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The Atmospheric Controls of Extreme Convective Events over the Southern Arabian Peninsula during the Transition Seasons

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In this paper, the processes behind severe convective events over the Arabian Peninsula during spring and autumn seasons and their local-scale impacts are investigated using reanalysis data, satellite-derived and observational products. The focus on the transition seasons is justified as Mesoscale Convective Systems (MCSs) are more common at that time of the year, in particular in the months of March and April. The analysis of 48 events from 2000 to 2019 revealed that they are triggered by low-level wind convergence and moisture advection from the Arabian Sea, Arabian Gulf and/or Red Sea. An equatorward displacement and strengthening of the subtropical jet also precondition the environment, as does the presence of a mid-level trough. The latter is generally part of a large-scale pattern of anomalies that are equivalent barotropic in nature, and therefore likely a response to tropical or subtropical forcing. At more local-scales, a drying of the mid-troposphere between 850 and 250 hPa typically by 50%, a reduction of the upper-level winds by about 5 m s^{-1}, and an increase in the upper-tropospheric and lower-stratospheric temperature on averaged by 2-3 K, are typically observed during a MCS event. Over the 20-year period, a statistically significant increase in the MCSs' spatial extent, intensity and duration over the UAE and surrounding region has been found, suggesting that such extreme events may be even more impactful in a hypothetical warming world. The rainfall they generate, on the other hand, shows an increase that is not statistically significant.