ECMWF NCEP

without ENSO	Ν	with ENSO	Ν	without ENSO	Ν	with ENSO	Ν
OLW	326		870	OIM	233		724
no MJO	161		437	no MJO	127		356
EQBO-MJO	162		384	EQBO-MJO	112		340
WQBO-MJO	90		340	WQBO-MJO	65		256
NQBO-MJO	74		142	NQBO-MJO	56		128
EQBO-noMJO	50		121	EQBO-noMJO	40		79
WQBO-noMJO	99		269	WQBO-noMJO	84		225
NQBO-noMJO	12		47	NQBO-noMJO	3		52





Figure S1. Boreal winter (DJF) composite ERA-I z500 anomalies subsampled to ECMWF initialization dates (1995-2016) for each MJO phase during EQBO vs lead at 49N and 0W.



Figure S2. Spatial correlations between ERA-I and ECMWF across longitudes and for leads 0-28 days averaged over EQBO-MJO events. Correlations are calculated within a 60° wide longitude box, centered at each longitude spanning $30-60^{\circ}$ N.



Figure S3. STRIPES values for (left) ECMWF hindcasts' dates in ERA-I and (right) NCEP hindcasts' dates in ERA-I for all MJO events. Black hatches denote STRIPES values that are statistically larger than expected by chance at 90% confidence in ERA-I.



Figure S4. Anomalous correlation coefficient between (top) EQBO-MJO and EQBO-noMJO and (bottom) WQBO-MJO and WQBO-noMJO for (left) ECMWF and (right) NCEP at each longitude and lead from model initialization. Gray dots denote significant decreases at 95% confidence in prediction skill from active MJO compared to inactive MJO under the specific QBO phase for the plot.



Figure S5. Anomalous correlation coefficient between (top) EQBO-MJO and NQBO-MJO and (bottom) WQBO-MJO and NQBO-MJO for (left) ECMWF and (right) NCEP at each longitude and lead from model initialization. Hollow black circles indicate significant decreases at 95% confidence in prediction skill from E/WQBO-MJO activity compared to NQBO-MJO activity.



Figure S6. Anomalous correlation coefficient between NQBO-MJO and NQBO-noMJO for (a) ECMWF and (b) NCEP at each longitude and lead from model initialization. The grey dots denote significant increases and decreases at 95% confidence in prediction skill from active MJO compared to inactive MJO under NQBO.



Figure S7. STRIPES values for (left) ERA-Interim and (right) ECMWF for all (top) NQBO-MJO, (middle) EQBO-MJO and (bottom) WQBO-MJO events with ENSO.



Figure S8. STRIPES values for (left) ERA-Interim and (right) NCEP for all (top) NQBO-MJO, (middle) EQBO-MJO and (bottom) WQBO-MJO events with ENSO.



Figure S9. Anomalous correlation coefficient with ENSO included between (top) EQBO-MJO and EQBO-noMJO and (bottom) WQBO-MJO and WQBO-noMJO for (left) ECMWF and (right) NCEP at each longitude and lead from model initialization.



Figure S10. Anomalous correlation coefficient with ENSO included between (top) EQBO-MJO and NQBO-MJO and (bottom) WQBO-MJO and NQBO-MJO for (left) ECMWF and (right) NCEP at each longitude and lead from model initialization.