Could El Niño Southern Oscillation affect the results of the Ashes series in Australia?

Manoj Joshi
University of Reading, UK

Introduction and results

El Niño Southern Oscillation (ENSO) is the largest mode of interannual climate variability in terms of globally averaged surface temperature. Its phase can be measured in different ways, but most measurements involve the sea-surface temperature (SST) of some part of the eastern equatorial Pacific Ocean. In its positive phase – known as El Niño – this region of the Pacific warms by about 1 degC for a period of a few months. In its negative phase – known as La Niña – this region of the Pacific cools slightly. In general the negative phase tends to have a smaller SST anomaly than the positive phase.

Associated with the change in SST is a change in the tropical atmospheric circulation causing an associated change in the pressure gradient between the western and eastern Pacific regions. In northern winters during an El Niño, Southeast Asia experiences lower-than-usual rainfall, and even drought. There are also increased occurrences of forest and bush fires in the Australian and Indonesian regions. On the other side of the Pacific Ocean, the equatorial Andes region of South America experiences higher-than-usual rainfall, with increased incidences of flooding, while the Amazonian Basin experiences drier-than-average conditions. Western Canada tends to get warm winters during an El Niño while the western USA is wetter.

The change in the ocean circulation in a prolonged El Niño event can also disrupt fisheries in the eastern equatorial Pacific Ocean by changing the amount of nutrient-rich cold water supplied to these areas by the Humboldt Current, which moves northwards off the western coast of South America. Indeed, the link between fisheries and ENSO has been known by local fishermen for centuries.

In the negative phase of ENSO, or La Niña, approximately the reverse of the above happens; wetter conditions prevail in Southeast Asia, with drier conditions in the eastern Pacific region. Reversed extra-tropical effects, such as the midwestern United States having drier-than-average winters, are also apparent.

The climate of Australia, especially in terms of its rainfall, is highly variable from year to year. Although there are several mechanisms behind this variability (Westra and Sharma, 2006), ENSO does play a large role. In El Niño years, rainfall is lower than normal over large regions of Australia, especially in the (austral) winter months June–August following the ENSO peak (McBride and Nichols, 1983). This is demonstrated in Figure 1(a), which shows precipitation in El Niño years divided by the (26-year) time average, and has been obtained from the CPC Merged Analysis of Precipitation (CMAP) dataset (Xie and Arkin, 1997). Dry conditions exist over most of the country, with the exception of west and northwest Australia. Higher-than-usual land-surface temperatures and evaporation also contribute to lower-than-average values of soil moisture in El Niño years (Jones and Trewin, 2000). In La Niña years, the reverse is found, with slightly wetter conditions existing over most of the country, as shown in Figure 1(b).

Cricket teams from England and Australia play the Ashes series approximately every two years. The two countries alternate as hosts, so that Australia is the host every four years. The matches (called Test Matches) take place between November and February and are each a maximum of five days in length, and there are five (and occasionally six) matches in total. While the venues for the matches are now fixed (one each in Brisbane, Adelaide, Perth, Melbourne and Sydney), this has not always been the case; for instance, Perth in Western Australia has only hosted matches since 1970. An analysis has been made of the results of Ashes cricket matches, and a significant correlation has been found between the results of these series and ENSO. In this study ENSO is measured using the Niño-3 index, which is the surface temperature anomaly in Kelvin in the region 5N-5S, 210E–270E. A positive Niño-3 index therefore corresponds to El Niño conditions, and a negative Niño-3 index corresponds to La Niña conditions.

