The impact of the systematic mean bias on MJO propagation and prediction in the ECMWF ensemble prediction system

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The impact of the systematic mean bias on MJO propagation and prediction is investigated using a 20-year reforecast dataset from the ECMWF ensemble prediction system which has been shown as superior for MJO prediction compared to other operational prediction systems. While most of the prediction systems show useful MJO prediction skill up to 3 weeks, the ECMWF system can predict the MJO above 4-weeks in advance. However, our current study found that the systematic mean biases over the equatorial Pacific limit the MJO propagation and prediction. Warm SST and excessive precipitation biases are found in the equatorial Indian Ocean extending to the western Pacific with a maximum over the Maritime Continent oceans. Over the equatorial eastern Pacific, cold SST biases are dominant with a significantly large maximum value of about -1.0 K. The strong SST gradient between the western and eastern Pacific induces a strong pressure gradient and associated low-level easterly bias. A small SST and easterly wind bias at the initial time exaggerates positive basinwide Bjerknes feedback as the forecast lead time increases. Another factor that amplifies the bias is the model resolution. The lead time when the model changes its horizontal resolution from about 32 km to 64 km, the wet bias almost doubles in magnitude in the center of the Maritime Continent. We found that these systematic biases hinder the MJO propagation and thus prediction. Both strong horizontal and vertical circulation biases make the West Pacific area unfavorable for the MJO propagation to the Pacific. Detailed analysis of the propagating mechanism related to the mean biases in the ECMWF ensemble prediction system will be presented.