The moisture circulation is critical to the summer rainfall over East Asia, and it is greatly influenced by the ENSO signal. To investigate its interannual variability and its relationship with ENSO in detail, the real-vector EOF analysis is applied to water vapor fluxes over East Asia. Two distinguished modes are found. The first mode (EOF1) mainly represents the water vapor transport anomaly associated with the comparative strength of Indian summer monsoon and tropical western summer monsoon, while the second mode (EOF2) exhibits a tripole-like pattern, reflecting the influences of the strength of western Pacific subtropical high and the activity of southward invasion of cooler air from mid-high latitude. In the investigation of the relationship between these two modes and the sea surface temperature anomaly (SSTA) over tropical eastern Pacific, the quasi-quadrennial coupling is found. That is, the positive phase of EOF2 tends to take place when the anomaly warm SSTA persists, positive phase of EOF1 comes up when the warm SSTA transfer into the cool SSTA, while the negative phase of EOF2 tends to occur when the anomaly cool SSTA persists, negative phase of EOF1 happens when the cool SSTA transfer into the warm SSTA. The evidence of this quasi-quadrennial coupling between moisture circulation over East Asia and ENSO can also be found in the associated atmosphere circulation anomaly. However, these results are diagnostic; the underlying physical mechanism for this quasi-quadrennial coupling still needs further study.