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On the robustness of relationship between ENSO and East Asian Summer Monsoon

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In observations, the leading mode of variability of East Asian summer monsoon (EASM) features enhanced precipitation along the Yangtze River Valley, and mainly occurs in El Nino decaying summer (Sun et al. 2010). Kiel Climate Model (KCM) developed by Park et al. (2009) in GEOMAR, Germany is capable of reproducing these EASM characteristics in its 1000-year twentieth century equivalent (20C) control simulation. Moreover, consistent with the results of ERA-40 reanalysis data, the 1000-year 20C simulation of KCM also demonstrates an unstable relationship of EASM and ENSO, and the reason is particularly investigated in this study. The simulated El Nino events are selected and grouped into 4 categories according to their intensities and their relationships with EASM, i.e. Strong ENSO Strong Relation (SESR), Strong ENSO Weak Relation (SEWR), Weak ENSO Strong Relation (WESR) and Weak ENSO Weak Relation (WEWR). Their comparisons indicate that in situations of strong EASM-ENSO relationship, the suppressed precipitation in the northwest Pacific is more significant, so are the major components of EASM, such as western Pacific anticyclone (WPA) anomaly, the western Pacific subtropical high (WPSH), and the East Asian subtropical westerly jet (EASWJ) regardless of strong or weak ENSO, and vice versa. As for the strong ENSO, the robust EASM-ENSO relation mainly comes from the mid-eastern tropical Pacific where obvious large positive ENSO SST anomalies exist. However, it is primarily from the much warmer tropical Indian Ocean for the weak ENSO. Furthermore, correlation results show that EASM-ENSO relationship is getting more robust when much warmer interdecadal SST anomalies appear in the tropical Indian Ocean, tropical Atlantic Ocean and mid-western off-equatorial Pacific Ocean, which causes remarkably reduced convection and precipitation over the western Pacific, and then enhanced WPA anomaly, WPSH and EASWJ. Finally, the interdecadal changes of oceanic and atmospheric basic states further strengthen/weaken the robustness of EASM-ENSO relationship in the case of SESR and WESR/SEWR and WEWR in turn.