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Variations in Atmospheric Perturbation Potential Energy associated with the South China Sea Summer Monsoon

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This study investigates the energetic conversion processes and their relation to convection (circulation) during the South China Sea summer monsoon (SCSSM) years from the viewpoint of atmospheric perturbation potential energy (PPE). An atmospheric PPE dipole pattern associated with the SCSSM develops over the western North Pacific (WNP) and southern Maritime Continent (SMC) in the boreal summer, serving as a link between the SCSSM and diabatic heating. Actually, the conversion between the energetic variations and the convection over the WNP is distinctly different with that over the SMC. The precipitation leads the PPE over the WNP, while similar situation is revised over the SMC. During strong SCSSM years, the higher PPE over the WNP, controlled primarily by the latent heat released from condensation related to surplus precipitation, is corresponding to the negative energy conversion (Ck) over there. This indicates that more PPE is converted to perturbation kinetic energy and further intensifying ascending motion over the WNP. Consequently, the descending movement reduces the PPE and is corresponding to positive Ck over the SMC, suggesting that the less PPE converts into the perturbation kinetic energy and in turn favors the descending movement and deficit precipitation there. This strengthened precipitation dipole and SCSSM Hadley circulation further favors the intensification of the SCSSM, implying that the SCSSM can maintain development through the positive convection–PPE–circulation feedback.