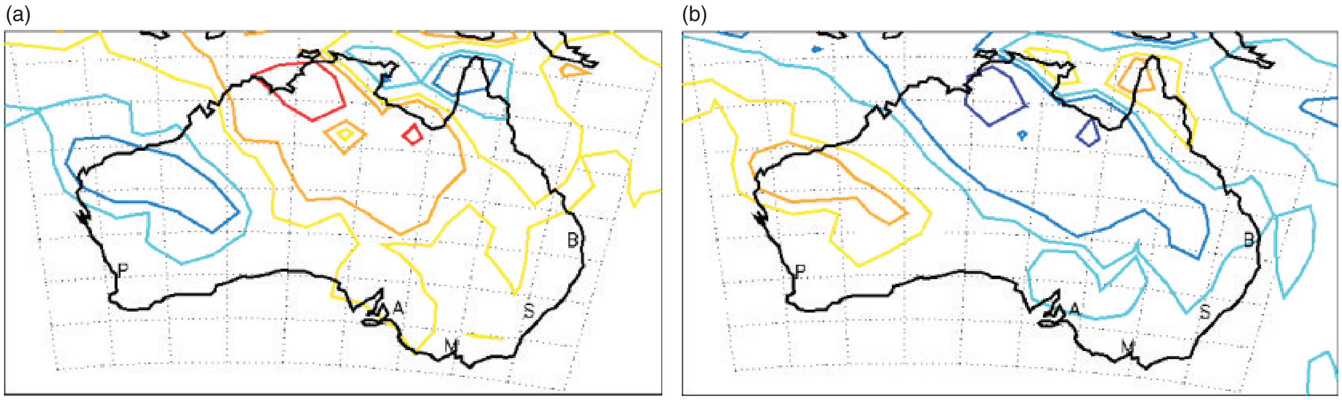

Figure 1. (a) June–August rainfall over Australia in El Niño years divided by the climatological mean for years 1979–2004. The colours are: 60% of mean – red; 80% –orange; 90% – yellow; 110% – cyan; 120% – blue; and 150% – dark blue. The locations of the Test Match venues are marked with their initial letters: P–Perth; A–Adelaide; M–Melbourne; S–Sydney; B–Brisbane. (b) As (a) but for La Niña years.

