

2017 Climate and Weather: The Year in Review

After two successive record warm years in 2015 and 2016, 2017's mean annual temperature of 27.7°C has returned to a level closer to the long-term climatological average. This was 0.2°C higher than the 1981-2010 long-term average and the joint 12th warmest year on record since 1929. However, it is notable that 2017 is the warmest year on record that was not influenced by an El Niño event, indicative of the long term temperature rise that Singapore has been experiencing.

El Niño Southern Oscillation (ENSO¹), a naturally occurring phenomenon and a major contributor to year-to-year rainfall and temperature variations over Singapore and Southeast Asia, was neutral throughout 2017 (except in November and December where it reached borderline La Niña values). Given the influence ENSO can have on temperatures, it is not surprising that following on the 2015 large El Niño event which contributed to 2015 and 2016 being successive record warm years, no temperature record was broken in 2017.

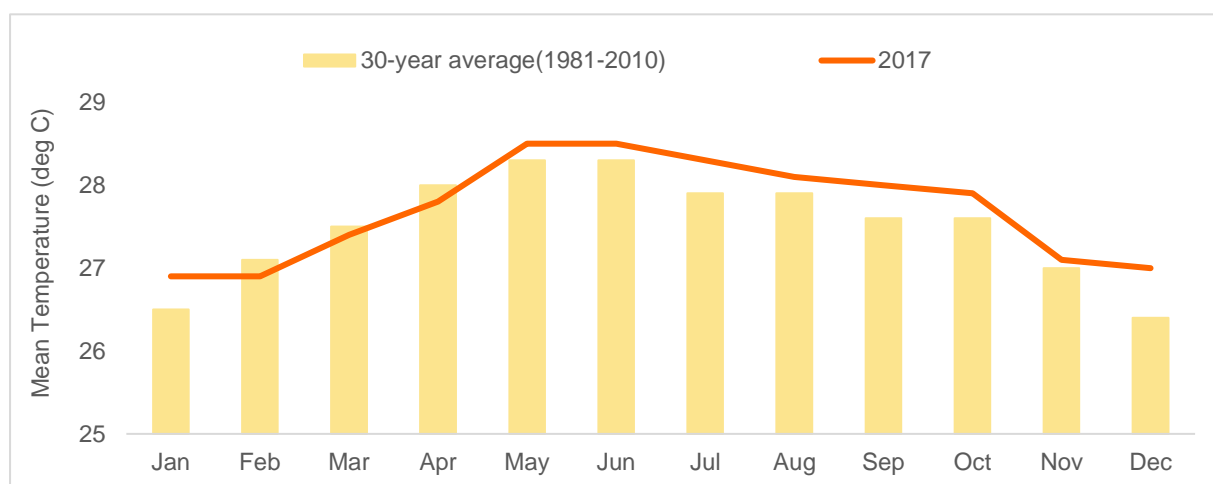


Figure 1: Monthly mean temperatures in 2017 compared with the corresponding long-term average.

There was a mixture of above and below normal rainfall for the individual months in 2017, but overall the annual total rainfall was close to normal, which was more likely to be observed during a largely neutral ENSO year. The total rainfall of 2,045.6mm recorded was around 6 per cent below the long-term average of 2,165.9mm.

¹ El Niño Southern Oscillation (ENSO) is a recurring climate pattern caused by interactions between the atmosphere and the ocean in the tropical Pacific. During El Niño, the central-eastern equatorial Pacific Ocean is warmer than usual, leading to drier and warmer conditions especially during the June to October period over Southeast Asia. During La Niña, the central-eastern equatorial Pacific is cooler than average and the atmosphere over the Southeast Asia region is typically wetter than average. El Niño or La Niña events occur on average once every three to five years.

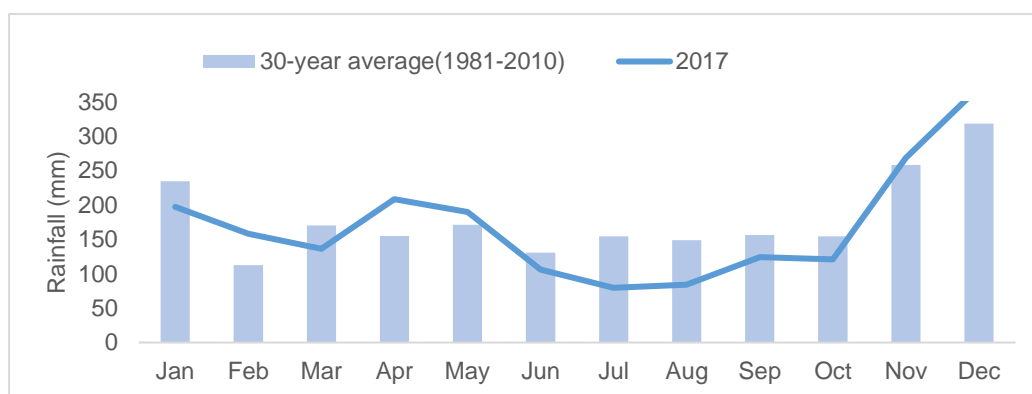


Figure 2: Monthly rainfall in 2017 compared with the corresponding long-term average.

