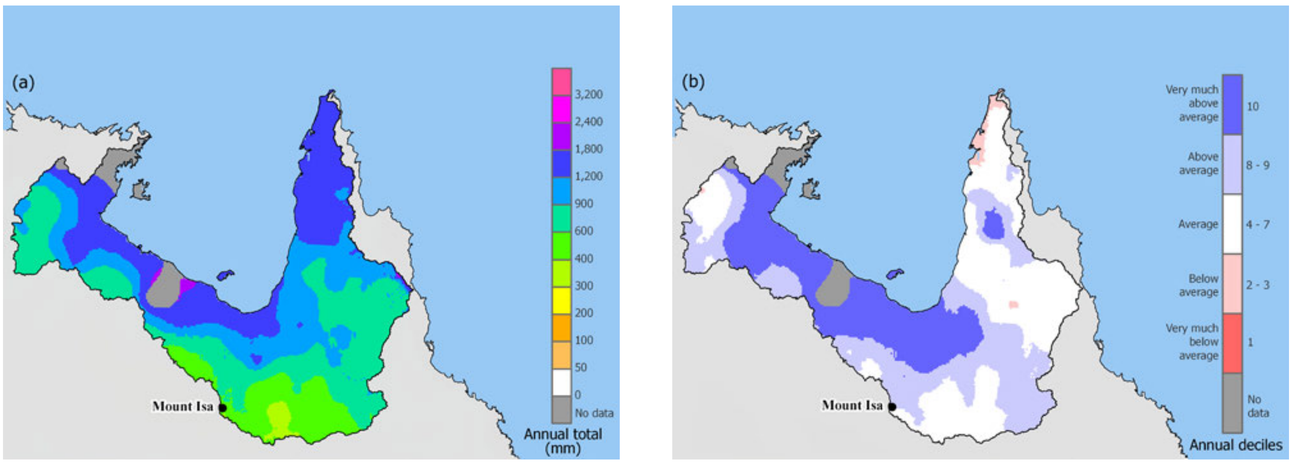
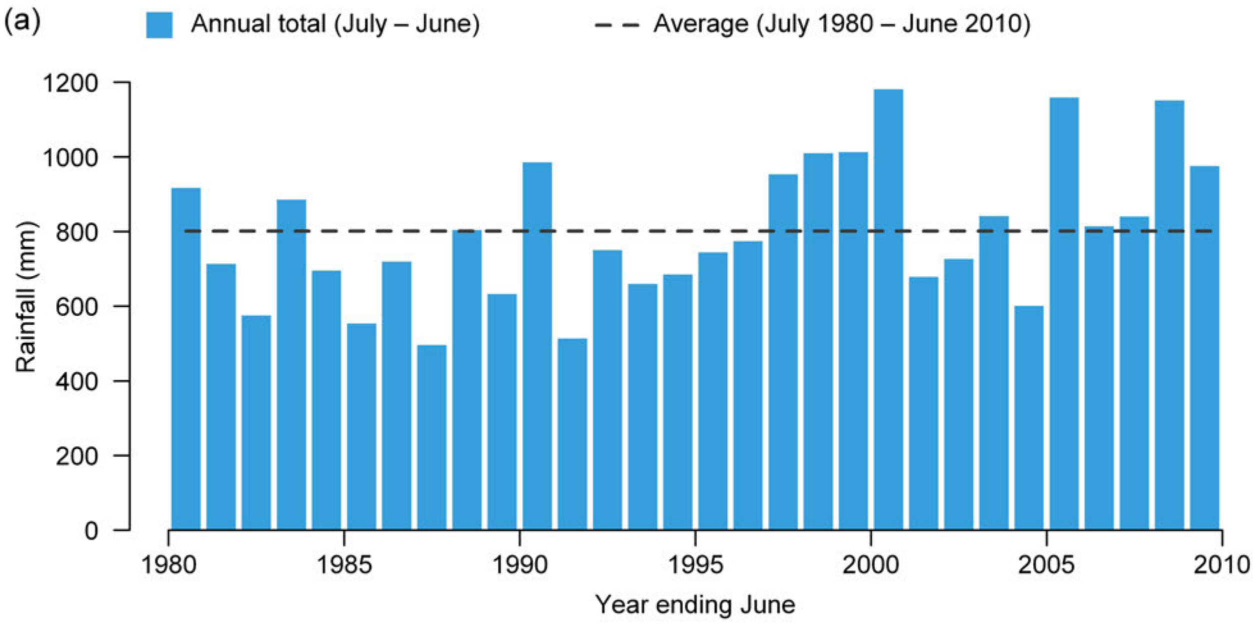


