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Fidelity of the CMCC SPS model in simulating the dominant mode of tropical variability in boreal winter

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The dominant modes of variability at the sub-seasonal to seasonal (S2S) time scales in the tropical atmosphere, with particular emphasis on the Madden-Julian oscillation (MJO), is investigated using the observed NOAA outgoing longwave radiation (OLR). This study focuses on the boreal winter season (November to April) of the period 1993-2016. The multi-channel singular spectral analysis (MSSA) method is introduced and used to isolate the dominant modes associated with the tropical boreal winter daily OLR anomalies. The results show that the dominant MSSA mode consists of an intraseasonal oscillation with a period of around 35-day and two seasonally persistent modes. The 35-day oscillation is related to the intraseasonal convective activity of the tropics with little contribution to the seasonal mean value, and the phase composites and propagation characteristics of the 35-day mode are almost identical to the MJO (referred to as the MJO mode). The seasonally persistent modes are characterized by large-scale patterns that prevail over most of the tropics with the same sign anomalies throughout the boreal winter season, which represent inter-annual variations and are related to the El Niño-Southern Oscillation (ENSO) pattern. In this work, the MSSA based analysis is applied to the fully coupled (atmosphere-ocean-land-cryosphere) Euro-Mediterranean Center on Climate Change (CMCC) seasonal prediction system to evaluate the model's performance in simulating observed dominant modes of the boreal winter tropical variability.