Comments on "Blocking over the South Pacific and Rossby Wave Propagation"

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In a recent study Renwick and Revell (1999, hereafter RR99) investigated the atmospheric blocking over the South Pacific. They found that the blocking events occur more frequently over the southeast Pacific during El Niño events in austral spring. Their analysis showed that blocking events are associated with large-scale wave trains lying across the South Pacific from Australia to southern South America. RR99 performed numerical experiments with a linearized barotropic model and showed that the tropical convective heating associated with OLR anomalies, presumably generated during El Niño events, can generate similar wave trains. The purpose of the present comment is to provide observational evidence to show that the Rossby wave propagation similar to the one noted by RR99 is in fact stronger and better organized in austral spring than in other seasons.

Several recent studies (Marques and Rao 1999, 2000; Renwick 1998; Sinclair 1996; Rutllant and Fuenzalida 1991) have found a new region of blocking in the South Pacific. Blocking in this region has important implications for weather over South America (Marques and Rao 1999). Rutllant and Fuenzalida (1991) noted the connection between the El Niño–Southern Oscillation (ENSO) and blocking over the southeast Pacific. Renwick (1998) found that the frequency of blocking over the southeast Pacific is related to ENSO. Using 25 years of National Centers for Environmental Prediction–National Center for Atmospheric Research (NCEP–NCAR) reanalysis data Marques and Rao (2000) found that the blocking frequency over the southeast Pacific has a negative correlation with the Southern Oscillation index during the austral spring, indicating a higher incidence of blocking during El Niño events.

We used monthly mean values of geopotential height for the period 1950–98 to obtain anomalies (observed minus mean) for the El Niño and La Niña events. Geopotential height data at several pressure levels were obtained from NCEP–NCAR reanalysis (Kalnay et al. 1996). The years of El Niño and La Niña episodes are identified in a season-by-season fashion as given by NCEP.[1] In the period considered there are 16 El Niño summers (January) and 13 La Niña summers, 14 El Niño autumns (April) and 9 La Niña autumns, 17 El Niño winters (July) and 10 La Niña winters, and 19 El Niño springs (October) and 14 La Niña springs (see Table 1).

Figure 1 shows the composite of anomalies at the 300-hPa level for El Niño and La Niña events, respectively, for the winter (July) and spring (October) seasons. For brevity composite anomalies for summer (January) and autumn (April) are not shown. In Fig. 1 positive and negative centers can be noted suggesting a wave pattern in a way similar to that noted by Karoly (1989). However, Karoly noted the wave pattern in winter (June, July, and August). In Fig. 1, although a wave train is visible in winter, it is better defined in spring and anomalies are also stronger in spring. The wave train lies across the South Pacific from Australia to southern South America. This seems to agree with the preferred waveguide shown by Ambrizzi and Hoskins (1997). Wave patterns cannot be identified in other (summer and autumn) seasons (figures not shown). In addition, at other levels (figures not shown) the wave train is better defined and stronger in spring and the centers of positive and negative anomalies lie at the same position suggesting an equivalent barotropic structure. Another interesting feature that can be noted in the El Niño spring composite is the location of a strong positive anomaly center in the southeast Pacific near southern South America. This indicates that the blocking highs are favored in this region. Further, unlike in the case of the Northern Hemisphere, stationary waves in the Southern Hemisphere (defined as deviations from the zonal mean) are stronger in spring and not in winter (Quintanar and Mechoso 1995). In Fig. 1d a wave train can be identified with opposite polarity compared to Fig. 1b. This suggests that during La Niña events blocking highs occur less frequently near southern South America.

A physical argument for the timing of the observed maximum in Rossby wave activity is given in Renwick and Revell (2000).