Figure 15-5. Maps of annual rainfall totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Carpentaria Coast region

3. Areas where rainfall interpolation was assessed to be greater than 20 per cent unreliable for any period of the long-term record were excluded from the landscape water balance modelling (classified as 'No data'). More details are presented in the Technical supplement.



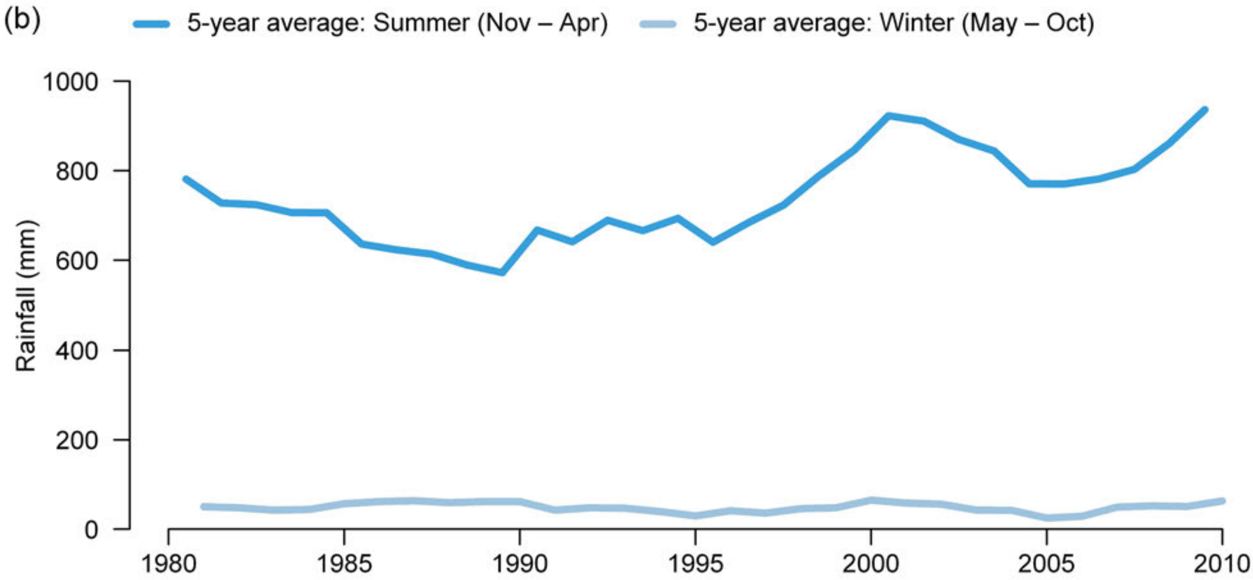


Figure 15-6. Time-series of annual rainfall (a) and five-year (backward looking) moving average of November–April (summer) and May–October (winter) totals (b) for the Carpentaria Coast region

15.4.1 Rainfall (continued)

Figure 15-7 provides a spatial representation of summer (November–April) and winter (May–October) rainfall trends throughout the region between November 1980 and October 2010. The linear regression slope calculated for each 5 x 5 km grid cell depicts the change in seasonal rainfall over the 30 years.

The analysis shows that over the past 30 years there were large increases in summer rainfall across almost the entire region. A small area of decreasing rainfall is indicated in the northeast of the region, potentially an artefact of erroneous rainfall data at a single station. The analysis of the lower magnitude winter rainfall shows very slight reductions in rainfall across the far south of the region and slight increases in the northeast and west.

