

Australia 2011–12: Drought versus deluge

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The El Niño/La Niña–Southern Oscillation (ENSO) is a natural climate phenomenon that has persisted for millions of years¹. In its neutral condition, meaning not unusually warm or unusually cool temperatures, ENSO and the trade winds allows warm water to "pile up" over the tropical Pacific Ocean. It is the movement of this warm water due to the behaviour of the trade winds which influences the climatic conditions experienced in our region.

La Niña and El Niño are the opposing phases of ENSO. These phenomena exert a powerful influence on the Earth's climate, and result in year-to-year changes in rainfall and snow on such a vast scale that they temporarily raise (El Niño) and lower (La Niña) global sea level².

Although greatly simplified, an El Niño event is when equatorial trade winds weaken, and a large pool of warmer-than-normal water is smeared over the surface of the central and eastern tropical Pacific Ocean. This pool of warm surface seawater triggers intense evaporation, and therefore rainfall, over the Pacific, and generally deprives the continents of moisture - drying them out. This drying effect is particularly strong over the world's tropical river basins³, and often results in lower-than-normal rainfall in many parts of Australia too⁴.

During a La Niña event, the trade winds strengthen, pushing the warm equatorial seawater across to the tropical western Pacific, where it piles up against the land masses of Papua New Guinea and the Philippines, and much of it is forced down into the subsurface layers. This burial of sea surface heat often leads to lower-than-normal global surface temperatures because the ocean is the main source of atmospheric warming. The proximity to Australia, of the ocean warming in the western tropical Pacific, tends to favour higher-than-normal rainfall over Australia⁵.

Episodes of La Niña and El Niño come in many flavours, no two are the same. They can differ in their intensity and the regions they afflict. It just so happens that the 2010–11 and 2011–12 La Niña events were two of the most significant in Australia's recorded meteorological history - driven by record warm sea surface temperatures, and therefore intense evaporation, in the seas to the north of Australia. These La Niña were associated with record rainfall and some of the biggest flooding in living memory.

We know that climate change and the warming over the past century has contributed to the recent record warm sea surface temperatures. It is very likely that the global average temperature will continue to rise through the 21st century. And it is also very likely that heavy rainfall events will also become more frequent across much of Australia. This means that when long dry periods are interrupted by welcome periods of wet weather, the rain is more likely to fall as heavy downpours than as extended drizzle⁶.

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¹ *El Niño in the Eocene greenhouse recorded by fossil bivalves and wood from Antarctica - Ivany (2011)*

² *Estimating Mean Sea Level Change from the TOPEX and Jason Altimeter Missions - Nerem (2010)*

³ *Terrestrial waters and sea level variations on interannual time scale - Llovel (2010)*

⁴ *Australian Bureau of Meteorology*

⁵ *Australian Bureau of Meteorology*

⁶ *The Impact of Climate Change and Variability on Heavy Precipitation, Floods, and Droughts - Trenberth (2005)*

The facts are that:

- 2011 was Australia's coolest year in a decade (2001–2011)
- 2010 was Australia's third-wettest calendar year on record.
- 2011 was Australia's second-wettest calendar year (with the wettest year since national rainfall records began in 1900 being 1974 – also a La Niña year).
- April 2010 to March 2012 was Australia's wettest two-year period on record.
- Widespread flooding occurred in many parts of Australia associated with the record rainfalls.
- The Murray–Darling Basin experienced its wettest calendar year on record in 2010 and Western Australia experienced its wettest year on record in 2011.
- Ocean temperatures to the north of Australia were highest on record in 2010.

Sources:

The Science Behind Southeast Australia's Wet, Cool Summer accessed at:

<http://resources.news.com.au/files/2012/03/15/1226299/911525-120315-climate-commission-report.pdf>

State of the Climate 2012 accessed at www.csiro.au/Outcomes/Climate/Understanding/State-of-the-Climate-2012.aspx

Record-breaking La Nina events accessed at www.bom.gov.au/climate/enso/history/La-Nina-2010-12.pdf