

Indian Ocean influences on Cold Events over southern Australia

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We are exploring the largescale influences on southern Australian ‘Cold Events’ (CEs), particularly those associated with conditions over the ‘upstream’ Indian Ocean. We define CEs as the bottom 0.4% of maximum temperatures in Melbourne and in Perth for each calendar month (Perrin and Simmonds 1995, Simmonds and Richter 2000) for the 1958-2006 period. Almost invariably these CEs are associated with an intensive high pressure-low pressure couplet, which is related with the intense cold southerlies. Our previous and current research (Simmonds and Rashid 2001, Ashcroft et al. 2009) has indicated that in southern Australian CEs the anticyclone component of the couplet is usually very long-lived, and can originate weeks before in the west Indian Ocean or even in the Atlantic Ocean.

We here focus on the composite of the SST anomalies in the week leading up to Melbourne summer (December - February) CEs. Figure 1(a) shows that the SST over those seven days are significantly less than normal over broad stretches of the Indian Ocean and the Great Australian Bight. These are the regions over which the high pressure component of the H-L couplet would have passed. The strength and scale of the anomalies is impressive. It can be argued that the presence of these cooler temperatures serve to, in a climatological sense, encourage and intensify high pressure systems passing over them. Consistent with this picture is the fact that positive SST anomalies are found to the south and east of the Tasman Sea, the region over which most of the low pressure components of the couplet form.

A similar display is presented in Fig. 1(b) for the case of Perth winter CEs. The broad structure of the SST anomaly field is very similar, after one takes in account the more westward position of Perth compared to Melbourne.

It is becoming well known how and why the Indian Ocean strongly influences Australian rainfall (Simmonds and Rocha 1991, England et al. 2006). The present work serves to emphasise the important role that the Indian Ocean plays in a wide variety of aspects of Australian weather and climate.

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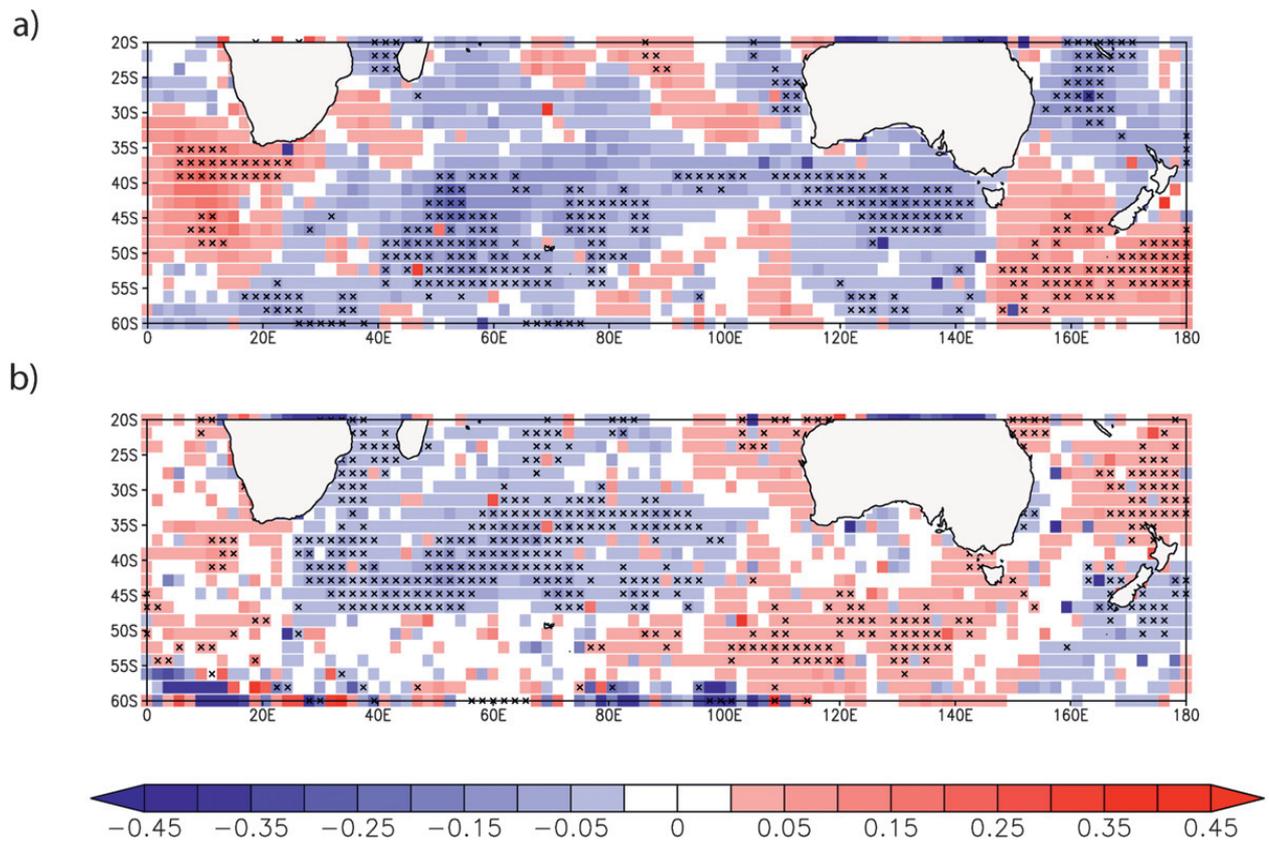


Figure 1: Average sea temperature anomalies ($^{\circ}\text{C}$) over the ocean for the seven days before a CE in (a) Melbourne summer and (b) Perth winter. Areas marked with a cross indicate regions of where the anomalies differ significantly from zero at the 90% confidence level.