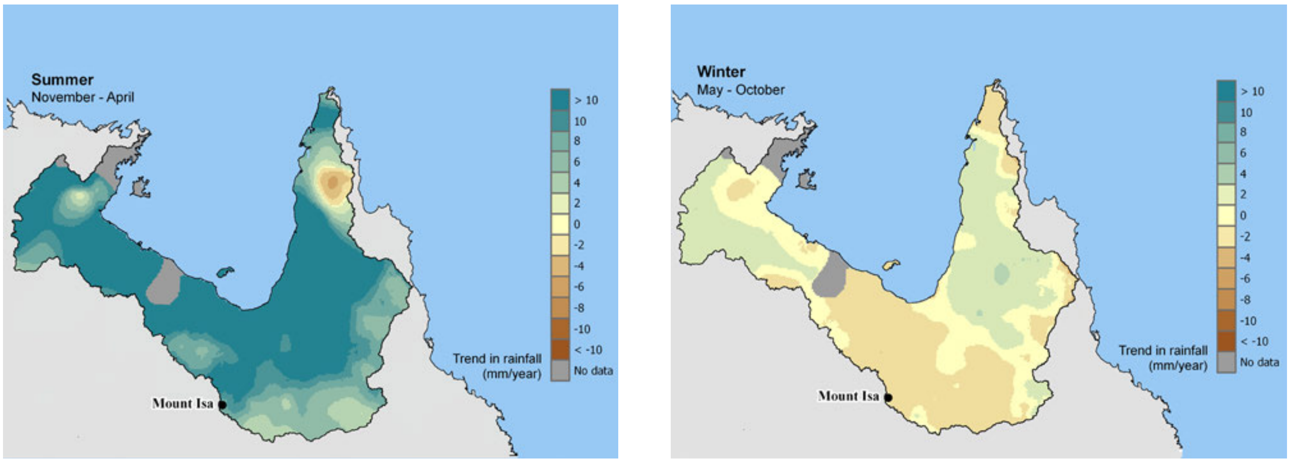


Figure 15-7. Linear trends in summer (November–April) and winter (May–October) rainfall over 30 years (November 1980 to October 2010) for the Carpentaria Coast region. The statistical significance of these trends is often very low

15.4.2 Evapotranspiration

Evapotranspiration for the Carpentaria Coast region for 2009–10 was estimated to be 679 mm, which is nine per cent above the region's long-term (July 1911 to June 2010) average of 622 mm. Figure 15-8 (a) shows that evapotranspiration for 2009–10 was estimated to be highest in the far northeast of the region. Lowest annual evapotranspiration occurred in the drier inland areas to the south. Evapotranspiration deciles for 2009–10, shown in Figure 15-8 (b), indicate evapotranspiration was above average across much of the centre and west of the region. Limited areas of below average values are identified across the east and northeast of the region.

Figure 15-9 (a) shows annual evapotranspiration for the past 30 years (July 1980 to June 2010). Over the 30-year period, evapotranspiration ranged from 549 mm (1987–88) to 805 mm (2000–01). The annual average for the period was 643 mm. The data show regional evapotranspiration is closely linked to water availability and clearly reflects the changes between periods of relatively low and high rainfall.

An indication of patterns, trends and variability in the seasonal evapotranspiration over the 30-year period summer (November–April) and winter (May–October) are presented using moving averages in Figure 15-9 (b). These data show that summer evapotranspiration is higher than during the winter. The seasonal averages for both summer and winter seasons show slight reductions through the drier first half of the 30 years and increase over the relatively wet second half of the period.

