A NEW APPROACH TO ASSESSING THE RELATIVE IMPORTANCE OF TROPICAL TEMPERATE TROUGHS FOR SOUTH AFRICAN SUMMER RAINFALL

N.C.G. Hart*, C.J.C Reason and N. Fauchereau
Department of Oceanography, University of Cape Town, South Africa

1. INTRODUCTION

Tropical Temperate Troughs (TTT's) have long been regarded as a major rain-bearing synoptic system over southern African. Numerous studies have associated these large-scale systems with widespread rainfall over the summer rainfall region of South Africa (Harrison, 1984; D'Abreton and Lindesay, 1993).

Principal component analyses of rainfall have revealed TTT-like patterns account for a large portion of the rainfall variability on the daily (Todd and Washington, 1999) to monthly timescale (Harrison, 1984). Since the summer rainfall region supports much of the South African farming industry, understanding of rainfall variability within this region is of great importance.

In this study an objective method based on clustering techniques is used to identify recurring synoptic patterns over southern Africa and assess their relative impact on summer rainfall over South Africa.

2. DATA AND METHODS

Cluster analysis is applied to daily outgoing longwave radiation (OLR) for the southern African region for the period NDJF, 1979-2007. Seven statistically distinct patterns are found and each day within the period is assigned to the pattern it is closest to. One cluster is found to resemble a TTT-like pattern over southern Africa and days associated with this cluster are extracted.

The Water Research Commission (WRC) daily rainfall dataset (Lynch, 2003) is used in calculating total seasonal rainfall for each station in the database.

Corresponding Author's Address: Neil Hart
Dept. of Oceanography, University of Cape Town,
Private Bag X3, Rondebosch, 7701, South Africa
email: neil.hart@uct.ac.za

The percentage contribution to the season total is calculated for each day associated with the TTT cluster. The sum of these daily contributions within a season gives the contribution of TTT events, to the season's total rainfall.

The method is currently being revised to include additional atmospheric variables in the clustering process.

3. RESULTS

The result of the cluster analysis reveals three clusters (6,5,7) with TTT-like cloud band features, but with only one cluster showing lower (enhanced convection) OLR values, over the sub continent (Fig. 1). In agreement with previous studies (Harrison, 1984; D'Abreton and Lindesay, 1993; Todd and Washington, 1999) the other two TTT clusters occur to the east of continent, over the SW Indian Ocean and Madagascar.

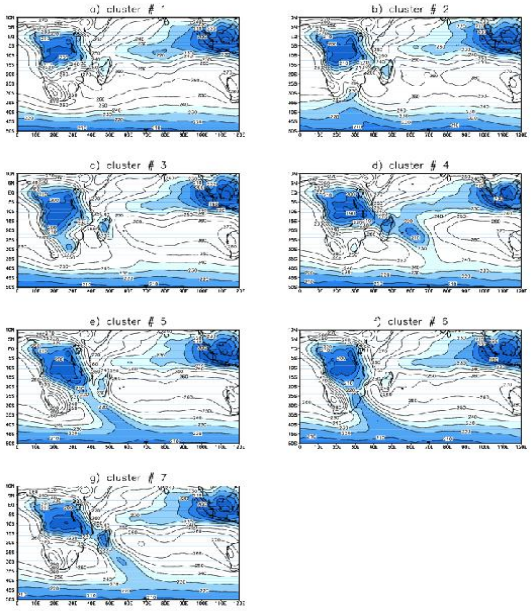

Fig.1 Clusters of OLR

Individual events are found to contribute between 5-20% of the total summer rainfall, with on average 9 events occurring each season. The seasonal

contribution of individual events is higher when occurring over central South Africa as opposed to the north-eastern regions. An example of seasonal contribution of an individual event is shown in Fig. 2.

4. CONCLUSION

This analysis has served to show that cluster analysis is successful in discriminating between various daily OLR regimes that occur over southern Africa. Thus it proves to be useful in identifying TTT events over the region.

Identification of individual events at the daily timescale allows assessment of the importance of TTT's in the total summer rainfall, as well as paving the way for further studies on intraseasonal variability.

Overlay plots of OLR, 850mb and 250mb vector winds revealed that days assigned to cluster 6 did not always necessarily represent TTT events. Further research is being done on including additional variables to better discriminate between different recurring synoptic regimes.

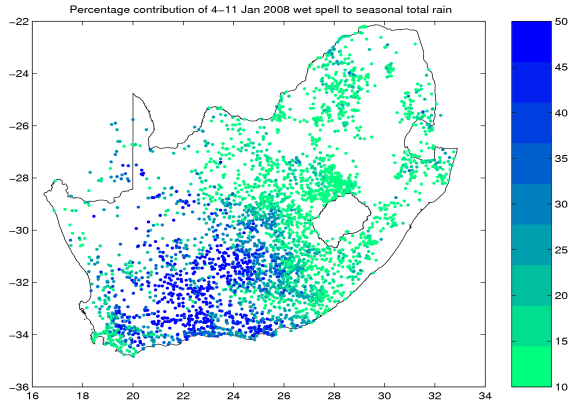

Fig.2 Contribution of a persistent TTT event (4-11 Jan 1998) to total NDJF season rainfall.

5. REFERENCES

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