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Drought variability driven by interannual and decadal teleconnection patterns in monsoon regions of Southeast China

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Drought conditions of Southeast China are associated with the sea surface temperature warm pool in the tropical Western Pacific, which is related to low-frequency hydroclimatic patterns and their teleconnections. Empirically, the moisture influx to the region is linked to the interannual and decadal teleconnections, including the Pacific Decadal Oscillation (PDO), the Pacific-Japan Oscillation (PJO) and the Silk Road Pattern (SRP). However, it is still unclear how those teleconnection patterns affect drought conditions in Southeast China via changes in monsoons' dynamics or wave activities. In this study, we use ERA5 reanalysis over the 1950-2019 period to explore the impacts of the PDO, PJO and SRP on Asian monsoons' dynamics and regional drought conditions over Southeast China, based on a self-calibrating Palmer Drought Severity Index (scPDSI). We specially use station data from the Greater Bay Area (GBA) which is a national key region for development in Southeast China which is affected by seasonal droughts in winters. Results indicate that drought conditions in Southeast China are significantly related to monsoons: the East Asia Monsoon (EAM), the Western North Pacific Monsoon (WNPM) and the Webster-Yang Monsoon (WYM), between 1950-2019. The strength of monsoons is modulated by PDO, PJO and SRP. A negative phase of SRP corresponds to a southward shift of the Asian westerly jet, strengthening winter Asian monsoons and causing drier conditions in the GBA. Similarly, a cold phase of PDO contributes to drier conditions in the GBA, by weakening Asian monsoons. For the negative phase of PJO, the trade wind of the Walker cell is weakened by the meridional pressure dipole over the West Pacific adjacent to the Southeast China coast. This pressure dipole reduces moisture influx to the continent by the weakened trade wind and leads to less precipitation over East China. Such three climate factors are also interacted through the modulations of monsoons and wave-activities. An extension of the Eliassen-Palm (EP) flux shows that the SRP relates to convective and dynamic wave-activities, which could explain changes in monsoons' dynamics and drought conditions in Southeast China. To investigate the future drought conditions over Southeast China, bias-corrected historical and RCP8.5 scenarios are used for six of the Coupled

Model Intercomparison Project Phase 5 (CMIP5) models (i.e. ACCESS1, BCC, CNRM, IPSL, MPI, and GFDL) between 1861-2100. Among six models, IPSL and GFDL models reproduce the teleconnections well between changes in the monsoons and drought conditions over the GBA, for both historical simulations and future projections. Our results provide insights into the mechanisms of teleconnection patterns affecting drought monitoring and risk management in Southeast China.