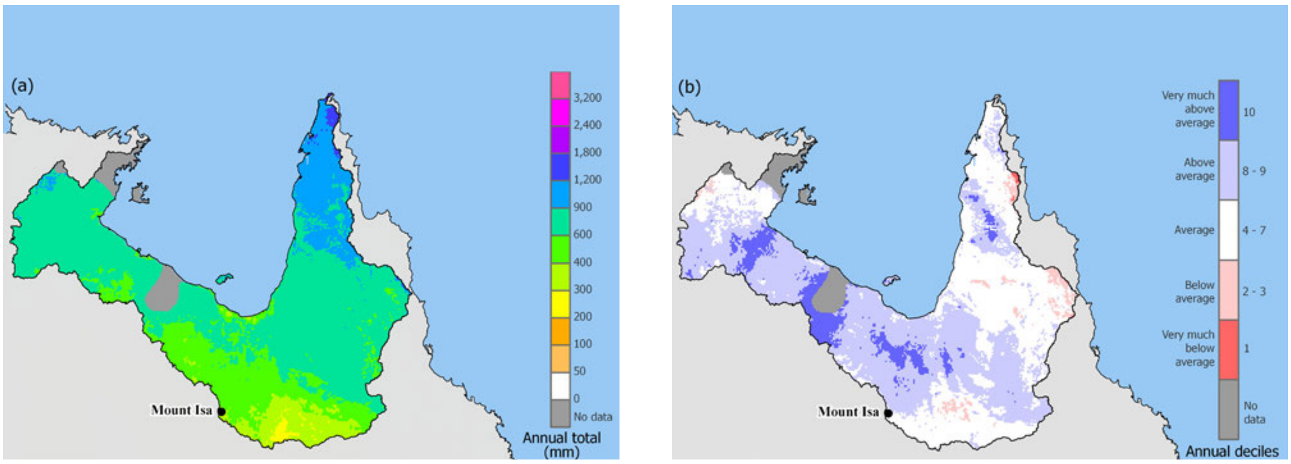
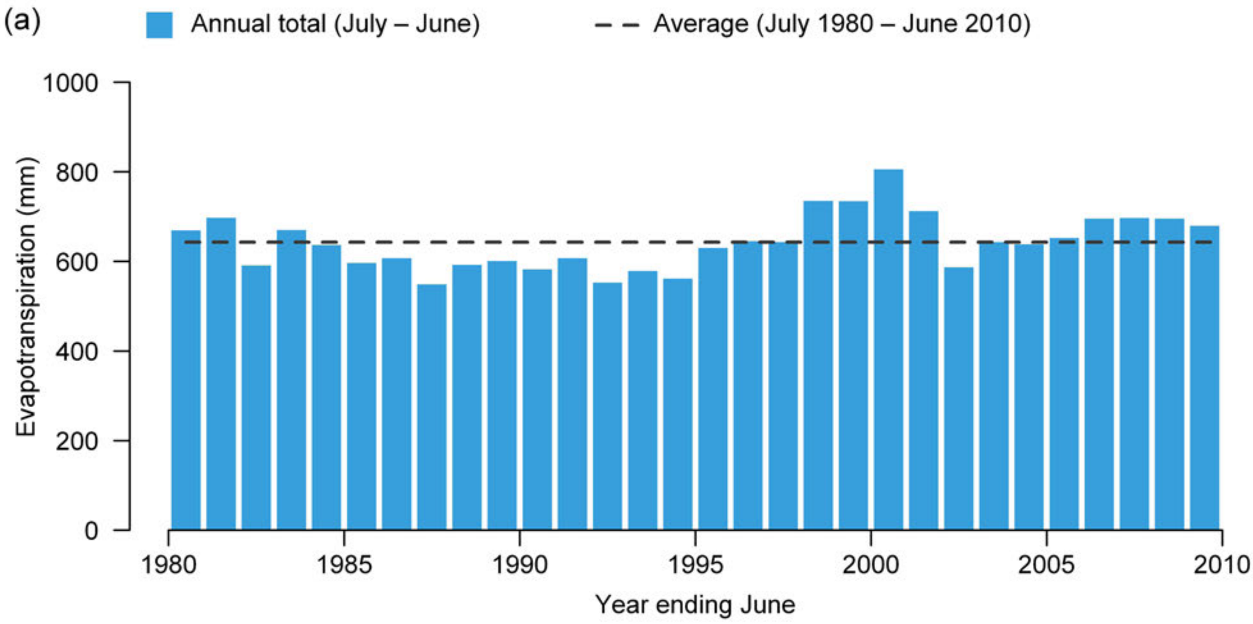


