# Influences of the Maritime Continent on the Eastward Propagation of the Madden-Julian Oscillation

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## Abstract

The Madden-Julian Oscillation (MJO) exerts significant influences on global weather extremes, and serves as a critical basis of the "Seamless Prediction" by bridging the forecasting gap between weather forecast and short-term climate prediction. However, the MJO remains poorly represented in the state-of-the-art general circulation models (GCMs) as well as NWP models. One particular challenge for modeling and predicting the MJO lies in its complex interaction with multi-scale convection over the Maritime Continent (MC). The eastward propagation of the MJO is often interrupted or weakened over the MC due to the so-called MC barrier effect, which is often exaggerated in climate models, thus significantly limiting our prediction skill for the MJO and associated weather extremes. Therefore, improved understanding of key processes on the interaction between the MC and the MJO becomes an urgent need to break this tropical prediction barrier.

In this proposed study, with a team of researchers and modelers between UCLA and NOAA/GFDL, we propose to comprehensively investigate key processes associated with the MC influences on the eastward propagation of the MJO. Particularly, we will capitalize on a new generation climate model recently developed at GFDL with full capability of representing the observed MJO propagation features over the MC, and the unprecedented observations over the MC to be collected from the upcoming YMC (Years of the Maritime Continent) field campaign. Roles of multi-scale interaction, topography, large-scale mean state, and air-sea interaction for propagation of the MJO over the MC will be comprehensively characterized based on GFDL GCM in both climate simulation and hindcast modes. Identified model processes will be extensively validated by utilizing the YMC in-situ observations and satellite datasets along with global reanalyses. Additionally, multi-model hindcast dataset from the WWRP/WCRP Subseasonal-to-Seasonal (S2S) Prediction Project, will be also analyzed to establish a possible linkage of specific model deficiencies to the model "MC MJO prediction barrier" issue. This project is expected to provide significant insights into key processes regulating MJO propagation over the MC, thus leading to improved S2S prediction skill. This project will also directly benefit development of the GFDL GCM through comprehensive validation by the observations.