Weather Extremes in 2017

	All Available Stations*	Climate Station (Changi)	Climate Station Records
Hottest Day (°C)	35.7 15 Mar (Jurong West)	34.6 18 Oct	36.0 26 Mar 1998
Coldest Night (°C)	21.7 11 Jan (Tai Seng and Pulau Ubin) 15 Aug (Tuas)	21.8 11 Jan	19.4 30 and 31 Jan 1934
Wettest Day (mm)	149.6mm 31 Dec (Buona Vista)	69.8mm 13 Dec	512.4 2 Dec 1978
Warmest Month (°C)	29.4 June (Marina Barrage)	28.5 May/Jun	29.5 Mar, 1998
Coollest Month (°C)	26.1 Feb (Clementi)	26.9 Jan/Feb	24.2 Jan 1934
Wettest Month (mm)	606.0 Nov (Sembawang)	371.2 Dec	818.6 Jan 1893
Strongest Wind Gust (km/h)	90.0 20 Sep (Pasir Panjang)	57.6 23 June	90.7 29 Nov 2010

Table 1 – Extremes in 2017 across all available stations and the climate station

*The non-climate stations complement the measurements at the climate station and provide indications of local conditions.

Notable Weather Events in 2017

Northeast Monsoon Surges

The early part of the year saw two occurrences of monsoon surge in the South China Sea that brought windy conditions and widespread rain to Singapore. The first occurrence brought a heavy downpour on 23 January that led to flash floods in several areas including Tanjong Pagar. The daily total rainfall of 106.0mm recorded at Kallang on that day was the highest for January 2017. The second occurrence in February, a normally dry month, brought periods of rain showers from 12 to 15 February, which contributed to a total of 15 rain days in February 2017, almost twice the average number for the month.

The year ended on a wet note as the island experienced widespread intermittent rain on the last two days of December (the last wet New Year's eve in Singapore was in 2012). The rainy weather was due to a monsoon surge coupled with the presence of a vortex that developed over the sea areas to the east of Singapore. On 31 December, the 63.4mm of rainfall recorded at the Changi climate station raised the month's total to 371.2mm, 17 per cent above the long-

term average for December. The year's highest daily total rainfall of 149.6mm (at Buona Vista, based on all rainfall stations) was also recorded on that day.

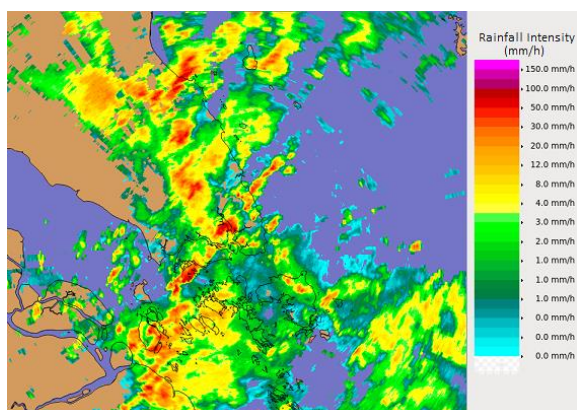


Figure 3: Weather radar image at 12.45pm on 31 December 2017 showing widespread rain over Singapore and the surrounding region

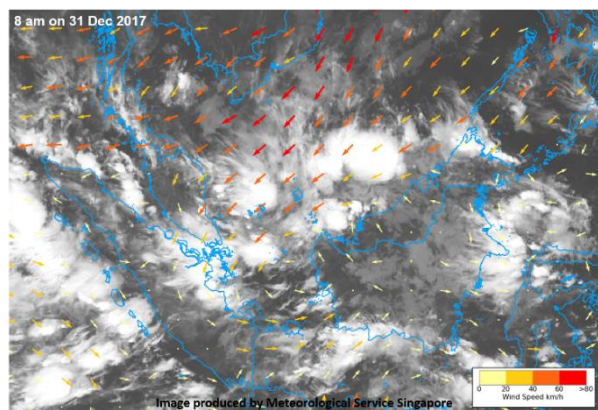


Figure 4: Satellite image at 8am on 31 December 2017 showing extensive cloudiness in the region due to the development of a monsoon surge

Intense Localised Thunderstorms

Localised thunderstorms are common in Singapore, arising from strong solar heating of land areas. When combined with convergence of winds over Singapore, intense thunderstorms can develop, such as on 13 December 2017 when the Changi climate station recorded daily total rainfall of 69.8mm, the highest for the year. Strong wind convergence over Singapore under the influence of a tropical cyclone in the region on 18 April 2017 triggered intense thunderstorms that led to flash floods in the central and southern parts of the island.