Figure 15-8. Maps of modelled annual evapotranspiration totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Carpentaria Coast region



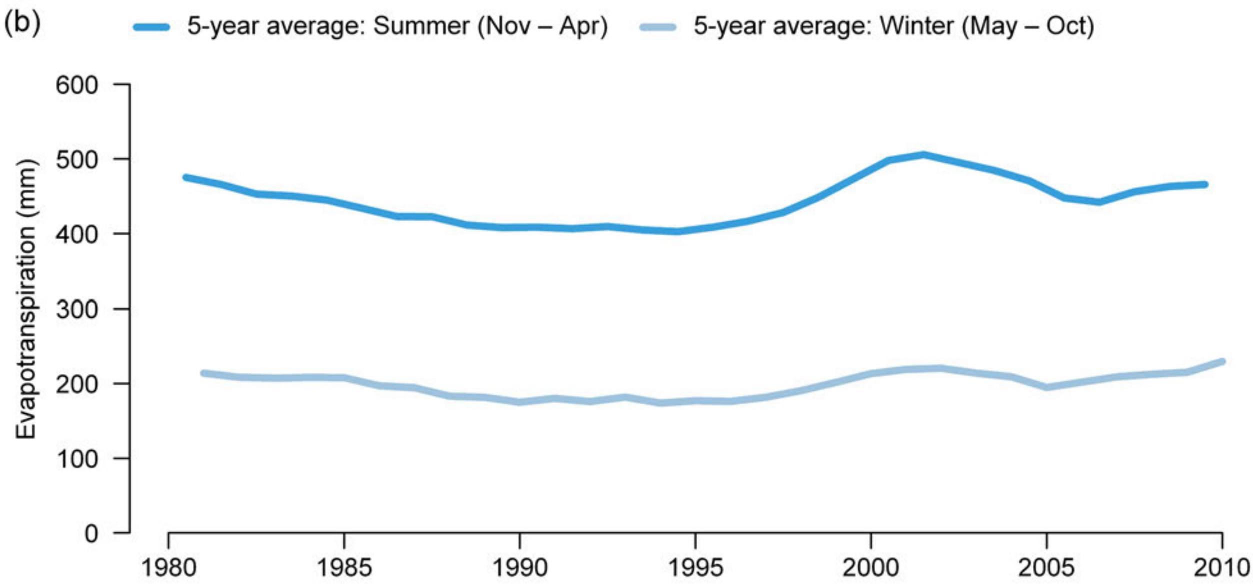


Figure 15-9. Time-series of modelled annual evapotranspiration (a) and five-year (backward looking) moving averages for summer (November–April) and winter (May–October) evapotranspiration (b) for the Carpentaria Coast region

15.4.2 Evapotranspiration (continued)

Figure 15-10 provides a spatial representation of summer (November–April) and winter (May–October) evapotranspiration trends throughout the region between November 1980 and October 2010. The linear regression slope calculated for each 5 x 5 km grid cell depicts the change in seasonal evapotranspiration over the 30 years.

The analysis indicates a slight increasing trend in evapotranspiration across the region for both the summer and winter periods. These increases are more apparent for the higher summer evapotranspiration period.