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[1] Available online at http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/

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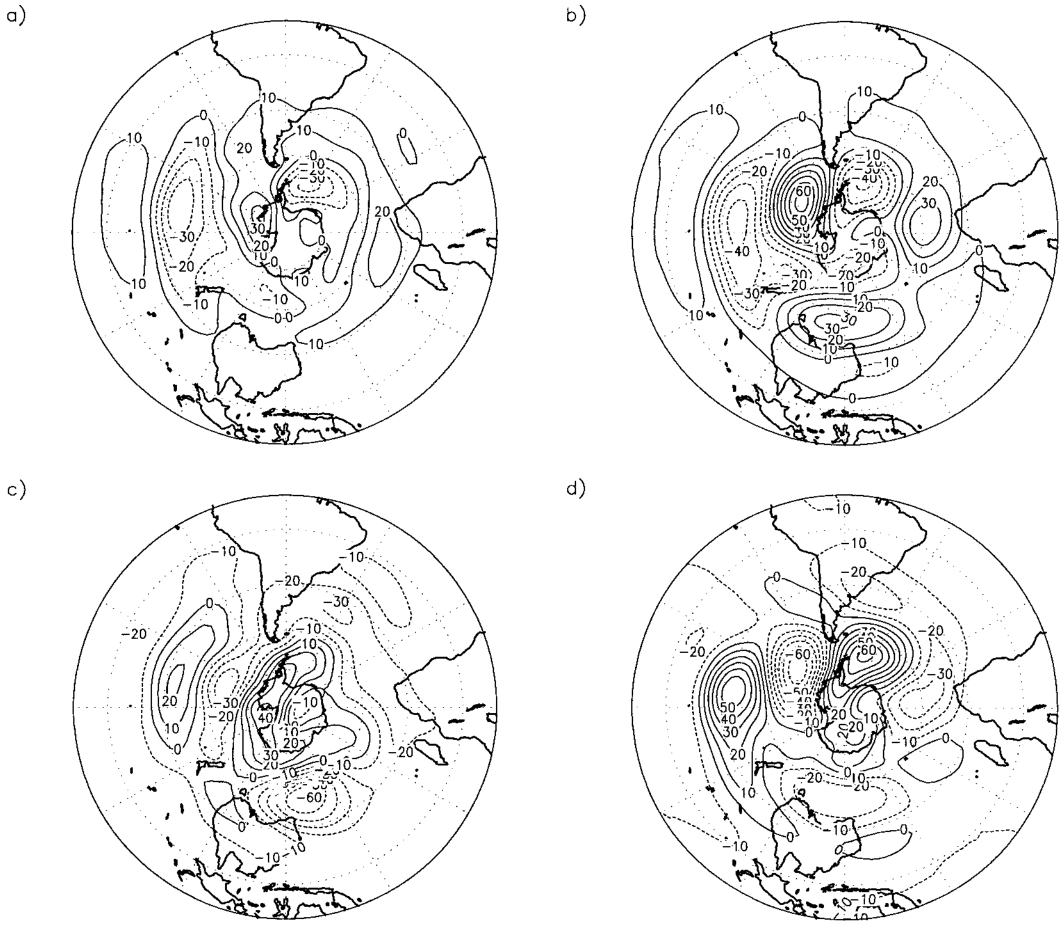

FIG. 1. Composite anomalies at 300 hPa for (a) Jul and (b) Oct (El Niño events), and (c) Jul and (d) Oct (La Niña events). Values in meters.

TABLE 1. El Niño and La Niña years.

	Summer (Jan)	Autumn (Apr)	Winter (Jul)	Spring (Oct)
El Niño	1958, 1959, 1966, 1969, 1970, 1973, 1978, 1980, 1983, 1987, 1988, 1991, 1992, 1993, 1995, 1998	1953, 1957, 1958, 1966, 1969, 1972, 1982, 1983, 1987, 1991, 1992, 1993, 1997, 1998	1953, 1957, 1958, 1963, 1965, 1966, 1969, 1972, 1982, 1986, 1987, 1990, 1991, 1992, 1993, 1994, 1997	1951, 1957, 1958, 1963, 1965, 1968, 1969, 1972, 1976, 1977, 1982, 1986, 1987, 1990, 1991, 1992, 1993, 1994, 1997
La Niña	1950, 1951, 1955, 1956, 1965, 1971, 1974, 1975, 1976, 1984, 1985, 1989, 1996	1950, 1955, 1956, 1971, 1974, 1975, 1984, 1985, 1989	1950, 1954, 1955, 1956, 1964, 1971, 1973, 1974, 1975, 1998	1950, 1954, 1955, 1956, 1964, 1970, 1971, 1973, 1974, 1975, 1983, 1984, 1988, 1995

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