



Rainfall Variability of South East Queensland

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The seasonal weather of southeastern Queensland (SEQ) is commonly described by a wet and a dry season. Rainfall in this area has been declining for the past fifty years and climate projections indicate decreasing trends in annual rainfall and increases in temperature. These factors combined with population growth suggest a need for Queensland to re-evaluate its water management. In order to understand the rainfall variability of SEQ, it is useful to consider the impact of the different weather patterns or synoptic regimes on the regional rainfall. Previous studies have examined the synoptic patterns associated with extreme wind and rainfall events in SEQ and the correlation between rainfall in northern Queensland and atmospheric variables, but a comprehensive climatology for the SEQ region is missing. Analysis of routine soundings is found to reveal relationships between surface precipitation and atmospheric structure.

Cluster analysis was performed on daily radiosonde data for Brisbane Airport spanning the period 01/01/1990-11/11/2009. The clustering was initially performed on seven atmospheric variables: total-totals, 850mb winds, wind shear between 850mb and 500mb, moisture flux and total water calculated from the sounding data. A sensitivity study reveals that the moisture flux parameters followed by total water and total-totals are the key variables in determining the regimes. The clusters were combined with daily rainfall records spanning the period 01/01/1995 – 01/06/2008 to determine the contribution of each regime to monthly rainfall.

The seven-cluster case describes three separate southeasterly regimes, three westerly regimes and an easterly regime. The contribution of each regime to annual rainfall was also determined. The regimes for SEQ can be divided into 'wet' and 'dry' cases. It is apparent that the rainfall is largely limited to the coastal strip, with maxima near regions with steep terrain. The main rainfall period is from November through to February, with peak falls tending to be in February. The 'wet' regimes are responsible for the majority of the region's rainfall. Southeasterly wind regimes are commonly associated with trade wind or 'stream' showers and coastal trade wind cumulus. When there is significant moisture such as for the 'moist' southeasterly regime these systems can bring significant rainfall to the region. The northwesterly regime can produce deep convection and contributes greatly to the total annual rainfall (21.7%) despite occurring less than 7% of the time. The easterly and westerly regimes also are major contributors to annual rainfall. There are also significant rainfall events during the dry season such as intense sub-tropical cyclones (east-coast lows) that bring sustained strong winds and intense rainfall to the region. In general, however, the winter season is dry and is well described by a southwesterly regime and a 'dry' southeasterly regime. The dominant synoptic regime, the southeasterly regime, does not contribute significantly to the total rainfall in any month.

The relationship between the Southern Oscillation Index (SOI) and rainfall over most of Queensland is strong. The correlation between SEQ monthly rainfall anomalies and the Southern Oscillation Index (SOI) was calculated over the period 1858-2008. A small but significant correlation is found between the SOI and rainfall in southeastern Queensland. The low correlation indicates that the rainfall is controlled by other factors in addition to the El Nino – Southern Oscillation.