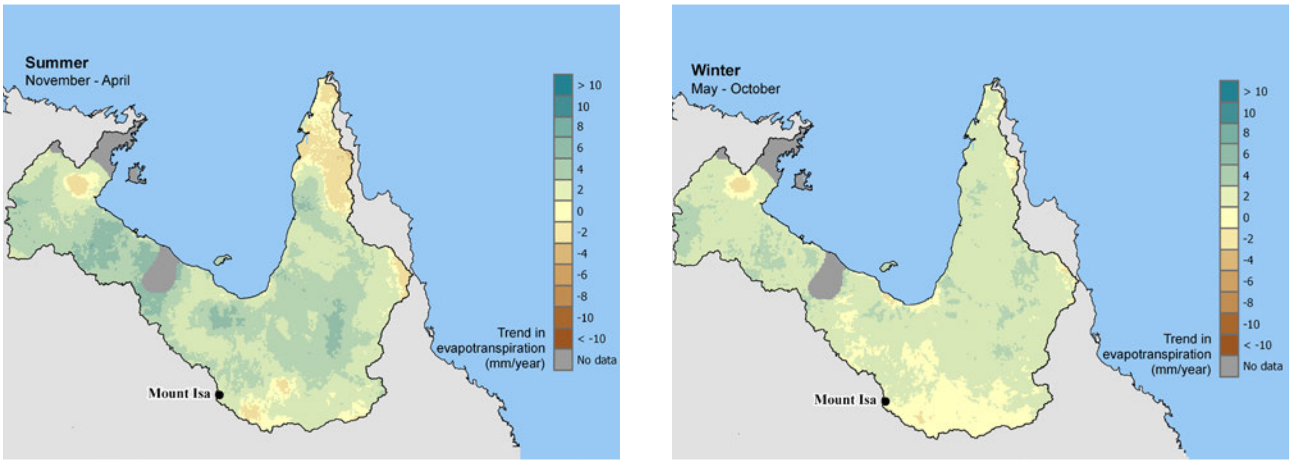


Figure 15-10. Linear trends in modelled summer (November–April) and winter (May–October) evapotranspiration over 30 years (November 1980 to October 2010) for the Carpentaria Coast region. The statistical significance of these trends is often very low

15.4.3 Landscape water yield

Landscape water yield for the Carpentaria Coast region for 2009–10 was estimated to be 268 mm, which is 99 per cent above the region's long-term (July 1911 to June 2010) average of 135 mm. Figure 15-11 (a) shows that during 2009–10, the pattern and distribution of landscape water yield is closely related to those observed for the region's rainfall (see Figure 15-5 [a]). The highest landscape water yield occurred in the coastal zone in the north and northwest of the region. Landscape water yield deciles for 2009–10, shown in Figure 15-11 (b), indicate much of the region experienced above average and very much above average values.

Figure 15-12 (a) shows annual landscape water yield for the region for the past 30 years (July 1980 to June 2010). Over the 30-year period, annual landscape water yield varied from 47 mm (1987–88) to 358 mm (2008–09). The annual average for the period was 165 mm. The data clearly show that landscape water yield over the wetter second half of the 30-year period was consistently much higher than during the first half of the period.

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using moving averages in Figure 15-12 (b). Landscape water yield averages are consistently higher for the summer period. Both seasonal averages show increases in water yield since around the early 1990s, with particularly marked increases in the higher summer period landscape water yield.

