Science and Technology Infusion Climate Bulletin
NOAA's National Weather Service
39th NOAA Annual Climate Diagnostics and Prediction Workshop
St. Louis, MO, 20-23 October 2014

Modulation of Atlantic Basin Tropical Cyclone Activity by the Madden-Julian Oscillation (MJO) from 1905-2011

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ABSTRACT

The Madden-Julian Oscillation (MJO) has been demonstrated to play a role in tropical cyclone (TC) activity around the globe in a number of recent studies. While the impact of the MJO on TCs in the Atlantic basin since the mid-1970s has been well documented, a newly-developed 107-year long index for the MJO allows for additional analysis of the impacts of the MJO on Atlantic TC activity. TC activity in the Atlantic increases when MJO-related convection is enhanced over Africa and the Indian Ocean while TC activity in the Atlantic is suppressed when the MJO enhances convection over the West Pacific. This long-term record of the MJO also allows for the analysis of how the MJO's impacts may be modulated by other climate modes, such as the El Niño-Southern Oscillation (ENSO) over interannual timescales (Figure 1) and the Atlantic Multi-decadal Oscillation (AMO) over multidecadal time scales (Figure 2). When climatologically unfavorable conditions such as an El Niño event or a negative AMO phase are present, even TC-favorable MJO conditions are not enough to generate statistically significant increases in TC activity from the long-term average across the Atlantic basin. However, climatologically favorable conditions during a La Niña event or a warm AMO phase act to enhance the modulation of TC activity over the Atlantic basin by the MJO.

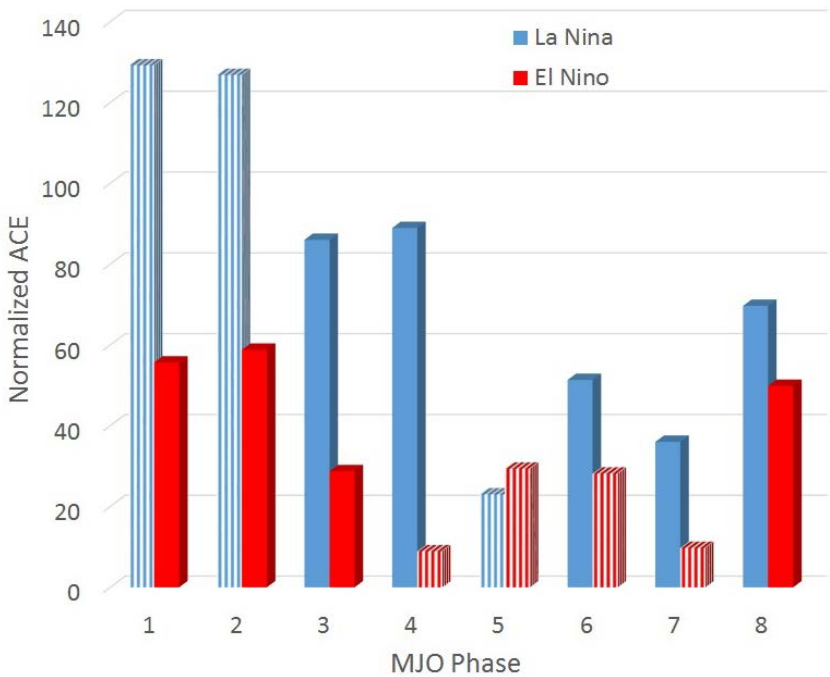

Fig. 1 Normalized ACE generated by each phase of the MJO for La Niña events (blue bars) and El Niño events (red bars). Statistically significant results are highlighted by vertical striping.

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This work is currently in press for Journal of Climate. It can be downloaded at: http://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-14-00509.1.

References

Klotzbach, P. J., and E. C. J. Oliver, 2014: Modulation of Atlantic basin tropical cyclone activity by the Madden-Julian Oscillation (MJO) from 1905-2011. *J. Climate*, in press, doi: 10.1175/JCLI-D-14-00509.1.

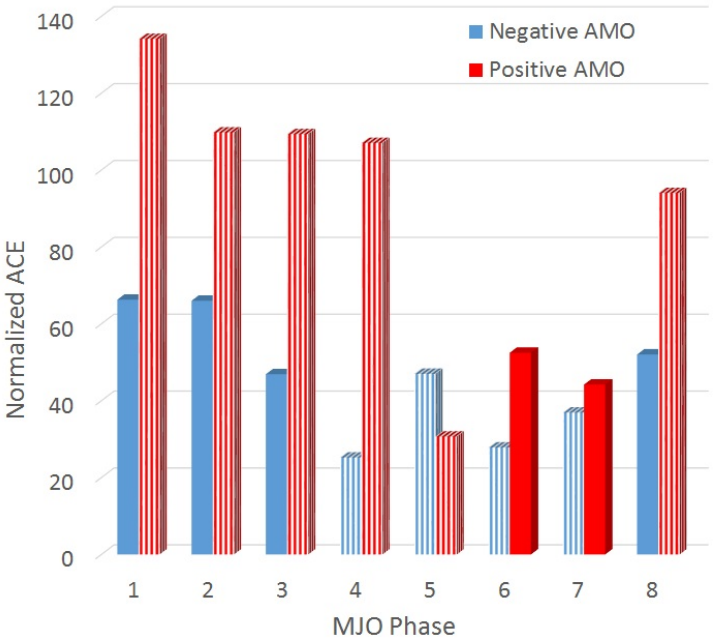

Fig. 2 As in Figure 1 but for positive AMO years (red bars) and negative AMO years (blue bars).