The summer monsoon onset (SMO) is considered to be the key characterizing indicator of the transition between dry and rainy season in the Indochina Peninsula (ICP). However, the SMO have not been sufficiently examined over Vietnam and the eastern ICP in general. Thus, first, the detailed climatological SMO over various sub-regions of Vietnam is examined. In the central coastal plain of Vietnam (CCV), rainfall reaches its maximum intensity in autumn; whereas, a strong mountain shadow effect causes relatively dry summer. Thus, a new specific onset criterion for this region has been proposed: The summer dry season onset date, which is indicated in late May and marks the appearance of dry conditions. From a large-scale perspective, the SMO in Vietnam and surrounding areas coincides with the northward retreat of the mid-latitude westerlies, and the eastward retreat of the easterly trade winds associated with the Western Pacific sub-tropical high (WPSH). A relationship between the occurrence of the Baiu front in East Asia and the SMO over the South China Sea (SCS) has also been identified.

Next, the climatology and precursory signals associated with the interannual variability of both the summer and autumn rainy season (SRS and ARS) onsets over the eastern ICP are investigated. Results indicated that during 1958–2007, the average onset
of the SRS and ARS in the CCV occurs respectively on May 6 and September 16 with a standard deviation of 13 days and 12 days. The SRS onset is characterized by the northward propagation of strong convection over Sumatra and the evolution of summer monsoon westerlies. Conversely, the withdrawal of the summer monsoon over northern and central Indochina in autumn favors the onset of ARS. Both onsets are strongly related with an intraseasonal oscillation (ISO) on the scale of 30–60 and 10–20-day. The results also suggest that ENSO has a considerable influence on interannual variations of the onset dates. In La Niña years, the following SRS tends to have early onsets. Simultaneously, the WPSH weakens and retreats eastward earlier. In addition, advanced ARS onset generally occurs during an El Niño developing autumn with weakened equatorial easterlies and suppressed convection over the central Indian Ocean from the preceding summer, as evident of a weakening Walker circulation. However, robust precursory signals in SST are observed only from mid–summer (July-August). Also an earlier ARS onset is associated with a development of an anomalous Philippine Sea anticyclone and a westward-extended WPSH from mid- to late summer. However, no coherent correlation is found between the late onset and La Niña.

Finally, a significant and abrupt delay in the withdrawal of the ARS over the CCV since around 1992/1993 is detected and associated dynamical mechanisms are discussed. During 1979-92, the mean withdrawal is in early December, which is three pentads earlier than that during 1993-2006. Since rainfall over the CCV is primarily produced by cold surge vortices formed by the interaction of easterly waves with the cold surge flow, the ARS withdrawal is characterized by a gradual equatorward propagation (retreat) of dry continental air by the northeasterly winter monsoon (tropical easterlies). Thus, the relatively late withdrawal in the recent epoch is determined by a westward extension of the tropical easterlies during early-to-mid December that causes an increase in the easterly wave activity over the Philippine Sea and the South China Sea (SCS), in response to the cold sea surface temperature (SST) anomalies in the central-eastern Pacific and warm SST anomalies in the western Pacific. As a result, since 1993, remarkable increases of convection and moisture convergence around the CCV and SCS have occurred during December. Large-scale circulation changes also favors an enhancement of the intraseasonal oscillation (ISO) activities on 30–60, 10–20 and 5-day scales that formed and maintained rainfall in the CCV. Another potential factor is a distinct increase in the number of tropical cyclones (TC) passing through the southern SCS in 1993-2006 compared with those occurring during 1979–92, which is
related to a strengthening and more westward-extended WPSH and a significant sea surface warming over the western Pacific. This enhanced ISO and TC activity, and the markedly delayed ARS withdrawal, which is associated with interdecadal circulation changes, may be attributed to a mean state changes in the Pacific basin since the mid-to-late 1990s characterized by a grand La Niña-like pattern, which also results in the simultaneous advance of the South China Sea summer monsoon onset.