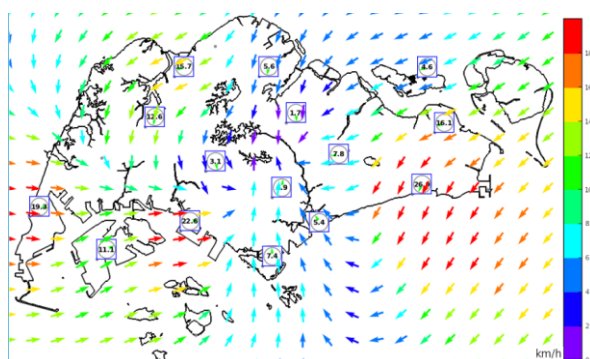


Figure 5: Strong solar heating and wind convergence over Singapore triggered intense afternoon thunderstorms on 13 December 2017.



Figure 6: A heavy downpour left cars stranded in flood waters in the Orchard Road area on 18 April 2017. (Photo credit: Stomp)

The highest recorded 60-minute rainfall (92.0mm at Tuas) during the year resulted from intense localised thunderstorms on 10 June 2017.

On 18 June 2017, a large waterspout, associated with intense thunderstorm clouds that developed over the sea areas south of Singapore, was observed at around 9.10am.

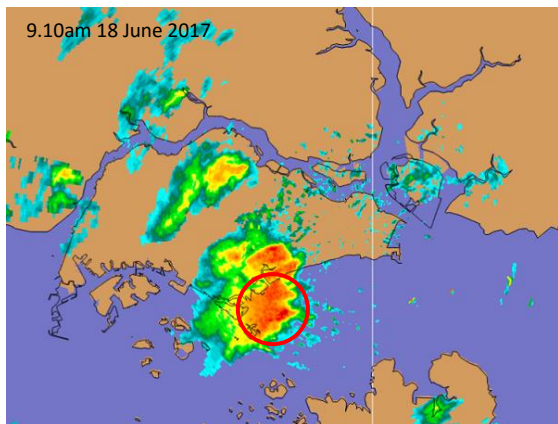


Figure 7: Weather radar image on 18 June 2017 morning (left) showing intense thunderstorms (circled) off the southern coast of Singapore that triggered the development of a large waterspout (right). (Photo credit: Harkiran Kaur Grewal)

In 2017, the Changi climate station recorded 181 lightning days, close to the long-term annual average of 185. Lightning from a thunderstorm struck SMRT's trackside equipment near the Bedok MRT Station on 20 November.

High Frequency of Sumatra Squalls

A high frequency of around 40 Sumatra squall events affected the island during the year. Although Sumatra squalls usually develop in the Southwest Monsoon and inter-monsoon periods, there were five squalls that hit the island in the Northeast Monsoon months of January and February 2017.

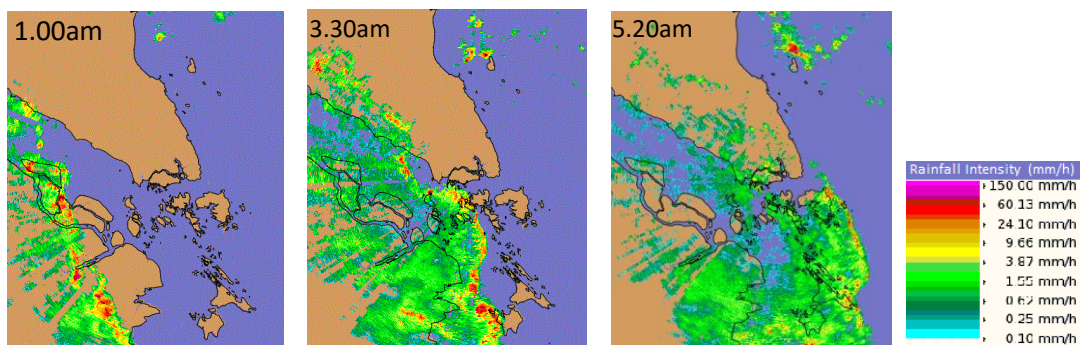


Figure 8: Sequence of weather radar images showing the passage of a Sumatra squall moving across Singapore in the early hours and predawn on 4 January 2017.

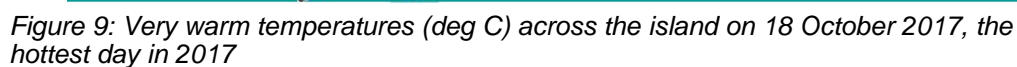
Sumatra squalls on 23 June and 20 September were accompanied by wind gusts of up to around 90.0km/h at Pasir Panjang, the strongest gusts recorded for the year based on all wind stations.

On 14 November, strong winds from a Sumatra squall uprooted a few trees in the Geylang area. The heavy rains from the Sumatra squall also produced the highest daily total rainfall for November 2017 based on all rainfall stations (130.6mm at East Coast Parkway).

Very Warm Days

Despite 2017 not being an El Nino year, there were still some very warm days in certain months.

January and December, normally the cooler months of the year, saw temperatures exceeding 34.0°C at some stations in the early part of both months this year.



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