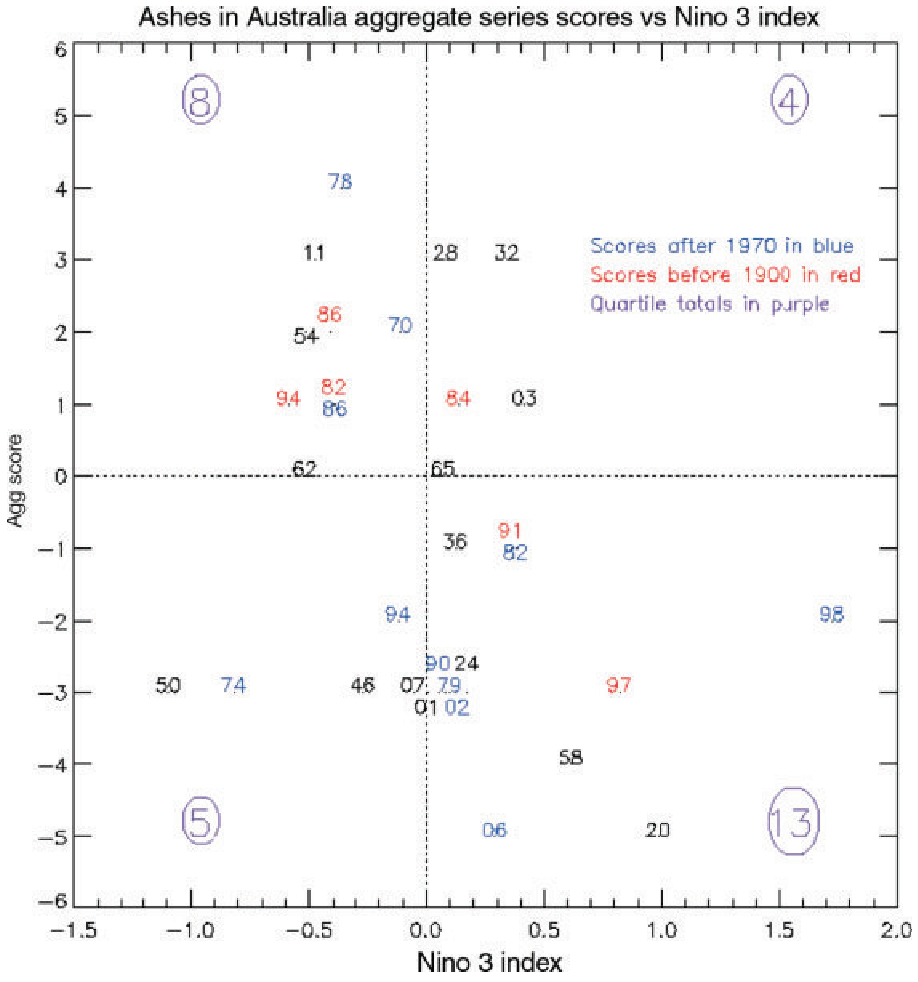

Figure 2. January–June Niño-3 temperature anomaly in year N vs aggregate Ashes series score in an Ashes series that starts in December of year N and continues into spring of year N+1. The Niño-3 index therefore leads the Ashes series score by 6–12 months. The aggregate score is simply the number of England wins minus the number of Australia wins in each series. Each data point is marked as year N (scores before 1900 marked in red, and scores after 1970 marked in blue). Where data points overlap they have been slightly offset from each other to ease clarity. The number of points in each quartile is shown in the purple circles (note the quartiles scores do not include the drawn series of 1962/1963 and 1965/1966).

Figure 2 shows Niño-3 index vs the aggregate Ashes scoreline (see caption for details). Scores before 1900, 1900–1970, and post 1970 have been colour-coded for clarity. The correlation between the two axes is −0.31. Indeed, it appears that the only time that England has won an Ashes series following a significantly positive January–June Niño-3 index in the last 100 years is the infamous 'bodyline' series of 1932/1933: a series that to this day remains controversial.

In El Niño years, Australia has won 13 out of 17 Ashes series played. On the other hand Australia has only won 5 out of 13 series in La Niña years. The probability of England winning an Ashes series therefore changes by over a factor of 2, from over 50% in La Niña years, to less than 25% in El Niño years.

The significance of this result was tested by calculating the correlation between the Ashes series results shown in Figure 2 and 10 000 sets of randomly generated numbers to represent the Niño-3 index: each set had 32 members (the same number as the number of Ashes series) and a normal distribution with a mean of zero and a standard deviation of 0.8, which is similar to ENSO observations. The chance of a correlation more negative than -0.31 was 5%, suggesting that the result is statistically significant.

Discussion

The physical mechanism behind the above correlation is now discussed. In El Niño years, austral winters are significantly drier than average (McBride and Nichols, 1983); associated with the reduced rainfall is lower-than-average soil moisture which can last months after the ENSO's peak (Timbal *et al.,* 2002). El Niño years are also associated with significantly higher land surface temperatures over most of Australia, which last for longer than the rainfall anomalies above (Jones and Trewin, 2000), and also lead to greater evaporation and drier soils.

The dryness of a cricket pitch can have significant effects on a match. Dry pitches are faster, so that when bowled, the cricket ball bounces off the surface higher and faster. Not only that but a bowled cricket ball swerves or 'swings' in flight much less when conditions are dry. On average, English bowlers tend to bowl with less speed and more swing than their Australian counterparts because the relatively damp and cool English summer climate favours this style. In addition, dry wickets tend to favour leg spin bowlers, which Australian teams have historically had more of.

It is theorized that in El Niño years, Australian pitches tend to be relatively dry, and the conditions are therefore less conducive to the bowling style favoured by the majority of English bowlers, which will favour the Australian team. It is interesting that in La Niña years, the results shown in Figure 2 are almost even. This is consistent with the mechanism above, which would indicate cooler and wetter conditions, which might favour England, or at least cancel the advantage of dry pitches in El Niño years.

An attempt was made to decompose the present results to individual cities, but no statistically significant link was found. This is not unexpected given that the response of Australian weather to ENSO is variable, both temporally and spatially (Jones and Trewin, 2000). In addition, there are of course many different factors governing the outcome of any given sporting contest, which would act as noise in this analysis. Future work might involve different statistical tests to try to tease out any signal in individual venues.

