P1.106 EASTERLY WAVES IN THE INTRA-AMERICAS SEA REGION

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1. INTRODUCTION

Initiation of hurricanes in the tropical northeast Pacific is strongly associated with tropical easterly wave activity in the region, as a majority of hurricanes in the tropical northeast Pacific are spawned from these disturbances. While several factors influencing the strength and number of waves in the tropical northeast Pacific each year have been suggested, including barotropic instability, orography, and free propagation from the Atlantic, the relative importance of these factors and the large-scale modulation of them remain topics of active research. In this study, the formation of tropical easterly waves within the Caribbean and tropical northeast Pacific is revisited using ERA Interim fields in the Intra-Americas Sea region for May-November 1989-2007.

2. RESULTS

Analysis of the conversion terms in the eddy kinetic energy equation in the vicinity of the Caribbean Low-Level Jet (CLLJ), and the extension of this jet into the tropical northeast Pacific known as the Papagayo Jet indicate a significant source of barotropic energy in the western Caribbean and eastern Pacific. These source regions are also coincident with track density and genesis maxima. Fig. 1 shows the track density weighted by the CLLJ index defined in Serra et al. (2010). The difference indicates a greater number of tracks in the eastern Pacific during the strong phase of the jet. Atlantic and Caribbean tropical storm formation is also found to be significantly anti-correlated with CLLJ strength, while eastern Pacific storm formation is correlated with jet strength (Fig. 2). These results indicate that while genesis is inhibited in the vicinity of the jet, it is enhanced downstream in the eastern Pacific.

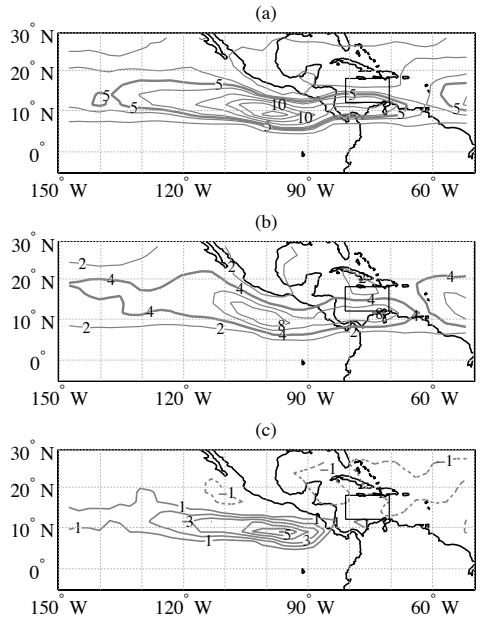

Fig. 1 – May-November 1989-2007 700 hPa track density composite for the CLLJ (a) strong and (b) weak phases and (c) the strong minus weak phase track density differences. Track density is in units of number of tracks per unit area per month where the unit area is a 5° spherical cap equivalent to ~10^6 km^2. The 75^{th} percentile track density is in bold in (a) and (b). Contours are every 1 density unit in (a)-(b) and every 0.5 density unit in (c). The box in the Caribbean indicates the region used to calculate the CLLJ index. (Adopted from Serra et al. 2010.)

3. CONCLUSIONS

Many previous studies have suggested a strong link between EWs in the Atlantic and Pacific basins, but these have generally been in the context of individual case studies. Track, genesis and lysis density statistics in this study show that synoptic-scale positive vorticity centers frequently

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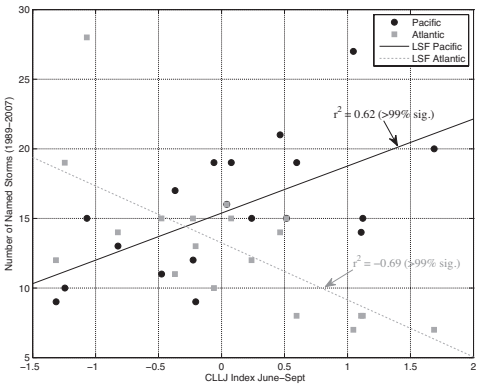

Fig. 2 – The number of named storms in the east Pacific and Atlantic for the 1989-2007 seasons plotted against the June-September CLLJ index. Also shown are the least squares fit (LSF) lines to these data along with the associated correlation coefficients and their significance. (Adopted from Serra et al. 2010.)

enter the IAS region from the Atlantic. However, regions of lysis across the central Atlantic indicate that this is not necessarily the primary source of synoptic activity in the IAS region. On the other hand, genesis is observed in the Caribbean as well as off the coast of Central America and Mexico, extending out into the east Pacific, pointing to a local source for EWs in the IAS.

Energetics analyses on all years from 1989-2007, as well as two case studies, suggest that barotropic conversions associated with horizontal shear in the zonal wind in the western Caribbean and eastern Pacific contribute to the growth of easterly waves in these regions.

The behavior of the CLLJ and EWs over the IAS region is strongly modulated by the large-scale basic state, which in turn affects the frequency and location of tropical storm genesis over the region. Several studies have found that periods of enhanced low-level westerly flow over the east Pacific related to the MJO enhance convective activity and eddy activity on synoptic time scales in the region (Maloney and Esbensen 2007), as well as favor cyclogenesis (Maloney and Hartmann 2001; Knabb et al. 2008; Aiyyer and Molinari 2008). The present study shows that periods of strong easterly flow are associated with a greater frequency of easterly waves and storms in the Pacific, with the opposite effect in the Atlantic. Further investigation is required to understand the time scales and relative importance of these two mechanisms for enhancing synoptic activity and cyclogenesis in the IAS region. The smaller vorticity structures on the lee side of the Sierra Madre seen in our regression analyses also require further investigation to under-stand the possible role of the orography in setting the scale of EWs in this region and/or initiating such disturbances due to interactions of Atlantic zonal flow and EWs with the terrain as suggested by Zehnder et al. (1999). The authors are currently pursuing these topics further.

4. REFERENCES

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