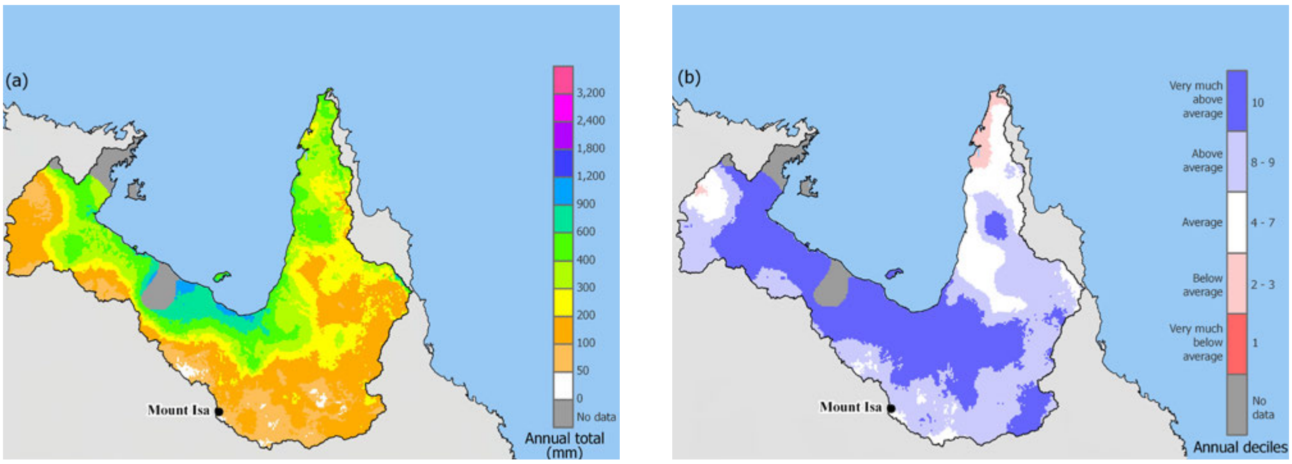


Figure 15-11. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Carpentaria Coast region

