DYNAMO

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The essential role of the Madden-Julian Oscillation (MJO) in bridging weather and climate cannot be overstated. As the MJO propagates from the Indian to western/central Pacific Oceans, it influences a suite of weather and climate phenomena globally. The potential predictability of the global atmosphere beyond 2 weeks mainly comes from the MJO. To meet the societal need, seasonal forecast must cover the range of variability in temperature and rainfall, including their extremes, which are modulated by the MJO. The current MJO prediction skill is, however, the lowest during its initiation over the Indian Ocean. Most climate models cannot reproduce the MJO. Such infidelity of our climate models seriously degrades their seasonal to interannual prediction, limits their applications in studying extreme events, and lessens our confidence in their projection of future climate.

The DYNAMO field campaign was designed to collect observations to expedite the advancement of our understanding of the MJO, especially its initiation, and the improvement of our ability of simulating and predicting the MJO. Three DYNAMO hypotheses were proposed:

Hypothesis I: Deep convection can be organized into an MJO convective envelope only when the moist layer has become sufficiently deep over a region of the MJO scale; the pace at which this moistening occurs determines the duration of the pre-onset state.

Hypothesis II: Specific convective populations at different stages are essential to MJO initiation.

Hypothesis III: The barrier layer, wind- and shear-driven mixing, shallow thermocline, and mixing-layer entrainment all play essential roles in MJO initiation in the Indian Ocean by controlling the upper-ocean heat content and SST, and thereby surface flux feedback.

Observations collected by the DYNAMO field campaign will facilitate the test of these hypotheses and prompt new ones.

The post-field activities of DYNAMO are focusing on data quality control, observational products directly applicable to modeling, modeling application of field observations, synthesis of preliminary results, forming new science teams to target pressing issues, evaluation of MJO forecast skills during the field campaign, and denial experiments to quantify the effects of field data on real-time prediction.

A critical issue pertaining the legacy of DYNAMO is integration of field observations and modeling. Because of the advanced observing technology and innovative experimental design, many DYNAMO observations are unprecedented. A multi-agency funding strategy is needed for PIs of field observations and modeling to work together and achieve the maximum benefit of DYNAMO field observations to model improvement and development. US CLIVAR can and should play a crucial role in the

post-field activities of DYNAMO as it did at the preparation stage of the DYNAMO field campaign.