It is finally noted that the US-NOAA NCEP prediction website shows predictions of Niño-3 index up to approximately a year in advance. Therefore it may be possible to tell as soon as the winter of 2009/2010 whether or not the England cricket team's next austral tour has a better or worse chance of success than previous tours. It might even be possible that the prediction could inform the selection of the England touring team, in terms of whether more fast bowlers or more 'swing' bowlers are picked. It is, of course, stressed that this last factor is a minor one in the context of picking a winning cricket team.

Acknowledgements

The Niño-3 time series has been obtained from http://climexp.knmi.nl/

The Ashes scorelines have been collated from www.334notout.com

CMAP precipitation data obtained from NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their website at http://www.cdc.noaa.gov/

The author would like to thank the anonymous reviewers of this manuscript, and John Nicol and Steve Woolnough for their comments.

References

Jones DA, Trewin BC. 2000. On the relationships between the El-Niño Southern Oscillation and Australian land surface temperature. *Int. J. Climatology* **20:** 697–719.

McBride JL, Nichols N. 1983. Seasonal relationships between Australian rainfall and the Southern Oscillation, *Mon. Weather. Rev.* **111:** 1998–2004.

Timbal B, Power S, Colman R, Viviand J and Lirola S. 2002. Does soil moisture influence climate variability and predictability over Australia? *J. Climate* **15:** 1230–1238.

Westra S, Sharma A. 2006. Dominant modes of interannual variability in Australian rainfall analyzed using wavelets. *J. Geophys. Res.* **111**, D05102.

Xie P, Arkin PA. 1997. A 17-year monthly analysis based on gauge observations, satellite estimate and numerical model outputs. *Bull. Am. Met. Soc.* **78:** 2539–2559.

Correspondence to: Manoj Joshi,
Walker Institute for Climate Systems Research,
Department of Meteorology,
University of Reading, Earley Gate,
Reading, RG6 6BB,
UK

Email: m.m.joshi@reading.ac.uk

DOI: 10.1002/wea.403

Photographs of dust uplift from small-scale atmospheric features

The photographs show small-scale atmospheric processes resulting in dust uplift into the atmosphere. Such dust is an important component of the climate system and the radiative impact of airborne desert dust can affect regional dynamics (Tompkins *et al.,* 2005).

Figures 1(a) and (b) show dust uplift in cold pool outflows from small precipitating convective clouds in arid regions of the USA and Niger. Although virgae can be seen in Figure 1(a), precipitation does not appear to reach the ground, but dust is still uplifted. A few minutes prior to the photo, a rainbow was visible with the same cloud. In Figure 1(b), the cloud was the first of a number of cumulus congestus and cumulonimbus clouds, which generated precipitation and outflows that resulted in visible dust uplift. The dusty cold-pool outflow is seen below the right-hand tower of the congestus cloud, and is probably contributing to generation of this tower.

The uplift of dust by cold-pool outflows from deep convective systems is a well-known phenomenon, with the earliest published scientific discussion of these features, which the authors are aware of, focusing on the Sudan (Sutton, 1925). There they are referred to as 'haboobs' (from the Arabic *habb***,** meaning 'strong wind') and this term is now used globally to refer to these features. The evaporation of precipitation from convective clouds results in a cold downdraught, and the resultant cold-pool outflow propagates along the land surface as a density current. Large haboobs can often be seen in satellite imagery, particularly in West Africa, where outflows from mesoscale convective systems (MCSs) can travel over

Figure 1. Two photographs showing cold pool outflows from precipitating convective clouds resulting in visible dust uplift. (a) Searles Valley near Death Valley in California, USA, 16 September 2008; (b) West African Sahel near Niamey, Niger, during monsoon onset, 26 June 2007. Figure 1(b) was taken during the GERBILS (GERB Intercomparsion of Longwave and Shortwave radiation) field campaign, aimed at understanding the differences between modelled and observed radiation in West Africa, which may be largely due to the airborne dust (Haywood et al.*, 2005). (© C. M. Grams.)*