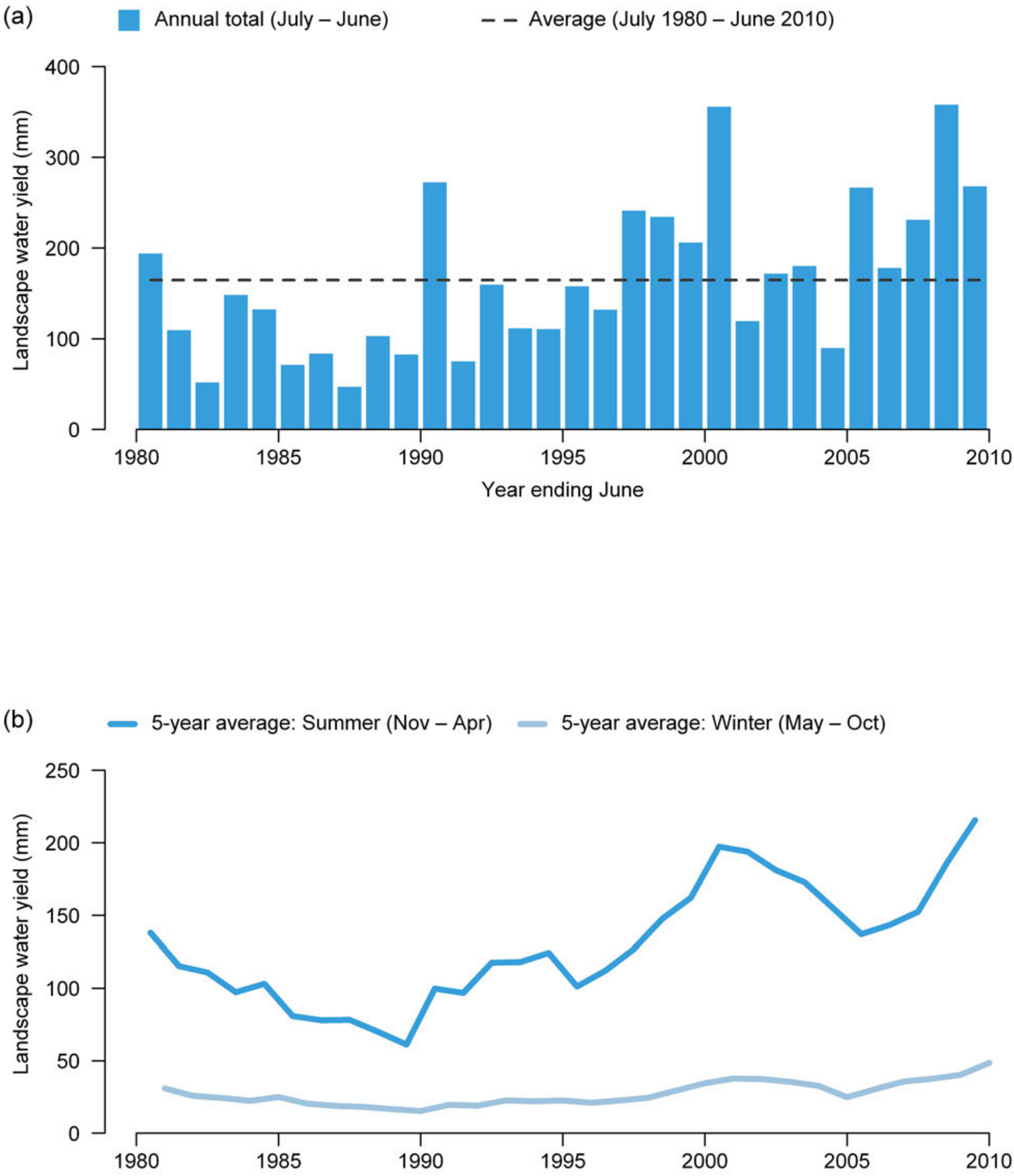


Figure 15-12. Time-series of modelled annual landscape water yield (a) and five-year (backward looking) moving averages for summer (November–April) and winter (May–October) landscape water yield (b) for the Carpentaria Coast region

15.4.3 Landscape water yield (continued)

Figure 15-13 provides a spatial representation of summer (November–April) and winter (May–October) trends in landscape water yield throughout the region between November 1980 and October 2010. The linear regression slope calculated for each 5 x 5 km grid cell depicts the change in seasonal landscape water yield over the 30 years.

The summer period analysis shows strong positive trends in landscape water yield across much of the region. This reflects a very clear link to the patterns of summer rainfall trends observed across the region. The summer period landscape water yield trends also clearly highlight the area of potentially erroneous negative trends in the northeast of the region. The lower magnitude winter landscape water yield shows slight increases across the north and centre of the region with negligible trends identified in the drier southern areas.

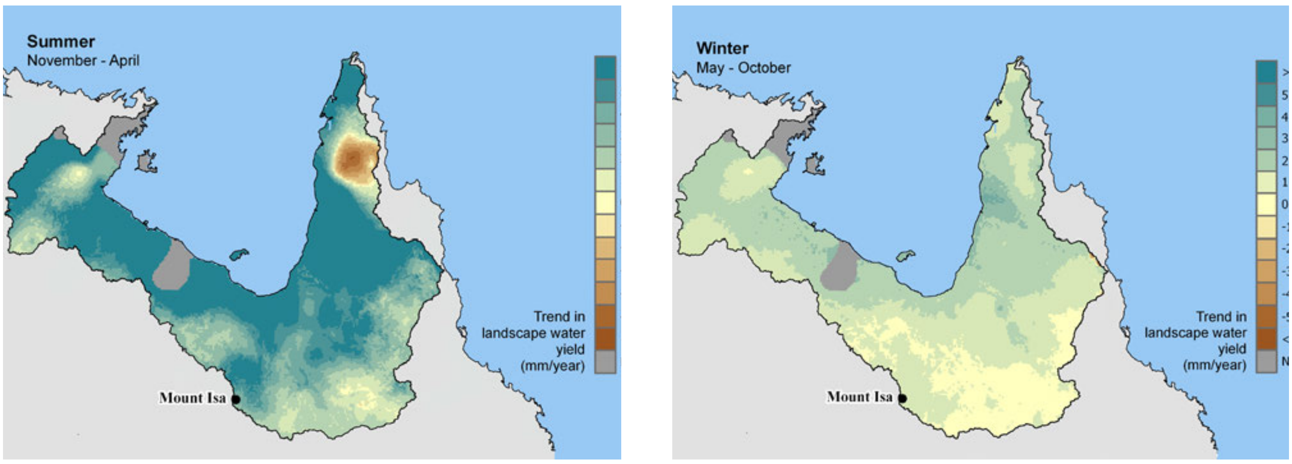


Figure 15-13. Linear trends in modelled summer (November–April) and winter (May–October) landscape water yield over 30 years (November 1980 to October 2010) for the Carpentaria Coast region. The statistical significance of these trends is often very low