# Real-time Multivariate Indices for the Boreal Summer Intraseasonal Oscillation over the Asian summer monsoon region

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The Boreal summer intraseasonal oscillation (BSISO) of the Asian summer monsoon (ASM) is one of the most prominent sources of short-term climate variability in the global monsoon system. Compared with the related Madden-Julian Oscillation (MJO) it is more complex in nature, with prominent northward propagation and variability extending much further from the equator. In order to facilitate detection, monitoring and prediction of the BSISO we suggest two real-time indices: BSISO1 and BSISO2 based on multivariate empirical orthogonal function (MV-EOF) analysis of daily anomalies of outgoing longwave radiation (OLR) and zonal wind at 850 hPa (U850) in the region $10^{o}$S-$40^{o}$N, $40^{o}$-$160^{o}$E, for the extended boreal summer (May-October) season over the 30-year period 1981-2010. BSISO1 is defined by the first two principal components (PCs) of the MV-EOF analysis, which together represent the canonical northward propagating variability that often occurs in conjunction with the eastward MJO with quasi-oscillating periods of 30-60 days. BSISO2 is defined by the third and fourth PCs, which together mainly capture the northward/northwestward propagating variability with periods of 10-30 days during primarily the pre-monsoon and monsoon-onset season. The BSISO1 circulation cells are more Rossby wave like, whereas the circulation associated with BSISO2 is more elongated and front-like. Phases 2-4 of the BSISO2 are favorable for the onsets of Indian and South China Sea monsoon. The two BSISO indices together are capable of describing a large fraction of the

total intraseasonal variability in the ASM region, and better represent the northward and northwestward propagation than the real-time multivariate MJO (RMM) index of Wheeler and Hendon.